Federal Laboratories–A National Resource

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Many of the social and economic problems that face our country could be solved by technology and expertise that exists or is being developed in federal laboratories. An effort is under way to make federal government scientific and technological resources available to other federal agencies, to state and local governments, to colleges and universities, and to private industry. An informal Federal Laboratory Consortium for Technology Transfer exists to coordinate the exchange of technology and expertise among these various agencies. The organization and operation of this consortium are described, and suggestions are given for making it more effective in serving the technology needs of the nation.

The significant investment this country has made in research and development, if properly adapted, could greatly contribute to the resolution of many of the problems of state and local governments. A current effort is under way to make available to state and local governments the vast science and technology resource available within the federal laboratories. This paper describes the Federal Laboratory Consortium (FLC) for Technology Transfer, of which I am chairman. Its major objective is the transfer of expertise and capability existing within these federal laboratories to help solve problems in the public and private sector.

NATIONAL INTEREST DEMANDS OPTIMAL USE OF TECHNOLOGY

A multitude of technical as well as social and economic problems faces our nation. If our standard of living is to remain at its current high level, we must pay immediate and serious attention to such problems. Among the more important national concerns that face all levels of government today are the energy crisis, unemployment, and high prices. An overabundance in some areas and deficiencies in others provide the fuel for continued unrest and uneasiness in the minds of many public officials and citizens. Rapid changes in public needs and private wants have brought about critical intergovernmental issues. The costs associated with addressing these problems can be extremely high. In many instances, use of technology that may exist but has not yet been applied is required.

State Government Problems

I would like to give you some examples of the kinds of problems faced by local governments. For instance, the technology-transfer coordinator for Oregon asked for help on several problems currently faced by Oregon. First, several cities in Oregon now use salt as a de-icing agent, but they would very much like to know of any alternative methods now being used by others. Second, the Oregon Public Utilities Commission is attempting to determine the effect of wind on railroad warning signs and lights. Having access to a wind tunnel would be most useful in providing reliable data. Finally, he mentioned a problem noted because of the collapse of a small state-owned bridge. The bridge collapsed because the wood pilings that supported the bridge had been eaten through by marine borers that are not detectable by the casual observer. The Oregon State Highway Department now must find a method of determining the structural soundness of all other state-owned bridges supported by wood pilings. To do an operation of this kind manually could cost the state several million dollars a year.

Cooperation Among All Technology Sectors Essential

Every available science and technology resource must be tapped if timely solutions are to be found to the nation's problems. The problems are complex and will require partnerships between state and local governments, the federal government, industry, and universities. No one sector can provide all the answers. Industry, which operates on a profit motive, can satisfy the wants of the average citizen, but what about the needs of state and local governments? The likelihood of industrial solutions to the problems of local governments appears minimal due to the lack of a developed and aggregate market. In general, our colleges and universities also are not designed or intended to offer the total spectrum of technical resources required to respond to problems of these government entities. Our federal government laboratories contain a large national investment in scientific facilities, equipment, capabilities, and experience. These laboratories, when properly mobilized, could possibly provide the solutions to many of our nation's problems.

FEDERAL GOVERNMENT LABORATORY RESOURCES

During the past decade, the federal government has spent more than $200 billion for research and development. Approximately $24 billion was spent in fiscal year 1977 for research and development purposes. Plant expenditures for research and development facilities and equipment were expected to reach approximately $4 billion during fiscal year 1977. These monies represent an investment made by each federal taxpayer. Not all federal government research and development funds are spent intramurally; a very large percentage is spent by the private sector. However, a good portion of these funds is invested each year in the federal laboratories. In fiscal year 1977 alone, these federal laboratories spent $6 billion on research and development.

The latest report on federal laboratories indicates that there are well over 700 federal laboratories and centers located throughout the nation. They represented, in 1972, a work force of 260 000 people and an intramural research and development budget that approached $7 billion. Over the years, a sizable amount of technology has been developed that could be adapted to help solve some of our country's problems. However, in many cases, no deliberate or active effort has been made to take full advantage of the problem-solving potential of existing and emerging technology.

