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THE UNCOUNTED BENEFITS: FEDERAL EFFORTS IN DOMESTIC TECHNOLOGY TRANSFER

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THE UNCOUNTED BENEFITS: FEDERAL EFFORTS IN DOMESTIC TECHNOLOGY TRANSFER

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FOREWORD

This study has been undertaken to describe organized technology transfer activities conducted by the agencies of the U.S. government. The focus is upon agency or departmental level activity rather than the laboratory level. It was sponsored by the National Aeronautics and Space Administration under contract NASW-3466 to give NASA's Technology Utilization Division a snapshot view of such activities so that more effective liaison might be undertaken to facilitate successful technology transfer. For this reason the NASA program has not been included in the survey.

None of the programs on which information was collected has been assessed or evaluated individually. However, the aggregate programs of the government have been judged in terms of obvious gaps and opportunities for future improvement.

The report is organized into two parts: Part I consists of an overview, descriptions of the various agency or department programs of technology transfer, a list of persons interviewed or consulted during the survey, and a bibliography of publications, reports and other material made available to the study staff; Part II is an extensive appendix of illustrative material collected from the various programs.

I am personally indebted to those persons listed at the conclusion of Part I who generously gave of their time in responding to questions and information requests about their programs. Thanks are due to Kathryn Hirst, Research Associate, and to Jody Briles, Program Secretary, who worked assiduously over the past year collecting and synthesizing data, arranging for travel and interviews, and coordinating the myriad details involved. A special thanks to our NASA project monitor, Leonard Ault, Deputy Director of NASA's Technology Utilization Division, who provided essential support, including understanding patience.

The study director is solely responsible for the content of this report. It does not necessarily reflect the views or policy of officials of either the National Aeronautics and Space Administration or the Denver Research Institute.

Richard L. Chapman
Study Director

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OVERVIEW OF FEDERAL AGENCY ACTIVITIES IN DOMESTIC TECHNOLOGY TRANSFER

This survey of technology transfer activities by Federal agencies was undertaken for the National Aeronautics and Space Administration (NASA) in order to provide them a "snapshot" view of such activities. NASA thereby might have a better perspective from which to pursue liaison activities with sister agencies to facilitate the domestic transfer of Federal technology. For that reason, NASA has not been included in the survey. It is worth noting that NASA is the only Federal agency with charter legislation that mandates the transfer of technology and a continuing program with a specific budget authority for technology transfer--since 1963.

The focus of the survey has been at the agency level--that is at the departmental or independent agency headquarters level. Reference to laboratories is made only to provide illustrations and some sense of working level activity being undertaken in technology transfer. Agencies surveyed were: Department of Agriculture, Department of Commerce, Department of Defense, Department of Education, Department of Energy, Department of Health and Human Services, Department of Housing and Urban Development, Department of Interior, Department of Transportation, Veterans Administration, and Environmental Protection Agency.

What is Technology Transfer?

The term "technology transfer" is not used uniformly across the Federal agencies that were surveyed. The term is used to denote both of the two principal types of transfer: (1) direct transfer where research is conducted and brought to application for a specific client group, whether that be inside a government agency sponsoring the research or outside the agency; and (2) "spinoff" or secondary use of technology where the user is not part of the clientele for whom the research originally was conducted. The term also denotes a variety of means for transfer from the publication of research results to "hands on" technical assistance by the researcher to the user, including substantial engineering development. This study included both types of transfer and a wide array of technology transfer mechanisms.

One must be careful, though, because the term "technology transfer," generally is used to mean the spinoff or secondary use of technology when referring to transfer activities within such organizations as the National Aeronautics and Space Administration and the Department of Defense laboratories. Within the Department of Energy it connotes both types of transfer--i.e., direct and secondary. In all other agencies surveyed the term, for practical purposes, was limited to direct transfer because these organizations did not give continuing attention to the secondary use of technology.

Technology transfer activities, particularly of the direct transfer nature, have been a part of the government scene for many decades, although they may not have been identified as such. The work of the Department of Agriculture's Extension Service, going back into the 19th century, has been a model for the successful transfer of technology from laboratory to user. Likewise, the Federal Highway Adminstration, the Public Health Service, and the Forest Service have conducted technology transfer activities for many decades. More recently, the Atomic Energy Commission (followed by its successor agencies, the Energy Research and Development Administration and the Department of Energy) engaged in technology transfer activities, as did the Department of Defense and, of course, NASA.

Federal Laboratory Consortium for Technology Transfer (FLC)

In the spring of 1970, the Naval Weapons Center began a project which considered the transfer of technology to other settings. Interest grew within other laboratories of the Department of Defense. A meeting was held in July 1971 at the Naval Weapons Center (China Lake) at which was established the Department of Defense Technology Transfer Laboratory Consortium.

Originally this group was interested in interagency transfer. It pursued this through establishing a liaison agent (on a temporary basis) at the National Science Foundation to promote cooperation among DOD laboratories and other Federal agencies. This liaison agent was administratively located in the intergovernmental program of the National Science Foundation, and there began to develop a stronger interest in technical assistance to State and local governments. Over the next several years this semiformal arrangement developed to the point where, by the fall of 1974, there was sufficient interest shown by non-Defense laboratories to include them as members. The name of the group was then changed to the Federal Laboratory Consortium for Technology Transfer (FLC). Increasingly, attention turned away from solely interagency transfer of technology to technical assistance to State and local governments.

In mid-1976 the FLC received its first grant to establish a secretariat function, then located at the Naval Weapons Center. The emphasis continued to be spinoff assistance to State and local governments. The FLC leadership was instrumental in providing information about technology transfer that led to the development and enactment of the Stevenson-Wydler Act in 1980.

As the consortium has grown, it has contributed to greater awareness of technology transfer by organizing orientation programs for new members, providing information sessions and literature at meetings of professional and public interest groups, conducting semiannual meetings for information exchange, and facilitating regional meetings where representatives of Federal agencies, universities, State or local governments and industry can meet to exchange information on technological advances and interests. In recent years more emphasis has been placed upon transfer opportunities to U.S. industry.

From the outset, the FLC has developed on the basis of a network, informally exchanging information, passing along requests for technical assistance, referring inquiries, and generally facilitating technical problem-solving for those seeking assistance.

The Role of the Stevenson-Wydler Act

In 1980 the Congress passed the Stevenson-Wydler Technology Innovation Act of 1980 (PL 96-480) to systematically tap Federal technology resources and to stimulate technological innovation in American domestic industry. It provided a bench mark for technology transfer activities in the Federal government, even though a substantial number were well underway before the passage of the act. In terms of technology transfer activities, the act did three things. First, it legitimated technology transfer activities already going on in Federal agencies and Federal laboratories and provided a general "charter" for such activities in the future. For example, section 11(a) states:

> It is the continuing responsibility of the Federal Government to insure the full use of the results of the nation's capital and 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.

Second, section 11(b) provided for a source of funds for technology transfer activities:

> After September 30, 1981, each Federal agency which operates or directs one or more Federal laboratories shall make available not less than 0.5 percent of the agency's research and development budget to support the technology transfer function at the agency and its laboratories, including the support of the Offices of Research and Technology Applications.

This could be waived under certain conditions. Finally, PL 96-480 provided a basic structure for focusing attention on technology transfer activities through these Offices of Research and Technology Applications (ORTAs) which were to be established in each agency or laboratory where the annual research and development budget exceeded $20 million.

PL 96-480 provided a basis for all Federal agencies to take part in technology transfer activities. The provisions did not mandate nor provide effective enforcement mechanisms to assure that these activities would take place where they had not in the past. Skillful managers always could identify a number of activities which would fit the mold of technology transfer sufficiently so that no added resources were devoted to this function. However, the act did provide a statutory basis upon which activities could be pursued where the agency leadership or the laboratory leadership encouraged or permitted them.

Synopsis of Federal Agency Activities

In the course of this survey as much information was collected as possible from officials of the participating agencies to provide some perspective about the nature of their respective programs and the scope of activities. This is described in greater detail later in the report. What follows here is a summary, cast according to the perspective of eight topics related to technology transfer: (1) program objectives, (2) program organization and funding, (3) pattern of activities, (4) interface with industry, (5) patents and licensing, (6) reporting of new technology, (7) assessment of potential commercial viability, and (8) documentation of technology transfer.

Program Objectives

The most common program objective was the transfer of technology to particular groups of users or of potential users. This was the basic program objective of all agencies surveyed except the Department of Defense. For example, the Environmental Protection Agency undertakes research in its laboratories or in cooperation with industry and others to provide basic information on pollutants, techniques for mitigation, innovative equipment, etc. which can be used by the agency, by State or local governments, and by industries subject to environmental regulation. Typically, the primary users have been EPA itself and the State or local agencies responsible for direct regulation and monitoring of various environmental parameters.

Program objectives tend to be developed in a "top down" mode much like most policy development. That is, it is initiated at the highest levels of the agency, subsequently refined, and then passed throughout the agency, ultimately to its various constituencies. That describes how program objectives usually are determined. It does not reflect the process by which the transfer of technology occurs, nor how specific instances of transfer may develop. For example, both the Agricultural Research Service and the Federal Highway Administration use advisory mechanisms, consisting of their various constituencies in the process of building research agendas. This is one means for assuring that research is undertaken to meet the "needs" of its potential users.

A somewhat contrasting approach to program objectives is in the transfer of technology to potential secondary users--not to the original group for whom the research was undertaken in the first place. Examples of this are to be found in the Department of Defense laboratories and in the laboratories of the Department of Energy where technology transfer denotes the "spinoff" type of transfer. Typically, this is a grass roots type of operation or "bottom up" approach. Strategies and processes tend to be developed on an ad hoc basis from one laboratory to another, although a general policy at the agency or department level may exist. In one sense this is to be expected because the nature of spinoff transfer is such that the potential user depends on the particular technology and circumstances at hand (one-by-one). Until the technology is defined, who knows what secondary uses might emerge?

Apart from meeting specific national objectives within particular program areas most technology transfer program objectives are directed at assuring the widest possible domestic use of Federally developed or supported technology, whether that be by public agencies, educational institutions, or American industry.

Program Organization and Funding

Only one department in the Federal government has a central point where responsibilities for technology transfer within the department clearly are focused. That is the Department of Transportation's Office of Technology and Planning Assistance under the Assistant Secretary for Governmental Affairs. Although it does not become involved in the management details of the bureau level organizations within the department, this office does have broad oversight for policies and program activities. The Department of Energy comes a close second, where the Director of Laboratory Management has general responsibility for the technology transfer activities, and acts as a focal point within the department for reporting by the laboratories. Reporting by program offices is conducted independently as are the activities of those program offices—even though some or many of them may be carried out within various laboratories in the department's system.

Within the Department of Defense, there is a point of contact within the Office of the Secretary of Defense. It is the Office of the Director of Research and Laboratory Management, located in the Office of Defense Research and Engineering. This function is only one of many performed by the individual so assigned, receiving modest attention. None of the other departments has a focal point for the department as a whole for technology transfer activities. The same is not true of those independent agencies surveyed. Both the Environmental Protection Agency and the Veterans Administration have agency-level points of contact (or ORTAs) to provide general guidance and oversight for these activities.

Funds for the technology transfer function either are embedded in particular program activities, without being separately identified, or are considered a part of the general overhead of a program or organization. Indeed, there has been a continuing debate among strong proponents of technology transfer about the desirability of separately identifying such funds. Some believe that such identification strengthens the case and the role for technology transfer, while others believe that it provides an inviting target for reduction or deletion by opponents who contend that technology transfer is either an inappropriate activity or one of little significance.

Since the range of activities that can be included within technology transfer span from issuing publications to supporting engineering development, the funds actually used in supporting the function are likely to come from a wide variety of sources. This circumstance makes it difficult to estimate funds devoted to technology transfer, so that estimates reported depend upon the individual doing the estimation and the purposes being served. In spite of that, estimated funds used for technology transfer vary from several hundred thousand dollars annually to just under seven hundred million dollars (Public Health Service's report to Congress under the Stevenson-Wydler Act, April 1985).

Pattern of Activities

The most universal activity undertaken in support of transfer of technology is the production and distribution of publications and the establishment of data bases. All of the agencies surveyed produce research reports, summaries of such reports, or similar descriptive material for dissemination. In some cases they publish newsletters with brief accounts of new developments for their particular constituency (such as Veterans Administration, Public Health Service, Navy, Bureau of Mines, Environmental Protection Agency, and Department of Housing and Urban Development, among others). The Center for Utilization of Federal Technology (CUFT) in the Department of Commerce concentrates upon synthesizing material of this nature from all agencies for wider public distribution and use. It also is instrumental in developing or facilitating the development of data bases for machine access to similar information.

Another frequently used type of activity is that of the conference where interested persons are brought together to exchange information, define problems and to provide an opportunity to discuss information about recent developments. Typically, the conference is used by agencies with specific user groups dealing with a particular topic of interest. For example, the Department of Housing and Urban Development will have a meeting of local officials concerned with building codes and the use of new materials or construction techniques, or the Federal Highway Administration will sponsor a meeting of State highway planning officials regarding new techniques for determining costs of highway routing.

A third area of activity that is used frequently by agencies with specific clientele is the demonstration. The purpose here is to illustrate the actual feasibility of a particular innovation for potential users. Such demonstrations may be undertaken on a joint basis between a Federal agency and another public entity or a private company or a trade association or professional group. The Federal Highway Administration, the Public Health Service, the Bureau of Mines, the Agricultural Extension Service, the Department of Education, the Environmental Protection Agency and the Department of Housing and Urban Development all have used demonstrations frequently in the past. Much of the evaluation activity that has been undertaken related to technology transfer has been done in conjunction with determining the relative effectiveness of particular demonstrations.

A fourth area of activity is that of active collaboration with potential users or representatives of user groups. This may occur in the laboratory (as frequently is the case in the National Bureau of Standards), through collaboration in the testing of particular innovations, or in the joint development of a specific application. The latter is especially useful when hardware is involved. It has been used with some frequency by the Bureau of Mines in developing new equipment, by the Federal Highway Administration, and by the Department of Energy.

Perhaps one of the most widespread, yet underreported activities is that of problem-solving. This can cover everything from a simple telephone conversation between an engineer in a particular company with one in a Federal laboratory, to a longterm, extensive collaboration in a laboratory or research and development setting. True success here depends upon the matching of the source of appropriate technical information with an individual organization having a problem or technical need. All of the agencies surveyed are involved in this type of activity, most frequently of the telephone or face-to-face visit type of assistance. Indeed, a substantial portion of the spinoff transfer occurs through this medium and is facilitated by the informal networks, such as that of the Federal Laboratory Consortium.

A sixth activity is that of technology transfer outreach. Here the purpose is to provide a broader awareness of the technology transfer opportunities and activities of Federal agencies. Generally, this is not well developed among the agencies surveyed. It can include such activities as publishing reports that are made available to the general public which illustrate the kinds of technology transfer activities that the agency involves itself with, perhaps citing examples of successful transfers, the value of transfer efforts, etc. Most notable for such activities are the Center for Utilization of Federal Technology, the Federal Laboratory Consortium, the Forest Service, the Veterans Administration, and the Department of Energy--all of which have produced reports available to the general public describing technology transfer, or have promoted use of various techniques for transfer.

Finally, several agencies have been involved in training activities. Responsible agency officials or those in client organizations have been provided with materials and guidance to improve themselves and to provide organizational context for facilitating technology transfer. For example, the Federal Laboratory Consortium conducts an orientation session for new members or newly appointed officers to the Office of Research and Technology Applications. The Forest Service has produced substantial training material for supervisors and others responsible for technology transfer, as has the Federal Highway Administration. (For example, see Appendix II-M, "Guide to Help Develop A Technology Transfer Plan," U.S. Forest Service.)

Interface With Industry

As might be expected, the strongest and most consistent relationships with industry are found in those agencies which have a constituency including elements of private industry. Such is the case in the Department of Energy with major elements of the electric utility industry, in the Food and Drug Administration with the drug industry, and with the Bureau of Mines with the mining industry. In each instance, the mission of the respective agency requires close working relationships with the particular industry concerned. Often there is close cooperation in research and related activities to attack common problems for the benefit of both government and industry.

A special example is the National Bureau of Standards which has an ongoing responsibility to collaborate with all segments of industry in the area of measurements and measurement standards. The experience of most of those agencies surveyed, however, is that there tends to be an easier and closer relationship with agencies of State and local government that are their counterparts, as well as being clientele, rather than with private industry.

In those instances where spinoff transfer is emphasized, continuing relationships with industry generally have not been well developed. If the spinoff of technology occurs within an organization or laboratory where there have been close ties to industry as part of direct technology transfer, this process is easier. However, until recent years, there has been a strong coolness (often encouraged by the Congress) for any activity sharing technology with private industry, especially where that industry was not clearly related to the clientele of the agency. There remains a lingering concern about "giving away" technology produced or made possible through public funds. Beyond that there is some reluctance on the part of industry as well. In the past there often has been an adversarial relationship between government agencies in general and the private sector, resulting in lingering suspicion on both sides about the appropriateness or desirability of cooperative endeavor.

Patents and Licensing

Shortly before the establishment of the Center for the Utilization of Federal Technology, the National Technical Information Service (NTIS) initiated a focal point for Federal licensing activities on behalf of those agencies which desired to participate. Now nearly all agencies except the Department of Defense, Department of Energy, and the National Aeronautics and Space Administration have delegated licensing activities to CUFT. The agencies still retain responsibility for seeking patents, where they seem justified.

With the establishment of this activity in CUFT, there is a notably more aggressive outreach to inform industry and encourage serious review of the innovative potential within the portfolio of Federal patents. The purpose is not so much to acquire funds from the private sector to offset Federal research costs as it is to facilitate the wider use of the technology. Increasingly, agencies are engaging in the patent process less as a defensive means or as a technique of recognition for scientific accomplishment, than to provide broader dissemination and use.

Reporting of New Technology

All agencies produce some type of data file consisting of reports on research completed. This is part of the normal scientific and technical information process which can be valuable to the technology transfer process. But it is passive and may lie dormant without aggressive follow-through and further action. Here our concern is with the reporting of new technology *for technology transfer purposes*. Many agencies produce research summaries of the individual research reports or abstracts published annually in compendia of research completed during the period covered. Such practice is followed by the Environmental Protection Agency, Federal Highway Administration, program offices in the Department of Energy, and others.

A few agencies produce research summaries designed to attract the eye of secondary users. For example the National Oceanic and Atmospheric Administration produces one or two page *Tech Briefs* which are based upon research reports, directed toward a wider audience. In a similar fashion Navy produces its monthly *Tech Transfer Fact Sheet*, consisting of brief summaries of research conducted in Navy laboratories and submitted by directors of the respective laboratory ORTAs—again directed to secondary users. The Department of Transportation takes the initial research reports and recasts them for use by decision makers and policy level officials. The Department of Energy's *Energy Notes* and DOE laboratory summaries, such as the Solar Energy Research Institute's *In Review*, also summarize research results for broader audiences.

The Department of Education, in its National Dissemination Network, relies upon reporting by the innovators themselves (usually schools or school districts) to produce material which the department then evaluates as to whether or not it will be entered into the National Dissemination Network.

Two agencies have a comprehensive system for collecting new technology specifically for technology transfer purposes. The Agricultural Research Service has a short report form which is submitted by the principal investigator or author at the time an article or conference paper is submitted for review. This summary then goes into the technology transfer system for both automated retrieval and for review in the transfer process. The Technology Transfer Branch within the Bureau of Mines actively monitors all of the bureau's research and development projects, periodically producing reports that will be published in its *Technology News* or produced in a special brochure for wide distribution.

As might be anticipated, because most of the agencies surveyed are concerned with direct technology transfer, reporting efforts focus upon the various means which appear to be most effective in communicating with their respective constituencies. Few agencies have undertaken comprehensive efforts to report technology in a form for the specific purpose of transferring it to secondary users. The principal exceptions are Navy, NOAA, and the Department of Energy.

Assessment of Potential Commercial Viability

The Stevenson-Wydler Act provided for the establishment of an Office of Research and Technology Applications in each major Federal laboratory. In quite a few instances this responsibility was located at an agency level to encompass a number of laboratories. Such is the case with the Agricultural Research Service, the National Institutes of Health, the Environmental Protection Agency, the Forest Service, and the National Oceanic and Atmospheric Administration. One of the principal functions of each ORTA, as defined in the act, was:

> to prepare an application assessment of each research and development project in which that laboratory is engaged which has potential for successful application in State or local government or in private industry [section 11(c)(1)].

These assessments were to be collected by the Center for the Utilization of Federal Technology as another means for providing information and dissemination on a broader basis to the general public. Ideally, each research project in a Federal laboratory would be reviewed periodically to determine potential spinoff for commercial application or utility to other public agencies. Although the motivation is commendable, the mechanism has some weaknesses. First, few ORTAs have been sufficiently staffed to meet the objectives of the legislation. Second, those closest to a particular piece of research are not necessarily the best judges of its potential commercial viability or utility. Despite such shortcomings there has been some assessment reporting to CUFT. It does not seem to be systematic, and it is difficult to gauge the extent to which it is comprehensive. However, the relatively small number of application assessments reported suggests that there is room for substantial increase in the future.

NOAA has a form specifically to handle this assessment task. It is described as "NOAA Technology Application Assessment Abstract" and calls for the description of the technology, its application within NOAA, and possible other areas of application. (See Appendix II-P.) In its reporting system the ARS also has provision on its reporting form for noting whether or not there are agencies outside of the Department of Agriculture (within the Federal government) or in private industry that might make use of the reported research.

The general goal sought in the Stevenson-Wydler Act might be more easily achieved if some "third party" assessment were used. Such party should have knowledge about the environment within private industry for research applications and could bring to bear this key element to the judgment of the potential applications of Federally developed technology.

Documentation of Technology Transfer

Nearly every agency has at least an informal collection of vignettes illustrating the successful transfer of technology from its laboratories—most frequently of successful use among its clientele groups. Generally, there is little effort to systematically document instances where information or other technical assistance has been put to actual use in the improvement or development of a new process or product.

More typically a running score may be kept of the number of inquiries answered, contacts made, conferences or symposia attended, etc. This is useful beginning data, but is insufficient for identifying, describing or measuring the impact and value of technology transfer. Admittedly, many of the mechanisms used for the transfer of technology such as face-to-face or telephone communications, professional meetings, and the dissemination of publications, do not lend themselves easily to tracking or followup procedures. However, some minimum amount of effort needs to be undertaken upon which to base legitimate estimates and extrapolations. Without more attention to systematic documentation, the case for the value of technology transfer, and subsequently more sustained management attention, is unlikely to be achieved.

Untapped Opportunities

In spite of several decades of activity directed toward technology transfer, and many supporting activities which span a much longer time, the unplowed ground remains great. None of the current programs is comprehensive. All have significant opportunities for expansion, if they can be perceived by agency management as promoting the interest of the agency. In that context, this survey suggests that the following opportunities remain to be exploited in most agencies: (1) the systematic documentation of the benefits of technology transfer activities; (2) the institutional means to stimulate "spinoff" opportunities; (3) the capacity to discover, then use discoveries made by Federal contract efforts, over and beyond those conducted in Federal laboratories; (4) an interest to develop stronger and more frequent ties among those interested in technology transfer and those interested in research and development management; (5) the willingness to engage in more systematic and inclusive assessment of technology transfer efforts; and (6) the interest in strengthening the Federal Laboratory Consortium as a mechanism to exchange information on technology transfer.

Documentation

Although irregular efforts have been made to document the benefits of technology transfer, it has not been undertaken on a continuing or a systematic basis except by the National Aeronautics and Space Administration. In spite of the many studies of the technology transfer process, it has yet to be fully understood--perhaps even more, fully appreciated. Therefore, it is important that knowledge about both successful and unsuccessful efforts be documented, and that careful studies be undertaken (in more than just an occasional agency) which will array and assess the value of such activities--including economic, technical, and related benefits. Even where the concern is direct transfer to a user group, rarely are resources and effort sufficient to the task made available. In spite of evidence to the contrary, most agencies reserve the lion's share of resources to research, with little serious attention to the process of promoting or facilitating its use. This institutional barrier will most likely be overcome to the extent that the value of the transfer process is clearly demonstrated.

Spinoff

Second, substantially more useful technology can be made available to the civil sector within the U.S. economy if institutional means are established to exploit "spinoff" opportunities. Here particular emphasis needs to be given to those agencies not now paying attention to this secondary application. That includes most agencies now conducting formal programs. Although these agencies make important contributions to their clientele, little evidence is in hand to estimate the possible foregone benefits due to lack of attention to potential spinoff opportunities. What appears to be lacking is a means for screening current or completed research for potential applications elsewhere. To do this effectively requires broad contacts ouside the Federal laboratory environment. Whether such screening is more appropriate as a government function or one in the private sector is in issue yet to be resolved. Regardless of where it is done, Federal laboratories need to invest more effort than currently is evident toward identifying that research which has potential for application elsewhere.

Contractor/Grantee R&D

Third, none of the agencies surveyed seek to identify opportunities that might be derived from Federally funded contractor or grantee conducted research and development. The primary emphasis is upon technological innovation within Federal activities. Some contractor innovations undoubtedly are commercialized through patent and licensing activities. However, one should not rely totally upon patent/licensing to bring forth new innovations. NASA's experience reveals that 80 percent of all new innovations reported by contractors consisted of innovations which were not patented or not patentable. Agencies could significantly expand the potential for the spinoff of technology by encouraging contractors and grantees to report all new technology through either technical or administrative contract reporting. This could stimulate contractors or grantees to be more alert to opportunities for possible applications that may have been overlooked in the past.

