

Technology Transfer Desk Reference



A Comprehensive Guide to Technology Transfer



Technology Transfer Desk Reference: A Comprehensive Guide to Technology Transfer

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Technology Transfer**
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PREFACE

This edition of the *FLC Technology Transfer Desk Reference* consolidates the information contained in the 2006 edition of the *Desk Reference*, as well as the 2007 edition of the *FLC ORTA Handbook*. The consolidation of these publications into a single document will enable the FLC to provide government and industry technology transfer practitioners with one convenient source for the information needed to facilitate the transfer of federally funded technologies from the laboratory to the marketplace.

LIST OF ACRONYMS/GLOSSARY

ARIPO	African Regional Industrial Property Organization
ASBDC	Association of Small Business Development Centers
AUTM	Association of University Technology Managers
CFR	Code of Federal Regulations
CPR	Cooperative Programs for Reinvestment
CRADA	Cooperative Research and Development Agreement
DOE	Department of Energy
DTIC	Defense Technical Information Center
EAPC	Eurasian Patent Convention
EPC	European Patent Convention
FAR	Federal Acquisition Regulations
FFRDC	Federally funded research and development center
FOIA	Freedom of Information Act
GOCO	Government-owned, contractor-operated
GOGO	Government-owned, government-operated
HPM	Hyperion Power Module
IP	Intellectual property
IRI	Industrial Research Institute
LANL	Los Alamos National Laboratory
LES	Licensing Executives Society
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
MTA	Material transfer agreement
NASA	National Aeronautics and Space Administration
NASVF	National Association of Seed and Venture Funding
NCI	National Cancer Institute
NIST	National Institute of Standards and Technology
NTIS	National Technical Information Service
OAPI	African Intellectual Property Organization
ORD	Office of Research and Development

LIST OF ACRONYMS/GLOSSARY (Cont.)

ORTA	Office of Research and Technology Applications
PCT	Patent Cooperation Treaty
PCTA	Patent Cooperation Treaty Application
PI	Principal Investigator
PVPC	Plant Variety Protection Certificate
R&D	Research and development
SBA	Small Business Administration
SBIR	Small Business Innovation Research
SCORE	Service Corps of Retired Executives
SOW	Statement of Work
SSTI	State Science and Technology Institute
STEM	Science, technology, engineering and mathematics
STTR	Small Business Technology Transfer
T2S	Technology Transfer Society
TRP	Technology Reinvestment Project
USC	United States Code
USDA	U.S. Department of Agriculture
USPTO	United States Patent and Trademark Office
WRAIR	Walter Reed Army Institute of Research

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Section One

INTRODUCTION

1.1 OVERVIEW

The federal government annually spends billions of dollars on the research and development (R&D) activities performed by federal laboratories. Through the federal technology transfer process, federal laboratories share the benefits of this national investment in R&D with all segments of society.

The *FLC Technology Transfer Desk Reference* presents a comprehensive introduction to the federal technology transfer process and the technology transfer initiatives, procedures, and mechanisms that are used to implement technology transfer. Although the technology transfer initiatives and mechanisms described in the *Desk Reference* are promoted and supported by the federal government and apply to all federal agencies and departments, the specific activities and procedures of each organization may vary, and the material presented here may need to be adapted for a particular laboratory or agency.

The primary goal of the Desk Reference is to help technology transfer practitioners become effective facilitators of technology transfer by explaining what technology transfer is and why it is necessary, relating the processes and mechanisms that make it happen, and describing issues and procedures useful in identifying and transferring technologies from the government sector to the private sector. To this end, the Desk Reference provides a thorough overview of the basic elements of technology transfer. It also provides the background, concepts, and practical knowledge required to assist FLC Laboratory Representatives, laboratory technology transfer personnel (including Office of Research and Technology Applications [ORTA] personnel) and other technology transfer practitioners—whether in government or industry—to facilitate the transfer of federally funded technologies from the laboratory to the marketplace.

The FLC Technology Transfer Desk Reference comprises the following interrelated topics:

- **Section One, Introduction**—Provides an overview of technology transfer, federal technology transfer policy, and the benefits of technology transfer for all participants.
- **Section Two, The Office of Research and Technology Applications (ORTA)—The Technology Transfer Office**—Examines the role and responsibilities of the ORTA, the organization tasked by technology transfer legislation with facilitating technology transfer at the laboratory level.
- **Section Three, The Technology Transfer Process—Collaboration and Commercialization**—Provides a model for a typical technology transfer process.
- **Section Four, Technology Transfer Mechanisms**—Examines the legislative authority, purpose, characteristics, and intellectual property issues relating to Cooperative Research and Development Agreements (CRADAs), and discusses procedures for developing CRADAs, as well as a variety of other major mechanisms used by federal laboratories to transfer technology to the private sector.
- **Section Five, Intellectual Property**—Focuses on the importance of intellectual property to technology transfer, protecting intellectual property, patenting and licensing an invention, and royalties.
- **Section Six, Organizations Supporting Technology Transfer**—Provides information about the federal and nonfederal organizations that support technology transfer and how to use their resources.
- **Section Seven, Marketing and Communications Outreach**—Examines how to market federal technology, providing practical information in areas such as establishing a technology transfer marketing plan, demonstrating the value of technology, marketing technology, and negotiating with a potential partner.

Also included are appendices that provide an overview of technology transfer legislation and related executive orders (Appendix A) and major legislative themes in federal technology transfer (Appendix B).

1.2 TECHNOLOGY TRANSFER BACKGROUND

1.2.1 Federal Technology Transfer Defined

There are many definitions of technology transfer, but at its most basic level technology transfer is generally considered the process by which technology or knowledge developed in one place or for one purpose is applied and used in another place for the same or different purpose. This broad definition covers a wide variety of procedures or mechanisms that can be used to transfer technology and is not necessarily restricted to federal activities.

For the purpose of this *Desk Reference*, however, the phrase “federal technology transfer” refers typically to transfers occurring between federal laboratories and any nonfederal organization, including private industry, academia and state and local governments mandated by a series of federal laws and executive orders dating back to 1980 (see Appendix A). In addition, to encompass the original intent of Congress to make full use of the results of the R&D investment of federal facilities in the nation’s economy, as well as to recognize that technology transfer activities vary by agency (see below) and may not necessarily include transfer of a physical technology or invention, the Federal Laboratory Consortium for Technology Transfer (FLC) has developed the following definition for federal technology transfer:

Technology transfer is the process by which existing knowledge, facilities, or capabilities developed under federal research and development (R&D) funding are utilized to fulfill public and private needs.

Technology transfer can also occur between federal agencies, although the primary emphasis is on transfers to all types of nonfederal organizations. In addition, federal technology transfer activities are not always from a federal laboratory to another party. Technology transfer mechanisms can be used by a federal laboratory to bring in from the outside technologies or knowledge that can assist the laboratory with achieving its mission goals. This might, in fact, be a lower-cost alternative to developing a technology or expertise entirely within the laboratory.

1.2.2 Congressional Policy and Goals for Federal Technology Transfer

In 1980, Congress began enacting legislation aimed at ensuring that the country benefitted to the maximum extent possible from national investment in R&D, legislating that: “It is the continuing responsibility of the Federal Government to ensure the full use of the results of the Nation’s Federal investment in research and development. To this end the Federal Government shall strive where appropriate to transfer federally owned or originated technology to State and local governments and to the private sector.” As Congress further noted: “Technology transfer, consistent with mission responsibilities, is a responsibility of each laboratory science and engineering professional.” Clearly, the express purpose of the congressional mandate to implement the transfer of technology developed in federal laboratories to the private sector is to utilize that technology to develop better and more useful products for the marketplace that will benefit the nation and the economy.¹

With this initial legislation and policy, as revised and amended over the years, Congress began the process of providing the means and mechanisms by which the nation would gain the full benefit of this annual R&D expenditure. Consistent with this policy, the overarching goals of federal technology transfer programs are to make the most of the R&D budget and the expertise of both government and nongovernment scientists and engineers, increase the return on investment of the federal R&D budget, and help federal agencies meet mission requirements while enhancing U.S. competitiveness in the world economy.

1.2.3 Agency Variations Affecting Federal Technology Transfer

While the policy, goals, and definition of federal technology transfer are clear, variations among federal agencies on several important criteria can affect technology transfer programs, and must be considered for

¹The legislation mandating and implementing technology transfer is codified in the U.S. Code (see 15 USC 3710); a summary of the legislation and executive orders relevant to federal technology transfer is provided in Appendix A, Legislative History of Technology Transfer. The primary resource for a comprehensive presentation of principle statutory and executive order policies constituting the framework of the federal technology transfer program is provided in Federal Technology Transfer Legislation and Policy (known as The Green Book), 4th edition, 2009, published by the FLC.

both implementation and assessment. These variations may drive how the federal laboratory technology transfer office is operated, which mechanisms are used or emphasized by each agency and lab, how intellectual property rights are applied, how technologies are marketed, as well as how to best assess performance.

One example of agency variations reflected in technology transfer programs is the different models for managing and operating federal labs. Federal labs are typically managed under two general models: the government-owned, government-operated (GOGO) model and the government-owned, contractor-operated (GOCO) model. GOGO laboratories are usually owned or leased by the federal government, and predominantly staffed by federal employees and supported by nonfederal contract employees. GOCO laboratories are institutions where the facilities and equipment are owned by the federal government, but the staff is employed by a private or public contractor that operates the laboratory under a contract with the federal government. The type of laboratory management can affect various aspects of the technology transfer mission at the lab, including intellectual property protection (see Section Five, Intellectual Property).

Another variation to consider is the authorizations each agency has for utilizing available transfer mechanisms. While all agencies are subject to overarching legislation, each agency may also have unique statutory authorizations for actions specific to its labs. The *Federal Technology Transfer Mechanisms Matrix* and the *Federal Technology Transfer Mechanisms Database*, which are available on the FLC website at <http://www.federallabs.org/education/t2mech/search/> and <http://www.federallabs.org/education/t2-matrix/>, identify and describe a wide variety of mechanisms, the agencies that use them, and Internet links to the agency website, where information about each agency's use of the mechanisms and samples of the mechanisms can be found.

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1.3 THE BENEFITS OF INVOLVEMENT IN TECHNOLOGY TRANSFER

Federal technology transfer ultimately benefits all of society by making available the results of federal research to meet societal needs, leveraging taxpayer investment in federal research capabilities to the benefit of the national as a whole. Select benefits of federal technology transfer to participant groups are highlighted below.

1.3.1 Benefits to the Government

For the government, benefits can be derived from technology moving out of the laboratories, as well as technical expertise coming into the laboratories. Technology transfer activities can be used to assist in accomplishing mission-oriented R&D, for example, when academic or industrial researchers provide needed expertise on collaborative efforts, thus leveraging research dollars. In the other direction, the government as a whole benefits when technology moves out of the laboratories because federally funded R&D is being put to new or expanded uses. This also results in a better return on investment and expedites the rapid movement of technology to the field. The government and individual laboratories also benefit financially to the extent that the technology transfer involves royalty payments to the government.

Given the belief that a healthy U.S. economy will be based on the commercial exploitation of innovative and expanded technologies, the government benefits from the stronger economy fostered by successful technology transfer programs.

1.3.2 Benefits to Industry

For industry, involvement in technology transfer projects can provide an increased awareness of government needs, giving commercial companies the opportunity to better serve government customers. As is the case for the government partner, the business partner can leverage R&D costs by building on the relevant R&D that has already been done in or through new collaborations with the federal laboratories, resulting in improved and more cost-effective technology development. Business partners may also benefit by using government facilities (e.g., for product testing)

rather than building new facilities, and making use of the expertise of federal scientists and engineers.

From a product point of view, exclusive licenses to government technology may provide a private sector firm the needed edge in entering the marketplace, and government collaboration in general may reduce the product development cycle and time to market.

1.3.3 Benefits to Academia

Researchers at universities and nonprofit organizations can benefit financially from various parts of the entire technology transfer spectrum, e.g., as participants in proposals and joint ventures for R&D grants. Individual researchers may benefit intellectually from the close contact with leading technologists in both government and industry. And, ongoing technology-oriented projects provide a useful incentive for student involvement and can provide students with valuable experience and contacts when entering the job market later.

1.3.4 Benefits to Technology Transfer Professionals

For the individual scientist or technologist in a federal laboratory, benefits include possible financial gain from awards and royalty payments, in addition to the personal satisfaction and professional recognition gained from holding a patent or participating in the launch of a new product. The collaboration with other scientists and technologists from industry and academia may improve the employee's ability to accomplish mission tasks, and will provide the knowledge that one is a strong contributor to government-mandated technology transfer processes.

1.3.5 Benefits to Economic Development

While federal technology transfer benefits national economic growth and competitiveness, these national-level benefits are a compilation of those realized at local, regional, and state levels. State and local government economic development efforts are supported and enhanced by partnering with federal labs via technology transfer initiatives. These collaborations, in areas from education to health to crimefighting and many others, may result in job creation, better products, improved quality of life, and a more positive future for citizens.

1.4 TECHNOLOGY TRANSFER WORKS

Technology transfer has had a dramatic impact on fostering mutually beneficial technology partnerships between industry and federal laboratories. These innovative partnerships have significantly contributed to the mission accomplishment of each member agency and laboratory, and have enhanced the economic well-being of the nation. They are a practical demonstration of the synergistic benefits of technology transfer. A few brief examples of successful, innovative technology transfer partnerships illustrate the benefits of technology transfer for the government, the laboratory, and industry:

- A novel fish vaccine that mitigates streptococcal disease in farmed food fish was developed in a U.S. Department of Agriculture (USDA) laboratory and transferred to a private-sector partner through a variety of technology transfer mechanisms, including nonfunded cooperative agreements, CRADAs, patents, material transfer agreements (MTAs), and licensing. Vaccination is the best method to prevent this disease in fish. It offers the safest alternative to using antibiotics and chemicals that can contaminate food and the environment; however, no effective vaccines that prevent streptococcal disease were available for farm-raised fish. The vaccine developed by USDA scientists was an innovative combination of killed cells and extracellular product that provides a safe and efficacious immune protection against streptococcal disease that is superior to standard vaccines consisting of killed cells only. The USDA used an MTA to transfer master vaccine cultures to its industry partner, and a license is pending. The company has estimated sales of 50 million vaccine doses annually. The potential economic benefit to the economy from these vaccines is a 20-percent increase in profits annually to the aquaculture industry due to reduced fish mortality and better growth performance.
- The Department of Health and Human Services' National Cancer Institute (NCI) has developed a “bank” of over 400 human tumor cell lines that have an important application as research tools to study a variety of cancers. This cell line bank is the result of exhaustive efforts by NCI scientists to provide the research community with comprehensive biological tools to study several cancer types. Transfer of these cell lines to the research community involved a variety of mechanisms, including consolidating them into a single umbrella

Invention Report that allowed researchers easier access to any of the 400-plus lines without having to negotiate separate agreements for each line. MTAs were used to transfer the cell lines to nonprofit entities, and Biological Material Licenses were used to distribute cell lines to for-profit entities. In addition, Commercial Evaluation Licenses were used to grant nonexclusive rights to evaluate the technology's commercial potential, and additional licenses are currently being negotiated.

- The Hyperion Power Module (HPM) reactor, a technology transfer from Los Alamos National Laboratory (LANL) to the private sector, may change the way the world looks at nuclear power and the distributed electrical infrastructure. Conceived at LANL, the intellectual property portfolio for the HPM was licensed exclusively to a private-sector company, which will develop the world's first small mobile reactor to provide clean, safe, affordable nuclear power generation for remote locations across the globe, thus avoiding the need for the costly and complex construction of massive conventional fossil-fueled or nuclear power plants. The HPM uses the energy of low-enriched uranium fuel and meets all of the nonproliferation criteria of the Global Nuclear Energy Partnership. Each unit will produce enough energy to provide electricity for 20,000 average American-sized homes or the industrial equivalent. Approximately 1.5 meters (slightly less than 6 feet) wide by 2 meters tall (slightly over 6 feet), the units can be transported by ship, rail, or truck to produce power for 5 to 7 years depending on usage. Significant interest in purchasing the HPM has been expressed by communities and industries on every continent. Because the HPM can be installed wherever power is needed—remote industrial operations, remote military installations, communities looking to supplement grid-supplied power, and oil and gas recovery sites—it can make clean, affordable power a reality in places where it was never before thought possible.
- A CRADA between the U.S. Army and private industry has resulted in the development and fielding of an innovative personal protection shelter in Iraq and Afghanistan, as well as in the commercialization of the technology for civilian use. This self-erecting bed net, which is designed to provide protection against mosquitoes and other biting insects, folds down to a 12-inch-diameter package that weighs only 2 pounds; when released, the bed net instantly pops up to its full size, ready for use on a cot or the bare ground. Acutely aware of

the diseases transmitted by mosquitoes, including malaria (which infects 500 million people and kills 1 million each year), dengue fever, yellow fever and West Nile virus, and concerned with the shortcomings of the standard military bed net used by the Army, the Walter Reed Army Institute of Research (WRAIR) assembled a team of outdoor product manufacturing and insect-repellent experts to develop a better bed net under the CRADA. The result of the collaboration was a revolutionary self-erecting bed net and a patent covering the invention. After years of refinement and testing, the Army and the original CRADA partners succeeded in making the bed net available to U.S. troops; and the private-sector partners licensed the patent covering the technology. Currently, the self-erecting bed net is widely used by the U.S. military and is available for purchase by the public. Further enhancements to the bed net design by the licensees have resulted in weatherproof tents that have also been transitioned back to the military and are available for use by campers. This innovative technology could benefit millions of people around the world, including the inhabitants of countries plagued by insect-borne diseases, American military personnel, and weekend campers.

- To help detect biological traces on Mars, scientists at the National Aeronautics and Space Administration (NASA) developed an ultrasensitive biosensor that utilized nanotechnology. Because the sensor is tiny, requires little energy and is highly sensitive to even minute amounts of its target substance, it is ideal for use in space—and on Earth as well. Using a Space Act Agreement, NASA exclusively licensed the biosensor to a private-sector company to support further research and development. The company developed a working version of the NASA biosensor calibrated to detect *E. coli* bacteria, which is known to cause acute gastrointestinal illness. The company also developed a method for placing multiple sensors on a single wafer, which permitted mass production and cost-effective testing. This resulted in a commercial water analyzer that builds upon the licensed NASA biosensor and can be configured to test for a suite of waterborne pathogens, as well as other bacteria, viruses, and parasitic protozoa. The sensor is incredibly sensitive and specific to the type of pathogen it is calibrated to detect in the water, and can monitor drinking water, farmland irrigation, feed water for animals, water purity for food and beverage companies, and the recreational water quality at beaches and lakes, while reducing sample analysis time from days to a matter of minutes.

Section Two

THE OFFICE OF RESEARCH AND TECHNOLOGY APPLICATIONS (ORTA)—THE TECHNOLOGY TRANSFER OFFICE

2.1 BACKGROUND

Technology transfer in federal laboratories is facilitated by a technology transfer organization known as the Office of Research and Technology Applications (ORTA). The original technology transfer legislation (see 15 USC 3710(b)) established an Office of Research and Technology Applications in each federal laboratory to coordinate and promote technology transfer. This organization (which has since come to be known under a variety of names depending on the agency and laboratory, and will be referred to as the “T2 office” in this document) serves as the focal point for technology transfer activities in federal laboratories. The legislation establishing technology transfer offices in federal laboratories specified that these offices should be staffed with “highly competent technical managers” who are “full participants in the technology transfer process.” The technology transfer professionals who staff T2 office positions should possess basic knowledge of intellectual property rights and basic technology transfer mechanisms; they are empowered to develop and promote the key partnerships necessary for technology transfer while recognizing that technology transfer, consistent with mission requirements, is a responsibility of each laboratory scientist and engineering professional.

To ensure the effectiveness of technology transfer activities, the law requires that each federal laboratory with 200 or more scientific, engineering, and related technical positions must have a T2 office staffed by at least one full-time person. In addition, each federal agency that operates one or more federal laboratories must make available sufficient funding to support the technology transfer function at the agency and

at its laboratories, including support of the technology transfer office. (Note: The specific staffing and funding levels for the various technology transfer offices are determined by each federal laboratory and its parent agency.)

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2.2 RESPONSIBILITIES OF THE T2 OFFICE

The T2 office in a federal laboratory functions as the technology transfer facilitator, connecting people inside the laboratory (the developers of technology and the initiators of technology transfer) and those outside the laboratory (the “customers” of technology transfer). The role of the T2 office as a laboratory’s technology transfer “nexus” is graphically illustrated on Figure 2-1.

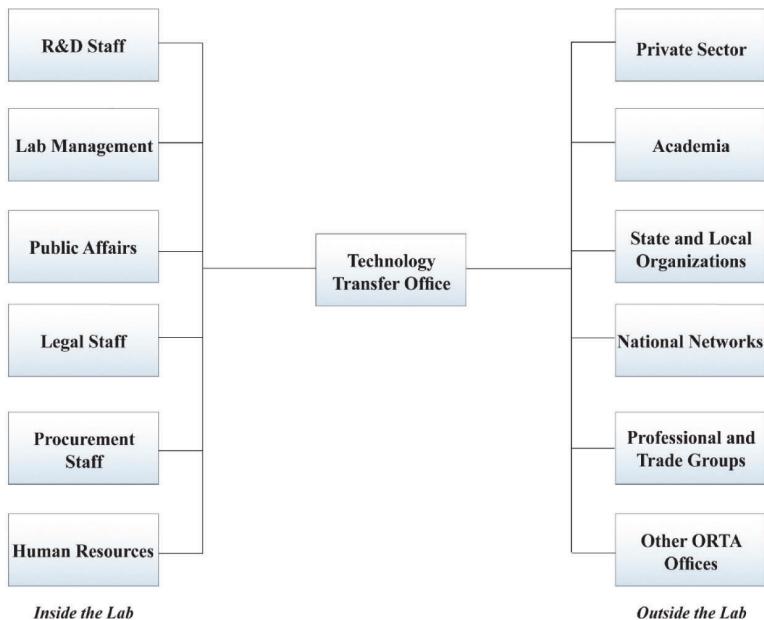


Figure 2-1. The T2 Office as the Link Between Lab and Technology Transfer Customers

According to legislation (see 15 USC 3710), the specific functions of each T2 office are to:

- Prepare assessments of selected R&D projects and technologies in the laboratory that may have potential commercial applications.
- Provide and disseminate information to state and local governments and private industry about potentially applicable federally owned or originated technologies, products, processes, and services.
- Cooperate with and assist the FLC, the National Technical Information Service (NTIS), and other organizations that link the R&D resources of the laboratory and the federal government to potential users in state and local governments and private industry.
- Provide technical assistance to state and local government officials.
- Participate in regional, state, and local programs designed to facilitate or stimulate the transfer of technology for the benefit of the region, state, or local jurisdiction in which the federal laboratory is located.

