

most PC's on the market or can be added inexpensively. Even if the information is only available in printed form, scanning technology can easily convert it to computer formatted information which can be indexed, stored, and retrieved by retrieval software.

Access by Personal Computers with modems have revolutionized information flow. Any individual with a modem-equipped PC has a preponderance of data bases, information services, and bulletin boards available free or at nominal cost which can provide access to almost any type of information.

Having the information readily available in a searchable system, however is only one step in making it accessible. Most corporations and small businesses are not trained in searching for information and can easily be overwhelmed by the volume of information available. Also, there is still a large percentage of the adult population which is computer illiterate. For these potential users, seeking technology and assistance through an intermediary such as a Small Business Development Center, a Regional Technology Transfer Center, or commercial assistance service can be more effective than long, perhaps fruitless search efforts, on-line. For this reason, the federal data bases and systems serve the assisting organizations better than the general public, and the service organizations play an important role as an intermediary. Documents, such as those available from NTIS, are also more appropriate for these clients.

## OVERVIEW OF FEDERAL SUPPORT FOR R&D

The research and development activities of the United States Government are vast and diverse, touching almost every conceivable area of technology that contributes to what is known as the National Technology Base. The sources of this technology come from both internal R&D programs conducted at the Nation's many R&D Centers and Laboratories and from the external R&D conducted through contracts and grants at American as well as foreign corporations and universities.

it is important to note, when considering technology transfer issues, that many Federal R&D activities are mission-oriented and are not in existence to produce spin-offs for commercial purposes. This is particularly true of the DOD, some DOE programs and NASA. Other agencies, such as the Environmental Protection Agency and the Federal Aviation Administration are regulatory in nature, therefore their R&D is also mission-oriented.

The technological resources of the National Technology Base include not only the technology itself, but also the expertise and know-how of thousands of scientists, technicians, and technical managers, A third element of this base is the diverse

number of unique laboratory and testing facilities that is also a part of the Nation's technological resource. All these resources - technology, expertise, and facilities - are elements in the technology transfer equation and the key to America's technological and economic strength as well as its National security.

Because the elements of this national resource are centered in a number of agencies as diverse as the technologies they spawn, the most effective way to describe the Federal support for R&D and the information that is associated with it is by examining the principal agencies involved and the programs that each has in place to carry out technology transfer. These programs, in general, all attempt to address the barriers to technology transfer and some are more effective than others due to the effects of mission and culture.

Every agency in the United States Government that sponsors R&D has some programs in place to systematically collect information on the technology produced. The majority of the agencies use the data and report collection capabilities of the National Technical Information Service (NTIS) to collect and provide the public with access to the technology that they generate. There are a few exceptions: The Department of Defense, which is concerned with National Security Issues; the Department of Energy which also has a concern with nuclear security issues; and the National Aeronautics and Space Administration, which has a concern about Aerospace critical technology. Because of their missions, and the need to protect mission critical technology from public disclosure and adverse "technology transfer" to potential adversaries, these agencies have their own collection and documentation programs that are described below.

Two other driving forces in national technology transfer are The National Technology Transfer Center (NTTC) and the Federal Laboratory Consortium (FLC). These organizations work closely together to simplify access to federal technology, expertise, and resources throughout the federal system. The NTTC and the FLC are described in further detail in the next section.

## CROSS-CUTTING TECHNOLOGY TRANSFER ORGANIZATIONS

### The National Technical Information Service (NTIS)

The results of Federally-funded R&D are documented in tens of thousands of technical reports and papers each year. The primary repository responsible for collecting those reports that are public-releasable (not military or space critical, or classified) is the U.S. Government's central technical information clearinghouse, the National Technical Information Service of the U.S. Department of Commerce.

NTIS is the central **source** for the public sale of U.S. Government - sponsored research documentation. Currently the collection incorporates over two million works covering research and development, business and management, translations of foreign reports, trade, general statistics, health and social sciences, and hundreds of other **areas**. It should be noted that NTIS topic coverage is world wide, with **nearly** one-third of new additions to the collection coming from foreign sources<sup>8</sup>.

As a cornerstone of the technological publishing structure in the United States, NTIS is a key participant in the development of advanced information products and services. In addition to printed reports, **NTIS** makes information available on tape, diskette, and optical disk. Specific services relevant to technology transfer are:<sup>9</sup>

- **Federal Research In Process (FEDRIP)**

NTIS maintains a data base of Federal Research In Process. This information is made available to the NTTC and several commercial computer modem data access networks including DIALOG and Knowledge Express. Use of this system is suitable to a knowledgeable database researcher who can find needed information quickly, thus keeping on-line expenses reasonable; but use of these commercial services is expensive for an untrained small business to use.

- **FEDWORLD**

NTIS has recently opened a free computer modem accessible gateway to over 100 Federal Bulletin Boards. This system, known as FEDWORLD, offers access to a wide spectrum of information ranging from environmental policy and hazardous waste disposal to the National Science Foundation's Science and Technology Information<sup>10</sup>.