R&D Management/Technology Transfer

Fourth, there is considerable common interest in the process of moving technology from the laboratory to actual use, regardless of whether the user is an in-house client or one outside the Federal government. This suggests that those managers responsible for direct transfer efforts within the departments and agencies are important sources of information and knowledge that should be tapped by those responsible for the transfer to clients outside the program. Although it is important to retain a focus on the transfer of technology to the civil economy, ties among all those interested in the transfer of technology from laboratory to practical use should be brought together for systematic exchange of information and experience. For example, program managers in the Department of Defense might benefit from the experience of those involved in spinoff transfer to State and local government or industry—and vice versa. Institutional obstacles, communications deficiencies, user participation and many other issues are common to both communities and deserve some joint, cooperative attention.

Evaluation

Fifth, too few broad-ranging assessments have been made of technology transfer efforts to date. The technology transfer process is a fragile one under any circumstance. Much growth is yet to be made. The kind of assessment needed is not so much the typical "audit" as that directed toward improving program direction and program function. Typical benefit-cost analysis tends to be narrow, although it can help provide important information directed toward identifying aggregate benefits. As part of this effort, more research should be directed toward means of measurement, even if only surrogates for measures not yet possible. This survey revealed little evidence that knowledge about particular assessments or studies was known in other agencies, let alone shared. Some interagency efforts are needed, perhaps through the FLC, to encourage systematic progress through the aggregation of assessment efforts.

Federal Laboratory Consortium

Finally, opportunities should be sought to strengthen the Federal Laboratory Consortium as a mechanism to exchange information regarding technology transfer. Within the Federal government it is the best fitted for the neutral exchange of information about techniques, benefits, and ways to stimulate or improve technology transfer. The Technology Transfer Society offers a similar mechanism for inclusion of industry, State and local governments, and universities. Each agency has its own unique mission and constituency--whether internal or external to the organization. Therefore, the organization for and conduct of technology transfer will vary considerably. It is not a function that can be ordered or directed to occur. Rather, it requires that the conditions be provided in which transfer can occur. This puts a premium upon leadership, with continuity and some patience. Given these circumstances it is especially important to have broad, open exchange of experiences through professional associations where formal bureaucratic delineations are relaxed. The FLC should be able to provide such opportunities.

In Retrospect

Although most efforts are of low visibility, there is an extensive amount of technology transfer occurring across many Federal agencies today. It is not often well supported in terms of personnel or financial resources. However, it seems to be fulfilling important needs of the clientele served, and often provides a "bonus" in terms of value not originally expected. These activities tend to be limited to relatively narrowly defined constituencies in most instances, and to be given little attention by the senior management within the respective agencies. Clearly, there are significant opportunities for improving the process of technology transfer, and for substantially expanding the benefits that can be accrued by more active, complete, and better organized programs. What remains is to develop the effort and to provide the information which can be convincing to both bureaucratic and political management that such efforts are worthy of further investment.

TECHNOLOGY TRANSFER ACTIVITIES IN THE DEPARTMENT OF DEFENSE

The research and development activities of the Department of Defense constitute the single largest group of laboratories and technical facilities in the United States. The DOD has 72 major laboratories (Army 35, Navy 23, and Air Force 14) with an annual research program in excess of $7.3 billion, employing some 26,500 military and civilian professional scientists and engineers.[1] With this awesome resource one might anticipate substantial opportunities for the movement of technology developed in these laboratories to the domestic civil sector.

Unlike many of its other functions, the Department of Defense does not provide strong oversight and direction for the domestic technology transfer function at the departmental level. The policy from the beginning has been one of decentralization to the working level--in this case the research laboratory or other technical facility. Within the Office of the Secretary of Defense the domestic technology transfer function is coordinated within the Office of the Director of Research and Laboratory Management, located in the Office of Defense Research and Engineering. The function is one of light oversight, to assure that the function meets the basic legal requirements of PL 96-480 (the Stevenson-Wydler Technology Transfer Act of 1980).

Coordination is largely through a small committee consisting of representatives from the Army, Navy, and Air Force. The Army member has been the Director for Technical Planning and Management of the Army Materiel Command. The Navy member has been the Technical Information Specialist in the Office of the Chief of Naval Research. The Air Force representative has been the Science and Technology Information Officer from the Air Force Systems Command. This group meets from time to time to discuss issues and/or problems relating to domestic technology transfer activities and what might be done to comply with the requirements of PL 96-480.

Although the Act was passed in 1980 the implementing regulation issued from the Office of the Secretary of Defense did not appear until April 1985 as DOD 3200.12-R4, "Domestic Technology Transfer Program Regulation." This regulation was issued under the authority of DOD Directive 3200.12, "Defense Scientific and Technical Information Program," dated February 15, 1983. Notable points cited in the regulation include "heads of DOD components may [emphasis supplied] issue supplementary instruction when necessary to provide for internal administration of this Regulation within their respective components." In the section termed "policy," the Regulation indicates that the defense components (e.g., Army, Navy, and Air Force) are to promote the sharing of technology, to share plans for future research efforts within the military departments, and to "support technology transfer . . . as an integral part of research and development effort . . ."

Responsibilities for domestic technology transfer were vested in the heads of DOD components--Army, Navy, Air Force, Defense Logistics Agency, etc. The heads were to specify activities that require fulltime individuals to

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[1] Data from Davidson, Department of Defense In-House RDT&E Activities, October 30, 1982.

staff the required Office of Research and Technology Applications (ORTA) and to "develop appropriate goals or corporate plans."

Generally, the stance taken at the Office of the Secretary of Defense has been that domestic technology transfer activities are a small part of the department's overall scientific and technical information program which is aimed primarily at providing information within the defense community, to include the military departments and those contractors which continually do business with the DOD. Outreach beyond this community has been left more or less as an optional activity that may be pursued by the various components, and subsequently the laboratories as they may wish. This approach to domestic technology transfer is based upon the strongly held opinion within the Office of Secretary of Defense that nothing should be permitted to intrude upon the basic mission of the DOD laboratories, which is to provide support to the development of weapons systems, to existing systems, and to the troops involved. Since no funds have been identified in the DOD budget specifically for technology transfer, it is unlikely to receive high level attention as an important part of the "regular manner of doing business" within the DOD R&D community. Typically, the interest in domestic technology transfer has been from the "bottom up," and it has been tolerated, and recognized as legitimate, as long as it does not become intrusive on the time of the scientists and engineers or the resources of the department.

It should be noted that considerably more attention is given to what is characterized as "negative technology transfer," or the flow of technology and technical information to either foreign competitors or antagonists. Four major DOD directives relate to this topic: (1) DOD Directive 5230.9, "Clearance of DOD Information for Public Release," April 2, 1982; (2) DOD Directive 5230.25, "Withholding of Unclassified Technical Data from Public Disclosure," November 6, 1984; (3) DOD Directive 5230.24, "Distribution Statements on Technical Documents," November 20, 1984; and (4) DOD Directive 2040.2, "International Transfer of Technology, Goods, Services, and Munitions," January 17, 1984. (See Appendix II-A for full text of these directives and the Technology Transfer Regulation.)

As noted earlier, the Defense Department puts its primary emphasis upon the provision of information for the use of the military departments and active defense contractors. The primary point of focus for this activity is the Defense Technical Information Center (DTIC) which is operated by the Defense Logistics Agency (DLA). The Defense Technical Information Center is analogous to the National Technical Information Service, but servicing defense needs, including classified documentation.

In order to better serve DOD clientele, 21 Information Analysis Centers have been established across the country to provide specialized technical information--eleven are contractor operated but administratively managed by DLA and DTIC, while ten are managed by other DOD activities. These centers deal with various topics ranging from the Coastal Engineering Information Analysis Center, through the Metals and Ceramics Information Center and the Nondestructive Testing Information Analysis Center, to the High Temperature Materials Information Analysis Center. These centers are supposed to provide a variety of products and services including: (1) abstracts and indexes; (2) technical inquiry services for authoritative advice and response to technical questions posed by the user; (3) bibliographic inquiry service; (4) scientific and engineering reference works; (5) state-of-the-art reports, e.g., summaries of the status of technologies that are pertinent to current research, decision making, with usefulness to all levels of research management; (6) critical reviews and technology assessments, e.g., the latest scientific or engineering information in a useful format on subjects of significant interest to the defense RDT&E community; and (7) current awareness publications, e.g., newsletters.

Presumably, the private sector has access to these Information Analysis Centers to the extent practicable without impairment of service to DOD and consistent with security and other limitations of release of such data. Inquiry suggests that this type of activity is limited to the defense community, with little awareness about them among American industry in general. Although there might be substantial potential for outreach to American domestic industry, it is not apparent that these centers are prepared to do so.

Although the Department of Defense regulation on domestic technology transfer permitted the defense components to issue further instructions and regulations regarding the topic, none saw fit to do so except the Department of the Army. Army's regulation was issued April 15, 1983, nearly two years before the Department of Defense regulation. More will be said about the Army regulation in the discussion on the Department of the Army's approach to domestic technology transfer.

In summary, domestic technology transfer activities are not strongly supported at the level of the Office of the Secretary of Defense. There is no antagonism toward these activities. They are tolerated, and recognized as legitimate activities. Basically, they are viewed as activities of utility and value, but also as activities which have the potential to infringe upon the basic missions of the research and development laboratories within the Armed Forces, and, therefore, are not actively promoted.

Department of the Army

Although the Army laboratories were not the first to become most actively involved in domestic technology transfer, the Department of the Army has provided institutional support at a higher level than any other DOD component.

On April 15, 1983, the department issued Army Regulation 70-57, "Military-Civilian Technology Transfer." Briefly, this regulation identified the purpose of these efforts:

> Technology transfer is addressed as an active effort to foster additional benefits of Army technology, developed for the primary military mission, by applying this technology to fulfill needs in the domestic civilian economy.

The regulation went on to indicate that it would:

a. Integrate military-civilian technology transfer into the mission of each appropriate research and development (R&D) activity.
b. Establish and staff an organization within each of these R&D activities to perform the technology transfer function in accordance with Section II, PL 96-480.

c. Prescribe Department of the Army management policies to assure the effective use of R&D resources and technology transfer activities.

The regulation vested responsibility for this function with the Deputy Chief of Staff for Research, Development and Acquisition, and more specifically provided that centralized coordination for Army domestic technology transfer activities would rest with the Commanding General of the Army Materiel Command. Later, in describing policy, the regulation noted:

> . . .the Army has continuing responsibility to insure the full use of the results of its investments in R&D. The Army is also required to actively promote and encourage the appropriate transfer of Army-owned originated technology to State and local governments and to the private sector. Further, it is DA policy to seek the civilian application of unique capabilities and mission-developed expertise. . .

The regulation laid out a number of management guidelines among which were:

> The level of work on civilian technology transfer will not impede the accomplishment of the military missions of the R&D centers, laboratories, and developing agencies. . . The projects selected for non-Defense technology transfer will be compatible with the primary mission and technology capability of the laboratory performing the work. . .

As noted earlier, coordination for the Department of the Army is vested in the Army Materiel Command and located with the Director for Technical Planning and Management (AMCLD). That office issued a pamphlet titled More Than National Defense providing a brief description of how domestic industry and State and local governments could tap technology within the Army laboratory system, and within the broader Federal Laboratory Consortium for Technology Transfer. (See Appendix II-B for a copy of this pamphlet.) It listed participating laboratories and facilities of the Department of the Army, along with contact points at the major laboratories for handling technical inquiries.

As part of this active program in domestic transfer, AMCLD developed a work management plan, issued in January 1985, that addressed 26 issues as part of an organized structure of objectives, work assignments and progress targets. These were assigned throughout the major laboratories of the Army and included such issues as Army patents, laboratory technology assessments, laboratory posture reports or equivalent annual reporting, funding to laboratories for technology transfer activity, recognition for Army technology transfer efforts, Inspector General reviews, industry/Army technology transfer program communication, Federal Laboratory Consortium for Domestic Technology Transfer, and a referenced data base to identify and provide access to Army experts. The Army's technology transfer plans have been informally published and made available to the various subordinate commands and laboratories, with specific assignments, goals, and deadlines to the collection of information, the development of further action plans, and similar activities. (See Appendix II-C for a more complete description.)

This initiative was a direct result of the interest and support given by the Commanding General of the Army Materiel Command. He saw the need to make technology transfer a normal part of doing business in an Army laboratory.

The staffing of the Office of Research and Technology Applications (the ORTA described in PL 96-480) has been a challenge to the Army as it has been to most agencies. The act called for a fulltime person for each laboratory with an annual budget of $20 million or more.

Typically what has occurred is that these ORTAs have been staffed with individuals who have a demanding array of other duties to perform as well. For example, the Army coordinator has not only the technology transfer responsibility, but also has been the point of coordination for those experts who are to judge export control decisions, the technical information point with regard to sources in Army laboratories, and the primary contact for the Government-Industry Data Exchange Program (GIDEP). This is typical of the range of activities undertaken by individuals assigned this responsibility.

A goal of the Army, yet to be realized, is to staff these offices with individuals of broad technical capability who are familiar with the range and depth of technology in their particular laboratory and who have the personal qualifications to interact easily and freely with counterparts in industry and State or local governments.

Three Army laboratories were visited in an attempt to obtain some sense of the domestic technology transfer activities and organization in the field. These laboratories were the Night Vision and Electro-Optics Center, Ft. Belvoir, Virginia, the U.S. Army Belvoir Research and Development Center, Ft. Belvoir, Virginia, and the U.S. Army Harry Diamond Laboratories at Adelphi, Maryland.

Night Vision and Electro-Optics Center

This laboratory is one of the laboratories of the U.S. Army Communications Electronics Research and Development Command (CECOM), and has the responsibility for providing the technical capability to permit the Army to engage in combat operations with equal effectiveness day or night, in good weather or poor weather by penetrating elements that obscure the battlefield. The laboratory employs just under 500 persons with a budget in excess of $140 million annually.

The domestic technology transfer function is located with the Director of the Office of Research and Technology Applications who also has responsibility for identifying scientists or engineers and technology in the laboratory for purposes of judging export control questions. The ORTA reports to the Laboratory Director through the Associate Director for Operations. This office receives strong support from the Laboratory Director. The laboratory has been directed (unlike many other Army laboratories) by a civilian employee of the Department of the Army.

At the Night Vision and Electro-Optics Center technology transfer for domestic purposes is regarded as an important and basic function of the laboratory. The technology transfer officer has been meeting with laboratory team leaders to help define the importance of domestic technology transfer and to stimulate the interest of these team leaders as a means of identifying potential technology for transfer.

The laboratory provides financial support to the Federal Laboratory Consortium and has undertaken a number of outreach activities. These include the orientation of professors in electrical engineering from colleges throughout Virginia, liaison with the Virginia Center for Innovative Technology, and active support of the Thomas Jefferson High School for Science and Technology, a newly established "high tech" high school, in a joint venture with industry.

The laboratory also has produced a report on its technology transfer activities covering the period from 1972-1981. That report lists a series of activities that involve numerous opportunities for domestic technology use including health and medicine, environment and space, safety, construction, facilities management and surveying, community service, law enforcement, and mammal studies. The report, Night Vision and Electro-Optics Technology Transfer, 1972-1981, was produced in September 1981 and noted as its purpose:

> To illustrate, through actual case histories, the potential for exploiting a highly developed and available military technology for solving non-military problems.
>
> To provide, in a layman's language, the principals behind night vision and electro-optical devices in order that an awareness may be developed relative to the potential for adopting this technology for non-military applications.
>
> To obtain maximum dollar return from research and development of investments by applying this technology to secondary applications. This includes, but is not limited to, applications by other Government agencies, State and local governments, colleges and universities and medical organizations.

Inquiries are handled basically on a one-to-one basis, putting the inquiring scientist or engineer in touch with the particular laboratory specialist. Officials at this laboratory acknowledge that the Stevenson-Wydler Act (PL 96-480) assisted domestic technology transfer at this particular laboratory by stimulating the formal establishment of the Office of Research and Technology Applications (ORTA).

The U.S. Army Belvoir Research and Development Center

The Development Center has 1,250 employees and conducts approximately two-thirds of its research via contract. It has responsibility for Army-wide research and development support for mobility, heavy duty equipment, fuels, physical security, portable electric power sources, camouflage, and potable water sources. The ORTA is located in the Office of the Chief Scientist—a headquarters' function. One of the real challenges at this location is the myriad duties that the ORTA is expected to undertake in addition to that of domestic technology transfer functions. For example, this ORTA has responsibility for small business liaison, small business innovative research, unsolicited proposals, and proposals from contractors for independent research and development. This center undertook the responsibility, on behalf of Army laboratories, for reviewing the "common" functions throughout the Army of persons assigned as an ORTA. The findings of this informal survey revealed that most of the persons assigned to this function were able to spend 10 percent or less of their total time on domestic technology transfer functions. In spite of substantial emphasis from the Army Materiel Command on domestic technology transfer, that emphasis does not often penetrate the various layers of command.

The center has been active in publishing an information booklet on how those outside of the Army may tap the expertise of the center, explaining a number of the technical activities of the laboratory and opportunities for potential civilian spinoffs. These range from portable detectors for checkpoints at airports and jails, through less toxic metal cleaners and paints, fiber reinforced cement and concrete, winterizing kits for construction equipment, improved packaging materials and techniques, to shock and impact resistant plastics. Although most of the transfer involved is from the center to other Federal laboratories or agencies, a considerable amount still is accomplished with State or local governments and private firms.

U.S. Army Harry Diamond Laboratories

The goal of the technology transfer program at the Harry Diamond Laboratories (HDL) is to assist American industry through recognition that the laboratory is an existing pool of expertise to be tapped by domestic industry. This means that the focus of the laboratory program is to make more broadly known to industry what the laboratory can do, and how that can be made reasonably available.

The ORTA reports directly to the Associate Director for Plans and Operations, providing a good overview of the entire range of the laboratory's technical programs. This ORTA has a fulltime director, its own budget, and access to as much as three-quarters of a professional (scientific or engineering) person year from other capabilities within the laboratory.

HDL has an active technical volunteer program to assist local government by engaging in a variety of tasks ranging from assisting in the review of bids for electronic equipment to helping local agencies select and install word processing equipment. It has been active for more than a decade in the Federal Laboratory Consortium providing support up to $10,000 annually. About one-quarter of the ORTA director's time is devoted to FLC technology transfer activities. It is considered that working with the FLC provides "good trading material" for working with other laboratories. Institutionally the laboratory, through the ORTA, works with both Maryland and Pennsylvania State officials on economic development problems related to industry.

The laboratory produces a number of pamphlets to promote technology transfer, titled Technology and Technical Assistance Available to You. From time to time tech briefs are published that describe the "leading edge" research which is judged to have potential civilian applications. A recent example of this is a series of tech briefs on fluidic sensors and related instrumentation.

The ORTA at Harry Diamond Labs receives strong support from the laboratory management in its outreach efforts to transfer technology to American industry.

U.S. Army Corps of Engineers Construction Engineering Research Laboratory

Another approach to domestic technology transfer in DOD is that practiced by the Construction Engineering Research Laboratory (CERL) of the U.S. Army

Corps of Engineers. Since the Army conducts research and development in support of its construction operations and maintenance missions, it is imperative that this research be incorporated by the industry serving the military mission. Nearly 80 percent of the architectural and engineering services required by the Army are provided by civilian firms. The R&D products will never serve the Army unless they are incorporated by the civilian construction industry. This means there must be an aggressive program of technology transfer. CERL has pursued this over the past several years, with some substantial success. (See Appendix II-D CERL Fact Sheets: (1) "Technology Transfer to the Private Sector," January 1985; and (2) "Technology Transfer Mechanisms: Involvement of Private and Nonprofit Organizations," February 1985.)

Department of the Navy

It was in a few Navy laboratories that the Federal Laboratory Consortium for Technology Transfer had its initial roots. In the spring of 1970, the Naval Weapons Center began a project which systematically considered the transfer of technology to other settings. Interest grew and other laboratories within the Department of Defense showed interest. A meeting was held in July 1971 at the Naval Weapons Center (China Lake) at which was established the Department of Defense Technology Transfer Laboratory Consortium.

Within three and a half years, others, including non-DOD laboratories, joined and the FLC was born. Today initiative in the Navy remains largely decentralized to its research and development laboratories and facilities. Although once housed in the Naval Materiel Command, where an instruction was issued relating to domestic technology transfer at an earlier time, the Navy did not feel the need to implement DOD Regulation 3200.12-R4 by its own instruction. The central coordinator for domestic technology transfer does have some funds available to sponsor Navy-wide activities or projects of interest. For example, it sponsors the Domestic Technology Transfer Fact Sheet which is published monthly by the Naval Surface Weapons Center, Dahlgren, Virginia. It highlights Navy technology of potential interest to State and local governments or private industry. In addition, the central point of coordination also provides support for the technical volunteer service which originally was begun at the Naval Underwater Systems Center. Support has been provided to the David Taylor Naval Ship R&D Center where Navy-wide coordination is maintained not only for other Navy labs but for other Federal laboratories that wish to have background information on how to develop such a volunteer program.

In summary, the domestic technology transfer activities within the Navy are largely the result of local initiative, circumstances, and interest at the laboratory level. These activities clearly must fit into the mission/responsibility of the individual laboratories, with the variation that one might expect from one laboratory to another. The three laboratories visited in the Navy were the Naval Research Laboratory, the Naval Surface Weapons Center at White Oak, Maryland, and the David Taylor Naval Ship R&D Center in Bethesda, Maryland.

Naval Research Laboratory

As corporate research laboratory of the Navy, the Naval Research Laboratory conducts broad-spectrum research and development to improve the effectiveness of the Navy. Founded in 1923 to promote advancements in science and engineering for the Navy, its program has evolved into one of closely coupled basic research, exploratory, and advanced systems development. The laboratory currently is conducting multidisciplinary programs in materials, equipment, techniques, systems, and related operational procedures for the Navy. The four major research areas at the laboratory are: space and communications, general science, material science and systems research.

Much of NRL's research has effects well beyond the laboratory's original defense-oriented mission. The availability of NRL technology to meet civilian needs in such fields as ecology, energy, transportation, health, and education often obviates the development of similar technology by civilian establishments. Much of the laboratory's work can be considered to be technology transfer related—either to components of the Navy, DOD, other government and State agencies, or to the public sector.

The ORTA at the Naval Research Laboratory is located in the Office of Management and Administration of the Executive Directorate. The ORTA at NRL conducts and develops approximately 60 technical assessments each reporting period for dissemination through DOD and CUFT for public use based on over 2,000 research and development projects. The ORTA provides unclassified technical advice and assistance to the Federal and State government agencies, universities, and industry that request it. Such information generally is transmitted together with appropriate NRL reports, technical papers and/or NRL patents.

The laboratory has had a close relationship with the Federal Laboratory Consortium for Technology Transfer (FLC) over the years and has contributed to the financial support of its operation. NRL supports the FLC with active participation in national and regional meetings and projects; it also has participated actively in activities of the Technology Transfer Society both in the Washington area and nationally. The ORTA office maintains liaison with and provides assistance to the Government Industry Data Exchange Program (GIDEP).

The ORTA office administers the NRL National Research Council Post-Doctoral Program, Naval Academy Faculty Program, and the Office of Naval Research Graduate Fellow Program for fulltime or summer visiting faculty and professional appointments. It also provides a number of technology transfer related functions internally for the Navy and DOD.

For the past eight years, the laboratory has been active in providing technical assistance, through the Intergovernmental Personnel Act of 1970, to State and local governments with its participation in Public Technology Incorporated's (PTI) Community Technology Initiatives Program (CTIP).

Naval Surface Weapons Center

This laboratory is more of a mission oriented development center that works on demand for the various systems commands throughout the Navy with the emphasis on naval surface weapons. The philosophy at NSWC is that domestic technology transfer is a two-way street which involves input from non-government sources as well as the "spinoff" from the government R&D community to potential outside users.

Some of NSWC's technology transfer activity includes work on non-DOD sponsored projects which can benefit from the technical resources and skills available at the center. In turn, this arrangement can broaden the center's technical skills base and increase its value in support of mission related programs. In general, the Nation's technology base is enhanced by two-way exchange.

NSWC also participates in the Navy Industrial/Cooperative Research and Development program which provides access to research and research planning information by contractors or potential contractors, thereby expanding the base of technical expertise and availability. It has initiated, during the period of the report, some 27 program policy agreements under the Navy Industrial/Cooperative Research and Development program.

Pursuant to the enactment of PL 96-480, NSWC issued its own directive establishing the Office of Research and Technology Applications in July 1983. This recently was revised and is designated as NAVSWCINST 5700.2A of 6 January 1986. The ORTA is a part of the advanced planning staff at the center. Approximately half time is spent on domestic technology transfer. Other duties include the Industry Independent Research and Development (IR&D) program as well as assisting in the center's five-year technical plan and the coordination of expert advice for licensing and export purposes.

The domestic technology transfer activities at NSWC have been given consistent support by the laboratory management. The center published a two-year report in October 1984 titled Naval Surface Weapons Center Technology Transfer Biennial Report (FY83/84). (See Foreward to this report in Appendix II-E.) The center cooperates with and participates in the Federal Laboratory Consortium activities and also has a strong program in manufacturing technology. It is the policy of the center that domestic technology transfer is to be encouraged, within appropriate security constraints, for the R&D activities undertaken by the center.

David Taylor Naval Ship R&D Center

The ORTA at this center is located in the Office of the Director of Technology which provides a point of oversight for the technical activities regarding potential domestic technology transfer. Approximately half of the ORTA's responsibilities are related to domestic technology transfer and the other half are in technical planning. Co-located with the ORTA is the official responsible for the center's Independent Research and Development program with Navy contractors.