In addition, at many laboratories the function of the T2 office includes the marketing of laboratory resources; the establishment, negotiation and management of cooperative R&D under collaborative agreements; and the negotiation of licenses for intellectual property. A T2 office is often similar to a “high-tech marketing department” that focuses on two types of marketing efforts: technology transfer services and, in conjunction with the technology developer, specific applications to potential collaborators or adopters. As with any high-tech marketing department, the T2 office must:

- Make potential partners aware of the laboratory’s technology and technical capabilities
- Identify to the partner the value of utilizing the technology
- Recognize and promulgate throughout the laboratory the understanding that technology transfer, consistent with mission responsibilities, is a responsibility of each laboratory science and engineering professional
- Work closely with technical staff and laboratory management

- Understand and appreciate issues related to commercial markets and commercialization, such as production and distribution
- Understand organizational resistance to change.

The responsibilities of the T2 office also include: education and training of laboratory personnel, screening of technology, technology applications assessment, and aid to potential partners through technical assistance and organizational outreach.

- **Education and training of laboratory personnel**—To effect technology transfer, many people must actively participate. The T2 office’s “technology transfer team” will most likely include:

- Laboratory management
- Researchers: internal and external
- Legal staff: internal and external
- Public affairs staff
- Procurement personnel.

For the above, the T2 office should provide training related to:

- The legislative mandate for technology transfer
- Technology transfer and the laboratory’s mission
- The benefits of technology transfer to the laboratory and to the inventors
- Potential benefits of technology transfer for the U.S. economy and global competitiveness
- Technology transfer mechanisms and procedures
- Technology transfer success stories and lessons learned.

In addition, intellectual property, including patenting and licensing of inventions, can be a major issue. The T2 office can facilitate technology transfer only if innovative laboratory technologies are identified and protected. Laboratory personnel need to be trained in the following intellectual property (IP) issues²:

²A full discussion of intellectual property issues, including the patent and licensing processes, is provided in Section Five.

- A general understanding of intellectual property and intellectual property rights
- The necessity of protecting innovations
- Avoiding premature disclosure
- Working with the technology transfer office and patent counsel
- Filing disclosure statements
- Filing U.S. and foreign patent applications.

Other T2 office responsibilities, which will be discussed fully in subsequent sections, include:

- **Screening of technology**—To identify technology that may be available for transfer, it is necessary to have a detailed understanding of the work being conducted in the laboratory. A portfolio management approach enables each technology to be assessed within the context of an organization’s current and future needs.
- **Technology applications assessment**—The assessment of laboratory technology is a process that must be flexible enough to reveal formerly unsuspected applications. This assessment often includes the T2 office staff continuously interacting with scientists and engineers, reviewing patent applications and other documents, and presenting assessment progress and results to management personnel. The technology applications assessment process should identify technology that is representative of laboratory capabilities and/or has a clear, economically significant commercial application. The result of the technology applications assessment process will be a knowledge base that the T2 office personnel can use to respond to inquiries and unanticipated application opportunities defined by potential clients, and information that may be used to generate “application assessment” documents.
- **Marketing**—There are two types of marketing efforts that T2 office personnel can pursue—technology “pull,” in which private industry seeks technology from the laboratory; and technology “push,” in which the T2 office and other laboratory representatives actively seek private collaborators to commercialize specific laboratory technology.³

³A full discussion of technology marketing is provided in Section Seven, Marketing and Communications Outreach.

- **Technical assistance and organizational outreach**—Technical assistance/organizational outreach services may be made available by the laboratory to state and local governments, the private sector, and schools and academia. These services, which would include help by laboratory volunteers with appropriate technical skills, should be marketed. Technical assistance may take the form of problem analysis, providing and interpreting technical information, “hands-on” technical help from laboratory volunteers, and limited projects within the laboratory. Providing such services to potential clients can enhance the image of the federal laboratory among many important constituents and easily result in positive technology transfer opportunities.
 - Technical assistance to state and local governments—One kind of technical outreach assistance involves helping state and local governments assist businesses in their area. This is based on the concerns of state governments and many local governments for economic development in their jurisdiction. The T2 office might, for example, help evaluate technical aspects of new business proposals or serve as a technical resource.
 - Technical assistance to the private sector—T2 offices have the opportunity to enhance U.S. competitiveness by linking interested private-sector companies with federal laboratory-developed technologies. Industry partners usually will only undertake activities that they believe will result in a profit. Even so, industry participation and investment in collaborative research activities are increasing as more private-sector companies discover the benefits of forming partnerships with federal laboratories.
 - Technical assistance to schools and academia—Assistance may include a variety of activities, such as help with a system operation, computer networking, or assistance to teachers and students to improve science and technical education.
- **Responding to queries from the private sector**—Developing systems and networks to handle incoming inquiries from the private sector helps to forge partnerships outside the laboratory. Some processes that may be helpful include:
 - Developing standard methods for recording information on incoming calls

- Having in place systems for tracking inquiries from initial call, to referral, to record of followup action
- Developing or utilizing databases of experts and areas of expertise in the laboratory for the purpose of directing referrals
- Following up referrals to determine if further action is needed.

The role and responsibilities of the T2 office are addressed in greater detail in Section Three, The Technology Transfer Process.

Section Three

THE TECHNOLOGY TRANSFER PROCESS—COLLABORATION AND COMMERCIALIZATION

Technology transfer, which is often referred to as a “contact sport,” is primarily a function of person-to-person relationships that must be forged inside and outside the laboratory. As detailed in Section Two, T2 office personnel play a central role in this process by connecting the people and organizations that are essential to the technology transfer process. A major role for T2 office personnel is making others inside and outside the lab aware of the technical expertise, facilities, and collaborative opportunities. To fully promote the lab’s capabilities, it is also crucial to educate current employees and contractors, and potential partners how the technology transfer process works when collaborating with others. Federal laboratory scientists can be the best advocates for collaborative work, as they are often the subject-matter experts with extensive networks of colleagues and past collaborators. The T2 office is in a unique position to bring multiple parties to the table to create new solutions. Bringing collaborative partners in contact with local, county, state, and federal economic development programs can increase the financial and technology resources needed to succeed.

The technology transfer process is often more of an art than a science, and any two technology transfer opportunities rarely follow a similar development process. However, this section provides a model for the typical technology transfer process conducted by a T2 office at a federal laboratory. (It should be kept in mind that the model in this section is only one suggestion for structuring the technology transfer process; there are other models for implementing the process.)

This process, which is illustrated on Figure 3-1, typically includes:

- Identifying the laboratory’s technologies, including intellectual property

- Assessing the laboratory's technologies
- Conducting outreach; i.e., identifying potential partners
- Identifying appropriate transfer vehicle(s)
- Implementing the transfer
- Conducting post-transfer activities.

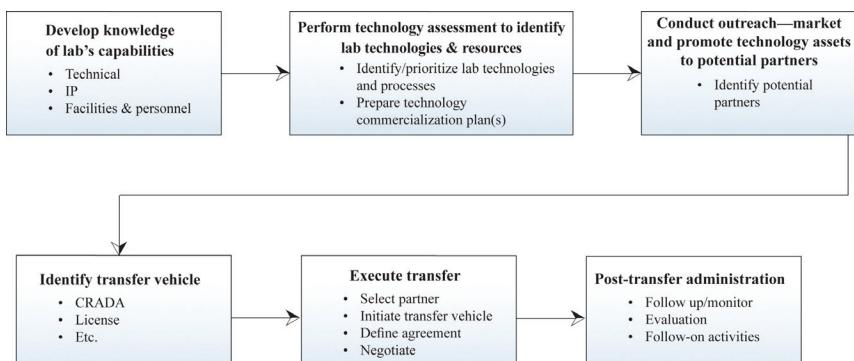


Figure 3-1. Technology Transfer Process

3.1 IDENTIFYING AND ASSESSING TECHNOLOGIES

3.1.1 Know the Laboratory's Capabilities

To identify technology that may be available for transfer, it is necessary to have a detailed understanding of the work being conducted in the laboratory, the laboratory's capabilities, and its specialized facilities. In larger laboratories, it may be impossible to know all of the activities. If this is the case, technology transfer personnel may want to concentrate on developing an in-depth understanding related to the laboratory's:

- Core competencies
- Areas of technical excellence
- Patented products and processes
- Unique facilities and personnel
- Areas where specific (and perhaps local) markets exist.

Some methods to maintain awareness of laboratory activities include:

- Talking frequently with researchers
- Reviewing patent applications

- Reading reports of R&D results in the laboratory
- Accessing databases of experts and areas of expertise
- Tracking funding and media/web coverage of the laboratory
- Attending program reviews and strategic planning sessions
- Making people aware of the T2 office and its role.

In order to effect technology transfer, technology transfer personnel coordinate with and involve laboratory management, technical personnel, and legal staff.

3.1.2 Perform Technology Assessment

A critical phase in the technology transfer process is the formal assessment of which technologies in the laboratory have transfer potential and the types of resources available at that facility for technology transfer. An assessment of laboratory technologies and resources can be conducted internally by laboratory personnel, externally by outside sources for a fee, or a combination of both.

The purpose of this assessment is to identify and prioritize technologies that appear worthy of full-scale evaluation. The first step is to determine the potential of candidate technologies for commercialization. Not all innovations for which invention disclosures or patent applications have been filed or for which patents have been issued can be commercialized. Determining the laboratory resources, technologies, and processes with the greatest transfer potential is essential.

Many technologies developed in the laboratory for a particular use may have a very different use in the private sector. For example, a technology might have been developed for defense purposes but might have potential for nondefense applications. Or a technology might be identified as a “spinoff” technology—from a technology developed in one particular technical area but with potential application in different technical areas or markets. Because a technology may be commercialized for purposes very different from the original intent, it is imperative to consider the commercial potential from diverse viewpoints. One way to do this is by convening a multidisciplinary team with diverse technical backgrounds to broadly consider the technology’s potential. A multidisciplinary team could:

- Define the technology in sufficient detail so all team members have an adequate understanding of it.
- Use brainstorming techniques to encourage divergent and creative thinking about possible uses of the technology.
- Select the most promising ideas for further discussion and identification of potential markets.
- Decide to consider options in more detail or not to pursue further.
- If the decision is to explore options, determine who inside and outside the laboratory should be consulted and assign responsibilities. Some areas that should be explored may include:
 - Estimation of capital requirements needed to bring the technology to commercialization
 - Manufacturing process needed
 - Patent likelihood
 - Potential of other forms of IP protection
 - Competitive advantage possibilities
 - Market niches
 - Possible field-of-use licenses (Patents can be licensed for more than one field of use. For example, a patent can be licensed for both medical and electronics applications.)
 - Possible problems related to classified technologies.

Other considerations include:

- Ranking
- Feasibility
- Compatibility with mission goals and technology transfer legislation
- Marketability, including technical considerations, partnering arrangements, scheduling details, cost issues, profitability, etc.
- Overall desirability of initiating transfer of the technology
- Potential markets and development partners for the technology
- Competing or complementing technologies
- Financial potential for the selected technology.

After completing the assessments, the T2 office may consider preparing formal or informal technology commercialization plans for each

candidate technology that is seriously being considered. Such plans would provide the technology developer and laboratory managers with critical information regarding the technology's potential and the steps necessary to accomplish transfer.

The contents of such a plan may include:

- Abstract of technology evaluation findings
 - Description of technology
 - Technology soundness and innovation
 - Technology development
 - Commercial potential
 - Manufacturing and production issues
 - Management and ownership
 - Financial potential
 - Transfer options
 - Supporting data.
-

3.2 OUTREACH—IDENTIFYING POTENTIAL MARKETS AND PARTNERS

The T2 office performs a critical role in connecting private industry, academia, state and local organizations, and professional and trade organizations to the laboratory. This includes identifying potential partners in private industry, academia, state and local organizations, and professional and trade organizations, and performing marketing outreach efforts to make technology transfer opportunities known to the private sector.

3.2.1 Identifying Potential Partners

Where particular areas of excellence or core competencies in the laboratory can be identified, some techniques for identifying potential partners outside the laboratory may include:

- Identifying and interacting with relevant professional and trade organizations; exhibiting at their conferences
 - Using professional technology transfer consultants
-

- Using Web-based commercial tools for technology assessment and determination of market potential
- Talking with area Chambers of Commerce
- Interacting with state and county economic development organizations
- Asking researchers to identify their peers outside of the laboratory.

3.2.2 Marketing Outreach Efforts—Making Opportunities Known to the Private Sector

Some of the techniques that have been used effectively by federal agencies and laboratories to inform the private sector, universities, and state and local governments about opportunities available in the federal laboratories are identified below. (See Section Seven, Marketing and Communications Outreach, for a full discussion of the role of marketing and communications in technology transfer.)

- **Innovator's contact with peers**—The direct contacts that inventors have with their peers through professional societies and conferences is a highly effective method for creating interest in specific innovations outside of the laboratory.
- **Technology briefs**—Short written or video summaries of technologies and their potential commercial uses can be widely distributed to targeted populations via mail, e-mail, or a website.
- **Presentation at professional and trade associations**—These associations bring together professionals with similar interests and can provide a forum to discuss opportunities in the laboratories. Advertisements in professional magazines have also proven effective.
- **Small business workshops**—Workshops targeted at small businesses in specific technology areas are often sponsored by laboratories. State economic development organizations and the Small Business Administration may be potential partners in sponsoring these workshops.
- **Technology roundtables**—Discussion forums can be organized around a particular technology area with representation sought from one or more laboratories, private industry, academia, and state and local governments.

- **Laboratory representation at national meetings**—The FLC, AUTM, and other similar organizations sponsor national forums where private-sector companies are invited to visit laboratory displays and talk with laboratory personnel.
 - **Advertisements and articles in R&D magazines**—Targeted exposure of laboratory technologies in R&D magazines can provide effective connections among parties with similar interests.
 - **Web posting**—Potential partners search for partnership or licensing opportunities on laboratory/facility websites, technology transfer search engines, and social networking groups.
 - **Advertisement in FedBizOps**—Widely read by many U.S. technology companies, FedBizOps (www.fedbizopps.gov) provides a forum for broad dissemination about possible opportunities in the laboratory.
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3.3 IDENTIFY THE TRANSFER VEHICLE

In addition to marketing and promoting the technology to potential partners, the T2 office should develop a transfer strategy and determine the transfer vehicle (i.e., CRADA, license, etc.) best suited to the technology, market, and audience. (A full discussion of technology transfer vehicles is provided in Section Four, Technology Transfer Mechanisms.) Considerations that should be taken into account when determining the most appropriate technology transfer vehicle include:

- Maturity of the technology
- Type of resources required for the development/commercialization effort
- Nature and status of the industry
- External economic factors
- Budgetary constraints
- Nature of the target audience.

3.4 EXECUTE THE TRANSFER—NEGOTIATING THE TECHNOLOGY TRANSFER AGREEMENT

The transfer phase of the technology transfer process begins when information about the technology is disseminated and the transfer strategy is implemented. In this phase, the technology transfer agreement (i.e., mechanism) is initiated, negotiated, and completed. Because a full discussion of the various technology transfer mechanisms is provided in Section Four, Technology Transfer Mechanisms, this section focuses on negotiating agreements that may be utilized to implement the transfer.

Whether the technology transfer vehicle is a license agreement, CRADA, partnership intermediary, or one of the other mechanisms identified and discussed in Section Four, negotiating an agreement with the private sector can be a complex process. Both federal and private-sector parties need to identify early in the process what they hope to gain from the agreement. Many factors that concern the laboratory, the technology, the potential partner, and the Government will need to be considered when negotiating an agreement that is advantageous to all parties. Some of these factors include:

- **Considerations for the laboratory**

- What is the relevance of the technology to the laboratory's mission?
- What are the benefits to and needs of the laboratory?
- What federal resources will be required? Will additional partners or contractors be needed?

- **Considerations regarding the technology**

- What is the stage of development of the technology?
- What resources will be required to bring it to commercialization?
- What additional "know-how" will be needed?
- What are the potential fields of use?
- What is the size of the market for the technology?

- **Considerations regarding the partner**

- What is the size of the partner (e.g., company, university, etc.) and what are its resources?

- What is its ability to develop, manufacture, market, and distribute the commercialized product?
 - What are the potential profits?
 - What is the need to protect proprietary data and to obtain a competitive advantage?
 - Are there trademark, copyright, or proprietary material opportunities?
- **Federal Government Concerns**—The federal government has unique concerns about the technology transfer process, including:
 - **U.S. Preference**—The Federal Technology Transfer Act of 1986 (P.L. 99-502) states that preference should be given to business units located in the United States, particularly companies that agree to manufacture the technology substantially in the United States. In order to ensure a maximum “payoff” on taxpayers’ investment in R&D, federal technology transfer policy is designed to ensure that U.S. business and U.S. workers receive preference in the commercialization of the technology. A waiver may be needed if the technology cannot be reasonably manufactured in the U.S.
 - **Special Consideration for Small Business**—The Federal Technology Transfer Act of 1986 mandates that special consideration be given to small businesses. Small businesses employ the majority of U.S. workers and are often more ready to accept risk and to innovate than larger companies. But small businesses generally do not have the R&D funds and other capital resources to commercialize technology, so giving consideration to the unique needs of small businesses is a concern for federal parties.
 - **Conflicts of Interest**—Before negotiating agreements, it is important to be familiar with local conflict-of-interest policies. Federal agencies and their laboratories are concerned with avoiding the appearance of impropriety in their dealings with private-sector parties. Generally, conflict-of-interest provisions regulate the employment of laboratory employees by private-sector parties, the acceptance of gratuities, and situations where inventors receive “undue gain” as a result of the position they hold in the federal laboratory. Legal interpretation of conflict-of-interest provisions as they apply to technology transfer negotiations may be needed.

- **Freedom of Information Requests**—The Freedom of Information Act (FOIA) of 1986 (P.L. 89-554) allows the public access to public records, including the results of federally funded R&D. Federal officials are required to respond to requests for information. In technology transfer activities, however, the private-sector party is unlikely to invest in commercializing a technology if its competitors have full access to knowledge about the technology. Certain provisions have been made in technology transfer legislation to protect data developed under a CRADA from disclosure for up to five years. However, it is important that private-sector parties mark as proprietary any data shared with federal parties that the private entity considers to be proprietary. It is also important that federal parties have procedures in place for protecting proprietary data provided by their private-sector partners. Invention disclosures and pending patent applications should be shared under a nondisclosure agreement; they are not de facto subject to FOIA.
 - **Freedom of Opportunity/Fairness of Opportunity**—Notice of opportunities should be made available to interested parties in as much detail as possible and to as wide an audience as possible. Avoiding the appearance of showing preference to a particular organization or individual is of concern to all federal laboratories and their agencies. It should be noted that when a GOGO laboratory agrees to grant an exclusive license, it is required to advertise that intent in the *Federal Register* prior to granting the license (this requirement does not apply to GOCO laboratories).
- **Private-Sector Concerns**—Private-sector concerns regarding involvement in technology transfer with the federal government include:
 - **Risk vs. Potential Return on Investment**—In assessing whether to proceed with the development of a new product or service, private-sector parties must weigh the potential risks of the situation. A low-risk opportunity would probably involve:
 - A realistic opportunity for potential profits
 - A need for a product that is widespread
 - A small investment to bring the technology to market
 - A high potential for a return on an investment.

Conversely, a high-risk situation might include:

- A small market niche
- A high investment to bring to the market
- A potential return on an investment that is low.

In order to weigh potential risk versus potential return on investment, private-sector parties will need to know:

- The potential lifetime of the technology
- The cost of development
- Ability to monopolize product sales
- Ability to obtain capital and the cost of that capital
- The extent of commitment of the federal parties, including potential government purchases of the product.

- **Speed of the Process**—The private sector often views federal laboratories as slow and bureaucratic. With technology developing so rapidly, the private-sector party is concerned with moving new technologies to the marketplace as quickly as possible. The private-sector party is also concerned about the level of effort required to come to an agreement with a federal laboratory.
- **Licensing**—The granting of a license may be exclusive, nonexclusive, or restricted to a particular field of use, and/or restricted to a particular geographic territory (partially exclusive). An exclusive license is generally preferable to the private-sector party because it keeps the competition from practicing the invention. Private-sector parties, however, may be very open to acquiring a license that is restricted to the particular field of use in which their company specializes or the specific geographic territory in which they do business (this is especially true when they see the costs of foreign patent protection).
- **State and Local Government Concerns**—State and local governments are interested in promoting new business in the community. Both are often willing to provide funds to foster the growth of new business; but funds are limited, and state and local governments must make decisions about where the greatest return on

investment to the community will occur. Additionally, state and local governments will be concerned with:

- Public perception
 - Potential environmental impacts
 - Potential creation of new jobs.
-

3.5 POST-TRANSFER ACTIVITIES: MONITORING AND ASSISTING PARTNERS

The post-transfer phase occurs after all negotiations are complete. During this phase the T2 office monitors the performance of the parties involved and ensures that the agreements of the transfer are implemented.

The T2 office role does not end when an agreement is successfully negotiated. Follow-up activities include:

- Maintaining a liaison role to ensure that the agreement is being successfully executed
- Resolving problems that arise
- Obtaining principles for renegotiating agreements if situations warrant
- Ensuring that the technology is being commercialized successfully
- Maintaining records of activities and sharing “lessons learned”
- Bringing additional government IP to the attention of the partner
- Introducing potential third-party partners for sublicensing or joint development.

In addition, there are many follow-on activities that the T2 office can utilize to help the laboratory’s commercial partner in its commercialization efforts. For instance, the formation of a “community of practice” linking the technology creators, the commercial partners, and the end-users can create fertile ground for future innovation. In the case of nonexclusive licensing, some groups are looking at creating a patent pool where all commercial partners can share their innovations with each other for free or for reduced compensation.

To bridge the “valley of death,”⁴ many federal labs are able to inject additional funding or research support to enable a commercial partner to move the technology forward. Sometimes the addition of additional intellectual property can enhance the commercial partner’s ability to raise capital.

⁴ The term “valley of death” usually refers to the transition from the technology creation phase to the early commercialization phase of product development.

Section Four

TECHNOLOGY TRANSFER

MECHANISMS

The laws, orders, and regulations that have been written to implement federal technology transfer have created or encouraged the development of various technology transfer mechanisms. Two of the most significant mechanisms are Cooperative Research and Development Agreements (CRADAs) and patent licenses. Other types of technology transfer mechanisms are common to all agencies, while others are unique to specific agencies. This section describes a number of the mechanisms that facilitate technology transfer efforts between federal laboratories and nonfederal entities, while providing a detailed focus on CRADAs and licensing. (Models/samples of many of these mechanisms utilized by various federal agencies and laboratories, including CRADAs and patent licenses, are available in the FLC Technology Transfer Mechanisms Matrix and the FLC Technology Transfer Mechanisms Database at <http://www.federallabs.org/education/t2mech/search/>.)