- **The Patent Licensing Bulletin Board (PLBB)**

The PLBB is an electronic bulletin board system operated by NTIS. The bulletin board provides the earliest possible information about hundreds of new Government R&D inventions available for licensing. The information is supplied by only seven agencies, and noticeably absent from the list are DOD, DOE, and NASA. It is available at no charge<sup>11</sup>. Information is searchable in ten major subject categories:

- **Biology and Medicine**

- Chemistry
- Electro-technology
- Food Technology
- General
- Instruments
- Mechanical Devices and Equipment
- Metallurgy
- Nuclear Technology
- Optics and Lasers

NTIS has established a Memorandum of Understanding with the NTTC to share R&D program and technology information obtained through the NTTC'S interface with Federal R&D Agencies.

While NTIS serves a **very** useful documentation function for the Nation, it cannot be considered as a principal facilitator of technology transfer. NTIS does not provide direct assistance to the public or referrals to federal agencies. As such, while there is a wealth of information available at NTIS for purchase, using NTIS has several drawbacks. Secondly, Federal system is slow to make information available to **NTIS**, which then must **be** cataloged and processed; thus the most current technical reports available may be a year or more old. Synopses of research in progress may be so synoptic that the true nature and value of the research can be obscure to the untrained seeker. Finally, the publications made available from NTIS must be purchased to be reviewed or used and may or may not be pertinent to a researcher; this serves as a deterrent to access, especially by small business. Many of these problems are inherent because NTIS must rely on other agencies to obtain its information, and the bureaucratic processes are slow. Also due to the fact that it deals primarily with publications, NTIS cannot be considered a rapid access method for finding a technical solution to a problem. Finally, as a side issue relating to Federal agencies interface with the private sector that could result in technology transfer, many government agencies find it more convenient to refer business and industry inquiries to NTIS rather than deal directly with inquiries of a technical nature.

#### The Federal Laboratory Consortium

A principal Federally-chartered organization critical to technology transfer is the Federal Laboratory Consortium (FLC) which was established by the Stevenson-Wydler Act of 1980, The FLC is a network of technology transfer professionals located principally in the laboratories and R&D Centers whose primary function is to facilitate technology transfer through Offices of Research and Technology

Applications (ORTAs) which are mandated to be at all laboratories with over 200 scientific and engineering personnel.

- **FLC Clearinghouse**

The contracted FLC Administrator in Sequim, Washington operates the FLC Clearinghouse which provides referral services to ORTAs in laboratories which conduct R&D in an area of interest to an inquirer. There is no significant automated information system of technology associated with this effort.

- **FLC Training**

The FLC is also instrumental in providing training to its members and in sponsoring technology transfer demonstration projects. Training focuses on technology transfer management from the perspective of the Laboratory ORTA. Courses are usually conducted at quarterly and annual workshops and involve such subjects as identifying marketable laboratory technology, outreach and marketing, administration, financial management, intellectual property, CRADA establishment and negotiation, and other subjects vital to the function of the ORTAs.

- **FLC Publications**

The FLC publishes a monthly newsletter - ***NEWSLink***, and a 220 page document on Federal laboratory technology, expertise, resources and information sources called ***Tapping Federal Technology***.

- **FLC Awards Program**

The FLC sponsors various awards to recognize outstanding technology transfer managers and organizations for superior achievements in technology transfer. The awards are presented at the annual FLC Symposium.

The National Technology Transfer Center

A major driving force in consolidating information and facilitating technology transfer is the National Technology Transfer Center (NTTC). This organization was established by the Congress in 1989 and funded by a grant through NASA. The Center is based in Wheeling, West Virginia, operates a Washington, D.C. Office and utilizes technology transfer agents throughout the United States. Because of its comprehensive approach and association with most Federal Agencies and Laboratories, it has become a primary organization in National Technology Transfer Activities. This national organization has two key objectives:

- to help American industry gain easy, rapid and productive access to marketable Federal technologies, the most relevant Federal laboratory expertise, and unique Federal laboratory facilities; and
- to help the Federal laboratories find appropriate private partners to develop and commercialize technologies.

The NTTC's mission is to serve as a hub for the national technology transfer network to expedite the movement of Federally developed technology into the stream of commerce. To accomplish this mission, the NTTC has focused its efforts in four areas: technology access (gateway), education and training, economic development and technology transfer services.

- The NTTC Gateway

The NTTC technology access gateway activity is centered around an evolving Computer Information System (CIS) which is an advanced indexing system for Federal research in progress, laboratory expertise, laboratory technology areas, and unique laboratory facilities. U.S. industry is able to access the NTTC Federal Technology Gateway through an 800 number (1-800-678-NTTC). A highly trained analyst staff works with the gateway user to define the technology requirements (typically through a 10 to 20 minute interview) and then utilizes the CIS to identify potential laboratory contacts for follow-up action. R&D Center and Laboratory ORTAs are then contacted to determine appropriate referrals. Once appropriate linkages are made, the analyst provides the information to the client. On the average, the NTTC spends at least 2 hours on the phone with each client, and several more in researching the problem and following up. The NTTC has established a tracking system to monitor the ensuing interactions between the user and Federal laboratory contacts to assure that the technology transfer process is reinforced by the NTTC. The tracking system provides the NTTC with important data to measure its value added and to adjust its services to meet the demands of both U.S. industry and the Federal laboratories.

Some examples of technology transfer successes facilitated by the NTTC to date include:

- a small company in Colorado who accessed technical information from Harvard and Yale research, established a working relationship with a Sandia Laboratory researcher, a business relationship with a

Philadelphia company, and has submitted proposals to both DOE and the Air Force for new instrumentation products.