The ORTA at David Taylor receives anywhere from five to twenty responses on each technical item that it publishes in the Navy Fact Sheet for domestic technology transfer. The ORTA retains a file on these inquiries, but there has been no followup to determine what the results of the particular inquiries were. The center cooperates closely with the Center for the Utilization of Federal Technology by providing technical assessments of technology with potential commercial value. But it has not received the same type of feedback with respect to these assessments as it has with those published in the Navy Fact Sheet. Inquiries from the Federal Laboratory Consortium network also are not nearly as numerous as those resulting from publication in the Navy Fact Sheet.

It is this center that acts as a point of coordination in making information available and stimulating interest in the technical volunteer service to provide assistance to State and local governments from technologists, scientists, and engineers at Navy laboratories--both those in active service and retired. Ten laboratories have initiated or are in the process of initiating this type of technical volunteer service which was begun in 1978 at the Naval Underwater Systems Center in New London, Connecticut. (A report on the establishment of a technical volunteer resource bank was published by the center in March 1985.)

Department of the Air Force

The Air Force, like the Navy, follows a general policy of minimum direction from the departmental level to its commands and laboratories or other technical facilities on domestic technology transfer activities. The main emphasis is placed upon providing technical information to current Air Force laboratories or Air Force contractors or to potential Air Force contractors. The latter is carried on through the Air Force Potential Contractor program. (See Appendix II-F for a brief description of this program.) Supplementing this activity is the Air Force Information for Industry Office which is located in the Air Force Systems Command. This program acts as a focal point for the industrial community to provide information regarding Department of Defense and U.S. Air Force acquisitions, research and development requirements, plans and future needs. Information of both a classified and unclassified technical nature is available at these Air Force Information for Industry Offices in Virginia, Ohio, and California. In one sense these programs do provide for technical interchange, but they are not classical domestic technology transfer activities.

An example of such an activity is that conducted by the Air Force Wright-Patterson Aeronautical Laboratories in Ohio which has a memorandum of understanding with the Ohio Technology Transfer Office (OTTO). OTTO provides technical and industrial information and advice to State agencies, local governments, and industry within the state of Ohio. As a part of this outreach activity the Air Force Wright-Patterson Aeronautical Laboratories, in September 1985, published a small handbook titled Points of Contact, which made available the names, organizational locations, telephone numbers, and areas of expertise for scientists and engineers within that laboratory. The pamphlet lists some 379 technical areas, from "accident investigation" to "winglets," which might be of interest to persons in domestic industry. The laboratory employs approximately 2,700 people and has a budget of $800 million annually.

Summary

Technology transfer efforts within the Department of Defense generally are local and self-initiating. Direction or support, except for Army, tends to be very modest and sporadic. The innovative activity at a number of DOD laboratories, such as those visited, suggests that substantial opportunity for spinoff transfer to the civil economy exists, with positive results for both DOD and the Nation. However, without more positive leadership from both senior civilian and military officials at the departmental level, these opportunities will remain largely unrealized.

TECHNOLOGY TRANSFER ACTIVITIES IN THE DEPARTMENT OF THE INTERIOR

At the departmental level, the Department of the Interior has no technology transfer organization or point of contact. Technology transfer, as a part of program activity, is to be found in varying degrees in three program areas at the bureau level: (1) the Geological Survey, (2) the Bureau of Mines, and (3) the Fish and Wildlife Service.

Geological Survey (USGS)

The mission of the USGS is "to collect, organize, interpret, and publish information about the nation's energy, minerals, water, and land resources; and to determine the geologic structure of the United States and develop an understanding of earth processes and hydrologic principles."[1]

It is thus perceived as both a scientific and a service agency, collecting unbiased scientific data for use by decision making and regulatory agencies. These agencies include the Departments of the Interior itself, Agriculture, Commerce, Defense, Energy, State, Transportation, and the Treasury, and independent agencies such as the National Aeronautics and Space Administration, the National Science Foundation, the Agency for International Development, the Central Intelligence Agency, the Environmental Protection Agency, the Federal Emergency Management Agency, and the Nuclear Regulatory Commission.

Within USGS, technology transfer becomes the "handing over" of USGS expertise to other interested parties. This is a diffuse and decentralized enterprise which takes many forms, primarily the written word and the computer byte. The place of technology transfer within USGS is recognized at the highest levels: "An essential part of the Geological Survey mission has always been the dissemination of the results of scientific data collection and research," writes Director Dallas L. Peck in his "Year in Review."[2]

The Office of Research and Technology Applications (ORTA), specified by PL 96-480, is located with the Chief of Plans and Programs in the Office of Programs within the USGS Director's Office. This office also serves as the point of contact with the Federal Laboratory Consortium, although there has been little interaction with the consortium. FLC interaction is expected to broaden as the scope of technologies covered broadens.

The fact that technology transfer is decentralized reflects the organization of USGS, which is divided into three program divisions (National Mapping, Water Resources, and Geologic) and two support divisions (Information Systems and Administrative). It is headquartered in Reston, Virginia, and operates three regional offices in Menlo Park, California (Western), Denver, Colorado (Central), and Reston (Eastern). In addition, it supports about 200 field offices throughout the US and Puerto Rico. It employed 11,385 people in

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[1] Program Activities, p.2.

[2] USGS Yearbook FY84, p.2.

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fiscal year 1984. The fiscal year 1984 budget was $583.2 million distributed among the program divisions as follows: National Mapping, $112.4 (19%); Water Resources, $220.4 (38%); and Geologic, $217.6 (37%). The nature of work at the program divisions varies among production, clearinghouse, and repository activities.

The National Mapping Division's mission is to produce, collect, store, and disseminate cartographic, geographic, and remotely sensed data in graphic and digital form. This information is disseminated through Public Inquiries Offices, the National Cartographic Information Center, and the Earth Resources Observation Systems Data Center. Ten Public Information Offices across the nation make USGS information accessible to the public through walk-in traffic as well as via mail and phone. Inquiries come from all over—other federal agencies, State and local governments, Congress, private individuals, and industry.

The Water Resources Division provides hydrologic information and assistance to achieve the best use and management of water resources, and to analyze the effects of hazardous waste on surface and ground water. To do this the division relies on a national water quality network to provide measurements from communities. The Federal-State Cooperative Program involves 800 State and local agencies engaged in 50:50 partnerships to conduct water resource investigations. The division also operates from 43 field offices. Some of the division's more outstanding accomplishments are: the annual National Water Summary, which analyzes conditions State by State; the State Water Research Institute Program, which supports 54 Water Research Institutes at universities in each State, the District of Columbia, Puerto Rico, the Virgin Islands, and Guam; the National Stream Quality Accounting Network (NASQAN); the National Water Data Exchange (NAWDEX); and the Water Data Storage and Retrieval System (WATSTORE).

The Geologic Division's mission is to assess energy and mineral resources, geologic hazards, geologic structures, and climatic changes. If National Mapping has the largest public outreach, Geologic has the least. It serves that section of the public interested in the basic scientific geological data it collects through such surveys as the Geologic Hazards Survey, Land Resource Survey, Mineral Resource Survey, Energy Geologic Survey, and Offshore Geologic Survey. The division does conduct an active outreach program to transfer earthquake, volcano, landslide, and ground failure hazards information and technical assistance to public safety officials, planners, political leaders, and other decision makers, as well as to technicians. It also maintains a world class earth resources library.

While USGS is in active contact with its clientele, the bulk of its technology transfer is based on the written word and other data storage methods. Publications are emphasized, including those which explain how to obtain information stored in other forms. Publications fall into three categories: professional papers which have been subjected to peer review and are considered contributions to the research community; circulars, or works in progress; and an open file of everything else written up about research.

In addition to this published material, such methods of dissemination as scientific and professional society membership, conference attendance, and other means of scientific collaboration occur among USGS scientists. Joint endeavors with private industry are minimal.

The economic value of these transfer activities remains undetermined. For example, USGS activities have encouraged the formation of private map dealerships to market computer tapes of maps and water data. USGS considers its technology transfer generally to be a "merit good" that benefits society at large.

Are there instances where USGS scientists, in their quest for data, have developed a technology that would be of interest to others? In the "Year in Review," Peck points out that, in developing the means to acquire and store resource data, USGS has "developed innovative new programs to manipulate and effectively use these large volumes of data." He also mentions that USGS "contributed to improved methods for estimating remaining oil and gas resources from past production records" and the "development of new methods for assessing oil and gas resources without damage to the fragile environments in cold regions"--the latter transferred to the North Slope Borough in charge of managing Alaska's Barrow gas fields. In 1984, USGS "successfully predicted three of the four latest eruptions of Mount St. Helens," implying a jump in volcano eruption technology. A study of the high plains regional aquifer led to the development of "a successful model to test alternative strategies for mitigating the effects of ground-water depletion." The same source touts "exciting new analytical techniques . . . which now make it possible to determine the ages of rocks and sediments that previously could not be dated." USGS undertook the necessary development to implement laser optical disk storage technology for the National Digital Cartographic Data Base, a technology which "offers significant advantages over conventional storage and retrieval devices."[3]

All of the above examples suggest that the classical "spinoff" may be taking place but is unrecognized as such.

Bureau of Mines (USBM)

USBM is responsible "for conducting research and for collecting, interpreting, and analyzing information involving mineral reserves and the production, consumption, and recycling of mineral materials."[4] The bureau's budget is $130 million annually, of which 10 percent goes to contractors and 90 percent remains in-house.

The technology transfer effort was begun in 1971, coinciding with an increase in the R&D budget. The Technology Transfer Branch is composed of six full time employees in Washington, D.C., and one in each of ten research centers nationwide. It reports directly to the director of USBM. The branch's principal purpose is to move research results into industrial practice.

USBM R&D can be technical or informational. The latter refers to USBM policies and other managerial aspects of mining, such as tax laws and their impacts on the mineral and mining industry. R&D concerns mining health, safety, and productivity, minerals processing, metallurgy, and recycling.

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[3] USGS Yearbook FY84, pp. 39 and 40.

[4] Research 84, p.1.

The Technology Transfer Branch is responsible for the dissemination of both information and technical developments. It has developed an extensive program for fostering the direct application of USBM sponsored research. Transfer is "vertical"—developer to client—and rarely takes the classical "spinoff" mode. That is in keeping with the USBM's mission. Unlike NASA or Defense, it does not use the technologies it develops.

The Technology Transfer Branch tackles its task of making potential users aware of new technology in several ways. It tries to involve companies or organizations in field testing prototype equipment. This procedure requires a memorandum of understanding between USBM and the cooperating organization. The branch ascertains why industry is or isn't using USBM developments, what barriers exist, reasons for delays, etc. It acts as a conduit between researchers and clientele, providing user feedback to researchers and bringing client needs to the attention of the research program. Research proposals include a technology transfer plan. Four of 15 factors involving selection of the project and performer relate to technology transfer. Branch staff also keep aware of current developments by attending program reviews of about 1,000 research projects and maintaining contact with project personnel during the course of the research.

The Technology Transfer Branch sponsors outreach mechanisms to USBM's clientele from the mining industry, mineral processing, manufacturing, and other government agencies. Included are publications, movies and videotapes, regional seminars, briefings, exhibits, and workshops. A portion of the agenda from an industry meeting on Water-Jet Assisted Cutting, held June 21, 1984, in Pittsburgh, illustrates the emphasis on direct transfer: Analysis of Mechanical Tool Force Reductions When Using Water-Jet Assist, Experience of Applying High Pressure Water-Jet Assistance to Mechanical Cutting, the Water-Jet Plow, Performance Review of Jarvis Clark Jet Bolter, Water-Jet Assisted Tunnel Boring, etc. (See Appendix II-G.)

Among its publications is Technology News, similar to the old NASA Tech Brief Flash Sheets. Technology News is published 30-40 times a year and has a mailing list of 30,000. (See sample in Appendix II-H.) Each issue features a proven technology ready to transfer for commercial application, and includes how to contact the technician involved, and the Technology Transfer Branch.

Another publication is Research magazine, a yearly status report of 200 of the 1,300-1,400 research projects. Research is distributed at conventions. The branch also publishes conference proceedings.

The branch is involved in patenting and licensing. Exclusive licenses are being granted more frequently—in 1984 there were five. This is believed to be necessary because of the small market size. Companies occasionally will fund research in exchange for exclusive rights.

The Technology Transfer Branch is the Office of Research and Technology Applications (ORTA) within USBM. The Federal Laboratory Consortium (FLC) is regarded as a "macro" organization without technology and USBM as a "micro" organization with technology.

Fish and Wildlife Service (F&WS)

The Fish and Wildlife Service is another mission oriented agency in which technology transfer is direct and not spinoff oriented. Its clientele is the Congress, operational arms of the Department of Interior, fish and wildlife management agencies of State and Federal governments (such as the Park Service and the Forest Service), and agencies or anyone else interested in natural resource management. The network also reaches 37 cooperative units at land grant universities.

R&D amounts to about $45 million per year. The nature of the research does not lend itself easily to technology transfer. Much of it deals with baseline biological data, management, and protection--scientific or operational pursuits rather than technology. Computerized geography-based information systems have more potential. The Fish and Wildlife Service has worked with industry, such as the catfish farming industry, steel trap producers, and outdoor/recreation-oriented business.

The scientific community served by the F&WS is small enough to know one another individually and establish good intercommunications. When a problem or need is raised, the requester is referred to a technician. Patenting is rare--one in two years--and is handled by the departmental patent office.

Before the Stevenson-Wydler Act made it mandatory, Fish and Wildlife Service involvement in technology transfer was limited. Research was undertaken by the laboratories and development by Biological Services. These have now been merged into an overall research and development function that supports one agency-wide Office of Information Transfer and an FLC representative (ORTA) representing all of R&D to the FLC. In addition, one person has been designated as a contact point for technology transfer at each of the seven laboratories. The ORTA is located as part of the Office of Extension and Publications, representing the F&WS at FLC meetings and the local Washington, D.C., agency group meetings as well. This office has not received any feedback calls. About one hour per week is devoted to ORTA functions. Resources of the Office of Information Transfer include 14 employees. There are seven employees in Extension and Publications. R&D produces from 300-400 publications a year. Publication activities receive the support of upper management.

Summary

The Department of the Interior presents a classic instance where technology transfer is centered at the bureau level. Resources, the ORTA, and general coordination of transfer activities related to bureau programs are located there. Little attention or interest is given this function from the department, nor are there guidance or even reporting functions. Spinoff transfer is not a concern; the organized transfer efforts are trained upon the organization's clientele by direct transfer.

TECHNOLOGY TRANSFER ACTIVITIES IN THE DEPARTMENT OF AGRICULTURE

Three organizations within the Department of Agriculture conduct systematic programs of technology transfer: the Extension Service, the Agricultural Research Service, and the Forest Service. Both the Agricultural Research Service and the Extension Service are part of an intricate network that stretches from the Federal to the local level, constituting a confederation of interests and actors for the purposes of improving all aspects of agriculture and rural life through research and education. This network was started with the establishment of the land grant universities in 1862 and has steadily developed since then. The land grant universities retain a central role in this network, providing a "home" and focal point for most network elements.

The research side of the network is composed of the Agricultural Research Service which is totally funded by the Department of Agriculture. With laboratories spread across the United States undertaking research, ARS follows a national agenda which has been developed through consultation with representatives of the many interests in agriculture from producer through product processors, and the final consumer. The Cooperative State Research Service, within the Department of Agriculture, provides a general supervisory umbrella for the allocation of Federal funds to agricultural research which will be conducted in the various States. Usually this involves the State Experiment Stations which generally are operated under the administrative tutelage of the land grant universities.

The education and technology transfer element is represented by the Extension Service at the Federal (Department of Agriculture) level, which provides a staff of technical specialists in the many areas related to agriculture, human nutrition and rural development. The Extension Service guides educational and other outreach or technology transfer activities to improve agriculture and the quality of rural life. The Cooperative State Extension Service provides a second cascading of this activity to the State level which then oversees the person-to-person activities of the county agents who "work in the trenches" with their primary clientele--primarily agricultural producers and homemakers. As in the case of research, these education outreach activities are most often headquartered at the land grant university in each State, deriving strength and technical knowledge from both the educational and the research aspects of the university and the experiment station. Although these various functions must cooperate closely and be well integrated--particularly at the State levels--the Extension Service and the Agricultural Research Service are separate entities at the Federal level.

The Forest Service combines in one organization the responsibilities for both research and outreach in addition to a stewardship responsibility for the 190 million acres of national forest to be used both for recreation and effective forest production.

In virtually all instances, these three organizations--the Extension Service, the Agricultural Research Service, and the Forest Service--primarily are focused on the direct transfer of technology to their statutory clientele. Attention to "spinoff" is relatively rare and not considered a mainstream responsibility by these organizations.

Extension Service

The Extension Service has what has been characterized by some as a "pre-organized client market." The primary focus is on agricultural producers and those closely affiliated with them. This client group is relatively homogeneous and perceived not to be in competition with one another. The Extension Service considers itself the technology transfer agent for the Department of Agriculture, stimulating and providing systematic inputs to the land grant institutions and experiment stations that are primarily responsible for applied research.

The Extension Service has several concerns regarding technology transfer. First is the transfer of technology from the agricultural research system. Although this is not fully perfected, it is acknowledged as being quite successful, having been the mechanism which allows the American farmer to lead the world in productivity. Second, the attention of the department recently has turned to stronger efforts to commercialize its research results through marketing its patents and licenses. Third, it is recognized that increasing attention needs to be given to research and technology related to the regulatory functions which statutorily have been vested with the department. Finally, there is a potential—which has always existed but has not been exploited--to increase "post-harvest productivity."

This latter is a somewhat different challenge than USDA researchers have faced in the past. It means focusing more attention on the steps *following* harvest, including processing and delivery to the consumer. This brings USDA into closer and more continuing contact with trade associations and related groups representing the food processing industry, among others. This issue recently was emphasized by the administrator of the Agricultural Research Service in an employee newsletter (July 1985):

> I suggest that we're going to have to *refocus our investment* and put *more research into the areas of product quality and post-harvest technology*. In a tight, highly competitive market, product quality is a prime selling point. Major losses through storage and transit or losses through the discard of presently useless parts of plants and animals should be addressed by a concerted research effort. Post-harvest costs run almost five times the cost of production. If we're going to attack the problems of food production efficiency, we'd better attack the problems of post-harvest efficiency with equal vigor.

In a general sense, the Extension Service has found that: (1) there are common needs across industry in the United States; (2) Federal laboratories *do* have relevant technology that could be made available to these industries; (3) industry associations can serve as a vital point of contact in the process of facilitating technology transfer; and (4) there is substantial opportunity for creating a "demand pull" from potential users—which history demonstrates to be most effective. The Extension Service still is in the process of making the necessary organizational and institutional accommodations to address this newer concern of "post-harvest productivity." It will require building stronger ties to major trade associations and businesses, cooperatively determining their needs, and assessing how these fit into the larger agricultural picture to meet the prime interests of both agriculture and the consumer.

In an oversimplified sense, the national program staff of the Extension Service deals with major areas of concern, technical specialties, and liaison with national industry or trade association groups. The State Extension Service will operate more on a geographic level of concern, dealing both with producers and processors, although the emphasis typically has been upon the producers. County agents still have most of their contacts with producers. Although this has changed some in the less rural areas, it remains to be seen how the typical county agent function will be modified to put greater emphasis on the post-harvest productivity issues.

Agricultural Research Service

Although the function of conducting agricultural research is old within the department, the Agricultural Research Service (ARS) is relatively new, having been established only in 1953 as the department's principal research organization. From that time it has had as one of its primary responsibilities the prompt transfer of ARS technology to key users—farmers and ranchers, agriculture-related industries, the Cooperative Extension Service, the Soil Conservation Service, and other action agencies, including State and local governments.

ARS's technology transfer plan, first published in 1984, lists four primary objectives:

(1) inform users and potential users of ARS capabilities, research programs, and cooperative stance;
(2) collect from users any feedback on their experiences with adopted ARS technology that could improve the planning and evaluation of research;
(3) interest and assist users and potential users in developing new technology from ARS findings and in modifying their operations for its adoption; and
(4) encourage and assist users in exploiting directly applicable ARS research findings.

In achieving these objectives, the ARS utilizes eight mechanisms to promote or accomplish transfer. These are:

(1) direct communications between scientists and users;
(2) involvement of users and potential users in research planning and evaluation;
(3) joint research with users and potential users;
(4) transfer of ARS research findings to the Cooperative Extension Services by computer;
(5) research reporting by ARS information staff;
(6) patent activities;
(7) participation in the Federal Laboratory Consortium; and
(8) system for electronically collecting, storing, and retrieving the latest research findings for technology transfer.

It was estimated that in 1983 ARS scientists spent three to four percent of their time making more than 61,000 contacts with key user groups. The total effort toward technology transfer objectives was estimated at approximately 85 staff-years.

The ORTA functions for ARS are under the responsibility of a staff person identified as the Technology Transfer Coordinator, who reports to the Associate Administrator for Cooperative Interactions.

Technology transfer activities represent a challenge to ARS, at least partly because much of the research in which ARS is involved is of a fundamental or early development nature. This means that ARS tends to have as its "closest" audience intermediate researchers. Within the USDA system, this suggests that more of the contact with the ultimate users falls upon the Extension Service as the technology transfer agent or other third parties. Typically, ARS research results need to be "translated" by some other party (such as the Extension Service or the Cooperative State Extension Service) to make this material more useful to the ultimate consumer or producer.

ARS has been aggressive in its efforts to make potential users and others aware of research results. One recent development has been the establishment of the Technology Transfer Automated Retrieval System. This system provides for the systematic accumulation of recent research results that can be accessed through a variety of networks available to prime users of ARS data. For example, the system currently is hooked up to the Extension Service network (Cooperative Systems Information Network), the Soil Conservation Service network, the Conservation Tillage Information Center, and the Bureau of Land Management, among others. (See Appendix II-I for an example of the way information is available on this network.) As more equipment becomes available this information will be accessible to others throughout the department. Industry will be able to tap into it directly or through commercial systems. This system also provides the exchange of information with other government agencies such as the Department of Energy, the Environmental Protection Agency, and NASA.

The data on the system consist of a brief interpretive summary followed by a short "technical abstract." At the end of the technical abstract there is a series of key words which describe the particular technology, principal person involved, the organization, the address, and both the commercial and FTS telephone numbers. The means of data input to this system is the ARS Form 115 which is the request to submit a manuscript for publication. (See Appendix II-J.) It is from these data that summaries for the Technology Transfer Automated Retrieval System are developed. Approximately 4,000 entries are made into the system yearly.

The Form 115 is submitted by an ARS investigator when he or she is in the process of developing a manuscript to present before a meeting or for publication. That form includes the name of the individual submitting the manuscript, the organizational location, key words, title of the manuscript, the place in which it is to be presented, and the principal kinds of users for the information provided in the manuscript. This is followed by an interpretive summary and the technical abstract, each limited to approximately 20 lines. The form is submitted through the various supervisors for approval, and a copy is made available to the ORTA. In order not to miss any information, the ORTA also receives copies of the Form 115A which is the form completed upon actual publication of the manuscript. This form includes information similar to the 115 but also has information such as the possible utilization of the results described in the paper. For example, the individual lists the sources of various requests for information and whether or not they are from other scientists, the Extension Service, producer or producer group, etc., including whether or not other government agencies are involved and, particularly, industry representatives.

A printed means of disseminating research information for potential users is ARS's Annual Research report which provides an overview of the progress made toward the major ARS goals. Information contained in this report also is primarily obtained from the Technology Transfer Automated Retrieval System. Approximately 1,800 items were received in the first six months of 1985 for inclusion in this network.

Another avenue being emphasized recently for technology transfer is the use of patents. ARS has issued 26 exclusive licenses that involve nearly $30 million investment on the part of industry in the past three years. There has been a fourfold increase in inquiries regarding possible licensing opportunities flowing from ARS research. The Center for the Utilization of Federal Technology acts as ARS's agent in negotiating licenses on behalf of ARS so that the agency does not have to undertake this burden. ARS uses patent evaluation panels to determine the desirability of obtaining a patent and to make judgments about ultimate commercialization. (See Appendix II-K.) Annually the ARS publishes what is called the Agricultural Inventions Catalog which includes information indexed by subject matter, showing patents granted, name and telephone number of the individual who can be contacted, and a brief summary of the contents of the patent involved for those patents which have been issued during the past 30 months. Older ones are listed by patent number, date, and title.

Forest Service

The Forest Service began its systematic approach to the transfer of technology in 1973 at the direction of the Forest Service Deputy Chief for Research. He saw the need to develop a system which would hasten research application and also serve as a prototype for planning and technology transfer. The effort began with a pilot program to transfer some 20 years of accumulated research results into a form that would be useful to the general public, professional arborists, foresters, land managers, and the academic community. From this were developed booklets, slide/tape programs, and related material. Gradually, there evolved a Forest Service technology transfer process built upon the following principles:

(1) identifying technology available and ready for applications;
(2) identifying a target (user groups) who will use the technology;
(3) developing an objective and formal plan for application;
(4) packaging the knowledge or technology for easy understanding;
(5) selecting the media for transfer;
(6) involving scientists and specialists with users and innovators; and
(7) troubleshooting, obtaining feedback, and evaluating the process and results.

The technology transfer program has been incorporated formally into the Forest Service management system through Title 1300 on management in the Forest Service manual. (See Appendix II-L for the most recent version.) A Technology Transfer Council was established, comprised of the associate chief from each main area within the service to establish and recommend policies, with the Associate Deputy Chief for State and Private Forestry as chairman of the council. The technology transfer staff, at that time, was located in the Planning and Development Office of the Washington headquarters. The location of that function has since been moved to the cooperative forestry staff under the Chief of State and Private Forestry Programs.

A central element in the program for technology transfer within the Forest Service has been the establishment of a technology transfer planning process. This has been accompanied by a significant amount of supporting material, including training and education, from the headquarters throughout the field installations to help install this planning process as a part of the regular daily business of the Forest Service.