4.1 COOPERATIVE RESEARCH AND DEVELOPMENT AGREEMENTS (CRADAs)

CRADAs were authorized under the Federal Technology Transfer Act of 1986 (P.L. 99-502) and modified or extended by later legislation. (As currently written into law, the stipulations and requirements for a CRADA are contained in 15 USC 3710a.) They provide federal laboratories with an extremely flexible vehicle to facilitate the transfer of commercially useful technologies from federal laboratories to the nonfederal sector. Later legislation extended the use of CRADAs to federal research centers and GOCO laboratories. Thus, the primary purpose of CRADA legislation is to allow GOGO and GOCO laboratories to enter into collaborative agreements for technology transfer with all types of organizations. CRADAs allow one or more federal laboratories and one or more nonfederal parties (i.e., units of state or local government; industrial

organizations; public and private foundations; universities and other nonprofit organizations; and other persons, including individuals who are licensees of government-owned inventions) to enter into agreements to conduct specified research and development-related activities that are consistent with the laboratory's mission.

Although a CRADA is neither a procurement contract nor a grant, it is nevertheless a contract. Through CRADAs, a federal laboratory can commit resources such as personnel, facilities, equipment, intellectual property, or other resources (with or without reimbursement), **but not funds**, to the nonfederal party. The nonfederal party can commit similar resources, as well as funds, as part of the agreement. Because CRADAs are not subject to the terms of federal procurement contracts, Federal Acquisition Regulations (FARs) are not applicable. However, CRADAs should not be viewed as an alternative to normal federal procurement procedures.

CRADAs support the broader purpose of providing the means for a federal laboratory to leverage its R&D efforts consistent with the laboratory's mission. Through a CRADA, for example, a laboratory may gain access to outside expertise and facilities (and in some cases, funds) that can be used to further the mission goals of the laboratory. In addition, the commercialization efforts of the CRADA partner may result, via licenses, in royalty payments to the laboratory, as well as to the laboratory inventor(s).

The establishment of cooperative R&D efforts through a CRADA has perhaps the greatest possibility for long-term payoff of any technology transfer mechanism. An intimate working relationship between federal and commercial researchers will allow the federal side to understand commercial needs and allow ideas from the commercial sector to flow into federal laboratories. The ideal CRADA partner will be an innovative and entrepreneurial organization that can succeed in taking federal technology to a competitive market and that has the potential for inspiring innovation in the laboratory's mission work.

With regard to licensing, CRADAs can incorporate a wide variety of arrangements. In addition, CRADAs are sensitive to the needs of business organizations to protect commercially valuable information. Trade secrets or

confidential information supplied by a partner should not be disclosed. Information developed in whole or in part by government employees during the course of a CRADA can be protected from disclosure for up to five years.

4.1.1 Advantages of CRADAs

A CRADA provides both parties with a number of benefits, including:

- A means to leverage research budgets and optimize resources
- A means for sharing technical expertise, concepts, and information
- Protection from disclosure by the federal government of any proprietary information brought to the CRADA by the partner
- Ability for federal and nonfederal scientists and engineers to work together
- Access by the nonfederal partner to expertise in a wide-range of disciplines within the federal laboratory system
- Agreement by the partners to share intellectual property that results from the effort or agreement to the retention by one of the partners of an exclusive license to patentable research
- Protection of information resulting from the CRADA from disclosure under Freedom of Information Act requests for up to five years.

CRADAs offer many additional benefits to the laboratories, the laboratory scientist, and the private-sector partner.

- **For the laboratory**, the CRADA:

- Allows a flexible mechanism for transferring the results of federally funded R&D to the private sector.
- Allows private-sector parties to provide funds as well as other resources to assist with the commercialization of technology.
- Allows federal laboratories to get a percentage of the royalties generated as a result of commercialization.

- **For the laboratory scientist or engineer**, the CRADA:

- Affords an opportunity for federal personnel to provide expertise to private-sector parties in the commercialization of their work.

- Allows the inventing scientists or engineers to receive a percentage of the royalties generated as a result of commercialization of any subject invention(s).
- **For private-sector parties**, the CRADA:
 - Allows nonfederal partners an opportunity to obtain rights to commercialize the results of government or joint R&D.
 - Provides for effective leveraging of resources through a team effort.
 - Provides access to federal expertise.

4.1.2 Characteristics of CRADAs

The following characteristics distinguish CRADAs from other technology transfer mechanisms:

- The work must be consistent with the laboratory's mission.
- Federal laboratories cannot provide funds as part of the agreement, but private-sector parties may.
- CRADAs are not subject to the terms for procurement contracts.
- Special consideration is to be given to small businesses.
- Preference is to be given to private-party collaborators who agree that products embodying inventions made under the CRADA or produced through the use of such inventions will be manufactured substantially in the United States.
- CRADAs must contain provisions to control a variety of intellectual property issues such as data rights, property ownership, and rights to subject inventions made under the CRADA.
- Certain data resulting from the work can be protected for up to five years.
- At a minimum, the government must have a nonexclusive, nontransferrable, irrevocable, paid-up license for use by the government of any government invention or joint invention.

4.1.3 Establishing a CRADA

A CRADA can be originated from sources within or outside of the laboratory.

- **Laboratory-initiated CRADAs**—The most common CRADA development scenarios involve collaborations initiated by individuals in the laboratory. The following paragraphs describe some typical scenarios:
 - An individual in the laboratory sees the commercial potential (or public-use potential) for an invention or idea that originated in the laboratory and is able to identify a potential external partner. For inventions with commercial potential, one of the principal roles of the industry partner is to market the invention. Therefore, the laboratory should seek an industry partner with the right resources and industry position to successfully market the invention.
 - An individual in the laboratory has developed a new and original technology, but it is so new that there is no existing market demand. In this case, the inventor should seek an industry partner who will eventually stimulate a market. In projects of this sort, the protection of trade secrets and confidential information is particularly important to preserve the advantages of owning an original technology.
 - An individual in the laboratory knows or is aware of a private industry or academic organization that has unique resources that the laboratory needs or would like to use. In this situation, the laboratory creates, with this partner, a CRADA that will mutually benefit the laboratory and the partner.
- **Industry-initiated CRADAs**—CRADAs may also originate with the nonfederal partner. In a typical scenario, a business may have begun developing a product, but believes that a government laboratory has unique resources or innovative technology that could enhance the success of the product. In this case, the business organization approaches the federal laboratory with a proposal to either pay for the needed resources or offers the government some form of joint ownership or profit-sharing as the basis for cooperation.

4.1.4 Generic CRADA Development Process

If the potential exists for establishing a CRADA, it is important that personnel from the T2 office be involved in the process as early as possible. Technology transfer staff can provide much valuable information and assistance in this area. Because the basic process involved in originating

a CRADA and following it through to approval and implementation is generally similar across federal agencies, this handbook provides the following generic step-by-step outline to familiarize the technology transfer professional with the overall CRADA development process. However, because each agency and laboratory is free to develop its own CRADA model (and even within an agency or an individual laboratory the exact process may differ from place to place or over time), technology transfer personnel must ensure that they utilize their agency's specific wording and format for CRADAs where mandated.

The **generic** CRADA process, which is slightly different for GOGO and GOCO laboratories, comprises the following steps (see Figure 4-1):

- Define the concept
- Draft the CRADA
- Review the CRADA
- Conduct formal negotiations
- Obtain appropriate laboratory signatures
- Review and approval by agency
- Execute the CRADA
- Final Report on the CRADA.

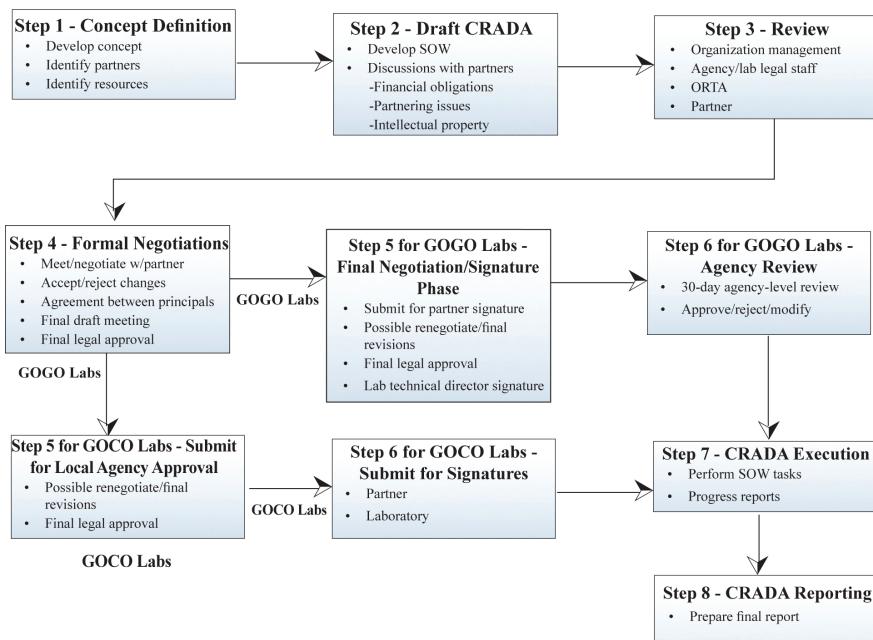


Figure 4-1. Generic CRADA Process

The technology transfer office usually oversees the entire process and can provide the Principal Investigators with the necessary documents and support to originate a CRADA. The following paragraphs provide a detailed description of the process, including the key role of the technology transfer office.

- Step 1: Concept Definition—The CRADA process usually starts with an individual in the laboratory who becomes the Principal Investigator (PI) for the project. If the idea for the CRADA originates within the laboratory, presumably the person with the idea is the PI. If the idea has originated outside of the laboratory, most likely the idea will be channeled to the T2 office from a PI in the laboratory with whom the outside entity has already discussed the concept.
 - PI (whether self-selected or assigned) develops the concept for the cooperative R&D project.
 - Technology transfer staff and PI coordinate and discuss the basic concept for the CRADA, the potential CRADA partner(s), and laboratory resources required to implement the CRADA.

- Technology transfer staff provides the PI with a CRADA information package (if available) consisting of a model CRADA used by the agency/laboratory, CRADA guidelines, and a CRADA checklist.
 - Technology transfer staff initiates contact with the laboratory/agency legal department.
- Step 2: Draft CRADA
 - Using the model CRADA provided by the technology transfer office, the PI identifies required information and drafts the preliminary Statement of Work (SOW).
 - Discussions are initiated with the potential partner regarding financial obligations, partnering issues, and intellectual property issues.
- Step 3: Review
 - Preliminary draft provided to the T2 office for review (after PI obtains organization management approval).
 - T2 office personnel ensure that the draft CRADA is reviewed by the laboratory/agency legal office.
 - T2 office tracks the progress of the potential CRADA internally.
 - The T2 office reviews the revised CRADA and provides the draft CRADA to the legal office for final review.
 - After legal office approval, the T2 office submits the draft CRADA to the potential partner for review.
- Step 4: Formal Negotiations
 - The T2 office convenes the laboratory negotiating team, which may consist of the PI, legal, management and technical personnel, and technology transfer office personnel.
 - The T2 office coordinates negotiations with the partner, which continue until there is a clear understanding and agreement between the laboratory and the partner regarding all terms of the CRADA, including intellectual property, the tasks outlined in the SOW, liability, resource commitments, etc.

- After negotiations, a final draft is prepared and forwarded to organization management, the T2 office, and the legal office for concurrence.
- Step 5 for **GOGO** Labs: Final Negotiations/Signature Phase
 - The technology transfer office coordinates final agency/laboratory approval and, after final approval by the legal office, submits the CRADA to the partner for signature. (Further negotiations with the partner may be required.)
 - After the copy signed by the partner has been returned, the T2 office attaches the laboratory concurrences and forwards the CRADA to the laboratory technical director for signature.
- Step 5 for **GOCO** Labs: Submit for Local Agency Approval
 - The T2 office submits the CRADA for final approval by the local agency and the partner.
 - The T2 office coordinates any required renegotiations with the partner.
 - After renegotiations, final revisions are made, and the final CRADA is prepared and forwarded to the legal office for final approval.
- Step 6 for **GOGO** Labs: Laboratory/Agency Review
 - After receiving approval from the laboratory technical director, the T2 office forwards copies to agency headquarters (usually the agency R&D head), legal office, organization management, research partner, and PI.
 - The agency R&D head has 30 days to act on the CRADA; actions may include approval, rejection, or request for modifications.
 - During this time, the T2 office manages the interface with the agency. If modifications are required, the process returns to Step 2.

- Step 6 for **GOCO** Labs: Submit for Signatures
 - After receiving final approval, the T2 office forwards the CRADA to the laboratory director and the partner for signature.
 - When the CRADA has been signed by both parties, it is ready to be executed.
- Step 7: CRADA Execution
 - When a CRADA is approved, the technology transfer office notifies the PI, organization management, legal office, and laboratory technical director.
 - The laboratory and partner then perform the cooperative R&D tasks outlined in the SOW according to the agreed-upon schedules.
 - The T2 office receives periodic progress reports from the PI and monitors the progress of the CRADA.
- Step 8: CRADA Reporting
 - When a CRADA is completed, the technology transfer office is often required to prepare a final report. The following is an outline of the information typically included in this report, although final reporting requirements are agency/lab-specific:
 - Description (Short, one paragraph narrative describing the project)
 - Timeline/Chronology (Note significant milestones and/or order of events)
 - Key Contacts (Include names, titles, address, phone, fax, email)
 - Project Summary (This narrative summary should include clear, concise descriptions of the project, including the technology, process, partner organization, laboratory, results and outcomes.)
 - Next Steps (List potential and/or suggested next steps, e.g., follow-up CRADA, patent, no further work anticipated.)
 - Benefits (Identify the benefits for all parties, potential users, and the public, i.e., why was this work important?)
 - Patent Applied for: Yes or No Date filed:

- License (List any licensing opportunities that have been identified.)
 - Publications (List all publications, titles of articles, dates and editions. Include copies or reference websites or other locations where material is available.)
 - Outreach Materials (List any outreach products, such as fact sheets, press releases, brochures, etc., created about this CRADA and include copies.)
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4.2 LICENSING OF INTELLECTUAL PROPERTY⁵

A license is a contract between a licensor (e.g., the holder or owner of a patent) and a licensee (e.g., an industry partner) that ensures the licensee that the licensor will not sue the licensee for patent infringement. In other words, the government agrees not to sue the industry partner for infringing the government's patent.

Licensing is the transfer of less-than-ownership rights to another party so that the other party can use the intellectual property. The licensing of government-owned patents is one of the tools used to promote the utilization and commercialization of inventions that arise from agency-supported R&D. The government may grant licenses to the private sector for the use of federally funded inventions, and the private sector may grant licenses to the government. For CRADAs, patent license agreements may be incorporated within the CRADAs and handled according to CRADA guidelines.

Before the government grants a license to a government patent, the industry partner must satisfy a number of conditions. The industry partner must supply the government with a satisfactory development or marketing plan, as well as information about its ability to implement the plan. The company must commercialize the invention within a specified period of time and must continue to make the benefits of the invention reasonably accessible to the public. The industry partner must report its utilization of the patent periodically to the government agency holding

⁵A full discussion of intellectual property protection and patents is provided in Section Five, Intellectual Property.

the patent. The government always retains an irrevocable royalty-free right to practice the invention. Preferably, licenses will be granted to companies that agree to substantially manufacture in the U.S. the product developed through the use of the invention. However, foreign licenses can be obtained.

4.2.1 Types of Licenses

The government may grant nonexclusive, partially exclusive, or exclusive licenses. **Nonexclusive** licenses are granted when participation by several companies offers better opportunities for the broad development and use of an invention or when an invention has already been substantially developed for commercial sale. **Nonexclusive** licenses may be granted without the publication of any notice. In general, nonexclusive licenses are preferred over exclusive licenses.

An **exclusive** or **partially exclusive** (e.g., limited to a field of use or geographic area) license grants the licensee the sole right to use, manufacture, and sell a patented article. When granting exclusive licenses, GOGO laboratories must publish in the *Federal Register* the notice of availability and the notice of intent to grant an exclusive license, and provide an opportunity for the public to respond. (Note: A partially exclusive license that is granted for a specific field of use (e.g., medicine) or for a particular geographic area allows the government to grant more than one license for that invention.)

For GOCO laboratories, the contractor organization implements similar licensing arrangements, but without the need to publish a notice in the *Federal Register*.

An exclusive or partially exclusive license can be granted if the following conditions are met (see 35 USC 209 and 37 CFR 404):

- If the licensing laboratory is a GOGO laboratory, a notice is published in the *Federal Register* of the invention's availability 15 days prior to the grant or without such notice where the federal agency, laboratory director, or designee determines that expeditious granting of such a license will best serve the federal government and the public interest.

- After any objections have been considered, the laboratory director determines that the license is still in the public interest, the desired application will not be readily achieved under a nonexclusive license, the license is a reasonable incentive to attract the investment of risk capital or otherwise promote the utilization of the invention, and the terms of the license are no more than reasonably necessary.
- No determination has been made that the license will substantially lessen competition, result in any undue concentration in any section of the country in a line of commerce, or create a situation inconsistent with antitrust laws.
- First preference is given to small business firms that are capable of bringing the invention to practical application.
- The government retains an irrevocable royalty-free right to practice the invention or to have it practiced on its behalf.
- The federal agency, laboratory director, or designee reserves the right to require the licensee to grant sublicenses when necessary to fulfill health or safety needs.

Whatever licensing arrangement (i.e., nonexclusive, exclusive, or partially exclusive) is made, the government must retain a nonexclusive, royalty free, paid-up right to practice the invention for government use.

The licensing of inventions arising under a CRADA must follow CRADA guidelines on licensing; however, the notice requirement in the *Federal Register* is waived.

4.2.2 Licensing From the Private Sector to the Laboratory

The government acquires licenses to software and other intellectual property through contracts that specify limitations concerning use, copying, transfer, and disclosure. All laboratory employees are bound to follow these agreements, and they should ensure that information or materials received are clearly marked with any restrictions that apply.

The laboratory and the individual may be held liable for violating the terms of the intellectual property agreements. The government routinely conducts audits to ensure that unauthorized software is not being used on government equipment.

4.2.3 Terminating a License

All licenses include the right of the federal agency, laboratory director, or designee to either partially or fully terminate a license agreement. Termination may occur if the laboratory director determines that the licensee is not executing the plan submitted with the license request and cannot demonstrate that it is able to achieve practical application of the invention within a reasonable time.

Other reasons for termination include public use requirements that might be stipulated in any subsequent federal legislation, or the licensee willfully made a false statement (or omitted a material fact) in the license application, or commits a substantial breach of the agreement contained in the license.

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4.3 ROYALTIES AND FEES

Licensing fees or royalties are determined based on the type of license awarded and its value to the development of the commercial product. They represent compensation for the use of intellectual property.

In arriving at a reasonable compensation figure, criteria to consider include the type of license being granted, the investment of the government and the licensee, the associated risks, the markets to be exploited, and the value of the potential products.

Licensing fees can include upfront fees, maintenance fees, milestone payments, royalties, or any combination of these.

Upfront fees represent one-time earnest money and reimbursement for the expenses involved in consummating the license. Royalties are payments based on sales or turnover of licensed products that may or may not include an annual minimum amount.

4.3.1 Royalty Rates

Royalty rates are generally established by negotiation between the federal laboratory and the private sector licensee; they vary considerably depending on the invention that is being licensed. Royalties can be based

on net sales of licensed products, the number of units of licensed products sold, or any other basis that is appropriate for a particular invention and acceptable to both parties. The specific royalty rate is most often based on the projected market value of the licensed products. Historical studies of royalty rates have shown that there are normal ranges for each industry sector and that these ranges correlate well with the expected gross profit margin of similar products sold in a specific industry sector.

The government policy on royalty rate negotiation basically involves arriving at a reasonable compensation that will best accomplish the success of the transferred product or process in the marketplace, using the best commercial licensing practice. If the rate is too high, it will serve as a disincentive for the private-sector licensee to make the investments necessary for product development and technology transfer. On the other hand, the intellectual property owner is entitled to fair market value for the rights granted, especially if the license is exclusive or partially exclusive. As with other business transactions, fair market value is ordinarily determined as the result of negotiations between a willing buyer and a willing seller.

In addition to the projected gross profit margin, many other factors may be weighed by the participants in royalty rate negotiations, including the value of the invention (e.g., is the invention a major breakthrough that will confer substantial marketplace advantages), the costs to bring the invention to the marketplace, the market potential of the invention, alternative methods that could be employed without using the invention, the need for post-sales support of the product, whether or not a long-term market exists, and the perceived effects of the terms and conditions of the license.

4.3.2 Fixed Payment Fees

In some cases, royalty rates may be difficult to establish because of the nature of the invention, and fixed fees or payments may be more appropriate. For example, if the invention is a process or method, or is used internally by a licensee, there may be no direct link between the sales price of individual items and the invention. In these cases, it may be possible to negotiate a fixed amount to be paid, regardless of sales volume or any other variable measure.

4.3.3 Distribution of Income

As required by federal technology transfer legislation, specific incentives are in place to encourage government employees to participate in the technology transfer process. Specifically, government employees who invent are entitled to a share of license revenues received by the federal agency from licensing their invention.

According to 15 USC 3710c, a federal agency must pay the first \$2,000 per year in license income and a minimum of 15 percent of the yearly income thereafter from all inventions to the inventors. Within this guideline, each agency is permitted to enact its own sharing scheme. However, the maximum that a single inventor can receive per year is \$150,000. Any residual funds are usually distributed to the activity where the intellectual property was developed. A laboratory or R&D center that receives income from technology transfer activities must use it to provide awards to other science and technology personnel in the laboratory who contributed to the invention, further research, or support the technology transfer program.

4.3.4 Incentive Awards

Federal technology transfer legislation contains provisions for awards to government employees who actively participate in technology transfer, e.g., through the creation of intellectual property that can be used by the private sector. The government recognizes that the requirements to cooperate with the private sector and provide help to nonfederal agencies represent a change in culture for most federal R&D activities. To facilitate this change, many agencies provide invention awards for accomplishments in domestic technology transfer and technical assistance. These are often cash incentive awards that are granted in recognition of an employee's invention that resulted in the filing of a patent application, the grant of a U.S. patent, or the licensing of a patent application or patent.

4.4 OTHER TECHNOLOGY TRANSFER MECHANISMS

In addition to CRADAs and licensing intellectual property, there are a significant number of other contractual or informal methods utilized

by federal laboratories to facilitate technology transfer depending on the statutory authority available to the relevant agency (see the *FLC Technology Transfer Mechanisms* database on the FLC website [<http://www.federallabs.org/education/t2mech/search/>] for a more extensive listing of the mechanisms and the applicable statutory authority.) Some of these mechanisms include:

- **Alliances**—These are informal tools that allow a federal laboratory to enter into a Memorandum of Understanding (MOU) with other organizations to pursue common technology interests. Alliances enhance the technical capabilities of partners and facilities, and are implemented by a nonbinding document that outlines the principles of the alliance.
- **Collegial Interchange, Conferences, and Publications**—Collegial interchange is the informal and free exchange of information among colleagues; it is a basic mechanism for technology transfer. Presentations at professional and technical conferences concerning results of research and development or discussions of work in progress are considered mechanisms of technology transfer. Conference presentations are often published and distributed to conference attendees. Government research and development results are often published in professional journals to share information with others having similar interests. Caution should be taken in all of these exchanges not to disclose information prematurely if the results of the research may result in a patent application or if other proprietary data are involved.
- **Consulting to the Laboratory**—Consulting services to the laboratory are procured by means of a contract. These contracts are generally for a specific period of time and involve a well-defined scope of work.
- **Consulting by Laboratory Personnel**—In certain cases, nonfederal personnel in GOCO laboratories may provide consulting to a private-sector party to further the technology transfer process. The laboratory must approve these arrangements to ensure that there are neither conflicts of interest nor potential intellectual property concerns. (Federal employees in GOGO laboratories may consult to a private-sector party via a CRADA.)