- A Kentucky company that makes safety switches for coal mines is working with Oak Ridge National Laboratory to incorporate new materials into a new product.
- A packaging firm in West Virginia that found and incorporated a new sealing process from an Army laboratory in New Jersey.
- A Virginia company that was linked to commercial speech-recognition technology and is working to apply it to closed-captioning technology for the hearing-impaired.

The NTTC Federal Technology Gateway system is continuously evolving in terms of capability, content and services. New Federal laboratory databases and technology programs are being added as the program expands. A new bulletin board concept known as "Business Gold" has recently been activated. Business Gold is a spinoff of a technology transfer demonstration between the former Strategic Defense Initiative, the Federal Laboratory Consortium and the Navy. Its primary emphasis is aimed at assisting small businesses. The Business Gold bulletin board is a modem accessible database that provides current SBIR solicitations, Federal technology available for licensing or further development via Cooperative Research and Development Agreements (CRADAs) and listings of state and local sources of business assistance.

It is estimated that the NTTC has obtained the majority (over 85%) of available documented technology and resource information from the major federal laboratories, research centers and agencies (see Appendix C). The Center continuously seeks and adds new data as well as refreshes and updates the data holdings in place.

The purpose of the gateway function is to link Federal laboratories and the national technology transfer network with American companies, trade/professional associations, investors, and economic development organizations. Opened in October 1992, the gateway handled over 3000 referrals in its first six months of operation.

- **Education and Training Programs**

The goal of the education and training function is to provide familiarization with and training in technology transfer to government, industry and higher education. To accomplish this goal, the NTTC has established a series of initiatives to facilitate the development and delivery of high-quality education and training programs; information and awareness materials; and model programs, standards and networks which enhance technology transfer and innovation management. Specific initiatives include developing training courses, curriculum, and needs assessments; and conducting seminars, conferences, and forums; and providing facilitator/catalysts/instructors to round out complete training and education packages.

The NTTC education and training activities will help government and industry better understand innovation management and technology transfer and to enhance personal and organizational approaches to these two important concepts,

- **Economic Development Programs**

The NTTC economic development program goals are to facilitate linkages between Federal agencies/laboratories and U.S. industry in fostering effective technology transfer management; and assist in regional/state/local technology transfer activities.

In this area, the NTTC has established several initiatives to begin building bridges to and between public and private organizations.

The Fund for Strategic Partnering is a program aimed at accelerating the formation of partnerships between Federal laboratories, industry and state/local economic development organizations. The NTTC developed the concept, obtained NASA approval and funding, and issued a solicitation that announced the project and requested proposals from appropriate teams, Over 100 proposals were submitted and in June 1993, the NTTC announced four winners who will share nearly \$600K of NTTC funding. The ultimate value of their partnerships exceeds \$1 M because of matching commitments by the winning teams, The NTTC will attempt to expand this activity in the future because the quality of the proposals was, in general, outstanding, and the lessons learned in forming cooperative partnerships will have far reaching influence on regional technology transfer initiatives.

Additionally, the NTTC is undertaking a technology transfer metrics initiative to identify **and quantify measures of effectiveness and best technology transfer practices**. The Center is working closely with the **Interagency Committee on Federal Technology Transfer** chaired by the Department of Commerce Technology Administration **to support the committee's Working Group on Measurement and Evaluation**. It is anticipated that this working group will develop, with NTTC assistance, a system to measure the impact of Federal technology transfer programs on **U.S. industry and the economy**.

The NTTC economic development focus will improve **U.S. technology transfer** by recognizing and **disseminating best practices**; initiating strategic partnerships; **addressing regional, state and local technology issues**; and **stimulating innovation in the technology transfer process**.

- **NTTC Technology Transfer Services**

The NTTC has the capability to provide a broad range of technology transfer services to Federal and industry clients. These services include **technology assessment**, market analysis, commercialization reviews, marketing and **outreach plans**, intellectual property **support business planning assessment** and other **relevant activities to transition technology from research** through productization **to the market**,

## **PRIMARY FEDERAL R&D AGENCY TECHNOLOGY TRANSFER PROGRAMS**

It is important in understanding **the technology transfer programs** of the agencies to review **not only their data collection and dissemination activities and information systems**, but also the **other programmatic details that foster access to this data and the overall mission of technology transfer**. Following is a description of the programs for technology transfer and commercialization in the primary Federal Agencies,

### **The Department of Commerce (DOC)**

As the keystone agency for technology transfer **in government**, the DOC has several **programs that support the management, documentation, access, and dissemination of technology**.