As H.G. Marx and G.H. Moeller recently observed,

> The Plan includes a commitment of time, talent, and money, with administrative and technical commitment as the foundation for program development and implementation. This approach requires managers to consider organizational frameworks and processes for making decisions, allocating funds, delegating authority and responsibilities, measuring performance, and accounting for production and accomplishment. Thus, technology transfer planning may actually require as much management as does research and development.[1]

Such a plan is not the product of a single person, but is put together by a team of those involved in the actual research, peers or compatriots from other State and Federal agencies, resource managers, Extension people, representatives from universities, and other users, as well as information and technology transfer specialists. As noted by Marx and Moeller,

> The function of a technology transfer planning team includes: outlining responsibilities, emphasizing overall program direction and coordination, and selecting media and the proper delivery systems. The team also develops the formal program document which contains: the message, what is being transferred; the audience, to whom the message is aimed; objectives; the expected accomplishment; mechanisms for transferring the technology; a budget; and a system for evaluating the process.[2]

As might be surmised from the description of the transfer plan and process, technology transfer within the Forest Service is aimed directly at "vertical" transfer to clearly defined clientele or potential users with a focus on the forest products industry, foresters and organizations related to forestry in Federal, State and local governments and private industry, and major users of products produced by the wood products industries.

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[1] H.G. Marx and G.H. Moeller, "Planning for Transferring Research Knowledge in the U.S. Forest Service," Technology Transfer and Forestry, proceedings of a IUFRO conference, Edinburg, United Kingdom, 1983, p. 9.

[2] Ibid.

The Forest Service has put a good deal of attention on useful, illustrative materials for use within the Forest Service in developing and executing technology transfer plans. For example, some of the publications which have been produced in this effort include:

- Guide to Help Develop a Technology Transfer Plan (See Appendix II-M.)
- Technology Transfer Opportunities, Fiscal Years 1985-1986, by the Forest Products Laboratory (See Appendix II-N for excerpts.)
- Examples of Technology Transfer Plans
- Technology Transfer Report, FY 1984
- The Supervisory Role in Technology Transfer
- The Practical Side of Technology Transfer
- Technology Transfer (Companion To Audiovisual Presentations)
- How To Develop A State Technology Transfer Plan
- Highlights of Technology Transfer Workshop
- Technology Transfer: A Case History
- Final Report and Evaluation, Colorado Technology Transfer Pilot Project: Pine Management

In addition to its systematic inhouse work, the Forest Service has actively participated and provided leadership for the Federal Laboratory Consortium, including providing financial support up to $5,000 annually.

Even with these substantial efforts to institutionalize technology transfer within the Forest Service, there remains a continuing challenge to overcome the tendency to equate effective technology transfer solely with the production of publications and scientific journals, combined with occasional press releases. At one point, some three or four years ago, as much as $600,000 was provided for technology transfer activities within the Forest Service. This has dwindled somewhat in the past few years—both in terms of manpower and financial resources devoted to the function. However, the Forest Service has made substantial contributions to technology transfer within the Federal government. Technology transfer remains a key element in the process of moving research conducted or sponsored by the Forest Service into practical use—both within the Forest Service and in other agencies, private and public.

Summary

The longest, most continuous organized effort at technology transfer began in 1862 with the establishment of the Department of Agriculture and the passage of the Morrill Act which authorized the land grant college system throughout the United States. Since that time the Department of Agriculture has been a leader in technology transfer, with many other organizations envious to emulate their success. Although there is no single, formal point of responsibility, department-wide, for this function, it seems to permeate the department in spirit. The three primary agencies overtly involved have made substantial contributions: the ARS by expanding its efforts and boldly sponsoring innovative studies on how to improve the process; the Forest Service through its systematic approach to educating and informing key personnel in the Service and among clientele; the Extension Service through its long experience as the premier technology transfer organization.

TECHNOLOGY TRANSFER ACTIVITIES IN THE DEPARTMENT OF COMMERCE

The Department of Commerce has unique responsibilities in the area of technology transfer which transcend stimulating or developing means to facilitate the transfer of technology from its own laboratories or technical agencies. That more common function can be found in the National Oceanic and Atmospheric Administration's technology transfer program as well as in that of the National Bureau of Standards. As discussed below, the National Bureau of Standards (NBS) does present a special case for a major laboratory in that it has a primary national mission, based on long standing statutes, for standards and measures for physical quantities and systems that make it the primary focal point in the United States for such science and technology, whether for public or private purposes.

A third organization, the Center for the Utilization of Federal Technology, which is within the National Technical Information Service (NTIS), was given the responsibility by Public Law 96-480 to be a coordination point for facilitating the flow of Federal technology from technical agencies and laboratories of the Federal government to private and other users. Thus, CUFT is not in the position of fulfilling the usual function, but is a means or mechanism to facilitate this activity for others.

The Department of Commerce has another unique function, apart from the other Cabinet departments and independent agencies, and that is its Office of Productivity, Technology and Innovation under the leadership of an Assistant Secretary. Within that office is located the Director of Federal Technology Management Policy--the only office in a department or major agency which has been vested with the responsibility to provide leadership for technology transfer and commercialization across the government. Although this is a relatively new function, it is consistent with the historic type of responsibility given to the Department of Commerce to stimulate and provide assistance to American commerce and industry.

This group has taken the lead in a number of recent legislative initiatives to provide greater authority and opportunity for Federal agencies, and their subelements, to move technology from the laboratory to use, particularly through intellectual property rights, cooperative agreements, and cooperative research ventures. For example, personnel of this office were architects of PL 96-517 and the subsequent regulation (OMB Circular A-124), which gave universities, not-for-profit organizations, and small businesses first rights on inventions which were the result of research and development work done under Federal grant or contract. It also took the lead on PL 98-620 which extended these rights to many contractor-operated laboratories, and has developed the implementing regulations. Both of these acts vested a surveillance function for their accomplishment within this office.

The patent licensing program is further enhanced by the recent establishment of what is called a Statutory Inventions Registration (SIR). The purpose of this is to provide a paper record in the form of a publication recognized as being in the public domain. It protects users from being subject to charges for its use. And it permits an organization or individual an alternative to defensive patenting, where the concern is not to prevent others use of the technology but to leave open its free use. Claims made in the SIR are not examined when the SIR is issued, but it does provide a record that can help protect the inventor.

The policy thrust of the Department of Commerce in the area of technology transfer has been to provide the legislative and regulatory base by which Federal laboratories and technical agencies may work more closely and easily with industry and other entities outside the Federal government toward solving both Federal laboratory problems and contributing toward the rapid commercialization of new discoveries. As part of this strategy, officials in the Department of Commerce believe that such authority needs to be decentralized to the largest extent possible, so that those actually involved and close to the particular technology have an important say in the mechanism and procedures by which such cooperation can be carried out or by which property rights may be transferred. It is believed those responsible for developing new technology should reap some of the benefits through a return of royalties to the inventor and his/her organization.

Coordination with other Federal agencies regarding such policies is handled through the appropriate Assistant Secretaries or similar officials in those agencies. In addition, considerable work is accomplished through the Federal Coordinating Committee on Science, Engineering, and Technology within the Executive Office of the President.

Attention will now be given to the operating units within the Department of Commerce which have direct technology transfer responsibilities or a general coordinating and facilitating role: the National Bureau of Standards, the Center for the Utilization of Federal Technology, and the National Oceanic and Atmospheric Administration.

National Bureau of Standards

The National Bureau of Standards (NBS) has a truly unique role in the scientific community as it relates to commerce and industry, and particularly the transfer of technology from the laboratory to practical use. NBS is charged with: (1) a "third party" responsibility for being the arbiter for measurements and measurement standards in the United States, regardless of where they are used—industry, government, academe, or elsewhere; and (2) responsibility for the solution of technical problems of national import. This requires NBS to be concerned with the entire spectrum of measurements from the most fundamental research to the practical problems of industry, government, and commerce. NBS can be used as the nation's corporate research laboratory. In addition to its R&D functions, NBS provides substantial measurement related service to industry and government.

As a result of close cooperation with industry, the NBS has grown accustomed to working with sensitive proprietary information, to working jointly with industrial, academic, and other agency scientists and engineers, and generally to providing a neutral ground for both substantive and institutional policy questions. This unique situation provides the NBS scientists and engineers a panoramic view of science and technology within their respective areas of expertise, allowing exchange of information and facilitating a broad interchange among peers and institutions.

NBS officials view technology transfer (in its broadest sense) as their primary business. The bureau has evolved and proven a wide variety of outreach and exchange mechanisms including publications, scientific visits, conferences and workshops or seminars, and personnel exchanges by which individuals from outside NBS work jointly at NBS. Facilities generally are designed to accommodate guests. NBS policy promotes work with others in their own locales. NBS scientists engage in cooperative research programs with industrial firms, with professional and trade organizations, and with universities. They also conduct research, often on a cooperative basis, with other government agencies. As much as 40 percent of the bureau's in-house laboratory work is for other agencies. Research for other agencies is kept within "reason" by applying strict criteria for accepting this kind of work: the research has to solve problems which promote the NBS mission.

Cooperative research with industry often involves work with trade associations or other industry groups, rather than individual companies, because of the generic nature of measurement science and technology. Currently industry is sponsoring 239 research associates for joint research in NBS laboratories. There are about 700 guests from universities, State and local governments.

NBS scientists foster technology transfer through participation in a large number of technical committees. For example the bureau has about 1,500 memberships on 1,000 standards writing committees of standards organizations.

Technology transfer is viewed as a two-way street in which information and know-how is exchanged. The bureau scientists benefit from interaction with their peers in industry, academia, professional societies, and trade associations. About 200 of their peers, carefully selected by the National Research Council, assess the bureau's research and facilites annually to help assure that the NBS is meeting national needs.

The NBS faces a substantial challenge because it does not have a neatly targeted clientele. Rather, the clientele consists of technical individuals in American industry and in Federal, State, and local government who have a requirement for or a need regarding standards and measurements. This calls for creative outreach. As a result, the NBS has been active in the Federal Laboratory Consortium for Technology Transfer and in the Technology Transfer Society. NBS sees significant benefits from this type of network operation which provides effective means for information exchange, wherever it is located.

Although the National Bureau of Standards fosters the active transfer of technology as part of its unique role as the national central reference laboratory for standards and measurements, the bureau established its Office of Research and Technology Applications in 1980 following the passage of the Stevenson-Wydler Act. Their ORTA is in the immediate office of the Director. NBS officials judge that this legislative mandate has helped to highlight the importance of technology transfer and has enhanced industrial interest in joint research and Federal technology. The bureau supports the Federal Laboratory Consortium activities including leadership for conferences and seminars that bring representatives of industry, government agencies, and universities together.

Center for the Utilization of Federal Technology

The Center for the Utilization of Federal Technology was established by PL 96-480 (Stevenson-Wydler Innovation Act of 1980). The legislation provided that CUFT have the following functions:

> Section 11(d). There is hereby established in the Department of Commerce a Center for the Utilization of Federal Technology. The Center for the Utilization of Federal Technology shall--
>
> (1) Serve as a central clearinghouse for the collection, dissemination, transfer of information on Federally owned or originated technologies having potential application to States and local governments and to private industry;
> (2) Coordinate the activities of the Offices of Research and Technology Applications of the Federal Laboratories;
> (3) Utilize the expertise and services of the National Science Foundation and the existing Federal Laboratory Consortium for Technology Transfer, particularly in dealing with State and local governments;
> (4) Receive requests for technical assistance from State and local governments and refer these requests to the appropriate Federal Laboratories;
> (5) Provide funding, at the discretion of the Secretary, for Federal Laboratories to provide the assistance specified in Subsection (c)(4) [Regarding functions of each laboratory Research and Technology Applications Office: ". . . provide technical assistance in response to requests from State and local government officials."]; and
> (6) Use appropriate technology transfer mechanisms such as personnel exchanges and computer-based systems.
>
> Section 11(e). Each Federal agency which operates or directs one or more Federal Laboratories shall prepare biennually a report summarizing the activities performed by that agency and its Federal Laboratories pursuant to the provisions of this section. The report shall be transmitted to the Center for Utilization of Federal Technology by November 1 of each year in which it is due.

The new Center for the Utilization of Federal Technology (CUFT) was not fully established until 1983, at which time the patent licensing group within NTIS in the Department of Commerce was folded in with the applied technology group to form the core of approximately 12 professionals dealing with the broader responsibilities of utilizing Federal technology.

The purpose of the patent licensing group is to serve as a "one stop center" where persons outside the Federal government can obtain authoritative information about patents held by Federal agencies, and negotiate licensing agreements for their use. CUFT handles this function, including foreign patenting, on behalf of all Federal agencies except the Department of Defense, the Department of Energy, and the National Aeronautics and Space Administration, which have their own programs for patent licensing.

CUFT's Office of Federal Patent Licensing reports that FY 1985 revenues have increased 75 percent over those of the previous year, totaling $1.5

million, with revenues for FY 1986 being estimated at approximately $4 million. These are based upon about $200 million of license product sales of which $60 million are export sales protected against foreign competition. The agencies for which CUFT licenses produce approximately 10 percent of all government patents; however, they accounted for 33 percent of all the licenses granted and 83 percent of all revenues produced by Federal licensing in FY 1984. The overall rate of use of Federal patents has doubled since 1976. Both CUFT and NASA have reached the 25-30 percent licensing level which is considered to be equivalent to the best university programs.

The shift in Federal policy which has permitted exclusive licensing has been a substantial boon. In 1983 approximately 60 percent of the new licenses were for exclusive use. This increased to approximately 76 percent in FY 1984. CUFT follows its mandate closely in pursuing the transfer and use of Federal technology. Conditions are attached to these exclusive licenses which require annual reporting to demonstrate progress toward the actual marketing of the innovation, or the license exclusivity will be withdrawn. Another means of assuring that licensees are "serious" is to require a business plan as part of the negotiation process to demonstrate how the potential licensee will commercialize the product, including the extent of investment that will be made. In FY 1983 these plans represented some $92 million in additional private investment, $81 million in 1984, and $97 million in 1985.

The applied technology group within CUFT has an equally challenging responsibility. Their mission is to find ways to tap into the stream of technical information from the agencies, and their respective laboratories, in order to provide the information in a way that will be useful to others. Because of the magnitude of this responsibility, the fact that it is just recently established, and the requirement (as part of the NTIS) that their operations be self sufficient from sales to the public, CUFT has placed its emphasis strictly on hard copy and data base information and not on "brokering" the expertise that might be available in Federal laboratories. The Federal Technology Data base will be searchable on-line in 1987. The administrative circumstances under which they work preclude acquiring the necessary staff that would require direct funding from appropriations. Also, experience at both NTIS and CUFT suggest that most scientists, engineers, or technologists who are involved in product development activities prefer to read something before calling on a particular expert who might reside in a Federal laboratory or agency.

Although PL 96-480 vests CUFT with coordinating functions, across the Federal government, this aspect has not been exercised vigorously because of the organizational milieu in which CUFT is immersed (NTIS), because of limited resources (required in a self sustaining operation), and by the natural inclination of other agencies to ignore or resist intrusion from sister organizations.

CUFT, therefore, has concentrated on the demanding responsibility of collecting the most useful technical information from the wide diversity of Federal technical agencies and laboratories, putting this in a manageable form that can be useful and salable to the public. In its short period of existence, CUFT has made some notable progress. Annually it produces the Catalog of Government Patents, which makes available to potential users the full panoply of patents available for licensing. Also produced is a Federal Technology Catalog which contains those innovations, inventions, and discoveries considered most likely to have immediate commercial use. Related to this catalog is a publication produced on a monthly basis called Tech Notes. This includes information which has been gleaned primarily from the various agencies (often from their own technical newsletters or similar publications), providing brief technical writeups by subject area including: computers, electrotechnology, energy, engineering, life sciences, machinery and tools, manufacturing, materials, physical sciences, and testing and instrumentation. The whole series is included in a single publication that can be ordered for $127 per year.

CUFT recently has published a Directory of Federal Laboratory and Technology Resources. It lists and provides specific information regarding facilities, expertise, and services that are available to industry, often on a reimbursable basis, from the various Federal laboratories. An important aspect of this directory is that it includes only those laboratories that are willing to be responsive to overtures from legitimate, outside users. In addition, the directory provides addresses and other relevant information for more than 90 information centers. CUFT also works closely with State technology assistance centers in making CUFT documents available to them and assisting them in a liaison capacity with agencies or laboratories. (See Appendix II-O for further description of CUFT publications.)

CUFT continually is challenged by two demanding aspects of its mission: first, to develop the means by which to acquire technical information of commercial utility from a broad span of Federal agencies; and, second, to expand its clientele by developing and producing material in a way that will be attractive and increase the number of users. The latter is vital in order that CUFT can acquire the resources to more thoroughly do both jobs.

The National Oceanic and Atmospheric Administration

The National Oceanic and Atmospheric Administration (NOAA) established an agency-wide Office of Research and Technology Applications (ORTA) in January 1983. It was decided that although NOAA has several large laboratories, the full span of some 62 laboratories, research and development program or project offices, and data or information centers should be included under the general oversight of an agency level ORTA. The office is staffed by two professionals and receives advice and assistance from a Technology Transfer Working Group which is composed of representatives from the five main operating or line organizations within NOAA: (1) the National Environmental Satellite, Data, and Information Service, (2) the National Marine Fishery Service, (3) the National Weather Service, (4) the National Ocean Service, and (5) the Oceanic and Atmospheric Research Service. The working group is charged with the evaluation and review of technology transfer activities and the proposal of activities into the future. It schedules meetings on a quarterly basis.

Recently NOAA published the NOAA Guide to R&D to make known both within the agency and outside the mission descriptions of the laboratories and other technical organizations within NOAA. It also included a discussion of the NOAA approach to implementing the Stevenson-Wydler Act, a description of the Department of Commerce's Patents and Incentives Programs, and an explanation of the recently instituted NOAA Industrial Research Associates Program whereby qualified scientists and engineers from industry or universities may undertake research in NOAA laboratories or other technical facilities.

The ORTA annually surveys the NOAA organizations to supplement and stimulate reporting of new technologies. The NOAA Technology Application Assessment Abstract is used for this technology transfer purpose. (See Appendix II-P for a copy of this form.) The assessment abstract includes a brief description of the technology and the application made within NOAA, title of the technology, where the technology was performed and principal investigator, organization involved, etc. as well as other possible applications, publications or reports that could be made available, its technological status, and a judgment of its patent potential. These assessment abstracts are now being entered on a computerized data base in the ORTA, and are used as the basis for selecting particular technologies for broader announcement and distribution through a NOAA Techology Brief. (See Appendix II-Q for examples of the NOAA Technology Brief.) The Tech Briefs are made available to interested parties, and to the general public through the Center for Utilization of Federal Technology. Recent experience shows that of those inquiries made by individuals reading NOAA Tech Briefs, 69 percent are from nonpublic organizations—i.e., industry or universities.

The ORTA in NOAA has been an active participant in the Federal Laboratory Consortium for Technology Transfer since its establishment as an ORTA. It also contributes financially to the support of the FLC and participates in its committees and the FLC/Agency liaison group.

NOAA plans the establishment of an in-house newsletter on technical developments in other Federal agencies which might be of interest to NOAA scientists and engineers.

In addition to its technology transfer responsibilities, this office also is responsible for the Department of Commerce's Small Business Innovation Research program (SBIR). This is similar to the practice of a number of ORTAs within the Department of Defense.

Since the technology transfer function at a central location within NOAA is relatively recent, considerable effort is devoted on the part of the ORTA officials to orienting the various NOAA components and scientists regarding the value and responsibilities of the technology transfer function, and, particularly, how it should be viewed as a systematic part of the normal research and development function within a public agency.

Summary

Although there is no single departmental contact point for technology transfer activities within Commerce, the department has both a policy and operational responsibility that is government-wide. The Assistant Secretary for Productivity, Technology, and Innovation provides leadership for technical assistance to U.S. industry, while the Center for the Utilization of Federal Technology offers technical information in a wide variety of formats to industry and others. The National Bureau of Standards has always served both industry and government and has provided opportunities for the transfer of technology since its inception. The National Oceanic and Atmospheric Administration has centrally organized its transfer activities in its ORTA and has systematically developed a program of orienting NOAA employees as well as reaching out to potential clientele.

TECHNOLOGY TRANSFER ACTIVITIES IN THE DEPARTMENT OF HEALTH AND HUMAN SERVICES

The Department of Health and Human Services technology transfer activities are focused within its major subunit, the Public Health Service. That organization is the Federal agency charged by law to promote and assure the highest level of health attainable for individuals and families in the United States, and to provide cooperation in health projects with other countries. Under the reporting requirements of PL 96-480 the following PHS organizations have established Offices of Research and Technology Applications as required: the National Institutes of Health (NIH), the Food and Drug Administration (FDA), Centers for Disease Control (CDC), the Alcohol, Drug Abuse, and Mental Health Administration (ADAMHA), and two entities not characterized as laboratories under the meaning of PL 96-480—the National Center for Health Statistics and the National Center for Health Services Research. For the purposes of coordinating reporting, the NIH's Office of Medical Applications of Research acts as the focal body for the department.

The broad purpose of coordination and cooperation is facilitated by the Technology Coordinating Committee which consists of representatives from all of the departmental elements that have some responsibility or relationship to health care technology and the assessment of health care technology in the delivery of care. In addition to HHS participation, there are included in this committee representatives from the National Academy of Sciences, seven private sector organizations concerned with health care technology, and the Prospective Payment Assessment Commission.

Within HHS, the Public Health Service agencies have a substantial research and development budget. For example, in fiscal year 1984 it is estimated that these agencies' combined budgets totaled nearly $4.7 billion. Of that amount they estimated that $689 million was expended for technology assessment and transfer activities.

These agencies put nearly all of their technology assessment and transfer efforts into what could be characterized as meeting "clientele" needs. Their transfer programs are established to move the results of PHS-conducted or sponsored research to medical practitioners and others in this related field--it is <u>not</u> directed toward "spinoff" type activities.

Within that context of research utilization, these organizations typically use a wide variety of methods for transferring research into practice. These include: clinical trials of new treatment regimens, equipment, or drugs; the establishment and use of centers that deal with specific maladies where research can be related to clinical practice; clearinghouses that provide data bases; outreach programs for cooperation with volunteers, professional organizations and State and local governments; workshops, seminars, and meetings to inform and instruct clientele groups on research results and assessment of those results; publications directed to particular subelements of the clientele and to the public at large; and the provision of focal points for inquiries which may include the basic research organizations themselves, special centers or clearinghouses.

In estimating the extent of HHS activities in the report prepared under PL 96-480, HHS includes assessment along with transfer activities. The department views the assessment of medical and health related technologies as an important step that must be part of the total technology transfer process. This will be described in more detail, but it is not an element that is as clearly defined in other organizations.

National Institutes of Health

The National Institutes of Health (NIH) has by far the largest organized effort within the department directed toward technology assessment and transfer. Of the total amount estimated to have been spent in fiscal year 1984 on this function, $595 million of that effort were spent by the National Institutes of Health.

Predating PL 96-480 was the establishment within NIH of the Office of Medical Applications of Research (OMAR) in September 1977. It was set up to be the focal point for activities aimed at improving the assessment and translation of results from NIH-supported biomedical research into knowledge that could be applied safely and effectively in the practice of medicine and public health. Since this was an existing organization whose purposes and functions were consistent with those outlined for an Office of Research and Technology Applications as required under PL 96-480, the NIH designated OMAR as its ORTA. This organization then became a logical point of focus for reporting under the act.

One of the primary activities of OMAR is the systematic assessment of biomedical technologies through what is called the Consensus Development Program. (This is explained more fully in "The Town Meeting for Technology: The Maturation of Consensus Conferences," Appendix II-R.) The basic process of consensus development encompasses both synthesis and reporting of the best available current evidence on health care topics that are considered to be of major importance to public health and also have significant potential to bring about change in medical care. The objective of this effort is to assist the medical profession in clinical decision making and to provide the best source of information possible to the public at large on the state-of-the-art regarding a particular medical topic. This program not only provides an important avenue for the transfer of medical technology, it also provides information in a form for further, more specific efforts at technology transfer.

OMAR also has responsibility for fostering the commercialization of NIH-funded inventions through the patent program. OMAR has been designated as the central clearinghouse for NIH patent related activities. OMAR conducts the medical technology assessments for the Health Care Finance Administration regarding the adoption of particular medical treatments, etc. for reimbursement through Medicare. OMAR coordinates the assessment of these medical care coverage issues that are referred to it by the Office of Health Technology Assessment. Finally, OMAR has fostered evaluation studies and activities to improve assessment and transfer efforts of NIH. It also serves as the focal point for the NIH Coordinating Committee on Assessment and Transfer of Technology which provides the director of NIH with a mechanism for coordinating NIH policy and activities in these areas.

A few comments are in order regarding the means by which medical research is transferred to the clientele groups and individuals. Assessment of safety and effectiveness is a key step toward the actual transfer. The most important assessment in NIH's repertoire is the clinical trial. NIH is the single largest supporter of clinical trials in the United States, having spent over $236 million for this purpose in fiscal year 1984. NIH defines a clinical trial (now called a clinical study) as a scientific research activity undertaken with nine or more human subjects to prospectively define the effect and value of preventive, diagnostic, or therapeutic agents, devices, regimens, and procedures.

A second mechanism is the specialized centers which include the disease-specific comprehensive "center" for the education, outreach and demonstration components which can provide valuable resources for disseminating information to both practitioners and laymen. Such center programs bring together facilities, research resources, and scientific personnel in the community and provide a specific focus for collaborative efforts among professionals in the many related disciplines. These programs facilitate the adoption of proven medical technologies by providing a means to introduce them into the health care practice at the community level. The extent and importance that NIH gives to these efforts is exemplified by the fact that in fiscal year 1984 NIH spent $401 million on such specialized centers in 464 separate locations.