- **Incubators**—An incubator is a multi-tenant business development facility for startup companies. During the time the startup company is physically located in the incubator facilities, the sponsor (i.e., state or local business community) can assist the company with technical and managerial aspects. After a certain length of time, though, the company is expected to move to a new location where it can function on its own.
- **Informational Materials**—Various mechanisms are used to implement technology transfer awareness among laboratory personnel and potential partners in the private sector, academia, and other government agencies. These may include presentations, newsletters, brochures and pamphlets, electronic and collateral materials, and Internet websites. (Note: Examples of these types of informational materials are available on the FLC website at www.federallabs.org.)
- **Memorandum of Understanding (MOU) and Memorandum of Agreement (MOA)**—An MOU or MOA is an agreement between two government, academic, or private-sector partners (e.g., government, university, or private sector, including nonprofits). In a number of cases, MOUs have been used to establish the organizational links in technology transfer efforts.
- **Partnership Intermediary Agreements (PIA)**—Affiliated with a state or local government, a partnership intermediary assists companies with utilizing federal technology, provides assistance to technology transfer offices, and serves as a technology broker (see 15 USC 3715). A partnership intermediary relationship is normally implemented via a contract or an MOU.
- **Personnel Exchange Programs**—Exchange programs provide for a transfer of personnel, either to the laboratory from another party or from the laboratory to another party. These arrangements are generally for the purpose of exchanging expertise and information. Exchanges of laboratory personnel to the private sector and private-sector personnel to the laboratory to exchange expertise and information can enhance the knowledge, expertise, and research of both parties, and are excellent first steps toward long-term alliances between federal R&D facilities and U.S. industry. Generally, no proprietary data are exchanged, the cost is paid by the organization sending the personnel, and the programs are short-term (usually one year).

- **Small Business Innovation Research (SBIR)**—The SBIR Program (www.sba.gov/sbir) was originally authorized in 1982 and reauthorized through 2008 by the Small Business Research and Development Enhancement Act of 2000. SBIR is a highly competitive program designed to encourage the commercialization of products and processes developed by small businesses through federal funds. Each year, 11 federal departments and agencies are required to reserve a portion of their R&D budgets for SBIR awards. These agencies designate SBIR R&D topics and accept proposals. SBIR awards or grants are awarded competitively to small U.S.-owned commercial businesses with less than 500 employees that submit proposals addressing topics published by the agencies. Following the submission of proposals, agencies make SBIR awards based on small business qualification, degree of innovation, technical merit, and future market potential. Small businesses that receive awards or grants then begin a three-phase program. The SBIR Program provides two years of confidentiality for data created in the program, and the contractor obtains title to the inventions. For more information on the SBIR program, visit the Small Business Administration's (SBA) SBIR/STTR website at www.sba.gov/sbir or contact the SBA Office of Technology at (202) 205-6450.
- **Small Business Technology Transfer (STTR)**—Authorized in 1992, STTR is a three-phase program similar in many ways to the SBIR program (see above). The key differences are that STTR funding is available only from five agencies and award applicants must be collaborative partnerships involving a small business and a U.S.-located college or university, nonprofit research organization, or federally funded research center. The designated agencies select R&D topics, accept proposals, and award grants for a three-phase program that mirrors the SBIR program. Awards are based on small business/nonprofit research institution qualifications, degree of innovation, and future market potential. The STTR program provides early-stage R&D funding directly to small companies working cooperatively with researchers at other research institutions. The objectives of the STTR program are to bridge the funding gap between basic research and commercial products, and to provide a way for researchers to pursue commercial applications of technologies. For more information about the STTR Program, visit the SBA SBIR/STTR website (www.sba.gov/sbir) or call the SBA Office of Technology at 202-205-6450.

- **Technical Assistance**—Technical assistance allows the laboratory or facility to provide knowledge, specialized equipment, and facilities to be used for promoting U.S. competitiveness. Technical assistance agreements allow government scientists and engineers to provide nonfederal parties assistance, with or without a fee, that may be as simple as providing information over the phone or as involved as spending a few days onsite.
- **Use of User Facilities**—Laboratory facilities designated by the government as “user facilities” contain unique, complex, experimental scientific equipment and expertise that are not readily available in the private sector. The government allows the use of user facilities by the technical community, universities, industry, and other federal laboratories and centers to conduct specified research. The research may be proprietary or nonproprietary in nature, and intellectual property provisions must be detailed in the agreement.
- **Nonfederal Work for Others**—Many agencies have statutory authority to sell services (including engineering and research services) that are not available in the private sector. This allows the private sector to tap into the intellectual knowledge of federal employees without requiring the collaborative activity of a CRADA.
- **Others**—Many other mechanisms are available, some on an agency-by-agency basis, that technology transfer practitioners use in accomplishing their technology transfer mission. These include tools such as clinical trial agreements, commercial evaluation license agreements, educational partnership agreements, material transfer agreements, Space Act agreements, and many more.

More detailed information on the tools available to each agency is provided in the Federal Technology Transfer Mechanisms Database, which is available on the FLC website at <http://www.federallabs.org/education/t2mech/search/>.

Section Five

INTELLECTUAL PROPERTY

Intellectual property can be a major issue in technology transfer. This section addresses intellectual property, with special attention to the patent process—from applying for a patent to licensing a patented product. The subject of intellectual property—and patents, copyrights and licensing, in particular—is immense and requires considerable legal expertise to cover thoroughly. Clearly, this section cannot cover all of the details of intellectual property, but it does provide a basic introduction so appropriate legal advice can be sought when the need arises.

The main topics in this section are:

- What intellectual property is and why it is important
 - Patent issues
 - Copyrights, mask works, trademarks, trade secrets
 - Protecting proprietary information.
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5.1 WHAT INTELLECTUAL PROPERTY IS

Intellectual (i.e., intangible) assets include products of the human intellect—such as inventions, discoveries, technologies, creations, developments, or other forms of expressing an idea—whether or not the subject matter is protectable under the laws governing the different forms of intellectual property. Intellectual property is that subset of intellectual assets that can be legally protected, and is defined by the forms of protection that have been enacted into law. The major forms of protection are patents, plant variety protection certificates, copyrights, trade secrets, and trademarks. Just as our legal system provides rights and protection for owners of real (i.e., tangible) property such as real estate, it also provides rights and protection to owners of intellectual property. The intangible right to intellectual property can be bought, sold, leased, rented, or otherwise transferred between parties. The transfer of intellectual property rights can affect the marketability of a product, as well as the selection of a producer or manufacturer of a product;

therefore, the right to intellectual property often involves considerable discussion among the parties in a technology transfer endeavor.

5.2 WHY INTELLECTUAL PROPERTY IS IMPORTANT

On the macro level, intellectual property plays a tremendously important role in our industrialized world. Continuation of our high standard of living depends to no small degree on scientific and technical advances. Systems that protect intellectual property rights (particularly patents) help incentivize investment in the inventive and creative activities that lead to those scientific and technical advances becoming commercialized.

In addition, a system that provides for intellectual property rights and protections also establishes a method to protect personal recognition for important creative and inventive contributions. The possibility of being recognized for an important contribution, and its accompanying prestige, often act as a powerful motivator for the would-be writer or inventor. For example, the copyright or patent helps establish the genius responsible for that Nobel Prize-winning book or important medical breakthrough.

The path from inception to the commercialization of new technology generally requires the investment of significant financial, time, research, development, manufacturing, and marketing resources. Each step on this path holds significant risk of failure. The costs for these various resources are great enough that the finances necessary to go forward usually must come from investors other than the inventor. Potential investors in the new technology will want as much assurance of potential success as possible before risking their money.

For example, the patent system gives the patent holder an advantage against competitors by excluding the competitors from certain technological avenues of competition for a limited period of time. Knowing that the competitors cannot legally use the patented technology, potential investors have a greater incentive to take a risk with their money and other resources to support bringing the new

product to market. Ultimately, upon successful commercialization of the technology, the intellectual property of a company becomes one of its top assets.

5.3 ROLE OF INTELLECTUAL PROPERTY IN TECHNOLOGY TRANSFER

To obtain the maximum benefits from the federal R&D investment, Congress has determined that, whenever appropriate, federally owned or originated R&D technology should be transferred to private industry, state and local governments, and universities for commercialization. This technology transfer process uses knowledge, facilities, or capabilities developed under federal funding to fulfill public or private domestic needs. A key element of this effort is to capitalize on the intellectual property resulting from R&D activities at federal agencies by encouraging employees to patent their inventions, seeking potential licensing partners who will commercialize these inventions, and developing CRADAs with private industry, universities, and state or local governments.

5.3.1 Intellectual Property and CRADAs

The U.S. Code provides guidelines for the treatment of intellectual property within a CRADA. The allocation of intellectual property rights should be structured to achieve the goal of transferring technology from the laboratory to the private sector. That goal is most likely to be achieved when intellectual property rights are placed in the hands of the private sector and when the private sector is given some measure of exclusivity for a reasonable period of time and for specified fields of use or market segments.

In the case of inventions, there may be background patents, as well as patents that arise from the CRADA effort. For background patents, that is, patents that existed before the creation of the CRADA, the guiding principle is to promote technology transfer. If the background patents are owned by the government, the patents may be licensed to the partner, perhaps on an exclusive basis subject to 35 USC 209. If the background patents are owned by the partner, government use for the purpose of procurement or research on a royalty-free basis should be negotiated.

For patents and other intellectual property arising from the CRADA effort, there are three cases to consider: government employees as sole inventors, jointly invented intellectual property, and the partner's employees as sole inventors. In the first two cases, whenever a government employee is involved as an inventor, the guiding principle is that the inventions should be made available to the partner on reasonable terms and conditions. Depending on situation, this might entail the federal laboratory either licensing or assigning rights to the partner. In both cases, the government retains a nonexclusive license to use the invention for government purposes.

When the partner's employee is the sole inventor, the government should normally not be required to pay royalties for use, and generally the partner should be able to retain all other rights for patents, copyrights, and technical data that its employees invent with the CRADA. In addition, the government normally retains a nonexclusive license to use the invention for government purposes.

Overall, the intent is to serve the public good, and the government recognizes that a successful commercial product resulting from a CRADA may be more beneficial to the public interest than trying to maximize near-term payback to the government.

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5.4 PATENTS

5.4.1 What Is a Patent?

A patent for an invention is a grant of a property right by the government to the inventor, who may assign his or her rights to others. It gives the owner of the patent the right, among other things, to exclude anyone else from making, using, or selling the invention for the life of the patent. Patents are issued by the United States Patent and Trademark Office (USPTO) and are valid throughout the United States. If patent protection is desired in other countries, applications must be filed in those countries, where laws and regulations governing the patent application process may differ from those in the U.S.

As written documents, patents have a distinctive style. The first part contains the title, a list of any related application data, and a list of references (usually other patents). The text of the patent may be divided into sections describing the technical field, background art (i.e., the relevant technology that is previously known), a summary, a detailed description, claims, abstract, and drawings, where applicable. The “claims” constitute the heart of the patent. The claims consist of a numbered list of items, written in legal style, that constitute what is covered by the patent.

The level of detail required in a patent is such that someone “skilled in the art” must be able to make and use the invention. This means that anyone who is technically proficient in the technology area represented by the invention must be able to understand from the patent exactly how the invention works and how it is to be constructed.

5.4.2 Who Is an Inventor?

An inventor is someone who comes up with something new and useful that somebody wants. His or her invention may lead to a patent or may be held as proprietary materials or methods. To be an inventor on a patent, a person must have conceived some or all of the invention. “Conception” is the formation in the inventor’s mind of a definite and permanent idea of the complete and operative invention, as it is thereafter to be applied in practice and as claimed in the patent. More than one inventor can be listed on a patent application. Performing work at the direction of others (“being a pair of hands”) or performing work that is not inventive does not qualify one as an inventor.

5.4.3 Provisional Patent Application

U.S. law permits filing for provisional patent applications (35 USC 111(b) and 119 (e)). Filing a provisional patent application in the U.S. permits the establishment of an initial “effective, or priority, filing date,” but which does not serve as the basis for measuring the 20-year term of patent protection. Provisional patent applications serve several purposes. First, they can protect an invention against a conflicting patent by establishing an earlier filing date, that is, against a claim that “prior art” bars the invention from being patented. Second, because the rest of the world’s

patent systems bar patents for inventions that have been previously disclosed publicly, a provisional patent application allows the inventors to publish or give presentations on their inventions without a threat of losing patentability.

The provisional application must fully describe (enable) the invention and contain a complete written description of the invention, any necessary drawings, and the required filing fee, but—unlike a complete patent application—does not have to contain claims, an oath, or declaration. The provisional application is kept in confidence by the USPTO, will not be examined, cannot mature into a U.S. patent, and will expire 12 months after the filing date. To begin the patent application examination procedure, the inventor must file, within 12 months of the filing date of the provisional application, a complete patent application that references the provisional application the inventor wishes to rely on for the “effective filing date.” An inventor may convert an existing patent application into a provisional application within 12 months of filing the regular patent application, but then must file another regular application, also within the 12-month period, before the examination can proceed.

However, the 20-year life of the patent begins from the filing date of the regular patent application—not the provisional application.

5.4.4 Types of Patents

There are three types of nonprovisional U.S. patents, as follows:

- Utility—The most common kind, they cover virtually any inventions that are useful.
- Design—Cover the unique shape or ornamental appearance of an object, such as hockey uniforms, ladies’ dresses, computer housings, automobile bodies, buildings, shoes, game boards, etc.
- Plant—Cover asexually reproducible plants such as flowers and fruit trees.

In addition, the Plant Variety Protection Act covers sexually propagated varieties such as soybeans and tubers such as potatoes. The owner of a Plant Variety Protection Certificate (PVPC) has the right to exclude others from multiplying, selling, importing and exporting, and stocking

the protected variety. However, the protected variety may be used to breed new varieties. Farmers may both sell seed of the protected variety as a commodity (for use in food or feed) and save seed to be used in the production of a crop for use on their own farms.

5.4.5 What to Patent

The patent statutes (35 USC 101) state that whoever invents or discovers any new and useful process, machine, manufacture or composition of matter, or any new and useful improvement to these categories may obtain a patent (subject to the conditions discussed below). This means that patentable subject matter includes any new and useful:

- Industrial, business, or technical process or method
- Machine
- Article that is made, including all manufactured articles
- Chemical compositions, including mixtures of ingredients and new chemical compounds
- Improvements, including new uses of old devices or new combinations of well-known components
- Software
- Biological materials.

Although these classes are quite broad, a few subject matter areas are generally not patentable, including:

- Printed matter
- Purely scientific or mathematical principles
- Physical phenomena (e.g., electricity or magnetism)
- Abstract ideas
- Laws of nature.

There is a special category for patent applications on classified inventions that are held secret until declassified. As times and technology change, the range of things that can be patented can also change. The question of patentability is constantly being reinterpreted by the courts.

5.4.6 Key Patent Conditions

The key conditions required to obtain a patent are that the invention must differ from prior art, not be obvious to someone of ordinary skill in the art, and must have utility. As stated in 35 USC 102-103, a patent cannot be obtained if:

- The invention was previously known; or
- The invention does not have utility; or
- The invention was described in print or patented anywhere, or was in public use or on sale in the U.S. more than a year before the date of a provisional application; or
- The invention had previously been made in the U.S. by someone else who did not conceal it.

The differences between the subject matter to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time to a person having ordinary skill in the art.

5.4.7 Who Can Apply

In the United States, a patent application can be filed only by the inventor or on behalf of the inventor, who must be an individual or a group of individuals (co-inventors). The inventor cannot be a corporation, partnership, joint venture, or other business entity. In other words, a patent can only be granted to a real person. An inventor may, however, assign his or her rights in the patent to other individuals or to legal entities such as corporations or the government. Even though the inventor sells or assigns the patent rights to someone else, such as an employer, the application must still be filed in the name of the individual inventor(s). Usually, when an invention is created as part of an employee's duties, the rights must be assigned to the employer as part of the terms and conditions for employment.

There are no personal qualifications for being an inventor. Anyone, regardless of age, nationality, mental competency, or any other characteristic may apply, so long as he or she is the true inventor.

5.4.8 Protection Provided by Patents

A patent gives the owner the right to prevent others from making, using, or selling the invention. If an individual or corporation is making, using or selling an invention (or an essential part of it) without the patent owner's permission, the patent owner may file a lawsuit. For government-owned patents, it is up to the Department of Justice to enforce the government's rights. However, the right of enforcement may be granted to licensees (35 USC 207(a)(2)). The patent owner may obtain an injunction against the infringer of the patent, ordering the infringer not to make, use, or sell the invention for the life of the patent. The patent owner may also be awarded monetary damages. A joint owner of a U.S. patent may make, use, or sell the invention, or any interest in the invention, without regard to the other owner(s) and without regard to the size of the joint owner's share in the patent, unless there is some other contract stating otherwise.

With respect to patent violations by the U.S. government or a contractor working for the government, a patent holder cannot prevent the government from infringing a patent; however, he/she can sue the government for reasonable compensation (28 USC 1498).

5.4.9 Patent Application Timing

Timing is critical when filing a patent application. In the U.S., a provisional or nonprovisional patent application must be filed within one year of the first printed publication, public use, sale or offer for sale of the invention; otherwise, the opportunity to obtain a patent is lost. In most other countries, the application must be filed before any public disclosure of the invention, meaning that there is no grace period between the first public disclosure and the date the application is filed. Regardless of the grace period in the U.S., premature public disclosure of an invention should be avoided. Patent review should be obtained from legal counsel or the Technology Transfer Office to protect the invention before it is publicly disclosed.

The time required to review a patent at the USPTO is at least two years in the U.S. In many cases applications are rejected, modified, and

resubmitted—either within a single application process or as a related series of applications. Rejected applications are eligible for an appeals process.

A patent application is published within 18 months of the priority date unless the applicant agrees not to foreign file. The priority date is the earliest filing date of a patent application or the filing date of a provisional application (see above) upon which the actual patent application is based. In any case, after the patent is issued, the USPTO publishes the specifications and accompanying drawings. Summaries of every patent are published each week in the Official Gazette of the USPTO. Online searches for issued patents and published patent applications can be conducted on the USPTO website at www.uspto.gov/patft.

5.4.10 Foreign Patents

The value of filing a foreign patent application for an invention can be a difficult issue to determine. Foreign patents may be valuable if the international markets for a given technology are large. On the other hand, the cost and efforts to secure foreign patents can be greater than the eventual returns (i.e., royalties or license fees) because it is necessary to file and prosecute a patent application for each country or group of countries in which the patent owner is seeking patent rights.

A United States patent is only effective in the United States, its territories and possessions. Therefore, in order to acquire protection in other countries, patent applications must be filed directly in those countries or under regional patent application systems that include those countries. Those regional arrangements include the European Patent Convention (EPC), which cover most but not all European countries; the African Regional Industrial Property Organization (ARIPO); the African Intellectual Property Organization (OAPI); and the Eurasian Patent Convention (EAPC). Furthermore, a Patent Cooperation Treaty Application (PCTA) may be filed to delay the actual patent filing in a foreign country or region and therefore substantially delay the costs associated with foreign filing. However, the patent owner or inventor must still file applications with the countries from which patent protection is sought.

In addition, the Patent Cooperation Treaty (PCT) provides an applicant the ability to file a consolidated patent application effective in a substantial number of countries by a single application (in English) and later converted into a national patent application.

As previously mentioned, the laws and regulations for patent applications can vary widely in other countries. Most countries, for example, do not provide a one-year grace period between the time of first public disclosure and the date of the patent application. If the patent owner intends to apply for foreign patents or wants to keep the option of a foreign patent available, he or she must adhere to foreign rules, even though U.S. regulations may not be as stringent.

In many cases, federal laboratories do not apply for foreign patents because the costs are judged to be greater than the benefits.

However, by agreement with foreign defense agencies, DOD-owned inventions may be offered for filing by those agencies in their countries. In return for the effort and expense of such filing, the foreign government receives a royalty-free, nonexclusive license to practice the invention under the foreign patent. Federal laboratories may consult with licensees to determine whether patent rights may be commercially valuable in other countries.

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5.5 HOW TO PATENT AN INVENTION

Before beginning the patent application process (see Figure 5-1), the inventor should be aware of what may be required for a patent application and prepare accordingly. In particular, maintenance of a laboratory notebook during the invention process is a primary requirement. Information contained in the laboratory notebook can be important later in the invention process (e.g., to prove the dates on which something was done). It is also in the inventor's best interest to be well acquainted with the prior art—both during the invention process and when beginning the formal application process. Finally, the inventor is responsible for filling in the necessary forms when initiating an application.

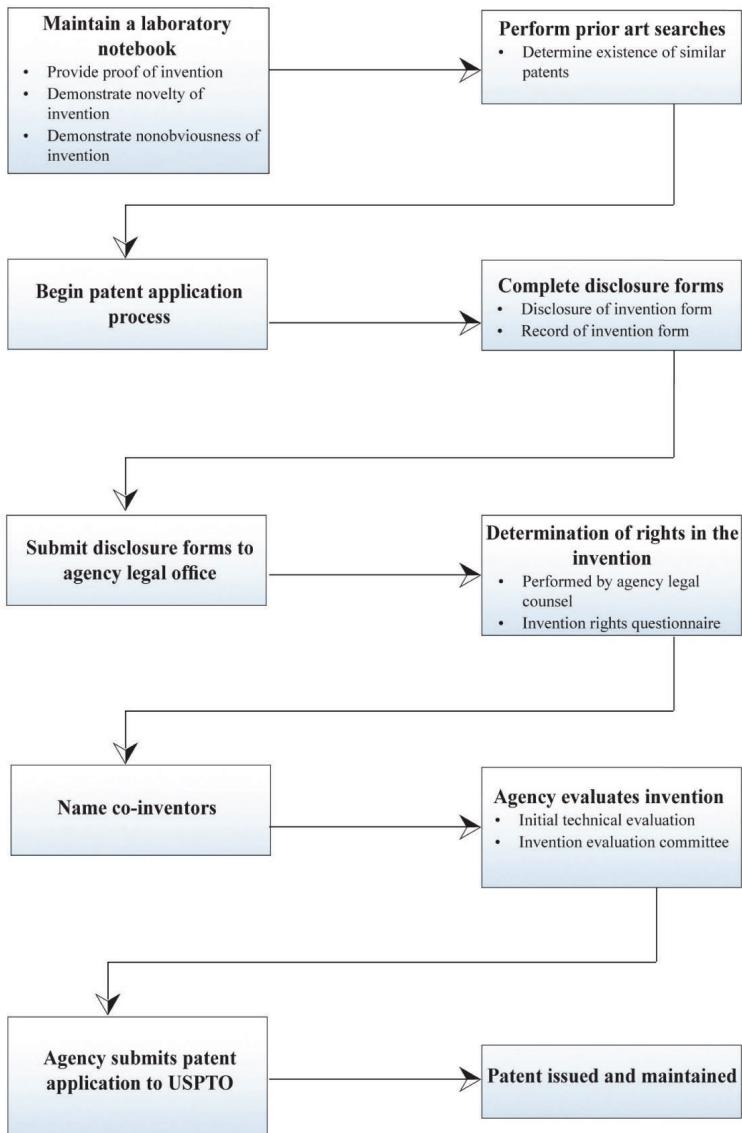


Figure 5-1. Patent Process Overview

5.5.1 Purpose of the Laboratory Notebook

A laboratory notebook, when properly filled out, is a useful record of all original work in a form that is acceptable as evidence in the event

legal conflicts arise concerning the patent application or, later, the patent itself. When properly documented, dated and witnessed, the entries in a laboratory notebook may:

- Provide proof of who is the first inventor.
- Demonstrate the novelty of the invention by proving that the invention was made before any publicly known or available prior developments or concepts.
- Demonstrate that the invention is not obvious (entries showing false leads and negative results are often used to prove that an invention was not obvious at the time).
- Alert patent attorneys to potential statutory problems (e.g., meeting the deadline to file an application within one year of a public disclosure).