- **The DOC Technology Administration**

**One of the primary responsibilities of the Technology Administration of the Department of Commerce is chairing the Interagency Committee on Technology Transfer. This committee, comprised of representatives of most of the Federal Agencies conducting R&D, is working on three major projects%**

- **Development of metrics (measures of effectiveness) of technology transfer. These will evolve to a set of parameters and methods to document them that can be used by various agencies to measure their success in technology transfer and take actions to improve their processes. The NTTC is the facilitator for the development of these metrics.**
  - **Harmonization of CRADA provisions that can make it simpler and easier for industry to deal with more than one agency in developing CRADAs,**
  - **Development of Conflict of Interest Guidelines that agencies can refer to in developing policy regarding technology transfer programs.**
- **The Clearinghouse for State and Local Initiatives on Productivity, Technology, and Innovation**

**The "Commerce Clearinghouse" serves as a central repository for information on initiatives by state and local governments to enhance the competitiveness of American business through the stimulation of productivity, technology and innovation, The information provides vital information on contacts for technology transfer driven by thrusts for ● conomic development. An electronic version is accessible through the NTTC.**

- **The National Institute of Standards and Technology (NIST)**

**NIST has recently become one of the primary facilitators of commercial technology development and transfer. The major mission of NIST is to help U.S. Industry improve the quality and competitiveness of its products. The NIST Advanced Technology Program is a primary element in the development of precompetitive technologies critical to America's economic growth. Its technology services enable American industry to access the latest in information on measurements and standards, and its many laboratories are advancing the state of the art in numerous**

areas valuable to American industry, offering cooperative R&D opportunities in such technical fields as **Electronics, Physics, Chemical Science, Materials, Computer Systems**, and other areas <sup>13</sup>.

The Manufacturing Extension Program (**MEP**) contains two component programs that are vital to the technology transfer efforts of the Federal Government:

- **The Manufacturing Technology Centers (MTC) Program** - this small program has established seven MTCs nationwide to help small and medium sized manufacturers to increase quality and productivity. Programs are tailored to the needs of local industry, but each MTC emphasizes technology transfer, helping manufacturers make effective use of the advanced technology most appropriate for their operations. They also focus on the concepts and practices of **total** quality management,
- **The State Technology Extension Program (STEP)** - this program works with state and local technology outreach programs to improve the competitiveness of small and medium-sized businesses through the application of science and technology. Assistance includes: stimulating cooperation and communication between and within states, collecting and distributing information about successful technology assistance activities, and providing matching grants for development and coordination of technology assistance activities.

NIST has established a Memorandum of Understanding with the NTTC to place a liaison person at NIST to facilitate technology transfer program cooperation and effectiveness between the two organizations and with the MTC's.

### **Patent and Trademark Office**

because of the need to protect intellectual property in the technology transfer, patents are an essential part of the process, The Patent and Trademark Office maintains the files of patented technology dating back to the birth of the Nation. heir automated search capability, provided on site, should be considered as an essential element in the documentation of technology and thus the process of Technology transfer, This system requires training and must be used under the supervision of Patent Office personnel; it is not a modem-accessible system available to the public or to intermediary technology transfer facilitators.

- **The Patent Licensing Bulletin Board (PLBB)**

**An electronic bulletin board system**, providing the earliest possible information about the hundreds of new Government R&D **inventions available for licensing is maintained by NTIS. (See above)**

### **The National Aeronautics and Space Administration (NASA)**

**NASA has been a traditional leader in technology transfer since the passage of the Space Act of 1958. As a part of its chartered mission, NASA makes technology available on a wide-spread basis to American industry through many elements that are part of its Technology Utilization Program. While not governed by the same legislation regarding technology transfer as the federal labs, NASA endeavors to cooperate fully with the FLC and other Federal agencies in fostering technology transfer programs and events to promote commercialization of Federal technology** <sup>14</sup>.

- **NASA Field Center Offices**

NASA has established Field Center Offices at each of its nine major centers and laboratories. **These** offices coordinate and **manage a full range** of technology transfer activities including the documentation of new technology developed at the center (which is provided to the **RECON** system - see below), technical assistance, cooperative project development, and outreach to industry,

- **Regional Technology Transfer Centers (RITC's)**

In close cooperation with the Federal Laboratory Consortium (FLC), NASA has reestablished its network of regional centers in line with the six regions of the FLC. These six not-for-profit centers provide services, on a reimbursable basis, to U.S. firms and industry within their designated regions. The RITC's help clients to locate, access, and acquire technologies from throughout NASA and the Federal technology base. RITC's use their internal developed data bases and access many of the others mentioned in this report to find technology, expertise, and resource information. The NTTC is a primary source of information for the RITC's.

- **Specialized Technology Transfer Centers**

In addition to the six regional **centers**, NASA **supports** several other technology transfer activities:

- **The Technology Applications Team - which works with NASA Field Centers, industry, and national associations to develop cooperative projects and relationships that address technological needs of a national or industry-wide significance.**
- e **The Computer Software Management and Information Center (COSMIC) which collects and documents computer software technology produced by NASA R&D programs and distributes it to U.S. private, government, and academic organizations.**
- **The Earth Data Analysis Center (EDAC) which provides technology transfer assistance and services in support of the distribution and transfer of remote sensing/geographic information systems data to the private sector.**
- **NASA Tech Briefs<sup>15</sup>**

One of NASA's primary vehicles for technology transfer is its monthly publication *Tech Briefs*, which has a free circulation to over 200,000 qualified government and industry readers. The magazine features information on the full spectrum of NASA developed technology with multi page descriptions of the technology and its applications. Many of these technologies are somewhat limited in their application **(Aerospace Systems)** but some have potential for spinoff to many other applications,

- **The NASA RECON Information System**

NASA maintains an on-line information system cataloging NASA generated technology at its Center for Aerospace Information (CASI) in Baltimore, MD.