A third mechanism includes conferences, workshops and symposia sponsored by NIH. Typically, these are used as means of technology assessment, but they also serve to transfer and update technology whereby experts from a single discipline or even multiple disciplines may meet to discuss and summarize recent findings, to exchange new information, and to formulate questions and stimulate new research directions. These sessions also are used as a means of providing educational material to clinicians and practitioners.

Another mechanism that has been widely used by NIH is the demonstration project--undertaken to insure that new technologies are demonstrated in a safe and effective way when applied in clinical practice.

A fifth means is the clearinghouse which provides for information dissemination. In fiscal year 1984 NIH sponsored 12 such clearinghouses at a cost of just under $13 million.

A sixth, and one of the more common methods of transfer of technology, is through publications for scientists, professionals and the public. Each of the bureaus, institutes, or divisions of the National Institutes of Health produces a variety of publications about health and health technology. This material is made available through the clearinghouses, through educational programs and seminars, and in response to direct request. Publications are supplemented by other media such as movies, video tapes, slides and audio tapes.

Finally, NIH considers its patent program an important avenue for transferring technology. Of the 282 invention reports filed by NIH employees between 1980 and July 1984, 73 percent were patented and 51 percent were licensed to the private sector. NIH also handles the patents of its grantees and contractors derived from NIH-sponsored research.

Alcohol, Drug Abuse, and Mental Health Administration

The main focus for technology transfer coordination in ADAMHA is the Office of the Administrator, specifically the Office of Prevention. In addition, there has been established an Office of Research and Technology Applications in each of the agency's three institutes: the National Institute on Alcohol Abuse and Alcoholism (NIAAA), the National Institute on Drug Abuse (NIDA), and the National Institute of Mental Health (NIMH).

Collectively these organizations had an R&D budget in fiscal year 1984 of just under $290 million, of which slightly less than $47 million was used in technology assessment and transfer type activities. ADAMHA has assigned an estimated 72 full time and 6 part time staff to ORTA functions in technology assessment and transfer activities.

As is the case in other PHS organizations, ADAMHA uses the broader concept of assessment and transfer activities that range from publications to seminars, various demonstration projects, clinical trials, etc. Technology transfer activities tend to be limited to meeting ADAMHA's basic clientele needs and attempting to move data from the research and development stages into clinical and related practices of its clientele groups. Because the agency works closely with State and local government organizations, considerable emphasis is placed upon frequent meetings with these officials where technical assistance is made available on a face-to-face basis.

Each of the three institutes conducts intramural and supports extramural research in their respective areas. Each also will use the full panoply of methods for assessment and transfer that were described above in relation to the National Institutes of Health.

Several activities need to be highlighted. First, the administrator of ADAMHA formally established a technology transfer committee in December 1983 for the purpose of coordinating the agency's technology assessment and transfer functions. The administrator also has initiated a series of forums and other meetings which provide research briefings for agency staff and researchers in order to provide a better basis for coordination and cooperation among ADAMHA's many activities.

In November 1984, ADAMHA sponsored the Knowledge Transfer Roundtable that included an exchange of information among representatives of Federal agencies and professionals in the mental health, drug and alcohol abuse areas. The conference dealt with each of the major stages of knowledge transfer, including research and development, assessment, dissemination, technical assistance, reporting, and evaluation. Also addressed were "user needs"—with particular emphasis upon the wide differences among the agency's clientele (human services delivered across the States and localities in the U.S.). Nearly 75 recommendations grew out of an assessment of the roundtable in terms of improvements and extensions of technology transfer activities that ADAMHA might undertake.

Food and Drug Administration

Unlike some of its sister organizations, the Food and Drug Administration is principally a scientific regulatory agency which has responsibility for safety in foods, cosmetics, drugs, medical devices, biologics, and radiological products. Because of this mission, the FDA does not conduct basic research, but directs its effort into applied research and development working in close proximity to researchers in industry. The applied R&D budget for fiscal year 1984 was slightly over $79 million. Nearly $4 million was assigned to FDA technology transfer activities. Much of the FDA's work is related to the testing, assessment, and evaluation that is necessary for a regulatory agency.

The focal point for technology transfer activities is the Office of Science in the FDA's Office of the Commissioner. The Office of Science has general oversight of and access to information regarding technology transfer throughout FDA. It maintains liaison with all FDA laboratories--both the agency-wide laboratories which conduct research to support and improve the regulatory process, and the field laboratories which are responsible for conducting tests, taking samples and otherwise providing data relevant to specific regulatory matters.

The FDA works closely with industry, sometimes on cooperative projects, or through visiting scientists in FDA laboratories. Close cooperation is useful both to FDA and industry because of the need to optimize exchange of information as part of an effective regulatory process. A substantial portion of these activities is reported in the open literature and through science information services such as those available through the National Technical Information Service (NTIS) and the National Library of Medicine. Selected research activities and reports are publicized through data bases and publication summaries such as the FDA Drug and Device Product Approvals List, the Drug Summary Bases for Approval, the Approved Prescription Drug Products with Therapeutic Equivalence Evaluation, and others. FDA also sponsors workshops and training programs and uses various media such as electronic mail, video programs, etc. in order to provide potential users--especially those in State and local governments and in the drug, food, and cosmetic industries--with direct access to new means for testing and assessment that have been found to be useful. For example, in 1983 FDA instituted its "Electronic Bulletin Board," an on-line data system accessible to word processors or personal computers and available via commercial subscription to any member of the public. (See FDA Talk Paper T83-14, Appendix II-S.)

Centers for Disease Control

CDC is the national focus for developing and applying disease prevention and control, environmental health, and health promotion and health education activities to improve the health of people in the United States and, in collaborative arrangements, in foreign countries. It works closely with public health service agencies in both State and local government and, therefore, will be at the forefront of new disease problems as they occur. The Laboratory Program Office of CDC has been designated as the ORTA for CDC. The CDC helps develop standards and provides classroom training courses for people involved in public health activities, training aids, consultation, testing and related disease control functions. The fiscal year 1984 budget for technology transfer activities was nearly $12 million, and that for technology assessment nearly $31.5 million. The full research and development budget for CDC is $76 million annually.

Summary

The Office of Medical Applications of Research within the National Institutes of Health (NIH) acts as the central point within the Department of Health and Human Services for technology transfer concerns. Only within the Public Health Service is there an organized technology transfer effort, and that is conducted by NIH, the Alcohol, Drug Abuse and Mental Health Administration, the Food and Drug Administration, and the Centers for Disease Control. Their efforts include technology assessment as a preliminary to technology transfer. Extensive resources are devoted to this function, though it is exclusively directed to direct transfer to agency clientele. PHS efforts in technology transfer are surpassed, in terms of longevity, only by those of the Department of Agriculture.

TECHNOLOGY TRANSFER ACTIVITIES IN THE DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT

The Department of Housing and Urban Development has no in-house laboratories, although it does conduct policy oriented research. Since much of the research (except for some in the policy and related offices of the department itself) is undertaken via grant or contract with universities, professional and trade associations, and other not-for-profit organizations, the principal emphasis is upon making information available to its particular clientele groups. These clientele groups consist principally of local governments, State governments, the housing industry, related public interest groups, and trade associations.

Given the nature of the research and the fact that it is not concentrated in a particular organization but actually conducted in a wide variety of places, the Department of Housing and Urban Development is not required to have an Office of Research and Technology Applications as provided by PL 96-480. In spite of this, HUD has conducted substantial technology transfer activity through its Research Utilization Division. That division is located in the Office of Policy Development which is one of the main components within the purview of the Assistant Secretary for Policy Development and Research. This organization has the bulk of the research and development dollars expended by the department.

The areas for major emphasis in both research and demonstration projects currently are: (1) the international year for shelter for the homeless; (2) affordable housing (being conducted at 31 different sites); and (3) the quality of life in public housing initiatives including project self sufficiency, home ownership, and small business opportunities.

Given this type of research and demonstration activity, the main task of the Research Utilization Division is to provide clear and useful documentation of the respective demonstrations for potential replication elsewhere, and to take the results of sponsored research and package it in a fashion that will be most useful to State and local government officials and the other members of their clientele.

The division uses most of the avenues one might expect in an organization that is dependent primarily on disseminating information. For example, their clientele mailing list represents a population of approximately 8,000 addressees. These are subdivided into a variety of special interests which can be separated to receive special packages of particular interest to them only. These packages may include research reports, pamphlets, newsletters, and other printed material.

The division periodically sends its data tapes, including information and results from research, to the National Technical Information Service. HUD also has its own research information service called "HUD User." Periodically HUD publishes a newsletter titled Recent Research Results, which profiles recently completed research and provides an opportunity for the reader to send for the specific research reports covered. (See Appendix II-T for a sample of this publication.) These information sources, and the reports, resource guides, and case studies, are made available on a cost basis so that the cost of providing information is borne by those who use the system.

The Research Utilization Division also is responsible for supporting and staffing conferences, symposia, workshops, and exhibits before various clientele groups as another means of providing up-to-date and useful information.

TECHNOLOGY TRANSFER ACTIVITIES IN THE DEPARTMENT OF TRANSPORTATION

The Department of Transportation was created in 1966, bringing together program agencies of the Federal government responsible for highways, railroads, civil aviation, mass transit, and the U.S. Coast Guard. The act creating the new department included among its responsibilities: "to promote and undertake development, collection and dissemination of technological, statistical, economic, and other information" and to "consult and cooperate with State and local governments." This statement of purpose underlies the department's technology transfer efforts.

Interest in technology transfer did not begin with the creation of the new Department of Transportation. For example, the Federal Highway Administration (FHWA) had long been concerned with the task of applying research results to highway problems. The FHWA renewed its efforts following a 1968 report of the American Association of State Highway Officials' Special Committee on Utilization of Research Findings. The report called for a streamlined process to bridge the gap between research and application. The committee noted several barriers to this process:

(1) findings were presented using technical jargon incomprehensible to the potential user;
(2) user needs were not being communicated to researchers;
(3) users (engineers) distrusted new technology and didn't have time to study it properly; and
(4) research funds did not extend into the field test and evaluation stage of R&D.

DOT's Technology Sharing Program was initiated following a general report on technology sharing produced in 1973. Study findings revealed that there was little "translation" of what technology and technical programs could accomplish for State and local government—especially for use by elected and appointed officials at the political levels. Without this "translation" State and local government leaders could not fully understand issues, problems, and solutions, and frequently dropped the technical programs. In reaction to the report findings DOT reorganized its technology transfer/information dissemination efforts into a single organizational location within the Office of Research and Development Policy.

In 1977 the technology sharing part of this information activity spun off from the Office of Research and Development Policy and was relocated in the Office of Intergovernmental Affairs within the Office of the Secretary of Transportation. It was renamed the Technology Sharing Division. Its purposes were to disseminate findings to users in their own terms, to disseminate findings and experiences from one user to others, and to identify unmet needs in order to initiate DOT research programs or stimulate State, local, and other groups to undertake research programs. The focus was on conducting R&D and directly transferring, or sharing, the results with its clientele of elected and policy level State and local officials.

DOT officials choose to call the effort technology sharing rather than transfer. They believe that technology "sharing" conveys the idea of a two-way process while "transfer" implies one-way. The emphasis is on direct transfer of a technology to a constituency rather than spinoff type transfers. Technology sharing can be a synthesis of materials and/or information, while technology transfer, though it may be linked to written and oral communication, signifies an application. Nevertheless, the two terms express the same activity: "the process by which the results of Federal research on problems faced by State and local governments are made available to these jurisdictions in a form which facilitates their application."[1] Because DOT's user audience is so broad (all levels of government plus the private arena) that process requires using a wide spectrum of dissemination agents: publications (reports, bulletins, abstracts, newsletters, reprints), audiovisual materials, meetings, presentations, workshops, conferences, demonstrations, training courses, computer data bases, and libraries.

DOT spends $70-$75 million on highway research annually. Formal needs surveys are conducted to identify clusters of needs, thereby influencing the direction of the research program. Results of cost-benefit analyses have supported the value of the Technology Sharing Program. A study by the Transportation Research Board looked closely at a number of case histories and concluded that research generates savings and improved products (Research Pays Off--The Return on Investment in Research and Development, Transportation Research Board, Washington, D.C., 1983). A 1985 FHWA report to the U.S. Senate identified 16 innovative technologies and estimated savings at several hundred million dollars.

DOT is the umbrella organization for several technical administrations, including the Federal Highway Administration, Urban Mass Transportation Administration, Federal Aviation Administration, Federal Railroad Administration, and U.S. Coast Guard. From the Office of the Secretary of Transportation, the Technology Sharing Program is linked to technical assistance efforts throughout these component organizations. A network of the means for transfer ensures that research innovations are passed on to potential users, while user needs and problems receive attention from researchers. The Office of Technology and Planning Assistance, under the Assistant Secretary for Governmental Affairs, provides overall program coordination.

The Department participates in the Federal Laboratory Consortium for Technology Transfer (FLC). Each administration does not have an ORTA but someone is designated to fill the function. The Technology Sharing Program cooperates with the Center for the Utilization of Federal Technology.

Overcoming patent and proprietary rights barriers so that private commercialization can take place remains a challenge. DOT facilitates commercializing technology when feasible. However, the manufacturers and businesses involved tend to be conservative. Within the general contract and bidding process for the construction of roads, bridges, etc., rarely is a provision found for introducing new, improved, less costly methods and technologies that might be developed during the course of the project. DOT is designing educational programs in hopes of changing this industry practice.

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[1] Technology Sharing, A Guide to Assistance in Obtaining and Using Research, Development and Demonstration Outputs, October 1979.

In addition to the Office of Technology and Planning Assistance, the Federal Highway Administration and the Urban Mass Transportation Administration are most actively engaged in technology transfer/sharing.

Federal Highway Administration

The FHWA conducts applied R&D at its Turner-Fairbank Highway Research Center and supports research by State highway agencies, private contractors and universities. It also supports the Transportation Research Board, operated by the National Academy of Sciences. A Strategic Highway Research Program (SHRP), costing $30 million a year for the next five years, has been proposed to focus upon: asphalt, concrete, bridge protection (e.g., from salt), maintenance cost effectiveness (a $15 billion a year business), and snow and ice control measures (e.g., commercialization of calcium magnesium acetate to replace salt). A 20-year portion of the study will address long-term pavement performance. The SHRP will be administered by the National Research Council in cooperation with FHWA and the American Association of State Highway Transportation Officals (AASHTO).

Technology transfer is accomplished through various means in addition to reports and on-line data bases, including audiovisual materials, demonstration and test programs, conferences, workshops, and symposia. The FHWA has supported the study of technology transfer methods including one on methods of effective transfer and implementation. The Technology Transfer Primer was produced by the University of Wisconsin to introduce users to information dissemination and technology transfer at a very basic level, beginning with a definition of technology transfer. At the agency level, the Federal Highway Administration stands out among those that have systematically developed materials and provided them to individuals in their respective organizations that have technology transfer responsibilities and to their client organizations. The FHWA funds technology transfer activities at a level of about $15 million a year.

Technology is disseminated from three offices: the Office of Implementation, the National Highway Institute, and the Office of Highway Operations' Demonstration Projects Division.

The Office of Implementation is responsible for conducting field testing and evaluation, and recasting research findings for potential users. It has responsibility for central oversight of FHWA technology transfer activities.

The National Highway Institute was established in 1970 to promote technical outreach through the training of Federal, State, and local highway employees. Training covers all aspects of highway procedures from planning to maintenance, and makes course materials available to schools across the country. Other avenues used to disseminate the information are a lending library, bulletins, and a Graduate Research Fellowship (GRF) program. Under the GRF program about 25 college students arrive annually to work at the Turner-Fairbank Laboratory on highway research problems. For example, a research fellow recently studied the extent of technology adoption by State governments, exemplified by case study cost savings and other benefits.

The Office of Highway Operations' Demonstration Projects Division takes promising developments out to where the potential users are, demonstrating how to make the application as well as how to conduct evaluation and field tests. These activities also establish a data base for the evaluation of new materials, equipment, etc. using the expertise and cooperation of the State highway agencies. Through this process, information is made available in a form that can be understood by State and local officials. On-site testing is administered through two technology transfer efforts: the Demonstration Projects Program (DPP) and the Experimental Projects Program (EPP). The DPP covers research deemed ready for on-site demonstration. The FHWA pays States to try a new technology and the States not only provide feedback, but exchange information among one another, and spread the word about successful developments. The EPP uses results of field tests incorporated into Federal-aid highway construction projects to determine a technology's readiness for widespread use. The technology tested can come from the private sector as well as from the publicly sponsored research.

The FHWA maintains regional and division offices with technology transfer experts. FHWA is encouraging State highway departments to name a technology transfer expert on their respective staffs. So far 43 have identified such a person, thereby providing more stable points of contact for transfer efforts.

The FHWA works with the 50 states plus U.S. territories and 39,000 local highway and transportation agencies responsible for public roads and bridges. Although the links to the States and territories are strong, the ties to local highway agencies are less sure. Part of this is due to the less technically sophisticated nature of many local agencies. To further aid in communication with such a large constituency the FHWA created its own Rural Technical Assistance Program in 1982, patterned after the Agricultural Extension Service. The RTAP is made up of over 39 Technology Transfer Centers, usually based at universities. These Federal-State-university consortia act as conduits between the local level and the FHWA, thereby improving the links with the ultimate users. They provide training and technical assistance to their respective localities.

All the offices and organizational components are linked in order to prevent duplication of efforts. An Executive Committee for Technology Transfer provides overall program oversight and recommends program policy and priorities for approval by the FHWA Executive Director.

The Office of Planning and Policy Development's Technology Exchange and Assistance Program and the Office of Direct Federal Programs tests and evaluates new technology in Federal construction projects and provides other agencies (e.g., National Park Service, Forest Service, and Bureau of Indian Affairs) with results. (See Appendix II-U, "Technology Transfer: Activities and Opportunities" which appeared, in slightly different form, in Public Roads, December 1985. It is an excellent overview of technology transfer challenges.)

Urban Mass Transportation Administration

UMTA does not have a single, central technology sharing entity. Instead, the effort is spread throughout the administration. Outreach consists of publications, workshops, training, and funds to test and evaluate new technology. UMTA maintains regional offices and a Transit Management Research Center. The administration endeavors to keep a finger on the pulse of State and local activity for potential wider dissemination, and to ascertain needs and problems via conferences, workshops, industry liaison boards, and user advisory groups.

Other

Technology sharing also occurs through other routes within DOT. The Office of University Research funded production of a publication, A Guide to the Use of Dissemination Techniques for Transportation Information, to "provide a systematic guide for selecting a technique or group of techniques to disseminate transportation information in the most efficient and effective way."

DOT also works on joint agency projects such as meals on wheels with the Department of Health and Human Services. It coordinates rural needs with the Department of Agriculture, e.g., rural and small transit systems technology, and delves into port security with the Navy. The agency shares technical information with the Forest Service, the Corps of Engineers, the Bureau of Land Management, the National Park Service, and the Bureau of Indian Affairs.

Summary

The Department of Transportation is the only department to have an integrated, department-wide program for technology transfer and a single department-level office as its focal point. Like most other agencies spinoff transfer is not a concern. Within the department, the Federal Highway Administration has an exemplary program, with rich experience in the technology transfer function.

TECHNOLOGY TRANSFER ACTIVITIES IN THE DEPARTMENT OF ENERGY

In order to understand today's approach to technology transfer within the Department of Energy, it is necessary to consider how that function evolved in the department's predecessor organizations--the Atomic Energy Commission and the Energy Research and Development Administration.

Within the AEC emphasis was on large, high technology mission programs. This resulted in technology transfer being embedded in the respective programs of the agency, rather than being established as a separate function. The agency was primarily interested in one form of energy--atomic energy--and much of the research was restricted by security classifications. Attention was focused upon military weapons systems, military reactors for naval propulsion or to produce electrical power for isolated bases, and, later, civil electric power reactors. In the latter case the industrial participants of the program consisted primarily of major electric utilities and their principal suppliers of heavy equipment. AEC also had primary responsibility for maintaining the Nation's high energy research program.

Interest in spinoff technology transfer developed during this period in the AEC and its laboratories, which had a relatively high degree of autonomy compared to other government laboratories. Although the facilities were owned by the government, they were operated by contractors representing a diverse group of organizations including associations of universities, single universities, and commercial firms. Senior scientists in the laboratories were instrumental in helping to set the AEC's research agenda.

With the establishment of the Energy Research and Development Administration the agency's scope was substantially expanded to include all types of energy, and broader, more civil-oriented programs to include energy producers, equipment suppliers, energy users, the transportation industry, and builders.

This broad arena was enlarged further with the creation of the Department of Energy which incorporated regulatory functions beyond that of nuclear energy as well as acquiring the remaining energy-oriented activities of other Federal agencies, to include hydroelectric power and organizations related to power distribution.

The first formal department-wide program for technology transfer was formulated to meet the requirements of PL 96-480 (the Stevenson-Wydler Technology Innovation Act of 1980). The policy is outlined in DOE Order Number 5800.1, "Research and Development Laboratory Technology Transfer Program." (See Appendix II-V.)

Primary responsibility was given to: (1) the Director of Energy Research for multi-purpose laboratories within the department; (2) the Assistant Secretary of Defense Programs for the six weapons laboratories; (3) the Assistant Secretary for Nuclear Energy for the five nuclear reactor-oriented laboratories; (4) the Assistant Secretary for Fossil Energy for the three coal and oil-oriented research centers; and (5) the Assistant Secretary for Conservation and Renewable Energy for the activities of the Solar Energy Research Institute.

This order made formal what had been practiced in AEC and ERDA, namely: (1) day-to-day technology transfer continued to be decentralized to program areas and to the laboratories; (2) funding for these activities most often was embedded in program funding or supported from overhead; and (3) to the extent that department-wide oversight was exercised, it was undertaken by the Office of Energy Research.

A central report summarizing laboratory technology transfer achievements is developed for the department on an annual basis by the Office of Energy Research, Director of the Division of Laboratory Management. This division also is designated as the principal official point of liaison for technology transfer. As noted earlier, program oversight is exercised by each of the five assistant secretarial areas designated in the general technology transfer policy, and department-wide policy oversight is exercised by the Director of Energy Research. There is a central point of policy coordination with respect to intellectual property matters in the Office of the General Counsel of the department, with coordination among the intellectual property attorneys for the department in the field operations offices.

Basic guidance for technology transfer activities has been issued by the Department of Energy headquarters through two principal means. First, memoranda from program or staff offices such as that issued by the Director of the Office of Energy Research on April 10, 1985. It laid out the guidelines for laboratory technology transfer programs and was issued to the laboratory directors. (See Appendix II-W.) In the transmittal notice the director noted:

> The department has established technology transfer as a fundamental role of the laboratories which should be implemented so as to reinforce rather than constrain the primary laboratory technology missions. All laboratories are required to maintain an Office of Research and Technology Applications function, identify technologies with potential for transfer, and assertively pursue technology transfer activities.

A second means of issuing policy has been the annual policy guidance issued by the Secretary. On May 8, 1985, the Secretary addressed a memorandum to all program managers, laboratory directors, and other DOE officials titled "Policy Guidance for FY1986-1991 Institutional Planning." In that memorandum he noted:

> The laboratories have other vitally important secondary roles. The laboratories make their special capabilities available to the domestic private sector on a reimbursable basis and with the approval of the department. The laboratories contribute, through cooperative programs with universities, to the education of scientists and engineers in the fundamental sciences and energy-related technologies. They provide for and encourage the transfer of technology developed at the laboratories to domestic private and public sectors. The laboratories may also work with foreign countries under cooperative agreements and with the permission of the department.

(See Appendix II-X.)

Program Office Interests

By way of example, two program areas that have pursued separately identified efforts for technology transfer are the Passive and Hybrid Solar Program and the Geothermal and Hydropower Technologies Program. Both concentrate upon serving a particular clientele, with minor emphasis on "secondary" or "spin-off" type of technology transfer.

Geothermal and Hydropower Technologies Program

Reports from the Geothermal and Hydropower Technologies Program reveal the philosophy that there needs to be an active involvement of their clients very early in the program planning process. While technology transfer usually has been embedded in a program area, in this one (although carefully integrated) it has been separately identified. In the period from 1977-1981 there were considerable resources devoted to demonstration type projects as a means of technology transfer. This emphasis has shifted in more recent years toward the basic research end of the spectrum, depending more upon such techniques as conferences, symposia, and other information exchange media as the primary means of transfer. Indeed, during the past two years funds are no longer identified specifically for technology transfer. The emphasis at present is to conduct basic or applied research to enable industry to consider further development of the technology for commercialization. Again, this has caused a shift of emphasis toward the longer term research of a basic or applied nature. (See Appendix II-Y for Multi-Year Technology Transfer Plan.)

The Division of Geothermal and Hydropower Technologies has worked closely over the years with the Electric Power Research Institute (EPRI) as an important means to make technical information available to industry. EPRI has cost shared a number of the division's projects involving funds from DOE, EPRI, and from private companies. In many respects industry associations or organizations, e.g., EPRI, are ideal means for technology transfer and cost sharing. In the case of EPRI, it represents nearly all of the major private power producers in the United States—ultimately, the fundamental user of much of the technology that the division is interested in developing. The division also works closely with the Gas Research Institute (GRI) and has important international bilateral agreements with both Italy and Mexico. DOE can collect and analyze data from geothermal fields in these countries and then analogize them to the U.S. where there is not the same scale of geothermal use, and where such data is proprietary and not generally available.

Another means of promoting technology transfer has been through the division's ties to the university laboratories which are training geothermal engineers who then become important new resources to both government and industry as they graduate.