5.5.2 How to Keep a Laboratory Notebook

(Note: Industries and government organizations are moving toward the implementation of electronic laboratory notebooks. Some are using dual systems, with a goal of going completely electronic. The information below applies to non-electronic notebooks.)

There is no specific format for the laboratory notebook; however, it is preferred that the notebook be bound and contain prenumbered pages. When using the laboratory notebook, keep the following guidelines in mind:

- Record data directly into the notebook; do not make notes on loose paper for later recopying.
- To show reduction to practice of invention, an entry should describe the purpose of an experiment or test, the method or means chosen to perform it, and the results obtained—both favorable and unfavorable.
- Entries should record all ideas, experiments and tests, as well as related activities such as conferences and the making of test equipment.
- Do not erase any part of an entry; instead, draw a line through the material to be deleted.
- Always make entries in ink to avoid any suspicion of alterations.

- Use pages in numeric order.
- Keep the notebook intact—do not tear pages out or remove affixed material.
- Do not leave blank pages or portions of pages without drawing a line through the blank area.
- If material is affixed to a page, such as taping in a sketch, sign and date the affixed material so that the signature is partially on the notebook page and partially on the affixed material. (The practice of affixing material should be reserved for material that cannot be written directly on the notebook page.)
- Entries should be in chronological order.
- Separate sheets and photographs affixed to pages should be referred to in a notebook entry.
- Separate sheets describing an important idea, experiment, or test should be witnessed.
- Do not change or revise drawings in the notebook; make new ones.
- Initial and date any corrections.
- Sign and date each page of the laboratory notebook as it is completed.
- Joint work should be signed by all contributors, and the text should indicate which work is attributable to which inventor.
- Any entry that relates to a possible patentable invention should be signed and dated by two witnesses who can understand the nature of the invention, with their signatures under a caption saying “performance observed and understood by.”
- Promptly prepare an invention disclosure for anything new or unexpected that is likely to lead to a patentable invention.

5.5.3 Prior Art Searches

Having an understanding of prior art, including similar patents for related inventions, can help a prospective inventor better understand the position of a proposed invention with respect to its prospects for obtaining a patent, and may even trigger ideas for technical improvements in one’s own work. In some cases, where the inventor is so familiar

with an industry or technical field, or is on the threshold of an emerging technology, it may not be necessary to conduct a formal prior art search through the existing patent database. (Online searches may be conducted at www.uspto.gov/patft.)

5.5.4 Disclosure Forms

Once a prospective inventor determines that he or she would like to begin the process of seeking a patent, the appropriate disclosure forms should promptly be completed and submitted to the appropriate agency/laboratory office, which can also provide the forms.

Procedures vary in each agency, but the inventor will usually need to complete at least two forms:

- Disclosure of Invention Form—Provides a detailed description of the invention. It should include enough information to ensure that reviewers have a clear understanding of what the invention entails.
- Record of Invention Form—Basically provides the inventor's name(s) and dates, and is primarily concerned with documenting the history of the invention.

Detailed instructions for completing these forms are provided with the forms.

Copies of pertinent laboratory notebook pages, if available, should be provided with the invention disclosure forms.

5.5.5 Invention Rights

Whenever an invention is made by a government employee, the rights of the government and the inventor depend upon the facts under which the invention is made. Depending upon such facts, there are three possible outcomes:

- The government will be entitled to all rights and the inventor to none, and the inventor assigns the patent rights to the government.⁶

⁶For GOCO laboratories, the inventor assigns the patent rights to the laboratory's management and operating contractor, which holds title to the invention.

- The government may be entitled to a license to use or practice the invention, and the inventor signs a license to the government.
- The inventor may be entitled to all rights and the government to none, and the inventor need not sign over any of the rights to the government.

The allocation of rights is based on the following (see 37 CFR 501):

- The inventor is entitled to all rights if there was no government contribution in hours, funding, facilities, etc., and the invention was not related to the inventor's official duties.
- The government is entitled to all rights if the invention was made during working hours, or government funds, facilities, equipment, materials, or information were used, including the time or services of other government employees on official duty; or the invention is directly related to or made in consequence of the inventor's duties.

Under any of these criteria, the inventor may be entitled to retain all rights if the government's contribution is insufficient equitably to justify a requirement of assignment, or the government determines not to pursue patenting or otherwise to promote commercialization of the invention. Retention of these rights by the inventor is subject to the government's right to freely use the invention for governmental purposes and in accordance with government employee conflict of interest statutes, regulations, and policies.

If asked to complete a form pertaining to invention rights, the government employee may want to obtain assistance from the agency legal counsel before completing the form.

5.5.6 Naming Co-Inventors

Because patent applications must be filed under the name or names of the inventors, a determination of inventorship is made for every application. An inventor is someone who has made a contribution to the conception of at least one allowed claim of a patent application. Prior to issuance of the patent, the actual naming of inventors should be reviewed based on the claims of the "to be issued" patent. Inventorship is a legal determination that is made by a patent attorney and depends on

the specific circumstances. Inventors must avoid naming other persons as joint inventors if they did not make a contribution to the claimed invention, since such action could render the patent invalid. Also, it is important to have knowledgeable witnesses who can corroborate the inventor's testimony regarding the invention; moreover, joint inventors cannot corroborate each other's testimony.

When a patent is granted to joint inventors, the issue of patent ownership becomes a major concern. A joint owner of a U.S. patent may make, use or sell the invention, or any interest in the invention, without regard to the other owner(s) and without regard to the size of the joint owner's share in the patent, unless there is some other contract stating otherwise. If the invention is assigned to the government, the government owns the patent. Those inventors assigning to the government are entitled to a share of the license income if the invention is licensed by the government.

5.5.7 Invention Evaluation Process

5.5.7.1 Initial Technical Evaluation

When the patent disclosure forms have been submitted to the appropriate agency office and checked for correctness, they may initially be forwarded to a technical evaluator or technical evaluation committee with knowledge of the subject area identified in the patent disclosure forms. The invention is then evaluated to determine its significance.

5.5.7.2 Invention Evaluation Committee

The next step, which usually determines whether or not a patent application is filed with the USPTO or any foreign patent office, is a review by the laboratory's invention evaluation committee. This committee generally consists of three or more technical experts with some perspective of the related commercial environment, along with a patent counsel and a technology transfer expert as either committee members or advisors. The reasons for selecting a technology for patenting include the desire to minimize liability for patent infringement for government-developed material, to encourage commercialization of government R&D, and to reflect the technical achievements of individuals or laboratories.

The specific guidelines used by invention evaluation committees typically include some or all of the following:

- Usefulness in advancing ongoing projects
- Applicability to other projects
- Value to the agency's mission and in minimizing potential patent infringements
- Potential dollar volume of future procurement
- Commercial potential (licensing, with or without royalties)
- Usefulness for public health or welfare
- Scientific or technical merit
- Whether patent protection is likely to be necessary for the commercial use of the invention
- Whether the invention's primary use is as a research tool.

Upon a vote by the committee, either a patent application is pursued, or the government expresses no interest in filing an application and the invention disclosure is inactivated. If the government has no interest in promoting commercialization, the inventor may retain rights in the invention and pursue a patent application at his or her own expense if no conflict of interest would arise (see 15 USC 3710d and 15 USC 3710a (c)(3)(A)).

If the government elects to patent the invention, the agency or laboratory will arrange for the application to be prepared, and the inventor will be asked to review the description, drawings, and claims for technical accuracy. Any forms that are necessary for filing with the USPTO will be completed by patent counsel or the inventor(s), as required.

5.5.7.3 Patent Office Action

After a patent application is received at the USPTO, it is assigned to an examiner who has technical training in the field of the invention. The examiner undertakes an examination process, which includes a study of the prior art and additional information filed with the application, and an independent search of the patent and technical literature to determine if the invention is novel and nonobvious. The examiner also determines if

the application discloses the invention in adequate detail. The examiner then issues the first office action, in which each claim is either allowed or rejected, or an objection is indicated.

Most claims are rejected or objected to in the first office action, which is usually completed by the examiner in two to three years, depending on the classification of the technology being considered. The patent attorney handling the application must respond to the USPTO within a specified amount of time, usually three months. For each claim that is rejected, the attorney may challenge the decision or amend the claim, which may require additional information from the inventor.

The USPTO examiner will review the responses and either allow or reject (or object to) each claim. When an unresolved disagreement has developed between the examiner and the attorney, the examiner will make the rejections and objections final and issue a final office action. A final rejection may be appealed to the Board of Patent Appeals and Interferences. Further appeals to the federal courts are possible, but rarely pursued because of the expense involved. In the case of a final objection, the matter may be petitioned to the Commissioner.

5.5.7.4 Patent Issued

If all pending claims are allowed, the examiner sends the attorney a Notice of Allowance. The attorney then pays the issue fee within three months. About three months after the issue fee is paid, the patent is printed and issued. Overall, a patent is typically issued within two to five years, depending on the technology. Patent protection begins when the patent is issued and is for a term of 20 years from the original filing date.

5.5.7.5 Patent Maintenance

Initially, a patent is active for four years. Keeping the patent active thereafter requires the payment of annual maintenance fees. An escalating series of fees is paid for years 5 through 7, 8 through 11, and 12 through 20. Individual inventors and small businesses are charged fees that are usually one-half of those paid by large organizations, including the government.

5.6 COPYRIGHTS

Copyrights provide legal protection for products of the mind that are produced in tangible expressions, such as writings, paintings, movies, music, sculpture, and computer software. The work must contain some original expression, which can exist in the form and arrangement of the material.

Copyright categories include:

- Nondramatic literary works such as fiction, nonfiction, poetry, textbooks, reference works, etc., including computer software
- Works of the performing arts, such as musicals, drama, motion pictures
- Works of the visual arts, such as photographs, paintings, prints, maps, globes, technical drawings, models, etc.
- Sound recordings.

Unlike a patent, a copyright protects the form of expression rather than the subject matter of the work.

Copyright protection is initiated with the creation of a work, without registration or notice. Registration of copyrights with the federal government is optional. However, registration is required in order to prosecute infringers. A work can be registered by submitting an application, one copy of an unpublished work or two copies of a published work, along with the appropriate filing fee, to the Copyright Office (Library of Congress).

Generally, a copyright owner has the exclusive right to do or authorize certain activities, including:

- Reproduce the copyrighted work
- Prepare derivative works
- Distribute copies of the work to the public
- Perform or display the work publicly.

Copyright protection for individuals (i.e., not works made for hire) extends for the author's lifetime plus 70 years. For a jointly developed work, the protection is for the length of the last surviving author plus 70 years. For

works made for hire, which covers most work done by employees where the employer automatically gets copyright privileges, copyright protection extends for 95 years from the date of the first publication or 120 years from the date of creation, whichever occurs first.

Federal law (17 USC 105) states that copyright protection is not available for any works by U.S. Government employees⁷, including government-developed software, with very limited exceptions (e.g., NIST can and does copyright and license Standard Reference Data). The government may, however, hold copyrights that are assigned to it or hold copyright protection in foreign countries.

Creative Commons (CreativeCommons.org) offers an alternative to traditional copyrights. By allowing greater leeway in rights to makers of derivative works, Creative Commons provides more flexibility and less restrictive access to the copyrighted materials.

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5.7 MASK WORKS

Mask works are patterns used in fabricating integrated circuits on semiconductor chips. In establishing separate protection for mask works, the law provides that an owner, subject to certain limitations, has the exclusive right to perform or authorize certain activities, including:

- Reproducing the mask work by optical, electronic, or any other means
- Importing or distributing a semiconductor chip product in which the mask work is embodied.

A mask work is protected for ten years after registration or its first commercial exploitation, whichever occurs first.

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5.8 TRADEMARKS

Trademark protection can be obtained for any word, symbol, or combination thereof that is used on goods to indicate their source. The owner of a trademark can exclude others from using a similar mark on

⁷This limitation does not apply to GOCO laboratories and their employees.

similar goods that would be likely to confuse consumers as to the source of the goods. This right pertains for as long as the owner owns the mark. Federal trademark registration must be renewed every ten years. State trademarks have various terms and also require renewal. Federal agencies vary in their authority to pursue trademark protection and how revenue from their trademarks may be used (see, for example, 10 USC 2260).

5.9 TRADE SECRETS

A trade secret is any commercial formula, device, pattern, process, or information that affords its owner a competitive advantage over others who do not know it. A trade secret derives its protection by being withheld from all except authorized users. Commercially sensitive information that would be compromised by being made public can be protected as a trade secret. Obviously, patent or copyright protection would not be sought for something that cannot be made public. However, trade secrets are well-suited to nongovernmental licensing programs and often can be more valuable than patents.

Unlike patents, copyrights, and trademarks, there is no formal governmental procedure for establishing ownership of a trade secret. The two requirements for establishing a trade secret are novelty and secrecy. The level of novelty need not be great. Secrecy, however, is essential. In the event of a lawsuit, the owner of a trade secret must show that adequate precautions were taken so that an individual accused of stealing a trade secret cannot claim that he or she did not know the information was secret. These precautions include the use of confidential disclosure agreements, security precautions against third parties entering an area where trade secrets are kept, stamping documents with a confidentiality label, limiting access to the documents, and informing individuals with access to trade secrets about the need for security.

The improper disclosure or distribution of trade secrets is covered under federal law (i.e., the Trade Secrets Act (18 USC 1905) and the Economic Espionage Act (18 USC 90)), as well as state laws. Misappropriation of a trade secret can entail both civil and criminal penalties. A lawsuit may be filed in state court according to the laws of that state to defend the

trade secret and claim damages. Moreover, if a criminal charge should be brought against a federal employee, the federal government could not defend the employee because it would be prosecuting him or her.

Generally, data generated at federal laboratories does not qualify as a trade secret (through it may qualify for protection from release as proprietary); however, under CRADAs, certain types of confidential data generated as part of the CRADA may be protected from disclosure for up to five years. If a trade secret is provided to a federal laboratory by the CRADA partner, it must be protected from disclosure.

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5.10 LICENSING

Section Four, Technology Transfer Mechanisms, includes a complete discussion describing how to license an invention, as well as royalty and payment issues.

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5.11 GENERAL GUIDELINES FOR THE MANAGEMENT OF PROPRIETARY DATA

The technology transfer office should develop a policy that states the importance of protecting proprietary information and establishes guiding principles for carrying out that policy and negotiating the restrictions on use of the data. General guidelines for such a policy are:

- Limit the acceptance of proprietary data to information that is absolutely essential to the success of the project or program objectives.
- Limit the use of proprietary data to essential activities or to individuals who need to know.
- Determine where the proprietary data are to be accessed and stored.
- Do not agree to protect orally transmitted data or information unless it is promptly reduced to writing by the owner or sponsor and appropriately marked with a legend.
- Categorize information received and place legends on proprietary data that specifically identify the restrictions for use and disclosure of the information or data.

An office policy should require identifying the office or personnel responsible for the management of proprietary data. Those responsibilities include:

- Determination of what proprietary information is essential to the project or program objectives
 - Overall protection of proprietary data
 - Assurance that each employee is aware of the confidential nature of proprietary data and the responsibility to protect it
 - Formal receipt of proprietary data
 - Assurance that private-sector parties abide by the terms of any nondisclosure agreements they have signed.
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5.12 A QUICK REFERENCE

Table 5-1 summarizes the methods for protecting intellectual property rights discussed in this section.

Table 5-1. Methods of Protecting Intellectual Property Rights

Method	Description	Term	Subject of Protection
Patent	Serves as a contract between the government and an inventor whereby, in exchange for the inventor's complete disclosure of the invention, the government gives the inventor the right to exclude others from making, using, importing, or selling the invention	20 years from date of filing application	Process, machine, manufacture, composition of matter, original design, certain agricultural plants
Copyright	Provides exclusive right granted by the U.S. government to authors, composers, artists, or their assignees to copy, exhibit, distribute, or perform their works	Life of creator plus 70 years	Products of the mind that are produced in tangible expressions, writings, paintings, movies, music, sculpture, computer software
Trade Secret	Provides the right to withhold any commercial formula, device, pattern, process, or information that affords a business person an advantage over others who do not know it	As long as secrecy is maintained	Any commercial formula, device, pattern, process, or information that is secret, substantial, or valuable
Trademark, Trade Name, Service Mark	Establishes the right to a unique expression that identifies goods or services for commercial purposes	As long as use is continuous	Word(s), name, symbol, device, numeral, picture, or any combination thereof

Section Six

ORGANIZATIONS SUPPORTING TECHNOLOGY TRANSFER

The ability to connect federal laboratory resources with other federal laboratories, industry, academia, and state and local governments is essential to the success of technology transfer. A number of federal organizations and many federal agencies, as well as many nonfederal organizations on national, state and local levels, share the responsibilities for technology transfer activities and are available to provide the connections needed to effect technology transfer. The key federal technology transfer organizations are the federal agencies, federal laboratories, federal technology transfer offices, and the FLC. In addition, a number of nonfederal organizations on national, state, and local levels can provide connections to industry, academia, and state and local governments that are necessary to effect technology transfer. These organizations include professional societies and state and local governments. The following pages provide information about these federal and nonfederal organizations and how their resources can be used to assist with technology transfer activities.

6.1 FEDERAL ORGANIZATIONS

The key federal technology transfer organizations are the federal agencies, federal laboratories, laboratory T2 offices, and the FLC; other organizations include professional societies and state and local government organizations. This section provides details on the roles played by federal organizations, the relationships among them, and the resources they make available to assist with technology transfer activities.

6.1.1 Federal Agencies

Executive Order 12591, “Facilitating Access to Science and Technology,” which was promulgated in 1987, directs federal agencies and departments to improve the transfer of federally developed technology and technical information to the marketplace. The Executive Order spells out the means by which federal agencies can accomplish technology transfer.

These include:

- Encouraging federal laboratories to collaborate with state and local governments, universities, and business through CRADAs
- Licensing intellectual property developed through CRADAs or by individual federal laboratories
- Encouraging “science entrepreneurs” to act as conduits among federal laboratories, universities, and the private sector
- Implementing royalty-sharing programs for federal inventors
- Developing a uniform federal policy permitting federal contractors to retain rights to software, engineering drawings, and other federally generated technical data in exchange for royalty-free use by the government
- Developing and implementing an exchange program for scientists and engineers in the federal laboratories to take temporary assignments in the private sector and vice versa.

Two federal agencies, the Department of Commerce and the Department of Defense, have specific defined roles to play in the federal technology transfer effort. These agencies are:

- **Department of Commerce**

National Institute of Standards and Technology (NIST)—

Formerly the National Bureau of Standards, NIST (www.nist.gov) promotes U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology in ways that enhance economic security and improve quality of life. During its 100-plus years of existence, NIST has served U.S. industry and the public with a mission and approach unlike any other government agency. Specifically, NIST’s primary goals are to strengthen U.S. industry’s competitiveness; support the science and engineering community through fundamental research; and improve public health, safety, and the environment. NIST provides a wide variety of services to help U.S. industry accomplish its most pressing tasks of innovation, rapid commercialization of technology, and achieving total quality in all facets of business operations, including:

- Baldrige National Quality Program—Promotes and recognizes organizational performance excellence
- Hollings Manufacturing Extension Partnership—Provides technical and business assistance to smaller manufacturers
- Technology Innovation Program (TIP)—Supports, promotes, and accelerates innovation in the United States through high-risk, high-reward research in areas of critical national need, making targeted investments in transformational R&D that will ensure sustained technological leadership
- Serves as host agency for the Federal Laboratory Consortium for Technology Transfer (see below).

National Technical Information Service (NTIS)—As the largest central resource for government-funded scientific, technical, engineering, and business-related information, NTIS actively disseminates scientific and technical information generated by federally funded research and development in over 350 subject areas from over 200 federal agencies. Such information includes technical reports, computer software, technology transfer application assessments, and information regarding training technologies. NTIS is open to the public and provides a range of services found at www.ntis.gov.

- **Department of Defense (DOD)**

Defense Technical Information Center (DTIC)—DTIC (www.dtic.mil) provides a central point within the DOD for acquiring, storing, retrieving, and disseminating scientific and technical information. DTIC maintains a variety of technical information databases and provides online access to these databases, as well as gateways to other government and commercial databases. In support of technology transfer, DTIC has organized a list of 22 technology transfer topics (e.g., domestic technology transfer, dual-use technology transfer, manufacturing technology transfer, technology assessments, etc.) and provides sample lists of citations to encourage access to the referenced reports. A new online system, the Cooperative Programs for Reinvestment (CPR), has recently

been established to provide Internet access to information on more than 300 consortia and federal programs. The CPR service provides, among other things, access to Technology Reinvestment Project (TRP) and Small Business Innovation Research (SBIR) announcements, and the technology transfer programs of individual federal laboratories. There are also plans to add information regarding active CRADAs to the system.

6.1.2 Federal Laboratories

Because federal law mandates that technology transfer is a responsibility of each laboratory (see 15 USC 3710), resources have been established to support laboratory science and engineering professionals in this task. These resources include the T2 offices and the Offices of Patent and General Counsel.

- **Office of Research and Technology Applications (ORTA)**—An ORTA, or T2 office, to facilitate technology transfer was established at each federal laboratory by the Stevenson-Wydler Technology Innovation Act of 1980 and reaffirmed by the Federal Technology Transfer Act of 1986. Laboratories with 200 or more R&D employees are required to establish and maintain a technology transfer office for the purpose of managing and coordinating technology transfer efforts with state/local governments, universities and private industry. At many laboratories, the function of the T2 office includes technology assessment; marketing of laboratory resources; the establishment, negotiation and management of cooperative R&D under CRADAs; and the negotiation of licenses for intellectual property. A complete description of the role and responsibilities of laboratory T2 offices is provided in Sections Two and Three.
- **Office of Patent and General Counsel**—This office in a federal laboratory or agency determines whether the government or the employee owns the title to an invention. If there is evidence that the government contributed in the form of funds, time, services of other employees on duty, equipment, facilities, information, materials, or supplies, the title will most likely be granted to the government. Staff in this office is generally responsible for filing activities associated with patents, licenses and copyrights, and they assist the laboratory technology transfer office with negotiating. The T2 office in each

laboratory should coordinate closely with the laboratory's or agency's Office of Patent and General Counsel.