NASA RECON is a controlled system due to its access to space critical technology. Access by qualified organizations can be arranged through CASI, the principal storehouse of NASA technology information. The Center maintains and distributes NASA technical and program publications and provides general assistance in response to inquiries from the NASA Tech Briefs readership and other U.S. public and private sector organizations,

- **NASA Technology Transfer Effectiveness**

Early this **year**, NASA announced the results of an internal study of its technology transfer efforts that reported that "there have not been many technology transfer successes compared to the potential., **and past successes have largely been**

anecdotal.” The study also reported that **NASA has been** too slow in transferring knowledge to industry. Technical papers take as long as nine months to be published, and listings in the NASA *Tech Briefs* are on the order of eighteen months old. The report also speaks to “cultural” problems in that NASA employees, managers, and contractors “do not feel technology is part of their job” and that “many developers of NASA technology have had little or no direct interest in non-aerospace applications. ””” The General Accounting Office, as a result of its review, stated that “NASA does not have an adequate system to comprehensively monitor and measure the applications of the technologies it develops. Without this information, the agency is not in a position to focus its **resources on research** and development activities that can contribute most to preserving the international competitiveness of the U.S. civil aeronautics industry, and cannot determine the impact of its technology transfer activities on the industry’s competitiveness ”.<sup>17</sup> The report concluded that NASA should intensify its efforts to better identify commercial applications and to find better ways of measuring the impact of its transfer and commercialization.

### **The Department of Defense**

Technology transfer in the DOD is hampered by concerns for mission priority, security, and poor documentation; all are factors in the DOD culture.

Military R&D naturally carries with it a major concern for security. This concern is pervasive with regard to technology, creating a perspective that everything developed in the military R&D community is sensitive and not open to disclosure to industry or the public. This unfortunate perspective causes many useful technologies which are part of subsystems and components to be held closely when they could have significant civilian commercial applications without jeopardizing National security.

Department of Defense directives require that all R&D contracts be documented for inclusion in the Defense Technical Information Center (DTIC). The reporting system calls for reporting of project definition information at the beginning of any R&D project, for follow-up reports on progress, and for a final report. Unfortunately, these reports are not always made, or if they are, they are very abstract. Federal Acquisition Regulations also provide for “Reports of Inventions” to be made on all federal contracts, Unfortunately, the documentation of these inventions is sparse and the system is not well enforced. The reports are managed through the contracts system and generally wind up in project files without being reported to any central source unless specific arrangements are made. (eg. the NTTC has taken the initiative to obtain electronic Navy patent information directly from the central Navy office that reviews and catalogues the patents). The result is that a

considerable amount of DOD technology remains undocumented. Even with this handicap, the DOD and its laboratories do document a considerable amount of R&D and technology information that has widespread commercial applications.

- **The DOD Office of Technology Transition**

Management of technology transfer activities in the DOD has traditionally resided in the office of the Director, Defense Research and Engineering (DDR&E) under the auspices of the Under Secretary for Acquisition, The FY 93 Defense Authorization Act directed the establishment of an Office of Technology Transition within the Office of the Secretary of Defense (OSD) to be the advocate for technology transfer<sup>18</sup>. This office has been established in name only and has, to date, done little in the area of policy or other activities directed in the Act.

- **The Defense Technical Information Center (DTIC)**

The Defense Technical Information Center (DTIC) focuses on Department of Defense (DOD) contractors and potential contractors. DTIC supplies technical reports of completed DOD R&D efforts as well as summaries of ongoing DOD R&D projects<sup>19,20</sup>.

- **The DTIC Technical Document Collection**

As the central DOD scientific and technical information service center, DTIC receives Defense-related reports with classifications ranging from unclassified to Secret and Restricted Data. DTIC's responsibility includes the processing, announcing, storing, and distributing of these reports. DTIC forwards all unclassified/unlimited defense reports (some 60% of all its accessions) to NTIS,

The DTIC technical document collection totals more than a million different titles, covering all areas of science and technology. The main information system for the DTIC collection is the Center's Work Unit Information System which contains the descriptions of ongoing, Defense-sponsored, R&D efforts. The database elements include a narrative description of each effort, its purpose, costs, and the organizations responsible (with names and telephone numbers of key personnel),

- **Defense RDT&E On-Line System (DROLS)**

DTIC operates the Defense RDT&E On-Line System that is a network of remote terminals connected to the central computer system at the facility in

Alexandria, Virginia. There are over 1,100 remote terminals tied into the on-line system located at Government or contractor sites. Special terminals in Los Angeles, Boston and at DTIC Headquarters provide access to registered user organizations in those areas,

- **Access to DTIC**

Access to DTIC holdings and services is restricted to U.S. government organizations, their contractors and their potential contractors. This automatically restricts non-defense companies from easy access to technology with commercial applications outside those that are military.

Organizations registered with DTIC have access to a variety of products and services. Most of these services are provided free of charge, while very nominal fees are charged for others. The Center provides free searches of the DTIC databases, free referral services, and free work unit information summaries. There is a service charge for paper copies of technical reports,

There are two separate programs through which industrial organizations (from large corporations to small companies) and individual researchers may establish eligibility to receive classified and unclassified data to assist in current research projects. Contractors, subcontractors, and grantees with current U.S. Government contracts or grants may obtain access by filing the necessary registration forms. These forms are reviewed by their Government sponsors prior to approval by DTIC. Potential defense contractors with adequate research and development capabilities can also gain access to DOD R&D planning, requirements, contacts in laboratories and other DOD R&D activities, and other scientific and technical information on DTIC databases. DTIC performs the central registration function for the DOD organizations sponsoring the program, but each of the military departments and the Advanced Research Projects Agency (ARPA) executes its own policy agreements with industrial participants. Registration for this program qualifies participants for access to the scientific and technical data bank at DTIC,

To enhance access to DTIC information, NTTC analysts have access to DTIC resources in order to identify DOD expertise and resources as well as information on unclassified R&D and technology.