The numerous federal laboratories can be segregated into three major categories:

1. Mission agencies that require high technology to develop equipment and other capabilities to meet national objectives, such as the U.S. Department of Defense (DOD);
2. Mission agencies that have an intrinsic requirement to work with other government agencies (federal, state, and local), such as the U.S. Department of Transportation (DOT); and
3. Federally funded research and development centers that are not part of the federal government but operate under federal funds. For example, the national laboratories operate under contract to the Energy Research and Development Administration. However, this type of laboratory is subject to different guidelines than are federally owned and operated laboratories.

SHARING FEDERAL TECHNOLOGY

There is one dominant justification for making the technical resource represented by the federal laboratories available to state and local governments: A greater return can be had on the taxpayer's investment in science and technology through more effective primary and secondary use of research and development results. State and local governments are aware that many of their problems can be solved only through the use of science and technology; however, these agencies cannot afford to invest large sums in research and development. Federal government laboratories may not have the technology to solve all the problems of these other government agencies, but substantial public investment in research and development has been made, and technologies do exist and are being developed that could fill important gaps.

If the productivity of state and local governments can be increased through use of these federal laboratories, industry, acting as the commercial link in the process, can also benefit from an expanded role of the federal laboratories. These laboratories can offer a large amount of technology that is not currently or widely available in the private sector and, if this technology has commercial potential, a transfer may prove economically possible.

FLC AS MEANS FOR SHARING

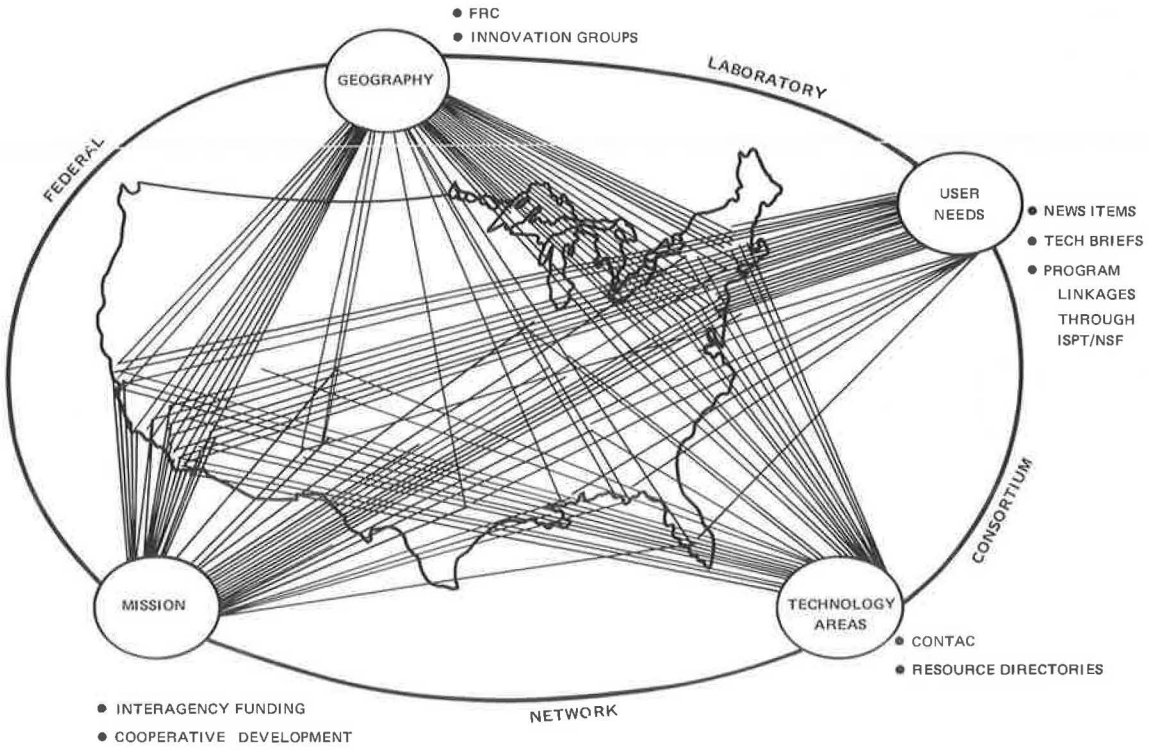
The next question is, How can the resource represented by these laboratories be made available? Federal laboratories are accountable to many federal government agencies, and no formal integrating management system exists within these laboratories to ensure that the technology transfer and utilization process is coordinated and productive. There is, however, an informal FLC for Technology Transfer that currently consists of more than 150 of the largest federal government laboratories and centers representing a number of high-technology agencies.