6.1.3 Federal Laboratory Consortium for Technology Transfer (FLC)

The Federal Laboratory Consortium for Technology Transfer (FLC) was organized in 1974 and formally chartered by the Federal Technology Transfer Act of 1986 to promote and strengthen technology transfer nationwide. The FLC is nationwide network of more than 250 federal R&D laboratories and centers and 18 parent departments and agencies that provides the forum to develop strategies and opportunities for linking laboratory mission technologies and expertise with the marketplace and provides opportunities for its member laboratories to collaborate in technology transfer activities with the private and public sectors. The FLC's activities, as authorized by the Technology Transfer Act of 1986 and codified in 15 USC 3710, include:

- Developing and administering technology transfer techniques, training courses, and materials to increase the awareness of federal laboratory employees regarding the commercial potential of laboratory technology and innovations.
- Providing advice and assistance to federal agencies and laboratories for use in their technology transfer programs.
- Providing a clearinghouse for requests for technical assistance from state and local governments, businesses, industrial development organizations, not-for-profit organizations, including universities, and federal agencies and laboratories.
- Facilitating communication and coordination between technology transfer offices at federal laboratories.
- Utilizing the expertise and services of the National Science Foundation, the Department of Commerce, NASA, and other federal agencies as necessary.
- Facilitating the use of appropriate technology transfer mechanisms.
- Assisting laboratories with establishing programs using technical volunteers to provide technical assistance to local communities.

- Facilitating communication and cooperation between federal laboratory technology transfer offices and regional, state, and local technology transfer organizations.
- Assisting colleges or universities, businesses, nonprofit organizations, state or local governments, or regional organizations with establishing programs to stimulate research and to encourage technology transfer.
- Seeking advice in each FLC region from representatives of state and local governments, large and small businesses, universities, etc., concerning the effectiveness of the technology transfer program.
- Working with the director of the National Institute on Disability and Rehabilitation Research to compile a compendium of current and projected federal laboratory technologies and projects with an impact on assistive technology for individuals with disabilities.

In accordance with these mandates, the Consortium creates an environment that adds value to and supports the technology transfer efforts of its members and potential partners, assisting federal agencies, laboratories, and their partners to accomplish the rapid integration of federal laboratory research results and technologies into the mainstream of the U.S. economy. The FLC promotes and facilitates the broad use of the technologies and expertise developed in federal laboratories; focuses on education, communication, and interagency/interlaboratory interaction; and promotes technology transfer through person-to-person mechanisms. The Consortium develops and tests transfer methods, addresses barriers to the process, provides training, highlights grass-roots transfer efforts, and emphasizes national initiatives where technology transfer has a role. For the public and private sectors, the FLC brings laboratories together with potential users of government-developed technologies. This is, in part, accomplished by the FLC's Technology Locator network and regional and national meetings.

6.1.3.1 Goals and Objectives of the FLC

The goals and objectives of the FLC are designed to provide the necessary environment, organization, and technology transfer mechanisms that will facilitate the fullest possible use of federally sponsored R&D by potential partners in both the public and private sectors. These goals and objectives are identified in Table 6-1.

Table 6-1. FLC Strategic Goals and Objectives

FLC Strategic Goals	FLC Strategic Objectives
Develop FLC members to be leaders in technology transfer	Provide and promote networking opportunities among members and with external organizations
	Provide technology transfer education and training opportunities
	Provide an awards program recognizing all levels of technology transfer professionals
	Provide membership and communications program optimizing FLC and technology transfer awareness
Foster the environment for technology transfer	Enhance access to federal technologies and facilities
	Maintain a comprehensive system of communications
	Assist state and local governments, regional organizations, and academia to encourage technology transfer
	Identify potential alliances
	Improve organizational structure
	Improve management processes and communication
Enhance the professional organizational structure	Increase FLC membership and participation
	Improve organizational structure
	Improve management processes and communication

6.1.3.2 Services Provided by the FLC

The users who seek technologies from the federal laboratories are an extremely diverse group that includes the private sector, academia, state

and local governments, and federal agencies themselves. These users have access to a number of FLC services, including:

- **Electronic Communications**—Includes a website that provides technology transfer data, access to searchable databases to find federal laboratories and resources, and technology news and events
- **Technology Locator Service**—Centralized service for reviewing and routing requests from potential partners to the appropriate resource (i.e., laboratory or center)
- **Meetings**—National and regional meetings that provide a forum for formal and informal exchanges of information
- **Training**—Courses and materials are offered at various expertise levels, from fundamental to advanced, to help participants carry out their technology transfer roles and responsibilities
- **Marketing Communications**—Includes a monthly technology transfer newsletter, *FLC NewsLink*, FLC informational publications, brochures, articles, exhibits, and panel presentations
- **Technology Transfer Awards Program**—National and regional awards for outstanding accomplishments in technology transfer are presented annually
- **Trade Shows**—Provide member laboratories with opportunities to showcase their technologies and offer the private sector “one-stop shopping” for federal laboratory technologies and services.

6.2 NONFEDERAL ORGANIZATIONS SUPPORTING TECHNOLOGY TRANSFER

A number of nonfederal organizations on the national, state, and local levels can provide connections to industry, academia, and state and local governments that are necessary to effect technology transfer. These organizations include professional societies and state and local governments. The following pages provide information about a select representation of some of the nonfederal organizations that support technology transfer efforts and how their resources can assist with technology transfer activities.

6.2.1 Some Nongovernmental Technology Transfer Organizations

- **Association of Small Business Development Centers (ASBDC) (www.asbdc-us.org)**—Hosted by leading universities, colleges and state economic development agencies, and funded in part through a partnership with the U.S. Small Business Administration, approximately 1,000 service centers are available to provide no-cost consulting and low-cost training. ASBDC's purpose is to promote growth, expansion, innovation, increased productivity, and managerial excellence for small and medium businesses in order to grow local, state, and national economies. The ASBDC network provides nationwide technical assistance, counseling, exchange of information, and advice to small and medium business owners and those who want to start their own business.
- **Association of University Technology Managers (AUTM) (www.autm.net)**—A nonprofit association with a membership of more than 3,500 technology managers and business executives who manage intellectual property. This network of T2 professionals—primarily from academia but also from government, the research and legal communities, and industry—is dedicated to promoting and supporting technology transfer through education, advocacy, networking, and communication. AUTM offers an annual licensing survey, the results of other research activities, annual and regional meetings, professional development courses, publications, and public education.
- **Licensing Executives Society (LES) (www.lesi.org)**—A professional association of 32 national and regional societies representing over 10,000 members interested in the transfer of technology, licensing, and intellectual property rights. LES membership includes professionals in the fields of law, academia, and science from both government and the private sector. LES focuses on networking and training to keep members up-to-date on developments in licensing practices, law, regulation and current issues relevant to licensing; and publishes numerous books, pamphlets and other educational materials relevant to licensing.
- **National Association of Seed and Venture Funds (NASVF) (www.nasvf.org)**—An organization of innovative capital leaders: private, public, and nonprofit organizations committed to building their local economies by investing in local entrepreneurs.

- **State Science and Technology Institute (SSTI)** (www.ssti.org)—A national nonprofit organization dedicated to improving government-industry programs that encourage economic growth through the application of science and technology. SSTI, which has developed a nationwide network of practitioners and policymakers., assists states and communities with building technology-based economies, conducts research on best practices and trends in technology-based economic development, encourages cooperation among and between state and federal programs, and disseminates information about technology-based economic development.
- **Technology Transfer Society (T2S)** (www.t2society.org)—A not-for-profit professional organization founded in 1975 and dedicated to sharing methods, opportunities, and approaches with the technology transfer community. T2S provides resources of information and contacts through: technology transfer programs, training, publications, including the *Journal of Technology Transfer*, a bimonthly newsletter, the *Annual Proceedings of the Technology Transfer Society*, forums, and annual conferences.

6.2.2 State and Local Technology Transfer Organizations

State and local programs designed to promote business interests will usually differ from state to state. Most states have a state economic development corporation or economic development agency with the purpose of fostering economic growth and developing programs that help businesses and entire business sectors within the state to grow and achieve success. A link to state economic development agencies/corporations can be found at <http://www.eda.gov/Resources/Resources.xml>.

In general, the economic development agencies in a particular state or region are effective intermediaries between the laboratory and the needs of business and industry in that state/region. These resources can assist the technology transfer office by providing a wide variety of services, including:

- Previewing technical assistance requests from businesses to ensure that assistance is not competing with private enterprise

- Providing existing networks to leverage resources leading to more contracts with small and/or disadvantaged businesses
- Matching laboratory/facility technology to industry
- Providing input regarding industry needs
- Ensuring that laws do not impede technology transfer
- Providing a matching grant approach to consortia of university and private research teams
- Starting venture capital or commercialization programs
- Providing incentives for adopting more productive technologies.

Among the variety of organizations, centers, and commissions that actively support technology transfer at the state and local levels are local Chambers of Commerce. These groups are very closely tied to the needs of local business and industry, and will most likely know most of the existing small businesses and economic development organizations in the state. Working through a local Chamber of Commerce can result in cooperative relationships with local civic and business leaders, as well as members of organizations who provide a variety of services to business and industry.

A federal laboratory may also make use of a partnership intermediary (PI) (see 15 USC 3715), which is an agency of a state or local government that facilitates a federal laboratory's technology transfer activities by assisting companies or educational institutions with utilizing federal technology. Through a partnership intermediary agreement (PIA), a PI provides assistance to the laboratory's T2 office, including serving as a technology broker and providing services that increase the likelihood of success in the conduct of the laboratory's cooperative or joint activities with small business or educational institutions.

Other state and local resources that can provide the technology transfer office with information about the needs of local industry include:

- Local business organizations, such as state bankers' or realtors' associations

- Local chapters of professional organizations
- Other area federal laboratories and agencies
- State agencies
- Local business incubators
- Service Corps of Retired Executives (SCORE), www.score.org
- National Association of Counties, www.naco.org
- National Conference of State Legislatures, www.nscl.org
- Council of State Governments, www.csg.org
- American Legislative Exchange Council, www.alec.org
- National Association of State Energy Officials, www.naseo.org
- National Congress of American Indians, www.ncai.org
- National Venture Capital Association, www.nvca.org

6.2.3 Academic Institutions

Most state and local post-secondary academic institutions work closely with state business and industry through collaborative research, consulting, provision of information services, and continuing education. Many academic institutions provide market research, innovation centers, and patenting and licensing services. Making area academic institutions aware of the resources in a local laboratory can help these institutions connect business and industry to resources in the laboratory, and may stimulate the academic institution to become involved in collaborative research with the laboratory in areas of mutual interest. Many research institutions have offices set up to execute their technology transfer mission. A search of their websites will typically yield the applicable office and a point of contact for technology commercialization and transfer.

Section Seven

MARKETING AND COMMUNICATIONS OUTREACH

Because marketing and communications play a significant role in the success of technology transfer efforts, these activities should be integral functions of the technology transfer office and not just activities that begin when a technology has been developed. Although outside partners can initiate a technology transfer action, the process actually begins when a federal laboratory scientist, engineer, or technology transfer professional recognizes a potential commercial application and is able to communicate with and convince others—both inside the government and among potential partners—of the value of a particular technology, process, resource, or capability to the private sector. It is the promotion of technology and a laboratory’s capabilities, implemented by the marketing and communication efforts of the laboratory’s technology transfer office, that often underlie successful technology transfer efforts.

Section Seven will first provide an overview of some of the concepts of marketing and communications as they relate to technology transfer, as well as links to marketing and communications resources and a checklist of marketing and communications actions to consider in carrying out the overall mission of the T2 office. The section will then focus more specifically on the commercialization process. In other words, once a technology has been developed by a laboratory or agency and is ready to go to market, what steps should be taken to proceed to commercialization?

7.1 AN OVERVIEW OF FEDERAL LABORATORY MARKETING AND COMMUNICATIONS

The following pages offer guidance to the technology practitioner on how to best promote and market a laboratory’s capabilities, technologies and accomplishments, and provide specific resources to facilitate with this endeavor. Information will be provided to help the technology transfer practitioner:

- Define goals
- Identify a target audience
- Develop a message that communicates mission and goals.

In addition, many resources, both in-house and external, are identified that can assist the technology transfer office with accomplishing its mission.

7.1.1 What Is the Goal?

In order to best guide the approach to these concepts and to effectively utilize the resources available, start with an articulation of the goals of the laboratory's T2 office. The following list of possible goals, though not all-inclusive, should be considered by the technology transfer practitioner:

- Publicizing the laboratory's capabilities and technologies—Highlight the expertise of the laboratory's personnel and the laboratory research mission, facilities and services that are available.
- Publicizing the laboratory's accomplishments—Highlight the broad spectrum of technology transfer activities at the laboratory, including the development of CRADAs, license and patent agreements, educational outreach to promote math and science in local schools etc.
- Collaborating with industry/academia—Describe opportunities available to provide access for industry and college/university personnel to facilities and services, personnel exchange, and technical training at the laboratory.
- Commercializing technologies—Because sharing information is a key component of technology transfer, the ability to communicate the successful outcomes of the laboratory's technology transfer activities is essential to the future success of the T2 office.

7.1.2 Who Is the Audience/Customer?

It is extremely important to clearly identify the audience upfront, as it will ultimately shape the T2 office's/laboratory's marketing and communications efforts. The organizations, groups and individuals with whom the technology transfer practitioner will need to communicate include:

- Laboratory and agency management—Make it clear that technology transfer successes contribute to the success of the laboratory and agency.
- Scientists and engineers within the laboratory—From the outset of their research, science and engineering personnel need to be educated about intellectual property issues, the identification of market potential, the commercialization process, etc.
- Congress and the Executive Branch—The federal government invests heavily in research conducted in federal laboratories. Congress and the Administration have a vested interest in the success of laboratory technology transfer practitioners.
- Other federal agencies—There is often a potential for agencies to collaborate and/or partner on the development of a given technology. Often, a technology developed in one agency may very well serve a different use in another agency.
- State and local economic development agencies—Technologies developed by federal laboratories may very well become an engine of economic development for the state or municipality where the laboratory is located.
- Chambers of Commerce—Local Chambers of Commerce often facilitate and promote partnerships that are advantageous to local economic growth.
- Academia—Nearby colleges and universities may benefit the laboratory by providing facilities, students for internships, and other opportunities for partnering.
- Industry—It is important for the laboratory to be visible to the sector of industry⁸ that reflects the laboratory's mission. This visibility is both for purposes of general communication and, more specifically, to market technologies.
- Media—Newspapers, trade journals, and electronic media always have a need for well-written, current information about technology development.

7.1.3 What Is the Message?

A key component of any marketing or communications plan is a well-articulated description of mission and goals. Often, those in technical

⁸ “Industry” refers to small, medium, and large business enterprises.

fields struggle to convert text that has a lot of complexity and technical jargon into something that is easily understood by a layperson. The laboratory's Public Affairs Department will be able to provide support and guidance. At a minimum, the T2 office will need to:

- Develop an “elevator pitch” about the mission of the technology transfer office. This is an overview of an idea for a product, service, or project. (The name reflects the fact that an “elevator pitch” can be delivered in the time span of an elevator ride [approximately 30 seconds or 100-150 words].)
- Develop descriptions of the technical capabilities, expertise, and infrastructure available at the laboratory.
- Develop succinct descriptions about specific technologies developed by the laboratory.

7.1.4 Who Are the In-house Partners? What Are the In-house Resources?

There are many resources already available within the laboratory and agency to assist with carrying out the mission of the T2 office and help its personnel to develop or disseminate its message. The following in-house resources should be carefully considered:

- Office of Communications/Public Relations/Public Affairs—This office is a key partner for any of the marketing activities of the T2 office. T2 office personnel should meet with the laboratory's public relations/public affairs personnel and establish a close working relationship. They can provide assistance on how to fine-tune the marketing message and provide a network for the dissemination of information via press releases, articles in agency newsletters, journals, and websites, trade and peer review journals; and assist with making contacts with appropriate media outlets. Each agency has its own process for vetting and approving contacts with the media. By working with this office, T2 office personnel can ensure that they do not violate any agency guidelines.

- Technical Reference Center/Library—Many laboratories have such a facility onsite. As a result of their expertise and access to a network of other libraries, library personnel can quickly locate information or sources.
 - Office of Legal Counsel—Whether the T2 office is moving forward to commercialize a technology, form a CRADA, or finalize an article for an outside publication, the expertise and assistance of the Office of Legal Counsel are invaluable. They can provide guidance so that no laboratory or agency guidelines are violated.
 - Procurement/Acquisition Office—if any technology transfer activity has contractual implications, this office will eventually be part of the process. Meeting with them early on and establishing a good working relationship is enormously beneficial.
 - Human Resources—if T2 office personnel are trying to find training in a specific area of technology transfer or in marketing and communications, this office will have the expertise and contacts to assist with that endeavor.
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7.2 EXTERNAL RESOURCES TO ASSIST THE MARKETING EFFORT

An array of resources exists to assist the technology transfer office in its marketing efforts. Some may be familiar; others involve newer technologies that are related to social networking. Some of the assistance available from outside the laboratory or agency includes:

7.2.1 Federal Laboratory Consortium for Technology Transfer (FLC)

The FLC (www.federallabs.org) has a wealth of resources to help the T2 office carry out its mission. These resources are summarized below. (A complete discussion of the FLC's resources is provided in Section Six, Organizations Supporting Technology Transfer.)

- Networking—the FLC can provide numerous contacts in the federal technology transfer arena and the opportunity to make contacts at its national and regional meetings.

- Information and resources—The FLC has numerous publications online and in print, including *Federal Technology Transfer Legislation and Policy* (the *Green Book*), *Federal Technology Transfer Desk Reference* (this publication), and the *Federal Technology Transfer Mechanisms Matrix*. In addition, the FLC publishes a monthly newsletter, *FLC NewsLink*, that provides information on the latest trends and developments in the federal labs and opportunities for the labs to promote their work. *Technology for Today* is an annual publication that provides highlights of federally developed technologies and research. The *FLC Planner* graphically demonstrates the best of T2 accomplishments in the federal government.
- Education and training—The FLC provides training courses at both the national and regional meetings. In addition, the online Technology Transfer Training Resources Database provides an extensive listing of T2 courses that are offered online, in the classroom, and at conferences.
- State and local government outreach—The FLC strives to educate state and local government organizations about the benefits available to them through technology transfer partnerships with federal laboratories.
- Awards—Each year at FLC national and regional meetings, awards are presented to recognize outstanding examples of technology transfer and to honor leaders in the federal T2 arena.
- Technology Locator—The FLC serves as a point-of-entry to federal laboratories by putting potential partners in contact with a federal laboratory with expertise and capability in a specific area of interest.

7.2.2 Technology Transfer Organizations

There are many technology transfer organizations outside the federal government that can provide information and contacts directly relevant to a laboratory's technology transfer efforts. These organizations, which are fully described in Section Six, Organizations Supporting Technology Transfer, include:

- Association of Small Business Development Centers (ASBDC)
- Association of University Technology Managers (AUTM)

- Licensing Executives Society (LES)
- National Association of Seed and Venture Funding (NASVF)
- State Science and Technology Institute (SSTI)
- Technology Transfer Society (T2S).

7.2.3 Traditional Networking Activities

Since technology transfer is a “contact sport,” there are numerous time-tested opportunities to make contacts that might prove helpful to a laboratory’s technology transfer efforts. These include:

- Conferences—Attendance at industry/technology-related conferences provides ample opportunities to make contacts and promote the laboratory. Serving as a panel speaker or moderator will provide T2 office personnel with even greater visibility.
- Trade shows/exhibits—Well-placed and well-designed exhibit booths offer wide exposure for a laboratory and its technologies. Be sure to provide handouts that have a good balance of graphics and text, are easy to carry, and have essential contact information.
- Professional contacts—Other technology transfer professionals may have information to assist the laboratory’s efforts. Sharing of best management practices provides a win-win exchange.

7.2.4 Web-based Resources/Social Networking Resources

There has been an explosion in the number of mechanisms on the web that provide opportunities for communications and networking. Some of these can be employed effectively to assist the T2 office with its marketing efforts. The ability to use these tools depends on the guidelines within each agency. T2 office personnel will need to check first with either the laboratory’s Office of Communications or Office of Legal Counsel to determine what is permissible in the agency. Regardless of the agency’s policy, it is important to become acquainted with these mechanisms as they have become extremely integral to the fields of marketing and communication.

Some of the better-known web-based resources include:

- Wikipedia (www.wikipedia.com)—This is the largest online encyclopedia that provides content from various contributors and sources. One caveat is that this information is not carefully vetted and in some instances may not be credible. However, “Wikis” may be established on individual websites to provide practitioners in a given field an opportunity to contribute information.
 - Linked-In (www.linkedin.com)—An interconnected network of experienced professionals that currently represents over 170 industries.
 - Facebook (www.facebook.com)—A networking website that is used primarily to connect “friends,” but may also be used to promote business entities by attracting “fans.”
 - Twitter (www.twitter.com)—A social networking and micro-blogging service that allows its users to send and read other users’ updates, which are limited to 140 characters in length.
 - Blogs—The word blog comes from a contraction of the words web and log, and is a type of website that allows people to post commentary, description of events, updates, etc.
 - Listservs—An electronic mailing list application that allows a message to be sent simultaneously to a group of email addresses.
 - Webrings—An application that enables individuals to join online communities and connect with others who share similar interests and ideas.
 - YouTube (www.youtube.com)—YouTube is a website to discover, watch, and share videos.
 - Internet searches—Implemented using such search engines as Google.com, Bing.com, Ask.com, etc.
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7.3 MARKETING TECHNOLOGY: FROM ASSESSMENT TO SUCCESS

Marketing and business planning play significant roles in any federal technology transfer effort because the successful initiation of technology transfer activity rests, in large part, on the marketing and business

awareness of laboratory staff. This is why it is crucial to work with laboratory scientists and engineers early in the research process so that they can be trained to recognize the commercial potential of their work and to protect its intellectual property. It is important to establish a good rapport with them to facilitate an ongoing exchange of ideas. Although outside sources can initiate a technology transfer action, more often the process begins when a federal laboratory technologist recognizes a potential commercial application and is able to convince others—both inside the government and among potential partners—of the value of a particular item, process, or resource. The employee who successfully promotes an idea that leads to commercialization most likely understands the basic business interests of the industry partner or licensee.

This section presents an overview of marketing and business planning issues relevant to effective technology transfer and commercialization. The focus is on how to:

- Identify products/technologies with commercialization potential
- Develop a marketing plan
- Develop a business strategy
- Conduct effective negotiations
- Measure outcomes.