- **The Ballistic Missile Defense Organization (formerly Strategic Defense Initiative) Technology Applications Program**

Recognized by Congress as a premier technology transfer program, this dynamic technology transfer activity was recognized in the FY 93 Defense Authorization Act as the model program for the establishment of a DOD Technology Transition Office. The program, established in 1986, conducts a full range of technology transfer activities and pioneered several new approaches to technology transfer which have produced significant results to date, including the establishment of 22 Spinoff Companies, generation of 97 new products on the market, filing of 97 patents, and establishment of 8 CRADAs<sup>21</sup>.

- **Technology Application Reviews**

The Technology Applications Program conducts technology applications reviews each focusing on a different technology area such as biomedical, optics, materials, electronics or power. These meetings are usually held at Federal R&D facilities, bringing together public and private experts to hear the results of the R&D from the actual scientists and engineers involved, and to work hand in hand with these specialists to develop application targets and commercialization strategies. Subjects addressed include intellectual property, business planning, project and company financing, strategic partnering, market requirements, market analysis, competition, and alternative strategies. After each review, the program follows through on promising technologies and provides tailored support to foster spinoffs that will benefit the nation's economy. The reviews also provide access to information on technology that is captured in the program's data base, the Technology Applications Information System.

- **The Technology Applications Information System (TAIS)**

The Technology Applications Information System contains over 2,000 abstracts of SDI/BMDO-funded technologies. The program is continuously updating and expanding these abstracts to include new developments in BMDO research. A TAIS user can make an on-line request for more information on any technology abstract and the program staff will link the user to the researchers involved with the technology, whether the technology has been developed in a Federal laboratory, university or business. The program staff follows up with the user to assure that his/her needs are met and to track successful linkages between the technology and potential market applications. The TAIS is open to any American business

or Individual who registers with the Defense Logistics Agency in a process that involves a simple form and about two weeks processing time. Over 20,000 companies and individuals are registered under this system. One of the unique features of the TAIS is its ability to document users and follow up on results. This capability has enabled the program to measure its success over the past seven years.

- **Proactive Outreach Program**

The BMDO Technology Applications Program, supported by the NTTC, produces several Technology transfer publications such as the *BMD High Technology Update*, a quarterly newsletter provided to over 6,000 recipients free-of-charge, and the *BMD Technology Applications Report*<sup>22</sup>, an annual summary that describes SDI/BMDO'S technology transfer program and highlights representative spinoff successes. Additionally, the NTTC provides focused articles on specific technology innovations or successful commercialization activities by researcher for publication in a broad range of media such as newspapers, magazines and technical/business journals.

The BMDO Technology Applications Program interfaces with professional and trade associations; Federal, state and local government organizations; universities; businesses; and other entities that share the organization's goal of improving America's economic well-being by introducing new technology into the marketplace.

The organization also promotes the commercialization of technology through technology transfer demonstration projects, working with small high-tech businesses, state organizations, and the Federal Laboratory Consortium,

- **Advanced Research Projects Agency (ARPA)**

ARPA has traditionally been recognized as a principal driver in generating technology that has commercial benefits, yet ARPA has no structured Technology Transfer Program per se. The ARPA approach maintains that technology transfer to industry is an integral part of every R&D effort that it sponsors and takes no additional effort to be proactive in commercialization of technology outside of the direct program sponsorship it provides.

ARPA defense R&D is focused across the spectrum of defense needs, and resident in four major programs dealing with simulation, software, materials and manufacturing, and space technology.

- **Technology Transfer in the Military Services**

The Military Services principally focus on activities within their own laboratories as the resource base for technology transfer. They do not normally consider the R&D sponsored outside of the laboratories (eg in corporations, universities, or via SBIR **Programs**) as a resource for technology transfer. The management structure is resident at the level of the Secretary of the Army and Air Force, and at the Office of Naval Technology for the Navy. These functions are strictly policy oriented and not well supported in terms of resources or personnel by any of the services.

A number of Defense Laboratories and R&D Centers have proactive programs in technology transfer. They have Offices of Research and Technology Applications (ORTAs), as mandated under legislation, which attempt to create awareness and provide access to technology and expertise resident in their individual laboratories. For the most part, these offices tend to be understaffed and must operate with budgets insufficient to the task of identifying and marketing the technology developed by their organizations. The ORTAs coordinate closely with the Federal Laboratory Consortium, and the National Technology Transfer Center. Both of organizations facilitate access by business and industry through the ORTAs.

- **The Corps of Engineers Construction Productivity Advancement Research (CPAR) Program**

CPAR is a program of cost-shared research, development and commercialization/technology transfer (R&D) projects between the U.S. Army Corps of Engineers and the U.S. construction industry<sup>23</sup>. The purpose of the program is to assist the U.S. construction industry in enhancing its productivity and domestic and international competitive position through the development and commercialization of advanced technologies, materials and construction management systems. Information on CPAR-sponsored technology is available through the NTTC.