The consortium is decentralized and can respond to virtually any technological problem. Clearly, the laboratories in this system represent the complete spectrum of federal research and development activity and are a national resource for assistance to state and local governments. The task ahead is to implement the FLC as a science and technology delivery system that can effectively coordinate and make use of these capabilities in the national interest and for the public good.

Beginning and Growth of FLC

The consortium actually had its beginning in the summer of 1971. At that time 11 DOD laboratories met at the Naval Weapons Center, China Lake, California, to determine common methodologies in finding greater uses for technical knowledge developed for military purposes. These 11 laboratories formed an informal affiliation called the DOD Technology Transfer Laboratory Consortium; it currently consists of 45 members. In November 1974, these and all other federal labora-

Figure 1. FLC for Technology Transfer: functional input divisions.



tories were invited to join a FLC for Technology Transfer that was patterned after the original DOD affiliation. FLC membership currently consists of 154 laboratories, represented by 76 technology-transfer coordinators within nine federal agencies. This informal organization represents a technical work force of approximately 100 000 people, a national investment of at least $6 billion, and an annual expenditure of nearly $4 billion.

Table 1. Technology areas researched by major FLC laboratories.

Technology Area	Contact
Atmospheric sciences technology	National Aeronautics and Space Administration (NASA)-Wallops Flight Center
Biomedical technology	Harry Diamond Laboratory
Business administration practices	Army Construction Engineering Research Laboratory
Communications	Naval Ocean Systems Center
Computer technology	NASA-Lewis Research Center
Construction technology	Army Construction Engineering Research Laboratory
Cold regions	Army Cold Regions Research and Engineering Laboratory
Detection	Army Night Vision Laboratory
Electrotechnology	Air Force Avionics Laboratory
Energy	
Alternatives	Los Alamos Scientific Laboratory
Solar	Lawrence Livermore Laboratory
Geothermal	Lawrence Berkeley Laboratory
Nuclear	Los Alamos Scientific Laboratory
Fire	Naval Weapons Center
Food sciences	Food Sciences Laboratory-Natick R&D Command
Hazardous materials	Chemical Systems Laboratory
Human resources research and development	Navy Personnel R&D Center
Investigative procedures	Federal Bureau of Investigation Laboratory
Law enforcement	Naval Ocean Systems Center
Library and information sciences	Naval Ocean Systems Center
Navagation and guidance	
Air	Air Force Avionics Laboratory
Water	Coast Guard R&D Center
Nuclear technology	Los Alamos Scientific Laboratory
Ocean technology	Civil Engineering Center
Ordnance	Naval Explosive Ordnance Disposal Center
Pollution	
Marine	Coast Guard R&D Center
Water and air	Chemical Systems Laboratory
Remote sensing	NASA-Ames Research Center
Standards science	National Bureau of Standards
Telecommunication	Institute for Telecommunication Sciences
Transportation	Transportation Systems Center
Urban & regional technology	Naval Underwater Systems Center

The basic objective of the FLC is to design, develop, and implement, on a systematic basis, mechanisms that facilitate the application of unique mission agency federal laboratory capabilities to nationally defined problems so that publicly funded research and development resources are made widely available on a cost-effective and timely basis. Special emphasis is given to problems associated with the intergovernmental use of federal laboratories and centers for the solution of domestic problems at state and local government levels.

Operation of FLC

FLC operation is aimed at eliminating, or at least minimizing, the effects of a multitude of barriers and constraints that hamper the technology-transfer efforts of the federal laboratories. The FLC emphasizes person-to-person communication between the civilian sector users and the resource people in the federal laboratories. The core activities of the FLC include:

1. The development of a well-organized information system,
2. The continuous involvement of the users in the problem definition and technology-transfer phases, and
3. The discrete use of linking agents or technology-transfer brokers to bridge the communication gap between researchers and users.