7.3.1 Identify Products/Technology with Commercial Potential

The first stage in technology transfer marketing and business planning is to identify the product or technology to be commercialized or transferred, as well as its potential applications, benefits, customers, etc. First, assess which products or technologies appear to have the greatest transfer or commercialization potential. (See Section Three, The Technology Transfer Process—Collaboration and Commercialization, for an overview of the technology assessment process.) The assessment process should consider the types of resources available for technology transfer. This process can be formal or informal, and can be conducted by an individual, a work group, or by the T2 office of the laboratory as a whole. It may be helpful at the beginning to prepare a brief list, organized by categories, of potential subjects of a technology transfer activity. Some categories include:

- Products
- Processes
- Materials
- Methods
- Software.

For some examples of successful commercializations, see the latest edition of *Technology for Today* on the FLC website (www.federallabs.org).

Anything in these categories that either directly or indirectly may have commercial potential or may be useful for general public welfare should be considered. However, not all innovations for which invention disclosures or patent applications have been filed or for which patents have been issued can be commercialized. Determining those technologies and processes with the greatest transfer potential is essential. Many technologies developed in the laboratory for a particular use may have a very different use in the private sector. For example, a technology might have been developed for defense purposes but might have potential for nondefense applications. Or a technology might be identified as a “spinoff” technology—from a technology developed in one particular technical area but with potential application in different technical areas or markets. Because a technology may be commercialized for very different purposes from the original intent, it is important to consider the commercial potential from diverse viewpoints.

Next, ask laboratory scientists and engineers to review the projects they have been involved with or that have been conducted by their work group. Read through the project documentation. When the projects were originally conducted, the personnel involved may not have been thinking about technology transfer opportunities. Again, working with laboratory scientists and engineers early on will greatly increase the potential for technology transfer in the laboratory. A fresh look at the project literature may trigger new ideas that can lead to a commercialization opportunity. In addition, talking to the other personnel involved, if possible, will enable the technology transfer practitioner to gather additional details and comments about the technology.

The goal of reviewing project documentation and talking to others is to generate ideas about how the basic technology may be used and what alternative uses may be possible. In the search for alternative uses, the technology transfer practitioner should look for embedded technologies. Any subsequent technology transfer efforts may be affected by the presence of an embedded technology that may or may not be easily included in the technology to be transferred. On the other hand, the identification of an embedded technology may result in recognizing the embedded technology itself as the candidate with commercial or public use potential.

Ideas for alternative uses can also be generated through brainstorming sessions, either alone or in groups, where “what-if” games are played with the ways a technology can be used. One way of considering commercial potential from a variety of viewpoints is to convene teams with diverse technical backgrounds to consider the technology’s potential. A multidisciplinary team could:

- Define the technology in sufficient detail so all team members have an adequate understanding of it.
- Use brainstorming techniques to encourage divergent and creative thinking about possible uses of the technology.
- Select the most promising ideas for further discussion and identification of potential markets.
- Decide to consider options in more detail or not to pursue further.
- If the decision is to explore options, determine who inside and outside the laboratory should be consulted and assign responsibilities. Some areas that should be explored may include:
 - Estimation of capital requirements needed to bring the technology to commercialization
 - Manufacturing process needed
 - Patent likelihood
 - Competitive advantage possibilities
 - Market niches

- Possible field-of-use licenses (Patents can be licensed for more than one field of use. For example, a patent can be licensed for both medical and electronics applications.)
- Possible problems related to classified technologies.

Alternative uses of a technology may include spinoffs of the existing technology, the evolution of the technology itself, and entirely new uses for the technology. In generating ideas for alternatives, it may be helpful to take a product or process and systematically place it in other industries such as:

- Medicine/health care
- Transportation/automotive
- Entertainment
- Energy/utilities
- Manufacturing
- Education
- Public safety
- Environmental
- Assistive technology.

7.3.2 Develop a Marketing Plan

The process of creating a marketing plan, executing the activities it specifies, and measuring the results is key to success in technology transfer. There are a number of excellent sites online that provide guidance about the development of marketing plans at no cost. Technology transfer practitioners should also consult their laboratory's Office of Communications and Library/Technical Reference Center for guidance and resources. The following provides some of the components that should be included in a marketing plan. (Note: A number of commercial websites offer free marketing plans and other free marketing information. They can be located by performing an Internet search.)

7.3.4 Determine Marketability

Once a list of candidate technologies is developed, they should be ranked according to criteria that will be helpful within the laboratory in pursuing technology transfer goals, including:

- Mission applicability—Although this should be a given, it is not always the case. Before proceeding, it must be determined that the candidate technology falls within the guidelines of the laboratory's mission.
- Feasibility—Is there something about a particular candidate that makes technology transfer not very feasible? Or is there something about a candidate that makes it very feasible?
- Suitability—A candidate may be feasible but not suitable, e.g., it may not be in line with the mission goals or regulations of the agency/organization, or it may not reflect the basic intent of the technology transfer legislation.
- Marketability—This may include technical considerations, partnering arrangements, scheduling details, cost issues, etc.

Once the technology that appears to have the most potential for transfer or commercialization has been identified, some critical questions relating to the technology need to be addressed, (see Figure 7-1) and succinct written answers (two-three sentences) prepared. These answers will form the basis of the T2 office's marketing/business approach.

Describe the technology or product in two to three sentences and identify key technical and commercial features.

- Are there any R&D hurdles? Is further R&D needed? Are there any time or cost constraints? Any current or past contractor role in R&D?
- What are the immediate and long-range applications?
- What are the current closest or competing technologies, products, inventions, etc.?
- Why is this discovery better or more advantageous than current or competing technologies?
- What are the unique features of the technology? What problems does it solve?
- Can this technology actually be turned into a product?
- Are unique personnel or facilities required to produce the product?
- Has a prototype been produced? Does it perform as designed?
- Who will use this product? Is the target market government, business, or consumers?
- Have potential users of this product been asked if they would buy it?
- What is the most important benefit this product will provide to the customer?
- Are there any patent and licensing issues?

Figure 7-1. Questions Relating to Product Marketability

If marketability were considered and analyzed from the moment R&D was initiated, there would be significantly more successful commercializations. Three characteristics of a product or technology that can significantly increase the marketability of the product, and thus the probability of success, are:

- **Unique and superior product**—A unique and superior product is the opposite of a “me too” product. Winners are characterized by a unique set of benefits from the customer’s point of view. These winners reflect an in-depth knowledge of customer problems, needs, wants, likes, and dislikes.
- **Strong market orientation**—Products with strong market orientation are the result of market research during the idea and product development stage. Market research involves ongoing input and feedback from potential end-users and customers.
- **Early market definition**—Early market definition means willingness to override the early technical design and technical objections with market-driven input.

On the whole, superior, winning products are “differentiated.” They offer unique features that are not available in competitors’ products, meet customer needs better than competitors’ products, have higher relative product quality, solve a problem that the customer might have had with a competitor’s product, reduce the customer’s total cost, and are innovative.

One of the first steps in determining the marketability of a product is to conduct a self-assessment. This assessment is traditionally done through an analysis of the product’s perceived strengths, weaknesses, opportunities, and threats (referred to as a “SWOT analysis”). This SWOT analysis helps to identify what the product can do best and what it does worst. Also, analyzing the opportunities and threats helps identify the marketplace opportunities that are open for the product, as well as the marketplace threats to its success. This analysis should be realistic and should help provide an understanding of how to maximize the strengths, how to overcome the weaknesses, how to take advantage of the opportunities, and how to protect against the threats.

It is often helpful to bring in an outside party to conduct this assessment, as it may be more objective in its analysis of the laboratory’s capabilities and the marketability of the technology slated for commercialization. Whether this analysis is conducted by laboratory T2 office personnel or an outside contractor (for a fee), it is essential that the laboratory’s scientists and engineers be involved in the process.

Clearly, the development of winning, differentiated products depends on understanding the market and the market potential of the product or technology. This has always been the case, but it is even more apparent in today's volatile high-tech marketplace, where product life cycles are decreasing at an alarming rate. In such rapidly changing markets, most information regarding market potential is based on existing conditions, and therefore has limited reliability and predictive value. One source that can help facilitate a response to such a demanding environment is direct customer input and feedback. The innovator who understands, addresses, and manages the expectations of potential customers in the market in which the product will actually be sold will significantly increase the likelihood of success.

As T2 office personnel gain a clearer understanding of the potential market and its customers, their responses to the critical decision factors determining marketability (identified in Figure 7-2) should help determine how to continue the development process.

Understanding of the industry

- How large is the industry?
 - Are there many or few suppliers?
 - Are there many or few customers?
 - Will the development effort be at the mercy of suppliers or too dependent on a few customers?
 - Are there many or few substitutes for the product?
 - Are there significant barriers to entry in this industry?
- Is the industry cyclical with the economy?
- What are the industry trends?
- What changes are taking place in the industry and why?
- What government regulations apply?

Understanding of the competition

- Who are the closest competitors?
- Approximately how many companies/competitors are in the industry?
- Do the companies compete mainly in price, service, quality, or advertising?
- What are the competitors' strengths and weaknesses?
- What are the strengths and weaknesses of the business?
- Have any companies recently appeared or disappeared, and why?
- What has been learned from watching the competition?

Figure 7-2. Critical Decision Factors in Determining Marketability

Is the product real?

- Is there a product idea?
- What product will be sold?
- Can the product satisfy the market?
- What are its unique features?
- What is the current development stage of the product (e.g., research, prototype, produced in quantity, etc.)?
- What research has been completed?
- Is the product still in the research stage? If so, what research needs to be completed?
- Is the product durable or nondurable?
- What new products will be developed?

Can the product be made?

- How will the product be produced?
- Will the production process be capital- or labor- intensive?
- What materials are used to produce the product?
- What does it cost to produce the product? Does this cost allow charging a competitive yet profitable price?
- What facilities are needed to support the manufacturing process (e.g., rail access, loading docks, etc.)?
- Will any work be subcontracted?
- Is it feasible to have someone else manufacture the product?

Is the market real?

- Is there a need or want?
- Can the customer afford to buy the product? Will the customer buy the product?

- Who or what is the target market?
- What is the size of the target market?
- Will the product be targeted at a specific market segment?

Can the product be competitive?

- Can it compete based on design and performance features?
- How will the market be penetrated?
- Is the timing right?
- What price will be charged for the product or service? Is the price right?
- How was the price determined?
- How does the price compare with that of similar products or services?
- What will be the primary form of advertising?
- How much money will be used for advertising? Will direct mail, email or telemarketing be used?
- How will market share be maintained and increased?
- How will the product or service be distributed?
- Will the business offer credit to customers?
- Is anything different being done from current industry practices, and, if so, why?

Figure 7-2. Critical Decision Factors in Determining Marketability (Cont.)

7.3.5 Assess the Competition

In analyzing marketability, a major effort should be made to understand the competition—who they are and what their strengths and weaknesses are. The analysis of the competition can be broken down in several ways. From a product viewpoint, one can identify similarities and differences with the competition’s products and assess how the competition approaches product improvements, as well as the competition’s pricing

strategies. The analysis may be geographical if product location is a factor. The promotional efforts of the competition can be reviewed to see how the competitors advertise and what messages they convey. The competitors' internal strengths can be judged by assessing how well each competitor is managed and the technical strengths of their employees, and by reviewing any available information on the financial soundness of each competitor. In general, in addressing the competition, what is looked for is something that will provide a competitive advantage, or something that will suggest a way to exploit a weakness or turn a competitor's strength into an argument in one's own favor.

7.3.6 Assess the Risks

In determining marketability and, in particular, identifying threats, risks that may not be attributable to any specific competitor or groups of competitors must also be analyzed. The major categories of risks are business risks and environmental risks.

Business risks include the cost structure of the industry, industry cycles, profit margins and sales volumes, and product alternatives. The cost structure of an industry refers to whether or not it is capital-intensive. A capital-intensive industry requires a large amount of capital to get started and to maintain production; to minimize risk, a large capital investment must be planned for. Similarly, whether the industry is cyclical (e.g., seasonal) must be taken into consideration in order to plan to minimize risk. The relationship between sales volume and profit margin must also be factored in. It may be riskier to have a product that is sold in low volume over a long period of time but with high profit margins, than a product that sells in high volume over a short period of time with low profit margins. And, there is always the risk that customers will turn to a substitute or an alternative means of doing something without buying one's product or a direct competitor's product.

Environmental risks are generally beyond one's control, but can nonetheless be recognized and sometimes mitigated through appropriate planning. Environmental risks include legal issues (including liability claims), economic issues (inflation, recession, etc.), and natural disasters and other changes in the physical environment.

7.3.7 Identify the Market for the Product

Up to this point, the direction of activities has been inward—looking at the technologies available within the laboratory or R&D center. Now the direction of the assessment shifts outward—looking at potential markets, that is, potential customers, competition, and partners.

Identifying potential markets starts with drawing up a list. Even if one is already familiar with what is considered the best market for a particular technology transfer endeavor, it is still helpful to generate a list of other organizations that might have an interest. These additional organizations might be customers or potential partners, or they might be seen as competitors. Where particular areas of excellence or core competencies in the laboratory can be identified, some techniques for identifying potential partners outside the laboratory may include:

- Identifying and interacting with relevant professional and trade organizations
- Using web-based commercial tools for technology assessment and determination of market potential
- Talking with area Chambers of Commerce
- Interacting with state economic development organizations
- Asking researchers to identify their peers outside of the laboratory.

If not sure of the potential market, the best thing to do is research the industry.

Companies in the industry can most easily be identified through both an Internet and literature search. The library or Technical Reference Center in the laboratory can be of great assistance in this effort. A simple search of the business press and periodicals will identify articles containing the names and, just as important, strategic goals of appropriate companies and the names of key industry contacts. Other common industry search resources that should be used and are available on the Internet include:

- Thomas Register of American Manufacturers (www.Thomasnet.com)
- Dun & Bradstreet (www.dnb.com)

- Standard and Poor's (www.standardandpoors.com)
- The North American Industry Classification System (NAICS) (The NAICS citation/link is: <http://www.census.gov/eos/www/naics/>).

Internet searches can yield company lists, profiles, and financial data in a fraction of the time and cost it would take to research and scan hard copy.

State and local economic development agencies and organizations, including partnership intermediaries, can provide lists of organizations by type of business and geographic location. In addition, through a partnership intermediary agreement (PIA), partnership intermediaries (see Section Six) can serve as a technology broker for the laboratory and provide other technology transfer assistance and services to the T2 office. City and county Chambers of Commerce are also sources of business lists. Other resources include: attendee lists from technical conferences; lists of one's own or colleagues' personal contacts with industry, academia, and public agencies; and CRADAs, strategic partnerships, joint ventures, or licensing agreements with companies that sell related products to the government or are known in the industry for developing new products.

7.3.8 Develop a Marketing Campaign

In addition to the efforts previously described, the individual, laboratory or other organization unit may conduct a marketing campaign to disseminate information about a technology or the laboratory and its technologies. In other words, the individual technologist or the laboratory may advertise its own products, i.e., the available technologies and expertise.

7.4 TECHNOLOGY TRANSFER MARKETING ADVERTISING/MARKETING TECHNIQUES

There are a number of methods to reach an audience, but it is not likely that major mass media (i.e., advertisements through television, radio, newspapers and magazines) will be employed since trying to reach a mass audience is usually not a goal of a laboratory marketing effort. The techniques for promoting technology transfer should be much more targeted. Some techniques will require money, but others can be used to generate free publicity.

Some of the techniques that have been used effectively by federal agencies and laboratories to inform the private sector, universities, and state and local governments about opportunities available in the federal laboratories are identified below.

- Innovator's contact with peers—The direct contacts that inventors have with their peers through professional societies and conferences is a highly effective method for creating interest in specific innovations outside of the laboratory.
- Technology briefs—Short summaries of technologies and their potential commercial uses can be widely distributed to targeted populations via mail, email, or a website.
- Presentation at professional and trade associations—These associations bring together professionals with similar interests and can provide a forum to discuss opportunities in the laboratories. Advertisements in professional magazines have also proven effective.
- Small business workshops—Workshops targeted at small businesses in specific technology areas are often sponsored by laboratories. State economic development organizations and the Small Business Administration may be potential partners in sponsoring these workshops.
- Technology roundtables—Discussion forums can be organized around a particular technology area with representation sought from one or more laboratories, private industry, academia, and state and local governments.
- Laboratory representation at national meetings—The FLC, AUTM, and other similar organizations sponsor national forums where private-sector companies are invited to visit laboratory displays and talk with laboratory personnel.
- Advertisements and articles in R&D magazines—Targeted exposure of laboratory technologies in R&D magazines can provide effective connections among parties with similar interests.
- Website posting—Potential partners search for partnership or licensing opportunities on laboratory/facility websites.
- Advertisement in *FedBizOps* (www.fedbizopps.gov)—Widely read by many U.S. technology companies, *FedBizOps* provides a forum for broad dissemination about possible opportunities in the laboratory.

A targeted direct mailing or emailing (or telephone campaign) is a good way to reach the specific people who are most likely to become technology transfer partners. This requires building a list of the people being targeted and producing (directly or indirectly) the material to be sent out, e.g., brochures, newsletters, articles, press releases, technology abstracts, etc.

Targeted strategic advertising is probably most beneficial when a medium can be identified that reaches the intended target market. For example, an industry publication that is read by the heads of R&D laboratories in the product's technology area may provide a good vehicle for a paid advertisement.

Free notice in the trade press often can be accomplished by sending out press releases to newsletters, newspapers, magazines and journals that cover the targeted industry or technology area. The press release should cover something that is timely or newsworthy, and should contain contact information for someone who can supply additional details about the technology and the opportunities for technology transfer. Press releases normally require approval by laboratory or agency communications staff prior to dissemination.

Along the same lines, an individual scientist or engineer can author articles for professional journals and the trade press, and write papers for, serve as a panel speaker and attend conferences that will indirectly promote his/her technical capabilities and the opportunities for technology transfer.

The Internet is one of the most effective methods being used to bring product awareness to a broader audience. There may be opportunities to establish on the laboratory's website a product sub-site that enables the T2 office to highlight the product, its uses, and its capabilities. The FLC website (www.federallabs.org) may also be used to highlight the technology. (To publicize a laboratory's technology on the FLC website, contact the FLC Management Support Office at 856- 667-7727 or at flcmso@federallabs.org.)

7.5 FINDING PARTNERS

Although a great deal of time and energy may have been expended in technological development and market research to reach this point, far more effort will be required to transform the technology into a viable commercial product or process. Now others must be involved to help move the commercialization activities forward.

The commercialization process involves many people, resources and some luck. As this process progresses, an ever-expanding number of “others” must begin to be relied on and must be enlisted in the commercialization effort. Among this group are certain critical participants, or “partners.” These are the “stakeholders,” “champions,” and “sponsors/investors.” Their involvement in the process will increase the likelihood of developing a product or process with commercial value. Often, contacts with these potential external partners may be made as part of the advertising/marketing activities described above, including contact with peers; and attendance at professional or trade shows, meetings, and conferences; small business workshops, technology roundtables, etc.

Many scientists or engineers are reluctant to seek the support of others. Unfortunately, the longer the involvement of others is delayed, the more difficult it becomes to reach out and build coalitions. This coalition-building process among the stakeholders, champions, and sponsors/investors is the focus of the next phase of the commercialization process, and is based on the list of organizations and key individuals identified during the market research phase.

7.5.1 Stakeholders

The first group of potential external supporters is referred to as “stakeholders.” **Stakeholders** may be defined as anyone affected by the innovation, product, or technology. (The scope of this definition further emphasizes the need and importance of building coalitions among the members of this potentially large, diverse group.) The stakeholders will be identified when the industry that the technology or innovation will affect is defined. Once the industry has been identified, every participant—from the technology transfer practitioner to the ultimate consumer—is a stakeholder.

Next, the appropriate stakeholders must be identified through market research. These stakeholders are always there, but one needs to know who they are and where they can be found. This will take time. To identify specific stakeholders, one must know the players in the industry. The place to start is with a personal network of educational, governmental, and professional associates, who may in turn lead to the other contacts. Other personal resources include attendee lists from technical conferences and lists of colleagues' personal contacts in industry, academia, and public agencies.

Initial contacts should be used as potential “multipliers” or “links” that can result in references to other potential stakeholders. The network of stakeholders can be expanded through market research, including:

- Trade or networking groups
- Venture capital groups
- Industry trade newspapers and magazines
- NAICS database.

The above may be located through either an Internet or literature search.

In addition, a scientific advisory board may be needed to validate the laboratory's research efforts.

Stakeholders with power are particularly important because they can influence others. These influential individuals often become “champions” and can play a significant role in attracting future investors.

7.5.2 Champions

Successful ventures and commercialization require “champions.” A champion is a person with status or clout who is an advocate for the product. In fact, champions provide legitimacy to the developer/inventor and have a powerful impact on the coalition-building process. Without champions, few products go forward. However, the initial champion must be the scientist or engineer. Thus, in the beginning of the commercialization process, the technologist must assume the role of champion and build the coalitions. The roles of champion

and business visionary are often the same and are filled by the same person. Nevertheless, many champions are necessary in the evolution of a product, and they often are the unsung heroes of successful commercialization.

While champions within an organization are important, champions outside the organization are even more important. Champions can be found among colleagues in the inventor's field of expertise, those who know his or her work, and those who know the inventor and think well of the innovation. Champions may also be among the earliest stakeholders. As these early stakeholders become involved in the commercialization process, they most likely will become champions.

External champions must be relied on to bring the inventor and product to the attention of others. Often, champions with influence are the best resource when working with corporate gatekeepers. While it will often be necessary for an inventor to speak on his or her own behalf, it can be far more effective to have someone with influence speaking as a "champion."

7.5.3 Sponsors/Investors

In terms of technology-driven commercialization efforts, sponsors are considered to be synonymous with investors. Sponsors bring resources, including money, equipment or special talent, all of which contribute to product development. Investors may be family, friends, stockholders, angels, venture capitalists, banks, collaborators, CRADA partners, business partners, and licensees. As a group, they are more likely to ask tough questions and have the greatest influence. Positive responses to their questions and concerns are essential, because they can become the most credible advocacy group. In any circle, the commitment of money is universally understood as a positive statement of support. Conversely, when this support is not forthcoming, its mere absence is perceived as negative.

Given the importance of sponsors/investors, how does the scientist or engineer proceed to develop the support of these individuals for the commercialization effort? The primary source of sponsors/investors

is the coalition comprising the innovator, stakeholders, and champions. Through this coalition, many stakeholders may be identified—a few of whom will become champions—who in turn can foster relationships with one or two investors.