Most of the technology transfer of this division is related to the type of transfer where the principal clients are either members who are directly involved in geothermal exploration and use or those who are closely allied such as well drilling in the oil industry. The division has traced specific developments sponsored by the Department of Energy in this area (approximately 40) that have been picked up and used by industry--again, primarily by clientele organizations.

Passive and Hybrid Solar Energy Program

The second program area which has put independent emphasis upon its technology transfer activities is the Passive and Hybrid Solar Energy Program. In August 1984 it published a "Five Year Technology Transfer Plan, 1986-1990." That plan is a useful model of how an organization can systematically approach technology transfer of the direct type. (See the plan in Appendix II-Z.) The division laid out six general guidelines for its technology transfer program:

(1) The technology transfer process must foster and build upon an interactive partnership between division-sponsored researchers and influential users, suppliers, and sponsors.
(2) The process must be an integral part of the division's research and development plans and programs.
(3) The process must be responsive to and build upon the technology needs of and opportunities available to the users, suppliers, and sponsors.
(4) The process must make effective use of existing Federal and other resources in meeting the industry's technology needs and opportunities.
(5) The process must incorporate participants' feedback and feature innovations developed by the division to improve technology transfer.
(6) The process must incorporate management features, including an evaluation component that will assure its continuing integrity and effectiveness.

The Division of Passive and Hybrid Solar Energy faced a challenging circumstance with respect to its clientele. Its primary "customers" were those involved in the U.S. building and construction industry as key links to the ultimate consumer—individuals purchasing and using commercial buildings or homes. This literally called for involvement of a number of intermediaries, such as trade associations or professional organizations that interacted on a daily basis with representatives of the building and construction industry. Such organizations were the Urban Land Institute, the American Institute of Architects, the National Association of Home Builders, and the whole array of industry associations relating to various building products such as wallboard, tile, brick, lumber, etc. Such intermediaries were essential as means to more directly reach the broader primary clientele. Collaborative activity was pursued through several means: cooperative field tests or experiments, participation in R&D planning, cost-shared development and collaborative research.

As a part of this challenge it was also recognized that the awareness of technology transfer had to be broadcast systematically. Leading organizations in the building industry established a new organization called the Passive Solar Industries' Council (PSIC) to provide a series of education and awareness programs for trade associations, professional organizations in the building and construction industry, and corporations.

The Division of Passive and Hybrid Solar Energy uses the Solar Energy Research Institute (SERI) as its main source of in-house laboratory capability and as a means for monitoring technical and other contractual work on behalf of the division. It also has used the Los Alamos National Laboratory, the Lawrence Berkeley Laboratory and the National Bureau of Standards. The division has undertaken a series of case studies to learn more about the specific problems of technology transfer within its area of mission responsibility. It also has undertaken steps to assure adequate evaluation of programs and procedures that are used to transfer technology.

DOE Laboratories

The Department of Energy has 30 program-dedicated laboratories and nine multi-program laboratories which participate in the transfer of technology. Two of these will be highlighted--the Solar Energy Research Institute (program dedicated) and the Los Alamos National Laboratory (multi-program)--because they represent somewhat different approaches to technology transfer at the laboratory level. The laboratories are very important to the technology transfer process because they are the primary loci for day-to-day technology transfer, whether it be the primary, direct transfer within a mission program or whether it be of a secondary or spinoff nature based upon the principal programs being conducted at the laboratory.

Solar Energy Research Institute

The Solar Energy Research Institute has its Office of Research and Technology Applications (ORTA) located within the Institute Development Office which reports to SERI's director. In fiscal year 1984 it is estimated that $540,000 was devoted to technology transfer activities with an estimated 4.5 full time equivalent personnel involved in various aspects of technology transfer. SERI annually has produced a report titled R&D Technology Transfer since 1982. The 1985 version of that report clearly defines SERI's view of technology transfer:

> SERI's technology transfer program promotes the exchange of knowledge before and throughout the research process. The solicitation of expert and peer advice in the planning of research directions is essential. Through faculty sabbatical researchers on site and collaborative research with colleagues in industry, new knowledge is diffused as it is gained. Professional papers and published reports expand that diffusion. R&D subcontracts, particularly in the latter stages of a development, bring industry resources to the refinement of a technology and plant the seeds for its commercialization. Industry workshops, visits, and trade shows provide opportunities to display more mature developments. SERI staff interacts with many organizations which serve as intermediaries to provide contact with specialized communities in the private sector.

SERI has six primary avenues through which it promotes or achieves technology transfer: (1) research planning, (2) collaborative research with industries and universities, (3) dissemination of information, (4) technical assistance to the private and public sectors, (5) cooperation with technology brokers, and (6) the Solar Technical Information Program.

SERI has established a number of science and technology committees which include representatives from industry, universities, and the public sector to meet, review, and provide advice on research plans and the quality of research. SERI views this as an important element in having potential user input to their research operations at an early stage to assure the best match when the research is concluded.

Collaborative research of both industry and universities is carried on in a number of ways including professional collaboration with industry and university and mutual research studies, the use of resident guest researchers at SERI, cost-shared subcontracts to attack mutual problems, institutional collaboration on common problems, and use of facilities (i.e., facilities of unique nature at SERI which are made available to other research organizations). SERI publishes a catalog of such facilities.

SERI also publishes its scientific and engineering reports, has its engineers and scientists present professional papers at societies and other conferences, and publishes a monthly newsletter that highlights significant research accomplishments and provides an overview of ongoing studies, called In Review. That newsletter is distributed to some 10,000 scientists, engineers and managers across the country.

SERI's Technical Inquiry Service handles about 3,000 requests for assistance per year, replying directly to about two-thirds of these. Such assistance may involve simply the mailing of a paper or research report, or direct contact with one of the laboratory scientists. In other instances, inquiries will be referred to the Conservation and Renewable Energy Inquiry and Referral Service (CAREIRS) or to the National Appropriate Technology Assistance Service (NATAS) which then picks up the responsibility for the inquiry.

SERI is an active and leading member of the Federal Laboratory Consortium for Technology Transfer (FLC), cooperating in that information network and assisting in the development and presentation of technology transfer workshops that include government agencies and industry. SERI is closely involved with a number of industry trade organizations as important channels for facilitating contact with the variety of clientele which SERI serves. For example, it conducted R&D update workshops with the National Institute of Homebuilders and the American Institute of Architects, and sponsors faculty summer programs with the American Society for Engineering Education.

Finally, SERI contributes directly to the Solar Technical Information Program (STIP) which provides tailored information and assistance to the solar energy community. SERI recently established a new publication titled Science and Technology Briefs which are short descriptions of new developments presented in a one page format to alert industrial organizations to technology opportunities resulting from SERI research.

Los Alamos National Laboratory

In contrast to SERI, the Los Alamos National Laboratory (LANL) is one of the older multi-purpose laboratories that was established during World War II and became a part of the newly formed Atomic Energy Commission in 1946. The laboratory has always had an interest in and has supported technology transfer in a "spinoff" mode. As the activities of the laboratory became technically more diversified, the technology transfer function was perceived to have value not only for the potential users but for the laboratory as well. In addition, the individuals responsible for this function handled it with care and wisdom. They tended to take a grass roots approach, gradually building support at the working level for technology transfer and then capitalizing on that enthusiasm to work with others in the laboratory. Another factor in fostering successful technology transfer was the fact that this function was placed within an organization which had broader responsibility for collaborating with outside organizations—in this case, the Industrial Initiatives Office.

Although direct technology transfer is a matter of continuing concern at this laboratory in order to serve its primary clientele, it usually is found embedded within the respective program offices, tended by senior management persons at the laboratory and at Department of Energy headquarters. The term "technology transfer" then becomes applied more frequently to the spinoff type of function than to the direct transfer type of function.

The Los Alamos National Laboratory has developed technology that has been spunoff over the years to commercial industry. In fact, some major technical developments in the laboratory itself were spunoff to a new venture, Mesa Diagnostics. The company was started with venture funding from Prudential-Bache Company and appears to have positive prospects for a successful transfer. Mesa was formed to exploit commercially technology developed at LANL, then patented by the University of California (LANL's "parent") and licensed to Mesa.

In 1983 the Materials Technology Division at Los Alamos asked its researchers to identify technologies that had commercial potential. This exercise produced a list of 192 technologies which were duly described, placed in a notebook, and made available to industry. As a means to stimulate more interest, LANL participated in a conference in 1984, inviting individuals who were known to be interested in materials and life sciences technology to hear reports on some of these more promising technologies that had commercial potential. The response was such that a similar conference was held by the LANL Life Sciences Group on the topic of plant genetic engineering.

In the summer of 1985 Los Alamos sponsored an intensive seminar on materials for approximately 65 representatives from 50 different companies in the field. This involved discussions, visits to the laboratories where the work had been accomplished, and one-on-one discussions between the industry engineers and those in the laboratory involved in the actual work. As a part of the preparation for this particular seminar, Los Alamos contracted with the Illinois Institute of Technology Research Institute to produce a series of technical profiles called "Technology Opportunities Profiles." Each "profile" contained information on the respective technology including current status of the technology, the characteristics of the technology, the potential of the technology, a market overview which described the market size, growth, and segmentation as well as who the producers might be and some of the competitive trends, and industrial awareness/legal protection issues. (See Appendix II-AA for an example of such a profile.) It was found that this kind of information was particularly helpful in focusing discussion and developing interest.

In addition to the many publications that are made available by the laboratory, LANL also promotes programs of visiting scientists, outside consulting by Los Alamos scientists (approximately 200 are involved in this each year), and the LANL participation in an incubator facility for new technological ventures which has been established by a not-for-profit corporation at Los Alamos.

Summary

The Department of Energy is very active in technology transfer activities. These are largely decentralized in program offices and in the laboratories, often embedded within a program or activity and not separately identified. The department offers general policy guidance and continuing oversight. Much of the technology transfer is of the direct kind within specific programs to serve particular clientele. Encouragement is given to the multi-purpose laboratories to conduct "spinoff" activities as part of their general research and development responsibilities.

TECHNOLOGY TRANSFER ACTIVITIES IN THE DEPARTMENT OF EDUCATION

A major focus of Department of Education technology transfer activities centers upon its National Diffusion Network which is a system that makes exemplary education programs available for adoption by schools, colleges, and other institutions. The system has been in operation for slightly more than 11 years and is funded primarily with money from the Secretary's discretionary fund. Since its beginning, approximately 400 such programs have been identified and matched with the needs of local school systems throughout the country.

In this effort to move innovative educational methods, technology, etc. to areas of need, the Department of Education has used as its model the Agricultural Extension Service. With a budget of just more than $10 million the Department of Education has been able to stimulate over $14 million in expenditures by State governments, local school districts, and others in meeting the solutions which have been developed by peer groups elsewhere.

The program has two major components. The first is directed at identifying successful programs irrespective of where they have been developed or by what type of sponsor. For example, it may involve curriculum, it may involve different kinds of practices, it may involve different elements of educational administration, and it can be directed at any level, from kindergarten through adult education. Subject areas include mathematics, science, and technology, including use of the computer and calculator for enhancing learning in various subjects. In addition there are programs in writing, reading, language arts, social studies, and programs for gifted and talented students. Some programs are designed to improve preservice and inservice teacher training. Other fields represented are special education, career and vocational education, adult education, health and physical education. Some programs are directed toward the processes to improve school administration and management and thereby improve instruction.

The second element of the National Diffusion Network is a means to help schools learn about the successful programs of others and adopt those programs for their own use. The National Diffusion Network disseminates information about these model programs throughout the country and provides for arrangements by which such programs may be adopted in other schools. This is accomplished through two types of project grants: (1) Developer Demonstrators and (2) State Facilitators. Developer Demonstrators provide information, training and followup services to schools interested in adopting their programs (that is, the programs developed initially by these Developer Demonstrators). The State Facilitators link the potential users with Developer Demonstrators. There is a State Facilitator in each State, the District of Columbia, Puerto Rico, and the Virgin Islands.

Selection of programs is made by the Joint Dissemination Review Panel, which consists of up to 30 members from the Department of Education's various program offices, chosen for their ability to analyze evaluation based data for evidence of effectiveness of educational programs. Each potential program is reviewed by a seven person panel which assesses the evaluation based data, such as test scores, to determine whether programs should be made available to other schools. Approval by the JDRP gives a program objective, professional recognition, and the opportunity to compete for National Diffusion Network dissemination funds. More than 400 such programs have been approved for such dissemination across the country, with approximately 15,000 schools having adopted programs. Each program is reviewed annually, and may be dropped if there has been little or no activity related to it.

The National Diffusion Network is organized in such a way as to make it relatively easy for a local school to obtain information about these programs at minimum cost. First, by having a facilitator in each State the network has established an instrument designed to assist schools and other organizations to learn about and develop the Diffusion Network programs. Information may be presented at conferences, teachers' meetings, requested visits, and other means for bringing information about the program to the attention of schools with a particular interest or need. Then, each Developer Demonstrator program receiving Federal dissemination funds maintains a demonstration classroom where schools or visitors are welcome. Also, many of the programs have demonstration sites in States other than the one in which the program was developed, and State Facilitators can arrange visits to a demonstration school or to an adoption site.

A variety of printed material produced both by the Diffusion Network and by the Developer Demonstrators is widely distributed through bulletins, articles and professional journals, brochures, and indexes or catalogs of program and subject areas. This material also is available to the State Facilitators who may be persons located in a State Department of Instruction or with a not-for-profit organization. These facilitators provide important linkages to potential users by assisting and identifying local needs and keeping in touch with the offerings of the network.

TECHNOLOGY TRANSFER ACTIVITIES IN THE VETERANS ADMINISTRATION

The Veterans Administration supports research in three program areas, all primarily related to biomedical concerns: (1) medical research, (2) rehabilitation research and development, and (3) health services. All of this work is conducted under an Assistant Chief Medical Director for Research and Development. In fiscal year 1985 the funds were allocated as follows: medical research $165 million, rehabilitation research and development $15 million, and health services research $6.5 million. Virtually all of these funds are expended on intramural research at 143 medical centers, involving 5,800 principal investigators in slightly more than 11,000 separately identified research projects. Some small portion of this funding is used for contract activity, primarily in manufacturing and building test equipment or demonstration equipment for the rehabilitation research and development activities.

The Veterans Administration characterizes its technology transfer as "a process that includes a series of events designed to move medical technologies, such as drugs, devices, procedures, and health care organizations and delivery systems, from their creation to their application in clinical practice."[1]

As evidenced by the above definition, the VA emphasizes direct transfer of technology to a well defined (if dispersed) clientele. It gives little attention to secondary or "spinoff" applications of its research and technology. Because the VA research is conducted at such a variety of locations, it does not meet the requirements of PL 96-480 for the establishment of an Office of Research and Technology Applications. However, reports on its technology transfer activities are made in consonance with the act through the Office of the Assistant Chief Medical Director for Research and Development.

The VA depends largely upon the provision of technical and research information through a variety of channels as the primary means of transferring technology. For example, the VA participates in the FEDRIP data base—that is, Federal Research In Progress, which is a cooperative information network of Federal agencies coordinated by the National Technical Information Service. Every six months the participating Federal agencies provide an update via a computer "dump," covering research completed or underway over a five-year period. Through this system it is possible to obtain abstracts and sources for further information about completed research or research in progress. The VA supplements this with its Research and Development Information System from which further data can be provided to those making inquiries. However, substantial details usually are not included in these brief information reports or abstracts. Under the VA system it is not anticipated that much detail will be provided until the principal investigator actually publishes the research results in a journal or similar form.

The Department of Medicine and Surgery produces a number of publications directly related to the transfer of technology. For example, they publish the

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[1] Technology Transfer in the Veterans Administration (DM&S) Research and Development Program (FY 1984) as submitted in conjunction with the requirements of Public Law 96-480.

Journal of Rehabilitation Research and Development as a means of making information on research, development and demonstration projects known to the general rehabilitation community. Another publication service is the research and development bulletin published by the Health Services Research and Development Service. Its purpose is to provide information to clinicians and others of recent developments and research related to clinical care. (See a recent example, Appendix II-BB.) The Health Services Research and Development Service recently established a Special Projects Office headquartered at the Perry Point, Maryland, Veterans Administration Hospital from which to provide this transfer activity.

The most overt technology transfer activity is undertaken by the Office of Technology Transfer operated by the Rehabilitation Research and Development Service. It presently is headquartered in the Washington, D.C., Veterans Administration Hospital where information and related assistance are provided to individuals interested in applying the most recent developments in rehabilitation research and development. This activity is scheduled to be moved to Baltimore, Maryland, during FY 1987. The Rehabilitation Research and Development Service has entered into an agreement with the Department of Commerce to stimulate private sector involvement in marketing devices for the disabled that result from VA sponsored research and development.

Although not directly a part of its formal technology transfer effort, the VA published an attractive booklet titled Medical Advances: The VA's Contribution to Health Care. In it are described key advances having their origins in VA-sponsored research, including prestigious awards honoring VA researchers. The booklet provides a better understanding of the breadth and value of research sponsored by the Veterans Administration.

The VA leadership emphasizes its policy whereby Veterans Administration medical staff usually become affiliated with an adjacent university medical school. There they teach and conduct medical research, in close relationship with their university colleagues. This is an informal but relatively systematic means for stimulating scientific communication and the transfer of technology.

TECHNOLOGY TRANSFER ACTIVITIES IN THE ENVIRONMENTAL PROTECTION AGENCY

The Environmental Protection Agency (EPA) is a regulatory and service agency dealing principally with State and local governments. In recent years the agency has followed a general philosophy of delegating regulatory functions to State and local governments, while providing oversight and both technical and administrative assistance to them.

EPA laboratories report to the Office of Research and Development in EPA headquarters. There are 16 technical groups of which 14 are laboratories and two are assessment groups. Generally, these are quite small. Only one reaches the $20 million per annum Stevenson-Wydler "threshold" for required reporting. The research and development budget of $246 million (fiscal year 1984) is directed principally in support of the regulatory function including a better understanding of pollutants, potential pollutants, their mechanisms of operation, and mitigation techniques.

The point of focus for technology transfer activities within the agency is the regional services staff of the Office of Research and Development (ORD). The fundamental nature of EPA's technology transfer activities is direct transfer to its clientele: State and local government officials and industry. Emphasis is not given to the secondary or "spinoff" type of transfer.

The regional services staff in EPA headquarters acts as a policy, coordination, and assistance group, while the principal activity within technology transfer occurs within the EPA program offices, its 10 regional offices, or its laboratories. The five program offices include the Assistant Administrators for Air and Radiation, Enforcement and Compliance Monitoring, Pesticides and Toxic Substances, Water, and Solid Waste and Emergency Response. With respect to the function of technology transfer, it is the agency's general policy to emphasize the responsibility of program managers for technology transfer—as an embodied element of their respective programs.

The technology transfer process within EPA tends to be informal, making use of personal networks and following the natural channels of information dissemination such as publication in journals, working with professional associations and public interest groups, and direct and continuing relationships with officials of State and local governments. Technology transfer activities generally are categorized according to three mechanisms: (1) technical information, (2) technical assistance, focused on specific problems and often dealing with a particular organization, and (3) generic technical assistance where clientele are reached through groups such as in workshops and in seminars.

Support for technology transfer in the various program offices is not specifically identified. However, in its report to the Department of Commerce on progress under the Stevenson-Wydler Act, EPA estimated that its fiscal year 1984 expenditures specifically for technology transfer amounted to $3.2 million. (See Table 1.)

TABLE 1
1984 (Dollars 000)

Regional Services Staff	$ 300.0	9.2%
Center for Environmental Research Information	$1,812.6	55.9%
Technological Information Product Management	$ 758.8	23.4%
Research Laboratory Technical Assistance*	$ 371.0	11.4%
TOTAL	$3,242.4	

*Does not include informal answers to inquiries on direct person-to-person basis.

As noted earlier, the emphasis is on decentralized activity. Therefore, laboratories are urged to deal directly with potential clients, especially in those instances where there are no jurisdictional problems between laboratories, or they are required to engage only minimum resources and do not need to call on headquarters for additional resources. This type of ad hoc assistance usually does not amount to more than 10 percent of a laboratory's R&D assistance type of activity.

Clientele often may have a direct effect upon the research agenda of EPA. For example, there was such an interest in flue gas desulfurization that EPA undertook formal research on the topic. However, the actual dissemination of the information resulting from the research was the responsibility of the program office, not the Office of Research and Development. Project Summaries represent one means of broad dissemination. (See Appendix II-CC.)

Although EPA does some cooperative work with private industry, the agency's preference is not to work with individual companies but with trade groups or trade associations because of the broader impact. This also avoids conflict of interest issues. Recently, as part of a concern on commercialization efforts generally, EPA has undertaken a survey of the latest services and products that might possibly be commercialized.

Particular attention has been placed upon quality assurance of data produced by testing laboratories that report on environmental protection parameters. This effort includes the identification of reporting laboratories that have problems in the quality of their data, and means to improve the process. Attention also has been given to the area of risk assessment, with particular emphasis upon human health risk assessment and the development of a computer data base for quick dissemination of toxicity information (Rapid Response Toxicity Assessment Project).

As Table 1 shows, the bulk of expenditures is directed toward information dissemination which is the primary responsibility of the Center for Environmental Research and Information. In addition EPA sponsors or conducts special seminars, workshops, exhibits and presentations at professional or trade associations and public interest organizations.

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APPENDIX II-A

January 17, 1984
NUMBER 2040.2

Department of Defense Directive

ASD(ISP)

SUBJECT: International Transfers of Technology, Goods, Services, and Munitions

References:
(a) Public Law 96-72, "The Export Administration Act of 1979," as amended (50 U.S.C. 2401 et seq.)
(b) Public Law 94-329, "The Arms Export Control Act," as amended (22 U.S.C. 2751 et seq.)
(c) National Security Decision Directive Number 5, "Conventional Arms Transfer Policy," July 8, 1981
(d) through (q), see enclosure 1

A. PURPOSE

This Directive:

1. Implements relevant portions of references (a) through (c) by establishing policy, assigning responsibilities, and prescribing procedures for international transfer of defense-related technology, goods, services, and munitions.

2. Establishes the DoD International Technology Transfer (IT^2) Panel and Subpanels, whose charters are at enclosure 2.

3. Cancels DoD Directive 2030.4, DoD Directive 5030.28, and the Secretary of Defense Memorandum of December 29, 1983 (references (d), (e), and (f)).

B. APPLICABILITY AND SCOPE

1. This Directive applies to the Office of the Secretary of Defense, the Organization of the Joint Chiefs of Staff (OJCS), the Military Departments, and the Defense Agencies (hereafter referred to collectively as "DoD Components").

2. This Directive applies to all technology transfer mechanisms and shall be implemented through such processes as strategic trade licensing, munitions licensing, security assistance, and DoD research, development, and acquisition activities.

3. The policies, procedures, and responsibilities contained in NDP-1 and DoD Directive 5230.11 (references (g) and (h)) concerning disclosures of classified military information are not affected by this Directive.

C. DEFINITIONS

The terms used in this Directive are defined in enclosure 3.

D. POLICY

It shall be DoD policy to treat defense-related technology as a valuable, limited national security resource, to be husbanded and invested in pursuit of national security objectives. Consistent with this policy and in recognition of the importance of international trade to a strong U.S. defense industrial base, the Department of Defense shall apply export controls in a way that minimally interferes with the conduct of legitimate trade and scientific endeavor. Accordingly, DoD Components shall:

1. Manage transfers of technology, goods, services, and munitions consistent with U.S. foreign policy and national security objectives.

2. Control the export of technology, goods, services, and munitions that contribute to the military potential of any country or combination of countries that could prove detrimental to U.S. security interests.

3. Limit the transfer to any country or international organization of advanced design and manufacturing know-how regarding technology, goods, services, and munitions to those transfers that support specific national security or foreign policy objectives.

4. Facilitate the sharing of military technology only with allies and other nations that cooperate effectively in safeguarding technology, goods, services, and munitions from transfer to nations whose interests are inimical to the United States.

5. Give special attention to rapidly emerging and changing technologies to protect against the possibility that militarily useful technology might be conveyed to potential adversaries before adequate safeguards can be implemented.

6. Seek, through improved international cooperation, to strengthen foreign procedures for protecting sensitive and defense-related technology.

7. Strive, before transferring valuable defense-related technology, to ensure that such technology is shared reciprocally.

E. PROCEDURES

1. In all technology transfer cases referred for review, the DoD Components concerned shall:

   a. Consider proposed transfers of technology, goods, services, and munitions on a case-by-case basis.

   b. Conduct policy reviews, technical evaluations, operational and military mission impact assessments, and intelligence assessments of proposed transfers.

c. Ensure that transfers of technology, goods, services, and munitions:

(1) Are consistent with U.S. national security and foreign policy objectives.

(2) Do not constitute an unreasonable risk to U.S. security in the degree to which they reduce technological leadtime.

(3) Receive positive consideration when such transfers will result in tangible and direct benefits to the defense objectives of the United States and its allies or to the defense industrial base. Such benefits should be at least equivalent to the value of the technology transferred.

d. Make sensitive transfers conditional upon agreements with allied and other nations that restrict the transfer of technology, goods, services, and munitions that harm or may harm the security of the United States and the security of U.S. allies and other friendly nations.

e. Oppose transfers of sensitive technology, goods, services, and munitions through multinational organizations in which potential adversaries participate.

f. Assess whether recipient nations:

(1) Restrict their transfer or export of U.S. technology, goods, services, and munitions to other nations who use, or may use, such technology, goods, services, and munitions against the best interests of the United States.

(2) Secure written U.S. Government agreement before reexporting U.S. technology, goods, services, and munitions.

(3) Maintain control over U.S. technology, goods, services, and munitions.

(4) Report promptly and fully to the U.S. Government any known or suspected transfers of U.S. technology, goods, services, and munitions that do not have U.S. Government approval.