The most important part of this federal laboratory network is its method of operation. The most obvious question when one looks at the federal laboratory system is, How can anyone interface effectively with such an immense and diverse resource? Regardless of whether you are a federal, state, or local government user, or industry, or another laboratory, the interface is extremely complex. Figure 1 is a conceptual schematic of this network according to divisions. The diagram is an attempt to show that there are some reasonable mechanisms to the entire network that make laboratory technology more accessible.

The four divisions on the periphery of the ellipse

Figure 2. FLC regional divisions.

are geography, user needs, mission, and technology areas. The mission division is a traditional mission agency notion (i.e., DOT laboratories respond to transportation needs and DOE laboratories respond to energy needs). Obviously, inputs are made to the system through the mission division, but, for technology transfer purposes, they may not represent the best entry because other agencies often have technical activities similar to those found in a mission agency.

Within the FLC is a technology area coordination system for contact for technological application coordination (CONTAC) that attempts to cut a cross section of the laboratories in terms of technology areas. Many technology areas currently identified with certain laboratories can be seen in Table 1. A resource directory is available that allows a user, whether public or private, to find out what is generally available in the laboratory system. Interestingly, no directory addresses the total spectrum of capabilities within the laboratories.

The user-needs division is an input mechanism that attempts to make the federal laboratory system aware of the needs of potential users. One mechanism currently used is a monthly FLC newsletter that makes user requirements known to consortium representatives. This and other planned efforts are combined with program linkages to the public sector implemented through the Intergovernmental Science Program at the National Science Foundation (NSF).

The geographical division is a regional network designed to aid state and local governments more directly (Figure 2). Within each FLC region, the laboratories maintain a close working relationship with the existing NSF intergovernmental activities previously mentioned. These regional activities form a technology-transfer network. If a person in a state or local government has a problem, he or she can interact with someone locally and not become too involved in the national network unless there is some overriding reason that makes it necessary to do so.

CONCLUSION

To use all available resources to solve national problems, there must be greater interaction and communication between the federal laboratory system and local levels of government, as well as with the private sector. The federal laboratory system is an important public investment, and only time and dedicated effort will tell if this system, when viewed as a national science and technology delivery system, will be successful.

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Federal and State Programs and Activities for Transportation Technology Transfer

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This paper describes some of the technology-transfer programs and activities within the U.S. Department of Transportation (particularly those of the Federal Highway Administration) and state transportation and highway agencies. The U.S. Department of Transportation programs highlighted include the Technology Sharing Division and Transportation Research Information Service of the Office of the Secretary, Transportation Systems Center activities, Urban Mass Transportation Administration planning systems, and major research, development, and demonstration programs. The technology-transfer programs of the Federal Highway Administration described include details on research implementation, experimental projects, demonstration projects, and National Highway Institute programs and the internal-technology-transfer delivery system established to conduct this function. Some of the principles and successful approaches being used by state highway and transportation agencies to conduct effective technology-transfer programs are also described.

From its beginnings, the U.S. Department of Transportation (DOT) has devoted major attempts to technical assistance with associated dissemination of results of research, development, and demonstration programs to states and cities. Most directly concerned with the subject of technology transfer are the specific research, development, and demonstration programs conducted in the Office of the Secretary and within the operating administrations. I will not attempt to go into detail on the many technology-transfer activities of DOT; however, I would like to highlight some of the more important ones.

OFFICE OF THE SECRETARY

The Office of the Secretary (OST) Technology Sharing Division is active in the technology-transfer efforts on a governmentwide basis. The efforts of Al Linhares, in particular, have been significant in the organizational and ongoing efforts of the Urban Consortium Transportation Task Force and the Committee on Domestic Technology Transfer, a coordinating body for civilian federal agencies, which is sponsored by the Federal Coordinating Council for Science, Engineering, and Technology. In addition, a Transportation Research Information Services (TRIS) network is being developed in OST to link transportation information service centers in a system to provide one-stop service of the information needs of transportation-oriented technologists and planners. Individual DOT-sponsored information systems, such as the Highway Research Information Service