### The Department of Energy (DOE)

As one of the three principal R&D agencies, DOE has a diverse spectrum of programs that facilitate technology transfer. The agency is home to nearly 60,000 scientists, engineers, and technicians who perform about \$6.6 billion worth of R&D each year. The agency has R&G responsibilities that include developing technology that produces or conserves energy, developing environmental restoration and waste minimization technology, and developing and protecting

nuclear energy technology for both civilian and defense applications. These R&D missions represent a challenge **for** technology transfer when **the** technologies are associated with nuclear programs and **an** embedded technology transfer responsibility for energy efficiency **and environmental technologies**<sup>24</sup>.

- **The Office of Scientific and Technical Information (OSTI)**

The principal repository for R&D and technology information for the DOE is placed with The Office of Scientific and Technical Information (OSTI) located in Oak Ridge, TN. This organization catalogues and provides access to DOE-generated technology through its own controlled systems. OSTI maintains and periodically publishes a list of DOE-funded technologies entitled **DOE New Technology**. OSTI also catalogues computer software through its Energy Science and Technology Software Center. OSTI's method for providing public access is by providing information and announcements to NTIS and the Government Printing Office.

OSTI Data Bases include:

- Energy Science and Technology - Bibliographic records of worldwide information related to energy and nuclear science and technology, This database is also available on DIALOG.
- Energy Science and Technology Software - Bibliographic records that describe scientific and technical software. This database is also available on DIALOG.
- New Technology from DOE - Brief descriptions of DOE research results that have potential for commercialization efforts.
- Research in Progress - Descriptions of current or recently completed research projects conducted or funded by DOE. This information is provided to NTIS and is made part of the FEDRIP information system.

Information on DOE R&D programs, technology, expertise and resources are made available to the NTTC under a Memorandum of Agreement between NASA and DOE established in July 1992.

- **DOE Technology Transfer Programs**

DOE **employs a full range of mechanisms to transfer technology. These** methods are explained in detail **In the section of this report titled “Mechanisms for Technology Transfer”, and include:**

- Cooperative Agreements
- Cooperative Research and Development Agreements (CRADAs)
- **R&D Consortia**
- **Exchange Programs**
- **Patent Licensing Agreements**
- User Facility Agreements
- Work-for-Others

- **Special DOE Technology Transfer Programs**

In addition to its SBIR program, the **DOE** sponsors two unique programs that provide for the development of inventions and innovations by individual inventors that foster energy efficiency and conservation, supporting DOE’s R&D efforts as well as contributing to DOE’s technology transfer efforts outside the laboratories.

- **The Energy-Related Inventions Program<sup>25</sup>**

The Energy-Related Inventions Program (ERIP) is a joint program of the Department of Energy (DOE) and the Department of Commerce (DOC). The program provides for a free evaluation of energy-producing and energy conservation-related concepts, devices, products, materials or processes. The invention may be in any stage of the development process ranging from novel concept to product ready for market. Evaluations are conducted by the National Institute of Standards and Technology (NIST). There is no fee or obligation for obtaining an evaluation from NIST. If an invention is recommended by NIST to DOE for funding and accepted, grants of up to just under \$ 100,000 may be provided for development of selected inventions. Since 1975, some 30,000 inventions and ideas have been evaluated, 591 were recommended, and about 80% of these have been funded.

The Energy-Related Inventions Program also provides two training courses throughout the country, with workshops for inventors that can assist them with the commercialization and marketing of their new products and technologies.

- **The Innovative Concepts Program<sup>26</sup>**

The Innovative Concepts (InnCon) program, sponsored by the Department of Energy, **provides seed-money** grants to encourage energy innovation and helps new technologies move quickly **from the concept stage into the marketplace. InnCon is a bridge between program managers in government and industry and creative people and technologists with new ideas for solving applied energy and environmental problems.** InnCon normally specifies the **topic areas of interest. For the past two years, the specific research topic area sponsored has been Waste** Minimization/Utilization. The seed funding is intended to further develop **the concept** to a stage at which other prospective sponsors **can more clearly assess the concept's potential.** After completion of the grant, the funded technologies and federally-supported technologies are **showcased at a technology and** business opportunity fair, held specifically to expose potential sponsors to the new concepts. **For some of these technologies, the fair is their first** public introduction, The InnCon Program provides grants of up to \$20,000 **for up to 15 inventions and technologies each year that meet the advertised** criteria. Projects are selected under **a competitive** process.

#### **Department of Health and Human Services (HHS)**

The principal R&D organization within HHS is the National Institutes of Health (NIH) Most of the department's technology transfer activities, including that of the Public Health Service (PHS), the NIH, the Alcohol, Drug Abuse and Mental Health Administration (ADAMHA), and the Center for Disease Control (CDC) are managed through the NIH Office of Technology Transfer<sup>27</sup>.