(5) Transfer non-U.S. critical technology, goods, services, and munitions harmful to U.S. security.

g. Assess annually the total effect of transfers of technology, goods, services, and munitions on U.S. security, regardless of the transfer mechanisms involved.

h. Support approved DoD programs designed to inform government, Congress, industry, academia, and the public on the dangers of the loss of Western technological leadership.

2. In strategic trade cases, the DoD Components concerned shall:

a. Assess whether proposed transfers of technology and goods through actual or potential military use could threaten U.S. security, regardless of the stated end use or end user of such technology and goods.

b. Ensure that potential transfers of technology and goods are assessed with a primary consideration to control of critical technology as described by Pub. L. 96-72 and the "DoD Militarily Critical Technologies List" (references (a) and (i)).

c. Disapprove exceptions to the Coordinating Committee of the Consultative Group (COCOM) lists that are disadvantageous to the security of the United States and its allies.

d. Support North Atlantic Treaty Organization (NATO) efforts to control technology and goods.

e. Provide support to, and cooperate with, non-COCOM countries to control the transfer of militarily relevant technology and goods to the Warsaw Pact nations.

f. Assess whether recipient nations support U.S. objectives in COCOM and the COCOM embargo.

3. In munitions licensing cases, the DoD Components concerned shall:

a. Give favorable consideration to transfers of services and munitions to U.S. allies and friendly nations that are intended to achieve specific U.S. defense objectives.

b. Ensure that transfers of munitions and services involving critical technology receive special scrutiny, taking into account the importance of arms cooperation with NATO and other close friendly nations and allies, potential third-party transfers, and the protection of advanced military operational capabilities and associated technology.

c. Ensure that decisions on munitions license applications that involve or may lead to the disclosure of classified military information are in compliance with NDP-1 and DoD Directive 5230.11 (references (g) and (h)).

4. The DoD Components concerned shall submit unresolved technology security cases and issues to the appropriate DoD IT^2 Subpanel for resolution.

5. Two subcommittee reports to the DoD Steering Committee on National Security and Technology Transfer (references (j) and (k)), when approved, may provide additional procedural guidance affecting publications and technology monitoring.

F. COORDINATING COMMITTEE OF THE CONSULTATIVE GROUP (COCOM)

1. COCOM, founded in 1949, is an informal multinational organization made up of the NATO nations (except Iceland and Spain) and Japan. COCOM'S mission is to maintain a uniform export control system among its member nations in order to protect Western security.

2. DoD Components concerned with strategic trade policy shall seek to strengthen COCOM by:

a. Promoting the development of a professional secretariat.

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b. Promoting the tightening of the strategic control list.

c. Encouraging enforcement of COCOM controls.

d. Promoting a threshold on the COCOM list beyond which technology and goods cannot be transferred to potential adversaries.

e. Promoting broader membership of free-world nations in COCOM and associate agreements with COCOM for advanced, industrialized nations.

f. Promoting the establishment of a military committee to consider strategic issues related to the control programs.

g. Providing full-time DoD policy representation to COCOM.

h. Supporting and promoting other measures that strengthen the COCOM organization and function and that support U.S. objectives.

G. RESPONSIBILITIES

1. The Under Secretary of Defense for Policy (USD(P)) shall:

a. Develop, coordinate, and issue policies relating to technology transfer control in accordance with DoD Directive 5111.1 (reference (1)).

b. Prepare technology transfer control and enforcement policy guidance and coordinate overall application of DoD policy.

c. Represent the Department of Defense in interagency, national, and international forums concerning policy for technology transfer control and enforcement matters.

d. For technology transfer policy matters, serve as DoD point of contact for foreign governments, international agencies, other federal agencies, interagency groups, industry, and DoD Components.

e. Act as the DoD receiving point for all strategic trade, COCOM, and munitions license cases.

f. Conduct policy reviews on technology, goods, services, and munitions transfer cases.

g. Prepare the coordinated DoD position for strategic trade, COCOM, and munitions license cases. If the projected recommendation differs from recommendations of the DoD Components concerned, advise the DoD Components of the recommendation and supporting rationale in sufficient time to permit submission of the issue to the DoD IT^2 Subpanel A before issuing the position.

h. Issue coordinated DoD recommendations on strategic trade, COCOM, and munitions transfer cases to the Commerce and State Departments.

i. Develop and maintain comprehensive reference data bases on technology, goods, services, and munitions transfer matters that are accessible to all DoD Components.

j. Provide to DoD Components a weekly update of the disposition of significant transfer cases.

k. Provide executive direction of the DoD IT^2 Panel in accordance with enclosure 2.

l. Develop, review, and negotiate international agreements under this Directive, DoD Directive 5530.3, and DoD Instruction 2050.1 (references (m) and (n)).

m. Assess, with the support of the Director, Defense Intelligence Agency (DIA), and the Chairman, National Disclosure Policy Committee, recipient nations':

(1) Laws, regulations, and internal operating procedures to determine their ability to enforce technology security and control provisions of applicable U.S. export license stipulations, specific cooperative program agreements with the U.S. Government, COCOM embargoes, and other industrial and government agreements.

(2) Reliability in maintaining control over technology, goods, services, and munitions that originate in the United States and whose transfer to other nations may be against the best interests of the United States.

(3) Reliability in securing prior written U.S. Government approval before exporting technology, goods, services, and munitions originating in the United States to other nations.

(4) Reliability and promptness in reporting known or suspected transfers of U.S. technology, goods, services, and munitions that were not approved by the U.S. Government.

(5) Support of U.S. objectives in COCOM and the COCOM embargo.

(6) Cooperation and support for the principle of sharing technology of comparable value with the United States.

(7) Reliability in preventing transfer to potential adversaries of non-U.S. critical technology, goods, services, and munitions harmful to the U.S. security.

n. Request the Under Secretary of Defense for Research and Engineering (USDR&E) to provide technical advisors and consultants necessary to support development of DoD technology transfer policy.

o. Assess annually the total effect of technology, goods, services, and munitions transfers on the security of the United States, regardless of the transfer mechanism involved.

p. Support the U.S. intelligence and enforcement communities in their efforts to halt or control the flow of technology, goods, services, and munitions to potential adversaries.

q. Establish, through the appropriate DoD IT^2 Subpanel, working groups and task forces to develop ways and means to protect technology from exploitation by potential adversaries.

2. The Under Secretary of Defense for Research and Engineering shall:

a. Manage overall DoD technical and acquisition efforts related to technology, goods, services, and munitions transfer in accordance with DoD Directive 5129.1 (reference (o)).

b. Oversee implementation of DoD technology transfer policy for all research, development, and acquisition matters.

c. For research, development, and acquisition matters, act as DoD point of contact with industry, other federal agencies, interagency groups, DoD Components, academia, and appropriate international forums.

d. Coordinate the technical review of strategic trade, COCOM, and munitions cases and establish the DoD technical positions, with supporting rationales, regarding the proposed transfer of technology, goods, services, and munitions.

e. Develop and administer programs to identify and define lists of militarily critical technologies that should be controlled for export, including necessary guidelines.

f. Manage technical efforts in support of DoD participation in and implementation of studies and analyses of COCOM, U.S. export controls, and related technology, goods, services, and munitions transfer matters.

g. Develop the DoD technical portion for the "DoD Militarily Critical Technologies List" (reference (i)) revisions and COCOM negotiations.

h. Provide technical advisors and consultants as needed to support the USD(P) in the development of DoD technology transfer policy.

i. Provide technical support of DoD views in interagency, national, and international forums of technology, goods, services, and munitions transfer matters.

j. Provide technical support for USD(P) assessments of the foreign availability of technology, goods, services, and munitions.

k. Develop, review, and negotiate international agreements in accordance with this Directive, DoD Directive 5530.3, and DoD Instruction 2050.1 (references (m) and (n)).

l. Develop and maintain a comprehensive technical data base for technology, goods, services, and munitions transfer cases.

m. Participate on the DoD IT^2 Panel and Subpanels in accordance with enclosure 2.

n. Support the U.S. intelligence and enforcement communities in their efforts to halt or control the flow of technology, technical data, goods, services, and munitions to potential adversaries.

o. For technology transfer research cases:

(1) Serve as the receiving point in the Department of Defense.

(2) Obtain a policy position from the USD(P).

(3) Conduct reviews and prepare coordinated DoD recommendations, with supporting rationales.

(4) Advise DoD Components if the projected recommendation differs from their recommendations and provide an opportunity for the DoD Components to submit the issue to the DoD IT^2 Subpanel B before issuing a DoD position. If a case is appealed, within 15 days the case shall be decided and all interested parties notified or the case shall be referred to the Deputy Secretary of Defense or Secretary of Defense for a final decision.

(5) Issue, after the appeal process is completed, the coordinated DoD recommendation.

3. The Assistant Secretary of Defense (International Security Policy) (ASD(ISP)) shall:

a. Monitor compliance with this Directive through the Deputy Assistant Secretary of Defense (International Economic, Trade, and Security Policy) (DASD(IETSP)).

b. Chair the DoD IT^2 Panel and participate on the DoD IT^2 Subpanels in accordance with enclosure 2.

4. The Chairman of the Joint Chiefs of Staff shall:

a. Conduct and provide operational and military mission impact assessments on technology, goods, services, and munitions transfer issues, as requested.

b. Provide operational expertise and military judgment in interagency, national, and international forums on technology, goods, services, and munitions transfer matters.

c. Participate on the DoD IT^2 Panel and Subpanels in accordance with enclosure 2.

5. The Director, Defense Intelligence Agency, shall:

a. Formulate DoD coordinated intelligence assessments concerning the types and numbers of illegal transfer of technology, goods, services, and munitions and the associated transfer mechanisms.

b. Designate a point of contact to represent the DIA on technology, goods, services, and munitions transfer matters.

c. Conduct and provide intelligence reviews on technology, goods, services, and munitions transfer cases.

d. Assess foreign availability of technology, goods, services, and munitions proposed for transfer.

e. Conduct end-user checks on the declared ultimate consignee on technology, goods, services, and munitions transfer cases.

f. Provide intelligence expertise in interagency, national, and international forums on technology, goods, services, and munitions transfer matters.

g. Provide intelligence concerning the total effect of transfers of technology, goods, services, and munitions on U.S. security.

h. Participate on the DoD IT^2 Panel and Subpanels in accordance with enclosure 2.

i. Assist in identifying and assessing critical technology.

6. The Heads of DoD Components shall:

a. Designate a point of contact in their respective Component for technology, goods, services, and munitions transfer matters.

b. Conduct assessments of proposed technology, goods, services, and munitions transfer cases as required and provide coordinated positions.

c. Assist in identifying and assessing critical technology and in supporting DoD participation in export control list reviews.

d. Participate on the DoD IT^2 Panel and Subpanels in accordance with enclosure 2.

e. Consistent with this Directive, DoD Directive 5530.3, and DoD Instruction 2050.1 (references (m) and (n)), coordinate the development and negotiation of international agreements pertaining to technology, goods, services, and munitions transfers.

f. Assure the calculation of nonrecurring cost recoupment charges in accordance with DoD Directive 2140.2 (reference (p)).

H. EFFECTIVE DATE AND IMPLEMENTATION

This Directive is effective immediately. Forward two copies of implementing documents to the Assistant Secretary of Defense (International Security Policy) within 120 days.

Caspar W. Weinberger

Caspar W. Weinberger
Secretary of Defense

Enclosures - 3
1. References
2. DoD International Technology Transfer (IT^2) Panel and Subpanels
3. Definitions

REFERENCES (Continued)

(d) DoD Directive 2030.4, "DoD Support for the Strategic Trade Control Program," December 11, 1962 (hereby canceled)
(e) DoD Directive 5030.28, "Munitions Control Procedures for U.S. Munitions List Export License Applications Referred to DoD by Department of State," March 10, 1970 (hereby canceled)
(f) Secretary of Defense Memorandum, "DoD Directive 2040.2, "International Transfers of Technology, Goods, Services, and Munitions," December 29, 1983 (hereby canceled)
(g) "National Policy and Procedures for the Disclosure of Classified Military Information to Foreign Governments and International Organizations" (NDP-1), September 9, 1981
(h) DoD Directive 5230.11, "Disclosure of Classified Military Information to Foreign Governments and International Organizations," March 2, 1979
(i) Under Secretary of Defense for Research and Engineering, "DoD Militarily Critical Technologies List (U)" (Secret Noforn), October 1, 1982
(j) Report when approved of the Subcommittee on Publications to the DoD Steering Committee on National Security and Technology Transfer, November 9, 1983
(k) Report when approved of the Subcommittee on Technology Monitoring to the DoD Steering Committee on National Security and Technology Transfer, September 19, 1983
(l) DoD Directive 5111.1, "Under Secretary for Policy," October 27, 1978
(m) DoD Directive 5530.3, "International Agreements," December 6, 1979
(n) DoD Instruction 2050.1, "Delegated Approval Authority to Negotiate and Conclude International Agreements," July 6, 1977
(o) DoD Directive 5129.1, "Under Secretary of Defense for Research and Engineering," November 29, 1978
(p) DoD Directive 2140.2, "Recoupment of Nonrecurring Costs on Sales of USG Products and Technology," January 5, 1977
(q) DoD Directive 5400.7, "DoD Freedom of Information Act Program," March 24, 1980

DOD INTERNATIONAL TECHNOLOGY TRANSFER (IT^2) PANEL AND SUBPANELS

A. THE DOD IT^2 PANEL

1. Functions. The DoD IT^2 Panel shall:

a. Identify and address technology transfer policy issues.

b. Resolve differences within the Department of Defense concerning program administration, interagency issues, and coordinated DoD recommendations on transfer cases referred by the DoD IT^2 Subpanels.

2. Organization and Management

a. The DoD IT^2 Panel shall be chaired by the ASD(ISP) or, in his absence, by the vice-chair.

b. The vice-chair shall be the Principal Deputy USDR&E (PDUSDR&E) or, in his absence, a person designated by the ASD(ISP) shall serve as chair.

c. In addition to the chair and the vice-chair, the Panel consists of representatives of the Office of the Deputy USD(P) (ODUSD(P)), the Office of the ASD(ISP) (OASD(ISP)), the Office of the USDR&E (OUSDR&E), the OJCS, the Defense Security Assistance Agency (DSAA), the DIA, the National Security Agency (NSA), the Defense Advanced Research Projects Agency (DARPA), and the Military Departments.

d. Panel members, excluding representatives of the NSA, DSAA, DARPA, and DIA, shall have one vote, and all voting members shall be polled on any decision. The NSA shall vote on matters having a potential impact on the cryptologic (communications security (COMSEC) and signals intelligence (SIGINT)), computer security, and electronic warfare (EW) mission areas. The DSAA shall vote on matters concerning security assistance. The DIA and DARPA shall serve in an advisory capacity.

e. Other DoD Components and other agencies and individuals may be invited to participate as necessary, but will have no vote.

f. Issues may be referred to the Panel on the recommendation of any voting member or from the DoD IT^2 Subpanels.

g. The Panel shall meet quarterly and at other times subject to the call of the chair.

h. On matters not concerning the resolution of DoD positions on specific transfer cases, a two-thirds majority vote shall resolve any differences.

i. In resolving differences concerning coordinated DoD recommendations on transfer cases, a unanimous vote is required to recommend approval of a proposed transfer.

j. Appeals shall be resolved by the Secretary of Defense or Deputy Secretary of Defense and may be made by any voting member of the Panel.

B. DOD IT^2 SUBPANEL A, EXPORT CONTROL POLICY

1. Functions. The DoD IT^2 Subpanel A shall:

a. Resolve differences within the Department of Defense on matters referred to it concerning the transfer of technology, goods, services, and munitions; IT^2 program administration and interagency technology transfer issues; and transfer cases requiring a coordinated DoD recommendation.

b. Identify and recommend solutions to technology transfer policy issues.

c. As required, form working groups drawn from member organizations and agencies to address specific issues raised by the DoD IT^2 Panel, by member organizations or agencies, or as deemed appropriate by the chair to address high-priority technology transfer policy issues.

2. Organization and Management

a. The DoD IT^2 Subpanel A shall be chaired by the DASD(IETSP), OASD(ISP).

b. The vice-chair shall be the Deputy Under Secretary of Defense (International Programs and Technology) (DUSD(IP&T)), OUSDR&E.

c. In addition to the chair and vice-chair, the Subpanel consists of representatives of the ODUSD(P); the ODASD(IETSP), OASD(ISP); the ODUSD(IP&T), OUSDR&E; the OJCS; the DSAA; the NSA; the DIA; DARPA; and the Military Departments.

d. Each member, excluding representatives of the DSAA, NSA, DIA, and DARPA, shall have one vote. All voting members shall be polled on any decision. The DSAA shall vote on matters concerning security assistance. The NSA shall vote on matters having a potential impact on the cryptologic (COMSEC and SIGINT), computer security, and EW mission areas. The DIA and DARPA shall serve in an advisory capacity.

e. Other DoD Components and other agencies and individuals may be invited to participate as necessary, but will have no vote.

f. Technology transfer issues may be referred to the Subpanel by any member when the issue requires resolution by establishing a precedent for critical or sensitive technology or when intelligence or political information dictates a policy review for specified countries.

g. On issues not concerning the resolution of DoD positions on transfer cases, a two-thirds majority vote shall resolve any differences. When a two-thirds majority decision cannot be reached, the matter under consideration shall be referred to the DoD IT^2 Panel for disposition.

h. Issues concerning coordinated DoD recommendations on transfer cases shall be referred to the Subpanel only after an attempt has been made to resolve the differences at the working level or if a DoD position on a case must be issued within 15 working days and the differences have not been resolved.

i. In resolving differences concerning coordinated DoD recommendations on transfer cases, a unanimous vote is required to recommend approval of a proposed transfer. Appeals on the cases under consideration may be made by any DoD Component having a voting member. The chair shall refer the cases to the DoD IT^2 Panel for review.

j. The chair of the Subpanel A shall chair the DoD IT^2 Panel if the Panel chair and vice-chair are unable to attend the Panel meeting.

k. Subpanel A shall meet monthly and at other times subject to the call of the chair. When a specific transfer case is appealed to Subpanel A, the Subpanel shall meet to resolve the case within 10 working days.

l. Administrative support for Subpanel A shall be provided by the Office of the DASD(IETSP), OASD(ISP).

C. DOD IT^2 SUBPANEL B, RESEARCH AND DEVELOPMENT

1. Functions. The DoD IT^2 Subpanel B shall:

a. Address issues and resolve differences in the Department of Defense regarding technical standards and definitions and the dissemination and exchange of technical information.

b. Consider appeals on recommendations in technology transfer research cases.

c. As required, form working groups drawn from member organizations and agencies to address specific issues raised by the DoD IT^2 Panel, by member organizations or agencies, or as deemed appropriate by the chair to address high-priority technology transfer research cases.

2. Organization and Management

a. The chair shall be the Deputy Under Secretary of Defense for Research and Advanced Technology (DUSD(R&AT)), OUSDR&E.

b. The vice-chair shall be the DASD(IETSP), OASD(ISP).

c. Other members of Subpanel B shall be representatives from the ODUSD(P), USD(P); ODASD(IETSP), OASD(ISP); ODUSD(R&AT), OUSDR&E; the Assistant Secretaries of the Army (Research, Development, and Acquisition), the Navy (Research, Engineering, and Systems), and the Air Force (Research, Development, and Logistics); the DSAA; the DIA; DARPA; and the NSA.

d. Each member, excluding representatives of the DSAA, DIA, DARPA, and NSA, shall have one vote, and all voting members shall be polled on a decision. The DSAA shall vote on issues concerning security assistance. The DIA shall serve in an intelligence advisory capacity. DARPA shall vote on issues affecting fulfillment of DARPA's mission. The NSA shall vote on issues concerning its missions in cryptology (COMSEC and SIGINT), computer security, and EW.

e. Additional DoD Components and other agencies and individuals may be invited by the chair or vice-chair to participate as necessary, but will have no vote.

f. Issues may be referred to the Subpanel by any member, including representatives of the DSAA, DIA, DARPA, and NSA.

g. A two-thirds majority vote shall resolve differences. Any member voting on a particular issue may appeal a decision to the DoD IT^2 Panel.

h. Administrative support for Subpanel B shall be provided by the Office of the DUSD(R&AT), OUSDR&E.

i. The Subpanel shall meet monthly and at other times as determined by the chair. When a research technology transfer case is appealed to Subpanel B, the Subpanel shall meet within 10 working days to resolve the case.

DEFINITIONS

1. Critical Technology. Technologies that consist of (a) arrays of design and manufacturing know-how (including technical data); (b) keystone manufacturing, inspection, and test equipment; (c) keystone materials; and (d) goods accompanied by sophisticated operation, application, or maintenance know-how that would make a significant contribution to the military potential of any country or combination of countries and that may prove detrimental to the security of the United States (also referred to as militarily critical technology).

2. Goods. Any articles, materials, supplies, or manufactured products, including inspection and test equipment. The term excludes technical data.

3. Items of Intrinsic Military Utility. End items other than those identified in the "DoD Militarily Critical Technologies List" (reference (i)) whose transfer to potential adversaries shall be controlled for the following reasons:

a. The end product in question could significantly enhance the recipient's military or warmaking capability either because of its technology content or because of the quantity to be sold; or

b. The product could be analyzed to reveal U.S. system characteristics and thereby contribute to the development of countermeasures to equivalent U.S. equipment.

4. Keystone Equipment. Includes manufacturing, inspection, or test equipment and is the required equipment for the effective application of technical information and know-how. Keystone materials have the same significant application.

5. Know-how. Includes both the know-how of design and manufacturing and the know-how and related technical information that is needed to achieve a significant development, production, or use. The term know-how includes services, processes, procedures, specifications, design data and criteria, and testing techniques.

6. Militarily Critical Technology. See critical technology.

7. Munitions. Includes:

a. Arms, ammunition, and other implements of war.

b. Any property, installation, commodity, material equipment, supply, or goods used to make military items.

c. Any machinery, facility, tool, material, supply, or other item necessary for the manufacture, production, processing repair, servicing, storage, construction, transportation, operation, or use of any article listed above.

d. Technical data related to State Department munitions list items.

8. Services. Includes any service, test, inspection, repair, training, publication, technical or other assistance, or defense information used to furnish military assistance, including military education and training activities.

9. Strategic Trade Cases. Cases involving technology and goods that are dual-use in nature, that is, capable of being used either for legitimate civilian purposes or capable of being used or diverted to increase a nation's military potential.

10. Technical Data. Classified or unclassified information of any kind that can be used, or adapted for use, in the design, production, manufacture, repair, overhaul, processing, engineering, development, operation, maintenance, or reconstruction of goods or munitions; or any technology that advances the state of the art or establishes a new art in an area of significant military applicability in the United States. The data may be tangible, such as a model, prototype, blueprint, or an operating manual, or may be intangible, such as a technical service or oral or visual interactions.

11. Technology. The technical information and know-how that can be used to design, produce, manufacture, use, or reconstruct goods, including technical data and computer software. The term does not include the goods themselves.

12. Transfer Mechanisms. The means by which technology, goods, services, and munitions are transferred, including but not limited to:

a. Commercial and government sales.

b. Scientist, engineer, student, and academic exchanges.

c. Consulting agreements.

d. Licensing and other data exchange agreements.

e. Codevelopment and coproduction agreements.

f. Commercial proposals and associated business visitors.

g. Trade fairs, exhibits, and airshows.

h. Sales to third-party nations.

i. Multinational corporation transfers.

j. Foreign technical missions.

k. International programs (such as fusion, space, and high-energy).

l. International meetings and symposia on advanced technology.

m. Patents.

n. Clandestine or illegal acquisition of military or dual-use technology or equipment.

o. Dissemination of technical reports and technical data, whether published or by oral or visual release.

p. Dissemination of technical reports under DoD Directive 5400.7 (reference (q)).

q. Diversion or evasion of control procedures.

r. Smuggling.

s. Dummy corporations.

t. Acquiring an interest in U.S. industry, business, and other organizations.

Department of Defense

DIRECTIVE

November 20, 1984
NUMBER 5230.24

USDR&E

SUBJECT: Distribution Statements on Technical Documents

References:
(a) DoD Directive 5200.20, "Distribution Statements on Technical Documents," September 24, 1970 (hereby canceled)
(b) Secretary of Defense Memorandum "Control of Unclassified Technology with Military Application," October 18, 1983 (hereby canceled)
(c) DoD Directive 3200.12, "DoD Scientific and Technical Information Program," February 15, 1983
(d) through (n), see enclosure 1

A. PURPOSE

This Directive replaces reference (a) to update policies and procedures for marking technical documents, including production, engineering, and logistics information, to denote the extent to which they are available for distribution, release, and dissemination without additional approvals or authorizations. It incorporates Secretary of Defense guidance provided in reference (b).

B. APPLICABILITY AND SCOPE

1. This Directive applies to the Office of the Secretary of Defense, the Military Departments (including their National Guard and Reserve Components), the Organization of the Joint Chiefs of Staff, the Unified and Specified Commands, and the Defense Agencies (hereafter referred to collectively as "DoD Components").

2. This Directive covers all newly created technical documents generated by all DoD-funded research, development, test and evaluation (RDT&E) programs, which are the basis of the DoD Scientific and Technical Information Program (STIP) described in DoD Directive 3200.12 (reference (c)). The provisions of this Directive also apply to engineering drawings, standards, specifications, technical manuals, blueprints, drawings, plans, instructions, computer software and documentation, and other technical information that can be used or be adapted for use to design, engineer, produce, manufacture, operate, repair, overhaul, or reproduce any miltiary or space equipment or technology concerning such equipment.