Investors or sponsors of government-developed expertise and technology are most often developed through CRADAs, strategic partnerships, joint ventures, or license agreements with companies that:

- Sell related products to the government
 - Are known in the industry for developing new products.
-

7.6 NEGOTIATING—THE CRITICAL FINAL STEP

Once a marketing approach and a business strategy have been developed, the T2 office and the inventor must be prepared to engage in negotiations. Negotiations might be required to obtain financing for a new business, to license an invention (see Section Five), or to arrange a CRADA partnership or collaboration (see Section Four). Negotiating agreements with the private sector is a complex process. Both federal and private-sector parties need to identify early in the process what they hope to gain from the agreement. Many factors will need to be considered when negotiating agreements that are advantageous to all parties. Some of these factors include:

- **Laboratory**
 - What is the relevance of the technology to the laboratory's mission?
 - What are the benefits to and needs of the laboratory?
 - What federal resources will be required?
- **Technology**
 - What is the stage of development?
 - What resources will be required to bring it to commercialization? What additional “know-how” will be needed?
 - What are the potential fields of use?
 - What is the size of the market for the technology?

- **Company**

- What is the size of the company and what are its resources?
- What is its ability to develop, manufacture, market, and distribute the commercialized product?
- What are the potential profits?
- What is the need to protect proprietary data and to obtain a competitive advantage?

While the art of negotiating is beyond the scope of this book, it is necessary to be aware of the following basic negotiating principles and guidelines.

- **Have an absolutely clear vision of what you want and what you have to offer**—This is the key to successful negotiations.
- **Identify concerns**—During initial contacts with the negotiating partner, ask open-ended questions to determine the other party's concerns. By uncovering these concerns, they can be addressed and appropriate responses formulated. Remember, problems that are perceived but not addressed are “deal breakers.”
- **Define what you have to offer**—Identify two or three assets you have to offer and articulate them in simple, nontechnical terms. This will provide a focus for the negotiations. If negotiations stray to noncritical issues, focusing on the primary assets can bring the negotiations back to the key issues.
- **Thoroughly research the other party's needs**—In addition to the information gathered from ongoing conversations, it is often helpful to revisit the public records and press statements of the negotiating partners. This research is often an extension of the research conducted when the marketing portion of the business plan was written; however, now the focus is on one organization. In fact, this may be the appropriate time to pay for professional research if the resulting knowledge will lead to more successful negotiations. This research also communicates the importance of the proposed relationship.
- **Have a clear understanding of issues that are not negotiable**—Once a personal rapport with the negotiating partner has been developed, it is best to bring up the non-negotiable issues because

your position suffers the least if you bring them into the discussions. By taking the initiative, you can package these issues in the most favorable light and avoid being placed in a defensive posture later. If these non-negotiable issues prove to be the “deal breaker” at the outset, they most likely would have been a deal breaker later in the negotiations and you will have saved yourself time, resources and ultimate disappointment.

- **Do not be afraid to ask for what you want**—Successful business people are usually willing to negotiate, even though they may say they have made their best offer. Be prepared to ask for what you want, and also be prepared to accept what you need.
- **Do not take absolute positions**—Always leave an option for movement. If negotiations become intense, give yourself and the other parties time to lower the intensity and think clearly.
- **Always have a “BATNA” (best alternative to a negotiated agreement)**—Have a pre-established alternative (BATNA) so that if you don’t get what you want, you will be able to walk away knowing you have another alternative (e.g., another partner).

Remember, the best definition of a good deal is one in which you gave a little more than you wanted to give and the other party got a little less than it wanted to get.

Appendix A

**HIGHLIGHTS OF TECHNOLOGY
TRANSFER LEGISLATION AND
RELEVANT EXECUTIVE ORDERS**

Since 1980, Congress has enacted a series of laws to promote technology transfer and to provide technology transfer mechanisms and incentives. The intent of these laws and related Executive Orders is to encourage the pooling of resources among federal laboratories, private industry, and academia to develop potential commercial technologies.

Highlights of major technology transfer legislation and relevant Executive Orders are discussed on the following pages. A table summarizing the major legislative themes is provided as Appendix B.

FINDING TECHNOLOGY TRANSFER LAWS, EXECUTIVE ORDERS, AND REGULATIONS

The technology transfer laws have been embodied (codified) in the United States Code (USC), which provides a single source uniting the provisions of each law. The primary section covering technology transfer is Title 15 (Commerce and Trade), Chapter 162 (Technology Innovation):

- 15 USC 3710 through 3704 cover the finding of Congress, the purpose of the legislation, definitions, and the establishment of various offices to carry out the intent of the legislation.
- 15 USC 3705 through 3708 provide for the establishment of Cooperative Research Centers, grants and cooperative agreements. Affiliated with universities or nonprofit institutions, Cooperative Research Centers engage in research that supports technological innovation, and provide assistance and training to individuals and small businesses. The centers must also use the expertise of federal laboratories, where appropriate.
- 15 USC 3710 through 3710d cover the establishment of federal technology transfer offices (i.e., Offices of Research and Technology Applications [ORTAs]); the FLC; Cooperative Research and Development Agreements (CRADAs); cash awards for inventions, innovations, computer software, or other outstanding contributions; and the sharing of royalties or licensing fees with laboratory inventors.

The complete text of these USC sections and other technology transfer legislation and Executive Orders can be found in the FLC's publication, Federal Technology Transfer Legislation and Policy ("The Green Book"),

available from the FLC website at <http://www.federallabs.org/store/greenbook/>. A PDF version of this publication is available for download at http://www.federallabs.org/pdf/FLC_Legislation_and_Policy.pdf. Executive Orders generally can be found at www.archives.gov/federal-register/executive-orders.

Regulations governing the licensing of government-owned inventions, including those made under CRADAs, are found in the Code of Federal Regulations (CFR) at 37 CFR 404. The CFR can be accessed at www.gpoaccess.gov/CFR.

Summaries of the technology transfer legislation and Executive Orders are provided below.

LEGISLATION AND EXECUTIVE ORDER HIGHLIGHTS

Executive Order 10096 (1950)

Executive Order 10096, “Providing for a Uniform Patent Policy for the Government With Respect to Inventions Made by Government Employees and for the Administration of Such Policy,” established federal policy that all rights to inventions made by government employees were assigned to the government if the invention was made within the scope of their employment; during working hours; or with a contribution by the government of facilities, equipment, materials, funds, information, or the time or services of other government employees on official duty. However, if the contribution of the government to the invention is insufficient to justify a requirement of assignment of the invention to the government of the entire right, title and interest to such invention, or if the government has insufficient interest in an invention, or if the government has insufficient interest in an invention, the employee retains title to the invention. In such cases, the government reserves a nonexclusive, irrevocable, royalty-free license in the invention with the power to grant licenses for all governmental purposes.

Stevenson-Wydler Technology Innovation Act of 1980 (P.L. 96-480)

The Stevenson-Wydler Act of 1980 is the first of a continuing series of laws to define and promote technology transfer. It made it easier

for federal laboratories to transfer technology to nonfederal parties and provided outside organizations with a means to access federal laboratory developments.

The primary focus of the Stevenson-Wydler Act concerned the dissemination of information from the federal government and getting federal laboratories more involved in the technology transfer process. The law requires laboratories to take an active role in technical cooperation and to set apart a percentage of the laboratory budget specifically for technology transfer activities. The law also established a technology transfer office, or Office of Research and Technology Applications (ORTA), in each laboratory to coordinate and promote technology transfer.

Bayh-Dole Act of 1980 (P.L. 96-517)

The Bayh-Dole Act of 1980, together with the Patent and Trademark Clarification Act of 1984 (P.L. 98-620), established more boundaries regarding patents and licenses for federally funded research and development. Small businesses, universities, and not-for-profit organizations were allowed to obtain titles to inventions developed with federal funds. Government-owned and government-operated (GOGO) laboratories were permitted to grant exclusive patent licenses to commercial organizations.

Small Business Innovation Development Act of 1982 (P.L. 97-219)

The Small Business Innovation Development Act of 1982 established the Small Business Innovation Research (SBIR) program, requiring agencies to provide special funds for small business R&D connected to the agencies' missions. SBIR has been reauthorized through 2008 by the Small Business Research and Development Enhancement Act of 2000. At the time of this update, the SBIR program is operating under a continuing resolution.

SBIR is a highly competitive program designed to encourage innovation, as well as the commercialization of products and processes developed by small businesses through federal funds. Each year 11 federal departments and agencies are required to reserve 2.5% of their extramural R&D

budgets for SBIR awards. These agencies designate SBIR R&D topics and accept proposals. SBIR awards or grants are awarded competitively to small U.S.-owned commercial businesses with less than 500 employees that submit proposals addressing topics published by the agencies. Following submission of proposals, agencies make SBIR awards based on technical merit, degree of innovation, and future market potential. Small businesses that receive awards or grants then begin a three-phase program. The SBIR Program provides four years of confidentiality for data created in the program, and the small business awardee obtains title to the inventions. A 2002 SBA SBIR Policy Directive forbids the SBIR awardee from partnering/subcontracting with a federal laboratory. However, on a case-by-case basis, the SBA may grant a waiver from this provision if the awarding agency provides sufficient justification, as outlined in the SBIR policy directive. For more information on the SBIR Program, visit the SBA SBIR/STTR website at www.sba.gov/sbir or contact the SBA Office of Technology at 202-205-6450.

Federal Technology Transfer Act of 1986 (P.L. 99-502)

The Federal Technology Transfer Act of 1986 was the second major piece of legislation to focus directly on technology transfer. All federal laboratory scientists and engineers are required to consider technology transfer an individual responsibility, and technology transfer activities are to be considered in employee performance evaluations.

This 1986 law also established a charter and funding mechanism for the previously existing Federal Laboratory Consortium for Technology Transfer (FLC). In addition, the law enabled GOGO laboratories to enter into Cooperative Research and Development Agreements (CRADAs) and to negotiate licensing arrangements for patented inventions made at the laboratories. It also required that government-employed inventors share in royalties from patent licenses. Further, the law provided for the exchange of personnel, services, and equipment among the laboratories and nonfederal partners.

Other specific requirements, incentives and authorities were added, including the ability of GOGO laboratories to grant or waive rights to laboratory inventions and intellectual property, and permission for current

and former federal employees to participate in commercial development, to the extent that there is no conflict of interest.

Executive Order 12591 (1987)

Executive Order 12591, Facilitating Access to Science and Technology (1987), was written to ensure that federal laboratories and agencies assist universities and the private sector by transferring technical knowledge. The order required agency and laboratory heads to identify and encourage individuals who would act as conduits of information among federal laboratories, universities, and the private sector. It also underscored the government's commitment to technology transfer and urged GOGOs to enter into cooperative agreements to the limits permitted by law.

The order also promoted the commercialization of federally funded inventions by requiring that, to the extent permitted by law, laboratories grant to contractors the title to patents developed in whole or in part with federal funds, as long as the government is given a royalty-free license for use.

Omnibus Trade and Competitiveness Act of 1988 (P.L. 100-418)

The Omnibus Trade and Competitiveness Act of 1988 emphasized the need for public/private cooperation in realizing the benefits of R&D, established centers for transferring manufacturing technology, established Industrial Extension Services and an information clearinghouse on state and local technology programs, and extended royalty payment requirements to non-government employees of federal laboratories. It also changed the name of the National Bureau of Standards to the National Institute of Standards and Technology (NIST) and broadened its technology transfer role, including making NIST the FLC's host agency.

National Competitiveness Technology Transfer Act of 1989 (P.L. 101-189)

The National Competitiveness Technology Transfer Act of 1989 provided additional guidelines and coverage for the use of CRADAs, extending to GOCO laboratories essentially the same ability to enter into CRADAs that previously had been granted to GOGO laboratories by the Federal Technology Transfer Act of 1986.

To protect the commercial nature of the agreements, the Act allowed information and innovations that were created through a CRADA, or brought into a CRADA, to be protected from disclosure to third parties.

The Act also provided a technology transfer mission for the Department of Energy's (DOE) nuclear weapons laboratories.

American Technology Preeminence Act of 1991 (P.L. 102-245)

The American Technology Preeminence Act of 1991 contained several provisions covering the FLC and the use of CRADAs. The mandate for the FLC was extended to 1996, the requirement that the FLC conduct a grant program was removed, and a requirement for an independent annual audit was added.

With respect to CRADAs, the Act included intellectual property as potential contributions under CRADAs. The exchanging of intellectual property among the parties to an agreement was allowed, and the Secretary of Commerce was asked to report on the advisability of creating a new type of CRADA that would allow federal laboratories to contribute funds to the effort covered by the agreement (which is not permitted at present). It also allowed laboratory directors to give excess equipment to educational institutions and nonprofit organizations as a gift.

Small Business Research and Development Enhancement Act of 1992 (P.L. 102-564)

This Act established the Small Business Technology Transfer (STTR) program. STTR is a three-phase program similar to the SBIR Program in many ways. The key differences are that STTR funding is available only from five agencies and the small business must partner a minimum of 30% of the effort with a U.S. college or university, nonprofit research organization, or federally funded research and development center (FFRDC). The designated agencies select R&D topics, accept proposals, and award grants for a three-phase program that mirrors the SBIR Program. Awards are based on small business/nonprofit research institution qualifications, degree of innovation, and future market potential. The STTR Program was reauthorized through 2009 by the

Small Business Technology Transfer Program Reauthorization Act of 2001. The STTR program provides early-stage R&D funding directly to small companies working cooperatively with researchers at other research institutions. The objectives of the STTR Program are to bridge the funding gap between basic research and commercial products, and to provide a way for researchers to pursue commercial applications of technologies. Unlike SBIR, a small business may partner with a federal laboratory that is an FFRDC without the need of a waiver from the SBA. For more information about the STTR Program, visit the SBA SBIR/STTR website, www.sba.gov/sbir, or call the SBA Office of Technology at 202-205-6450.

National Department of Defense Authorization Act for 1994 (P.L. 103-160)

This Act broadened the definition of a laboratory to include weapons production facilities at the Department of Energy (DOE).

National Technology Transfer and Advancement Act of 1995 (P.L. 104-113)

This law amended the Stevenson-Wydler Act to make CRADAs more attractive to both federal laboratories and scientists and to private industry. The law provides assurances to U.S. companies that they will be granted sufficient intellectual property rights to justify prompt commercialization of inventions arising from a CRADA with a federal laboratory, and gives the collaborating party in a CRADA the right to choose an exclusive or nonexclusive license for a pre-negotiated field of use for an invention resulting from joint research under a CRADA. The CRADA partner may also retain title to an invention made solely by its employees in exchange for granting the government a worldwide license to use the invention. The law also revised the financial rewards for federal scientists who develop marketable technology under a CRADA—increasing the annual limit of payment of royalties to laboratories from \$100,000 per person to \$150,000.

In addition, the Act permanently provided the FLC with funding from the agencies.

Technology Transfer Commercialization Act of 2000 (PL. 106-404)

This Act recognizes the success of CRADAs for federal technology transfer and broadens the CRADA licensing authority to include preexisting government inventions to make CRADAs more attractive to private industry and increase the transfer of federal technology. The Act permits federal laboratories to grant a license for a federally owned invention that was created prior to the signing of a CRADA. In addition, the Act requires an agency to provide a 15-day public notice before granting an exclusive or partially exclusive license, and requires licensees to provide a plan for development and/or marketing of the invention and to make a commitment to achieve a practical application of the invention within a reasonable period of time; however, the Act exempts from these requirements the licensing of any inventions made under a CRADA.

Energy Policy Act of 2005 (P.L. 109-58)

This Act established within the Department of Energy a technology transfer coordinator as the principal advisor to the secretary on all matters related to technology transfer and commercialization; a technology transfer working group to coordinate technology transfer activities at DOE labs (with oversight by the technology transfer coordinator); and an energy technology commercialization fund to provide matching funds with private partners to promote energy technologies for commercial purposes.

America COMPETES Act (PL 110-69)

This Act, which was promulgated in 2007, authorized programs in multiple agencies focused on the overarching themes of increasing funding for basic research; strengthening teacher capabilities and encouraging student opportunities in science, technology, engineering and mathematics (STEM) educational programs; enhancing support for higher-risk, higher reward research; and supporting early career research programs for young investigators. The primary impact on technology transfer included the elimination of the Department of Commerce Office of Technology Administration, and the associated Under Secretary, which had the principal reporting and analytical responsibilities

for technology transfer activities government-wide (these duties were reassigned within Commerce).

Other Legislation

Other laws that are part of the technology transfer effort, although perhaps not quite as directly as the previously discussed legislation, include:

- The Cooperative Research Act of 1984 (P.L. 98-462) established several R&D consortia (e.g., Semiconductor Research Corporation and Microelectronics and Computer Technology Corporation) and eliminated some of the antitrust concerns of companies wishing to pool R&D resources.
- The Trademark Clarification Act of 1984 (P.L. 98-620) permitted patent license decisions to be made at the laboratory level in GOCO laboratories and permitted contractors to receive patent royalties to support the R&D effort. Private companies were also permitted to obtain exclusive licenses.
- The Japanese Technical Literature Act of 1986 (P.L. 99-382) improved the availability of Japanese science and engineering literature in the U.S.
- The National Institute of Standards and Technology Authorization Act for FY 1989 (P.L. 100-519) permitted contractual consideration for intellectual property rights other than patents in CRADAs, and included software developers as eligible for technology transfer awards.
- The Defense Authorization Act for FY 1991 (P.L. 101-510) established model programs for national defense laboratories to demonstrate successful relationships between the federal government, state and local governments, and small businesses and permitted those laboratories to enter into a contract or a Memorandum of Understanding with an intermediary to perform services related to cooperative or joint activities with small businesses.
- The National Defense Authorization Act for FY 1993 (P.L. 102-484) extended the potential for CRADAs to some Department of Defense-funded FFRDCs not owned by the government.

APPENDIX B

MAJOR LEGISLATIVE THEMES IN

FEDERAL TECHNOLOGY TRANSFER

Major Legislative Themes in Technology Transfer

Theme	Initiation	Progression
Technology Transfer as a Mission	<p>1980 Stevenson-Wydler Technology Innovation Act established technology transfer as a mission of the federal government</p> <p>1986 Federal Technology Transfer Act (FTTA) made technology transfer a priority not only for GOGOs, but for every GOGO employee</p>	<p>1987 Executive Order 12591 emphasized the government's commitment to facilitating access to science and technology</p> <p>1989 National Competitiveness Technology Transfer Act (NCTTA) established a mission for GOCOs and GOCC employees</p>
U.S. Manufacture	<p>1980 Patent and Trademark Amendments Act (Bayh-Dole) provided exclusive rights to inventions arising under funding agreements with federal agencies to small businesses and nonprofit organizations agreeing that products embodying the invention will be manufactured substantially in the U.S.</p> <p>1980 Stevenson-Wydler Technology Innovation Act required that preference be given to industrial technology transfer partners agreeing to substantially manufacture in the U.S. any products resulting from technology transfer</p>	<p>1984 Trademark Clarification Act (amending Bayh-Dole) extended substantial manufacture in the U.S. provisions to all partners of federal agencies</p> <p>1986 Federal Technology Transfer Act (FTTA) required that preference be given to CRADA partners located in the U.S. and agreeing that products embodying inventions made under the CRADA will be manufactured substantially in the U.S.</p> <p>1989 National Competitiveness Technology Transfer Act (NCTTA) established congressional intent that CRADAs be performed in a manner that fosters the competitiveness of U.S. industry</p>

Major Legislative Themes in Technology Transfer (continued)

Theme	Initiation	Progression
Small Business	<p>1980 Patent and Trademark Amendment Act (Bayh-Dole) permitted small businesses to obtain title to inventions developed with government support</p> <ul style="list-style-type: none"> • Established the Small Business Innovation Research (SBIR) Program • Required agencies to provide special funds for small business R&D connected to the agencies' mission <p>1982 Small Business Innovation Development Act</p> <ul style="list-style-type: none"> • Established the Small Business Innovation Research (SBIR) Program • Required agencies to provide special funds for small business R&D connected to the agencies' mission 	<p>1991 Defense Authorization Act established model programs for laboratories to demonstrate successful relationships between government and small business</p> <p>1992 Small Business Technology Transfer Act mandated government agency funding of cooperative R&D projects between small businesses and universities, federally funded R&D centers, or nonprofit research institutions</p> <p>1992 FY 1993 Defense Authorization Act directed DOE to facilitate and encourage technology transfer to small business</p>

Major Legislative Themes in Technology Transfer (continued)

Theme	Initiation	Progression
Title to Inventions	1980 Bayh-Dole Act permitted universities, not-for-profit organizations, and small businesses to obtain title to inventions developed with government support	1984 Trademark Clarification Act allowed laboratories run by universities and nonprofit institutions to retain title to inventions within limitations
Specific agency authorizing legislation	1986 Federal Technology Transfer Act (FTTA) allowed GOCOs	1988 Omnibus Trade and Competitiveness Act extended royalty payment requirements to inventors at the laboratories who are not government employees
		<ul style="list-style-type: none"> • To make advance agreements with large and small businesses on title to inventions resulting from CRADAs • To grant and waive rights to laboratory inventions and intellectual property
		<p>1995 National Technology Transfer and Advancement Act</p> <p>gave CRADA partners sufficient intellectual property rights to justify prompt commercialization of inventions to GOCOs that had been established for GOCOs by the FTTA</p> <p>or nonexclusive license to an invention resulting from a CRADA</p>
		<ul style="list-style-type: none"> • The act also required that inventors who are government employees share in royalties from patent licenses

Major Legislative Themes in Technology Transfer (continued)

Theme	Initiation	Progression
Dissemination of Information/ FOIA:	<p>1966 Freedom of Information Act (FOIA):</p> <ul style="list-style-type: none"> • Provided a vehicle to inform the public about federal government activities • Gave citizens the right to request agency records and have them available promptly 	<p>1980 Stevenson-Wydler Technology Innovation Act focused on dissemination of government information through an active commitment to technology transfer</p> <p>1980 Bayh-Dole Act protected descriptions of inventions from public dissemination and FOIA for a reasonable amount of time to allow patent applications to be filed</p>
Authorization of CRADAs	<p>1986 FTTA authorized CRADAs for GOCOs</p>	<p>1989 NCTTA authorized CRADAs for GOCOs</p> <p>1992 Energy Policy Act authorized DOE to enter into CRADAs directly, without laboratory participation</p> <p>1992 FY 1993 Defense Authorization Act extended potential CRADAs authority to some DOD-funded federally funded R&D centers not owned by the government</p>
Establishment of Organizations to Advance Technology Transfer	<p>1980 Stevenson-Wydler Technology Innovation Act enabled funding for the establishment of Offices of Research and Technology Application (ORTAs) at major federal laboratories</p>	<p>1986 Federal Laboratory Consortium (FLC) legislated by the FTTA</p> <p>1989 Conference Committee Report of the FY 1990 Independent Agencies Appropriations Act recommended the establishment of the National Technology Transfer and Technology Transfer Center (NTTC) by NASA</p> <p>1991 FLC mandate extended by the American Technology Preeminence Act</p> <p>1992 NASA established six Regional Technology Centers (RTTCs) under authority granted in the National Aeronautics and Space Act of 1958</p> <p>1995 National Technology Transfer and Advanced-ment Act permanently provided the FLC with funding from the agencies</p> <p>2005 The Energy Policy Act of 2005 established within DOE a technology transfer coordinator and working group.</p>



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