- **PHS Office of Technology Transfer On-Line (PHS-OTTO)**

The PHS-OTTO is an electronic bulletin board that contains a variety of **essential technology transfer data**, This service contains downloadable copies of PHS technology transfer guidelines and model agreements, **a list of current CRADAs** and PHS Scientists interested in new CRADAs, as well as summaries of inventions available for licensing, It is updated periodically **during the year** and is also made available to the NTTC,

- **Computer Retrieval of Information on Scientific Projects (CRISP)**

CRISP is **a major scientific information system** containing data on the research program sponsored by the Public Health Service. Most of this research falls **within** the broad category of extramural projects: grants, contracts and cooperative

agreements. PHS and other Federal agencies can establish an account to access CRISP. The information is also made available to the NTTC and DIALOG.

### **The U.S. Department of Agriculture (USDA)**

As one of the oldest institutions conducting technology transfer, the USDA Agricultural Extension Service is known as the grandfather of all technology transfer programs. USDA, through the Agricultural Research Service (ARS) generates a significant number of inventions and technology that have wide-spread applications.

- **TEKTRAN - The USDA Technology Transfer Information System**

USDA developed the TEKTRAN system to document agricultural technology and make it accessible via modem to potential **users**. **Over 12,000** summaries of the latest research results on genetic engineering, safeguarding crops and animals from diseases, biological control of pests, human nutrition, and other fields are available. The service is provided at no cost<sup>28</sup>.

- **The Alternative Agricultural Research and Commercialization Center (AARC)**

The purpose of the AARC is to facilitate and accelerate development and commercialization of industrial (non-food, non-feed) products manufactured from farm and forestry materials. Information on technology developed by the program will be provided to the NTTC for dissemination<sup>29</sup>.

- **The Agricultural Inventions Catalog<sup>30</sup>**

USDA publishes a 150 page catalog containing abstracts of thousands of patented inventions developed under USDA sponsorship. This catalog is available on-line through the NTTC.

### **The Department of Education**

The principal technology development activity within the DOEd is that conducted by the National Institute on Disability and Rehabilitation Research (NIDRR). This organization manages a number of activities important to technology transfer<sup>31</sup>.

- **Rehabilitation Research and Training Centers (RRTCs)** - each center focuses on a particular aspect of behavioral, medical, or vocational rehabilitation. Knowledge contributed by these centers has greatly influenced the fields of

rehabilitation medicine, psychological rehabilitation, integration, vocational strategies, and architecture.

- **Rehabilitation Engineering Centers (RECs)** - these organizations seek solutions to disability-related problems through technology. Areas of study **include sensory loss, mobility impairment, chronic pain, and** communication difficulties.
- **The Rehabilitation Information System (RIS)** - contains information on R&D activities. It is made available via computer modem to rehabilitation professionals, researchers, and people with disabilities to locate technology and information.

### **The Environmental Protection Agency (EPA)**

The EPA is principally a regulatory agency, thus much of its R&D activities are oriented toward enforcement technologies. The agency does produce technology with commercial applications, has a proactive technology transfer program and maintains several data bases of interest<sup>32</sup>:

- **The Alternative Treatment Technology Information Center (ATTIC)**

ATTIC is a comprehensive, automated information retrieval system that integrates technical hazardous waste information into a centralized, searchable resource. ATTIC provides data and technical information on methods of hazardous waste treatment and is accessible to all members of the Federal, State, and private sector involved in site remediation. The service is provided free<sup>33</sup>.

- **The Pollution Prevention Information Clearinghouse (PPIC)**

PPIC is a clearinghouse dedicated to reducing industrial pollutants through technology transfer, education, and awareness. The system contains technical, policy, programmatic, legislative, and financial information. The service is provided free<sup>34</sup>.

- **The Vendor Information System for Innovative Treatment Technologies (VISITT)**

VISITT is a compilation of technical information and products provided by hundreds of pollution treatment vendors. The VISITT data base can also be accessed through the NTTC.

## **The Department of Transportation (DOT)**

The principal technology developers within DOT are the Federal Aviation Administration (FAA), and the Federal Highway Administration (FHWA).

The FAA manages its technology transfer program principally through the FAA technical Center ORTA in Atlantic City, NJ. Principal R&D programs and points of contact are contained in the FAA Plan for Research, Engineering and Development<sup>35</sup> which is provided to the NTTC for electronic access.

The FHWA operates an extensive technology transfer network with Local Technical Assistance Program (LTAP) offices in each state. The FHWA promotes technology transfer through demonstration projects, Applications Projects, Test and Evaluation Projects, and Special projects for evaluation<sup>36</sup>. Technical abstracts of these R&D projects, locations of the centers, training and technology resources, and the Nationally Coordinated Plan of Highway Research, Development, and Technology<sup>37</sup> are electronically accessible through the NTTC.

### Other Federal Agencies

Other federal agencies that conduct Research and Development operate their technology transfer programs principally through their laboratories and the FLC. The individual laboratories are asked to provide electronic media information to the National Technology Transfer Center which provides a gateway service for the ORTAs at each laboratory.

## **The Critical Technologies Institute (CTI)**

The Critical Technologies Institute is an organization of the White House Office of Science and Technology Policy. It was created by Congress in 1991 as a Federally Funded R&D Center (FFRDC) and is operated by the RAND Corporation. CTI provides analytical support to the Executive Office of the President<sup>38</sup>.

### ● **The CTI Data Base System**

CTI is conducting a top-down, fiscal-based survey of all Federal R&D Programs. The information is derived from:

- **The Federal Procurement Data System - managed by General Services Administration (GSA), containing information on all contracts awarded by the Federal Government.**