3. It applies to unclassified technical data in the possession of or under the control of a DoD Component that have military or space application and that may not be exported lawfully without an approval, authorization, or license under Executive Order 12470 (reference (d)) or the Arms Export Control Act (22 U.S.C. 2751 et seq. (reference (e)).

4. This Directive does not apply to technical documents categorized as cryptographic and communications security, communications and electronic intelligence, and such other categories that may be designated by the Director, National Security Agency/Chief, Central Security Service.

5. This Directive does not apply to technical documents that contain RESTRICTED DATA (RD) and FORMERLY RESTRICTED DATA (FRD), as defined in the Atomic Energy Act of 1954, as amended. Distribution, control and marking of documents that contain RD and FRD information are specified and defined by the said Act and joint Department of Energy and DoD directives.

C. DEFINITIONS

The terms used in this Directive are defined in enclosure 2.

D. POLICY

It is DoD policy to pursue a coordinated and comprehensive program to provide for a strong and viable military research, acquisition, and support program consistent with requirements of national security, export laws, and competitive procurement.

E. RESPONSIBILITIES

1. The Under Secretary of Defense for Research and Engineering shall monitor compliance with this Directive within DoD Components and take such actions that may be required to ensure consistent and appropriate implementation of this Directive within the Department of Defense.

2. The Under Secretary of Defense for Policy shall prepare and issue, as required, policy guidance with respect to the dissemination and control of information within the scope of this Directive.

3. The Assistant Secretary of Defense (Public Affairs) shall provide necessary reviews to allow for marking technical documents with distribution statement A and shall provide such other assistance as may be necessary to ensure compliance with this Directive.

4. The General Counsel, Department of Defense shall assist in carrying out the provisions of this Directive by advising DoD Components with respect to the statutory and regulatory requirements governing the export or other dissemination of technical data.

5. Heads of DoD Components shall ensure that the provisions of this Directive are implemented within their respective Components in a uniform, consistent manner and shall establish procedures to ensure that technical documents are marked correctly.

F. PROCEDURES

1. All DoD Components generating or responsible for technical documents shall determine their distribution availability and mark them appropriately before primary distribution.

2. DoD distribution statement shall not be required on contractor technical proposals or similar documents submitted in anticipation of the award of contracts.

3. The distribution statement markings in this Directive shall be mandatory for all technical documents, including such informal documents as working papers, memoranda, and preliminary reports if those documents are not already in the public domain, and if they are likely to be disseminated outside of the Department of Defense.

4. Managers of technical programs shall assign an appropriate distribution statement to each technical document generated within their programs.

a. All unclassified DoD technical documents shall be assigned distribution statement A, B, C, D, E, F, or X (see enclosure 3).

b. Classified DoD technical documents may be assigned distribution statement B, C, D, E, or F when there is need to restrict dissemination beyond the limits provided by application of security clearance and "need-to-know" controls. The distribution statement assigned to a classified document shall be retained on the document after its declassification or until changed specifically or removed by the controlling DoD office. Technical documents that are declassified and have no distribution statement assigned will be handled as distribution statement F documents until changed by the controlling DoD office.

c. Scientific and technical documents that include a contractor imposed limited rights statement shall be marked and controlled in accordance with subsection 9-201(c) and 9-601(j) of the DoD Supplement to the Federal Acquisition Regulation.

d. For each newly generated technical document, managers of technical programs shall determine whether the document contains export-controlled technical data; DoD Directive 5230.25 (reference (f)) provides guidance for making this determination. Additional guidance may be obtained from component legal counsel. All documents that are found to contain export-controlled technical data shall be marked with the statement contained in paragraph 8 of enclosure 3, in addition to statement B, C, D, E, F, or X.

e. Technical documents in preliminary or working draft form shall not be disseminated without a proper security classification review and assignment of a distribution statement as required by this Directive.

5. Distribution statements shall remain in effect until changed or removed by the controlling DoD office. Each controlling DoD office shall establish and maintain a procedure to review technical documents for which it is responsible to increase their availability when conditions permit. The controlling DoD offices shall obtain public release determinations in accordance with DoD Directive 5230.9 (reference (g)). When public release clearance is obtained, the controlling DoD office shall assign distribution statement A, cancel any other distribution statement, and notify the cognizant document handling facilities.

6. Technical documents marked with superseded distribution statements shall be reviewed when a request for the document is received, and shall be assigned an appropriate distribution statement.

7. Technical documents in information repositories that have superseded distribution statements shall be converted as follows:

a. Documents bearing distribution statement A of B of DoD Directive 5200.20 (reference (a)) and documents bearing distribution statement A, B, C, D, E, or F contained in reference (b), need not be reevaluated.

b. Technical documents bearing distribution statement numbers 2, 3, 4, and 5 of superseded DoD Directive 5200.20, March 29, 1965 shall be assigned, respectively, distribution statements, C, B, E, and F.

8. Controlling DoD Offices shall notify the Defense Technical Information Center (DTIC) and other cognizant technical document dissemination facilities promptly when:

a. Addresses of designated controlling DoD offices are changed.

b. The controlling DoD office is redesignated.

c. Classification markings, distribution statements or export control statements are changed.

9. The distribution statement shall be displayed conspicuously on technical documents so as to be recognized readily by recipients.

a. For standard written or printed material.

(1) The distribution statement shall appear on each front cover, title page, and DD Form 1473, "Report Documentation Page."

(2) When possible, parts that contain information creating the requirement for a distribution statement shall be prepared as an appendix to permit broader distribution of the basic document.

(3) When practicable, the abstract of the document, the DD Form 1473 and bibliographic citations shall be written in such a way that the information will not be subject to distribution statement B, C, D, E, F, or X.

b. If the technical information is not prepared in the form of an ordinary document (such as this Directive) and does not have a cover or title page (such as forms and charts), the applicable distribution statement shall be stamped, printed, written, or affixed by other means in a conspicuous position.

REFERENCES, continued

(d) Executive Order 12470, "Continuation of Export Control Regulations," March 30, 1984

(e) Arms Export Control Act, Title 22, United States Code, Section 2751 *et seq*.

(f) DoD Directive 5230.25, "Withholding of Unclassified Technical Data From Public Disclosure", November 6, 1984

(g) DoD Directive 5230.9, "Clearance of DoD Information for Public Release," April 2, 1982

(h) DoD 5200.1-R, "Information Security Program Regulation," August 1982, authorized by DoD Directive 5200.1, June 7, 1982

(i) DoD Instruction 7930.2, "ADP Software Exchange and Release," December 31, 1979

(j) DoD 5220.22-M, "Industrial Security Manual for Safeguarding Classified Information," March 1984, authorized by DoD Directive 5200.22 December 8, 1980

(k) Federal Acquisition Regulation (FAR), Part 35, Subchapter F

DEFINITIONS

1. Contractor. An individual or organization outside the U.S. Government who has accepted any type of agreement or order to provide research, supplies, or services to a U.S. Government agency including both prime contractors and subcontractors.

a. Qualified U.S. Contractor. In accordance with DoD Directive 5230.25 (reference (f)), a private individual or enterprise located in the United States whose eligibility to obtain export controlled technical data has been established under procedures developed by the Under Secretary of Defense for Research and Engineering.

b. DoD Potential Contractor. An indiviudal or organization outside the Department of Defense declared eligible for DoD information services by a sponsoring DoD activity on the basis of participation in one of the following programs:

(1) The Department of the Army Qualitative Requirements Information Program.

(2) The Department of the Navy Industry Cooperative Research and Development Program.

(3) The Department of the Air Force Potential Contractor Program.

(4) The DoD Scientific and Technical Information Program, or

(5) Any similar program in use by other DoD Components.

2. Controlling DoD Office. The DoD activity that sponsored the work that generated the technical data or received the technical data on behalf of the Department of Defense and; therefore, has the responsibilty for determining the distribution of a document containing such technical data. In the case of joint sponsorship, the controlling office is determined by advance agreement and may be either a party, group, or committee representing the interested activities or DoD components.

3. Critical Technology. Technology that consists of:

(a) Arrays of design and manufacturing know-how (including technical data).

(b) Keystone manufacturing, inspection, and test equipment.

(c) Keystone materials.

(d) Goods accompanied by sophisticated operation, application, or maintenance know-how that would make a significant contribution to the military potential of any country or combination of countries and that may prove detrimental to the security of the United States (also referred to as militarily critical technology).

4. Distribution Statement. A statement used in marking a technical document to denote the extent of its availability for distribution, release, and

disclosure without additional approvals or authorizations. A distribution statement marking is distinct from and in addition to a security classification marking assigned in accordance with DoD 5200.1-R (reference (h)).

5. Document. Any recorded information regardless of its medium, physical form, or characteristics.

6. Foreign Government Information.

a. Information that is:

(1) Provided to the United States by a foreign government or governments, an international organization of governments, or any element thereof with the expectation either expressed or implied, that the information or the source of information, or both be held in confidence.

(2) Produced by the United States following or as a result of a joint arrangement with a foreign government or governments or an international organization of governments or any element thereof, requiring that the information or the arrangement or both be held in confidence.

b. Information described in subparagraphs 6(a)(1) and (2) above and in the possession of the Department of Defense is classified information in accordance with DoD 5200.1-R (reference (h).

7. Primary Distribution. The initial targeted distribution of or access to technical documents authorized by the controlling DoD office.

8. Scientific and Technical Information. Communicable knowledge or information resulting from or pertaining to conducting and managing a scientific or engineering research effort.

9. Secondary Distribution. Release of technical documents provided after primary distribution. It includes loaning, allowing the reading of, or releasing a document outright, in whole or in part.

10. Technical Data. Recorded information related to experimental, developmental, or engineering works that can be used to define an engineering or manufacturing process or to design, procure, produce, support, maintain, operate, repair, or overhaul material. The data may be graphic or pictorial delineations in media such as drawings or photographs, text in specifications or related performance or design type documents, or computer printouts. Examples of technical data include research and engineering data, engineering drawings, and associated lists, specifications, standards, process sheets, manuals, technical reports, catalog-item identifications, and related information and computer software documentation.

11. Technical Document. Any recorded information that conveys scientific and technical information or technical data.

12. Technical Information. Information, including scientific information, that relates to research, development, engineering, test, evaluation, production, operation, use, and maintenance of munitions and other military supplies and equipment.

DISTRIBUTION STATEMENTS

The following distribution statements are authorized for use on DoD technical documents.

1. DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

a. This statement may be used only on unclassified technical documents that have been cleared for public release by competent authority in accordance with DoD Directive 5230.9 (reference (g)).

b. Technical documents with this statement may be made available or sold to the public and foreign nationals, companies, and governments, and may be exported.

c. This statement may not be used on technical documents that formerly were classified unless such documents are cleared for public release in accordance with DoD Directive 5230.9 (reference (g)).

d. This statement will not be used on classified technical documents.

2. DISTRIBUTION STATEMENT B. Distribution authorized to U.S. Government agencies only (fill in reason) (date of determination). Other requests for this document shall be referred to (insert controlling DoD office).

a. This statement may be used on unclassified or classified technical documents, if necessary, to ensure distribution limitation in addition to need-to-know requirements imposed by DoD 5200.1-R (reference (h)), or in the event the document is declassified.

b. Reasons for assigning distribution statement B include:

Foreign Government Information	To protection and limit distribution in accordance with the desires of the foreign government that furnished the technical information. Information of this type normally is classified at the CONFIDENTIAL level or higher in accordance with DoD 5200.1-R (reference (h)).
Proprietary Information	To protect information not owned by the U.S. Government and protected by a contractor's "limited rights" statement, or received with the understanding that it not be routinely transmitted outside the U.S. Government.

Test and Evaluation	To protect results of test and evaluation of commercial products or military hardware when such disclosure may cause unfair advantage or disadvantage to the manufacturer of the product.
Contractor Performance Evaluation	To protect information in management reviews, records, of contract performance evaluation, or other advisory documents evaluating programs of contractors.
Administrative or Operational Use	To protect technical or operational data or information from automatic dissemination under the International Exchange Program or by other means. This protection covers publications required solely for official use or strictly for administrative or operational purposes. This statements may be applied to manuals, pamphlets, technical orders, technical reports and other publications containing valuable technical or operational data.
Software Documentation	Releasable only in accordance with the provisions of DoD Instruction 7930.2 (reference (i)).
Specific Authority	To protect information not specifically included in the above reasons and discussions, but which requires protection in accordance with valid documented authority such as Executive Orders, classification guidelines, DoD or DoD Component regulatory documents. When filling in the reason, cite "Specific Authority (identification of valid documented authority)."

3. DISTRIBUTION STATEMENT C. Distribution authorized to U.S. Government agencies and their contractors (fill in reason) (date of determination). Other requests for this document shall be referred to (insert controlling DoD office).

a. May be used on unclassified technical documents or on classified technical documents, if necessary, to ensure distribution limitation in addition to need-to-know requirements imposed by DoD 5200.1-R (reference (h)) or in the event the document is declassified.

b. Reasons for assigning distribution statement C include:

Critical Technology	To protect information and technical data that advance current technology or describe new technology in an area of significant or potentially significant military application or that relate to a specific military deficiency of a potential adversary.
Administrative or Operational Use	Same as distribution statement B.
Specific Authority	Same as distribution statement B.

4. <u>DISTRIBUTION STATEMENT D</u>. Distribution authorized to the Department of Defense and DoD contractors only (fill in reason) (date of determination). Other requests shall be referred to (insert controlling DoD office).

a. May be used on unclassified technical documents or on classified technical documents, if necessary, to ensure distribution limitation in addition to need-to-know requirements imposed by DoD 5200.1-R (reference (h)) or in the event the document is declassified.

b. Reasons for assigning distribution statement D include:

Premature Dissemination	To protect information on systems or hardware in the developmental or concept stage to prevent premature dissemination.
Software Documentation	Same as distribution statement B.
Critical Technology	Same as distribution statement C.
Specific Authority	Same as distribution statement B.

5. <u>DISTRIBUTION STATEMENT E</u>. Distribution authorized to DoD Components only (fill in reason) (date of determination). Other requests shall be referred to (insert controlling DoD office).

a. May be used on unclassified technical documents or on classified technical documents, if necessary, to ensure distribution limitation in addition to need-to-know requirements imposed by DoD 5200.1-R (reference (i)) or in the event the document is declassified.

b. Reasons for assigning distribution statement E include:

Export Limitations	Document contains export-controlled technical data which has been designated by competent authority in accordance with DoD Directive 5230.25 (reference f) to be of such significance for military purposes that release for purposes other than

	direct support of DoD-approved activities may jeopardize an important technological or operational military advantage of the United States.
Foreign Government Information	Same as distribution statement B.
Premature Dissemination	Same as distribution statement D.
Software Documentation	Same as distribution statement B.
Critical Technology	Same as distribution statement C.
Specific Authority	Same as distribution statement B.

6. <u>DISTRIBUTION STATEMENT F</u>. Further dissemination only as directed by (inserting controlling DoD office) (date of determination) or higher DoD authority.

a. Normally used only on classified technical documents, but may be used on unclassified technical documents when specific authority exists.

b. Distribution statement F is used when the DoD originator determines that information is subject to special dissemination limitation specified by paragraph 4-505, DoD 5200.1-R (reference (h)).

c. When a classified document assigned distribution statement F is declassified, the statement shall be retained until the controlling DoD office assigns the proper distribution statement from this Directive.

7. <u>DISTRIBUTION STATEMENT X</u>. Distribution authorized to U.S. Government agencies and private individuals or enterprises eligible to obtain export-controlled technical data in accordance with regulations implementing 10 U.S.C. 140c (date of determination). Other requests must be referred to (insert controlling DoD office).

a. This statement shall be used on unclassified documents when distribution statements B, C, D, E or F are not applicable, but the document does contain technical data as explained in DoD Directive 5230.25 (reference (f)).

b. This statement shall not be used on classified technical documents; however, it may be assigned to technical documents that formerly were classified.

8. <u>ADDITIONAL NOTICES</u>. In addition to the distribution statement, the following notices will be used when appropriate:

a. All technical documents that are determined to contain export-controlled technical data will be marked "<u>WARNING</u> - This document contains technical data whose export is restricted by the Arms Export Control Act (Title 22, U.S.C., Sec 2751 <u>et seq</u>.) or Executive Order 12470. Violation of these export laws are subject to severe criminal penalties."

b. All technical documents marked with distribution statements B, C, D, E, F, or X will also be marked "DESTRUCTION NOTICE - For classified documents, follow the procedures in DoD 5200.22-M, Industrial Security Manual, Section II-19 or DoD 5200.1-R, Information Security Program Regulation, Chapter IX. For unclassified, limited documents, destroy by any method that will prevent disclosure of contents or reconstruction of the document."

CONTRACTOR-IMPOSED DISTRIBUTION STATEMENTS

1. Part 35, Subchapter F of the Federal Acquisition Regulation (FAR) (reference (k)), stipulates control procedures for contractor-controlled technical data to which the Government has limited rights. In this case an approved statement from the FAR shall appear on all copies of each document. Unmarked or improperly marked technical documents supplied by a contractor shall be handled in accordance with the FAR. Limited rights information shall be assigned distribution statement B.

2. The limited rights statement shall remain in effect until changed or canceled under contract terms or with the permission of the contractor, and until the controlling DoD Component notifies recipients of the document that the statement may be changed or canceled. Upon cancellation of the statement, the distribution, disclosure, or release of the technical document then shall be controlled by its security classification or, if unclassified, by the appropriate statement selected from this Directive.

3. Reference (k) defines limited rights as the right to use, duplicate, or disclosure technical data in whole or in part, by or for the U.S. Government with the expressed limitation that such technical data, without the written permission of the party furnishing such technical data, may not be:

a. Released or disclosed in whole or in part outside the Government.

b. Used in whole or in part by the Government for manufacture, or in the case of computer software documentation, for reproduction of the computer software.

c. Used by a party other than the Government, except for:

(1) Emergency repair or overhaul work only by or for the Government, when the item or process concerned is not otherwise reasonably available to enable timely performance of the work, provided that the release or disclosure thereof outside the Government shall be made subject to a prohibition against further use, release, or disclosure, or

(2) Release to a foreign government, as the interest of the United States may require, only for information or evaluation within such government or for emergency repair or overhaul work by or for such government under the conditions of subparagraph 3.c.(1), above.

G. **EFFECTIVE DATE AND IMPLEMENTATION**

This Directive is effective immediately. Forward one copy of implementing documents to the Under Secretary of Defense for Research and Engineering within 120 days.

William H. Taft

William H. Taft, IV
Deputy Secretary of Defense

Enclosures - 4
1. References
2. Definitions
3. Distribution Statements
4. Contractor-Imposed Distribution Statements

Department of Defense

DIRECTIVE

November 6, 1984
NUMBER 5230.25

USDR&E

SUBJECT: Withholding of Unclassified Technical Data From Public Disclosure

References: (a) Title 10, United States Code, Section 140c, as added by Public Law 98-94, "Department of Defense Authorization Act, 1984," Section 1217, September 24, 1983
(b) Executive Order 12470, "Continuation of Export Control Regulations," March 30, 1984
(c) Public Law 90-629, "Arms Export Control Act," as amended (22 U.S.C. 2751 <u>et seq</u>.)
(d) through (n), see enclosure 1

A. PURPOSE

Under reference (a), this Directive establishes policy, prescribes procedures, and assigns responsibilities for the dissemination and withholding of technical data.

B. APPLICABILITY AND SCOPE

1. Reference (a) applies to all unclassified technical data with military or space application in the possession of, or under the control of, a DoD Component which may not be exported lawfully without an approval, authorization, or license under E.O. 12470 (reference (b)) or the Arms Export Control Act (reference (c)). However, the application of this Directive is limited only to such technical data that disclose critical technology with military or space application. The release of other technical data shall be accomplished in accordance with DoD Instruction 5200.21 (reference (d)) and DoD 5400.7-R (reference (e)).

2. This Directive:

a. Applies to the Office of the Secretary of Defense (OSD) and activities supported administratively by OSD, the Military Departments, the Organization of the Joint Chiefs of Staff, the Defense Agencies, and the Unified and Specified Commands (hereafter referred to collectively as "DoD Components").

b. Does not modify or supplant the regulations promulgated under E.O. 12470 (reference (b)) or the Arms Export Control Act (reference (c)) governing the export of technical data, that is, 15 CFR 379 of the Export Administration Regulations (EAR) (reference (f)) and 22 CFR 125 of the International Traffic in Arms Regulations (ITAR) (reference (g)).

c. Does not introduce any additional controls on the dissemination of technical data by private enterprises or individuals beyond those specified by export control laws and regulations or in contracts or other mutual agreements, including certifications made pursuant to subsection C.2., below. Accordingly, the mere fact that the Department of Defense may possess such data does not in itself provide a basis for control of such data pursuant to this Directive.

d. Does not introduce any controls on the dissemination of scientific, educational, or other data that qualify for General License GTDA under subsection 379.3 of the EAR (reference (f)) (see enclosure 3) or for general exemptions under subsection 125.11 of the ITAR (reference (g)) (see enclosure 4).

e. Does not alter the responsibilities of DoD Components to protect proprietary data of a private party in which the Department of Defense has "limited rights" or "restricted rights" (as defined in subsections 9-201(c) and 9-601(j) of the DoD Federal Acquisition Regulation Supplement, reference (h)) or which are authorized to be withheld from public disclosure under 5 U.S.C. 552(b)(4) (reference (i)).

f. Does not pertain to, or affect, the release of technical data by DoD Components to foreign governments, international organizations, or their respective representatives or contractors, pursuant to official agreements or formal arrangements with the U.S. Government, or pursuant to U.S. Government-licensed transactions involving such entities or individuals. In the absence of such U.S. Government-sanctioned relationships, however, this Directive does apply.

g. Does not apply to classified technical data. After declassification, however, dissemination of such data that are within the scope of subsection B.1., above, is governed by this Directive.

C. DEFINITIONS

1. Except for the definition in subsection C.2., terms used in this Directive are defined in enclosure 2.

2. Qualified U.S. contractor.[1] A private individual or enterprise (hereinafter described as a "U.S. contractor") that, in accordance with procedures established by the Under Secretary of Defense for Research and Engineering, certifies, as a condition of obtaining export-controlled technical data subject to this Directive from the Department of Defense, that:

a. The individual who will act as recipient of the export-controlled technical data on behalf of the U.S. contractor is a U.S. citizen or a person admitted lawfully into the United States for permanent residence and is located in the United States.

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[1] Canadian contractors may be qualified in accordance with this Directive for technical data that do not require a license for export to Canada under section 125.12 of the ITAR (reference (g)) and section 379.4(d) and 379.5(e) of the EAR (reference (f)) by submitting an equivalent certification to the U.S. Department of Defense.

b. Such data are needed to bid or perform on a contract with the Depar ment of Defense, or other U.S. Government agency, or for other legitimate busin purposes[2] in which the U.S. contractor is engaged, or plans to engage. The purpose for which the data are needed shall be described sufficiently in such certi fication to permit an evaluation of whether subsequent requests for data, pursu to subsection E.4.b., above, are related properly to such business purpose.

c. The U.S. contractor acknowledges its responsibilities under U.S. export control laws and regulations (including the obligation, under certain circumstances, to obtain an export license prior to the release of technical data within the United States) and agrees that it will not disseminate any export-controlled technical data subject to this Directive in a manner that would violate applicable export control laws and regulations.

d. The U.S. contractor also agrees that, unless dissemination is permitted by subsection E.8., below, it will not provide access to export-controlle technical data subject to this Directive to persons other than its employees or persons acting on its behalf, without the permission of the DoD Component that provided the technical data.

e. To the best of its knowledge and belief, the U.S. contractor knows of no person employed by it, or acting on its behalf, who will have access to such data, who is debarred, suspended, or otherwise ineligible from performing on U.S. Government contracts; or has violated U.S. export control laws or a certification previously made to the Department of Defense under the provisions of this Directive.

f. The U.S. contractor itself is not debarred, suspended, or otherwise determined ineligible by any agency of the U.S. Government to perform on U.S. Government contracts, has not been convicted of export control law violations, and has not been disqualified under the provisions of this Directive.

When the certifications required by subsections C.2.e. and f., above, cannot be made truthfully, the U.S. contractor may request the certification be accepted based on its description of extenuating circumstances.

D. POLICY

1. In accordance with 10 U.S.C. 140c (reference (a)), the Secretary of Defense may withhold from public disclosure, notwithstanding any other provision of law, any technical data with military or space application in the possession of, or under the control of, the Department of Defense, if such data may not be exported lawfully without an approval, authorization, or license under E.O. 12470 (reference (b)) or the Arms Export Control Act (reference (c)). However, technical data may not be withheld under this section if regulations promulgated under either the Order or Act authorize the export of such data pursuant to a general, unrestricted license or exemption in such regulations. (Pertinent portions of such regulations are set forth at enclosures 3 and 4.)

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[2] This does not require a contract with or a grant from the U.S. Government.

2. Because public disclosure of technical data subject to this Directive is tantamount to providing uncontrolled foreign access, withholding such data from public disclosure, unless approved, authorized, or licensed in accordance with export control laws, is necessary and in the national interest. Unclassified technical data that are not governed by this Directive, unless otherwise restricted, shall continue to be made available to the public as well as to state and local governments.

3. Notwithstanding the authority provided in subsection D.1., above, it is DoD policy to provide technical data governed by this Directive to individuals and enterprises that are determined to be currently qualified U.S. contractors, when such data relate to a legitimate business purpose for which the contractor is certified. However, when such data are for a purpose other than to permit the requester to bid or perform on a contract with the Department of Defense, or other U.S Government agency, and the significance of such data for military purposes is such that release for purposes other than direct support of DoD activities may jeopardize an important U.S. technological or operational advantage, those data shall be withheld in such cases.

4. This Directive may not be used by DoD Components as authority to deny access to technical data to the Congress, or to any Federal, State, or local governmental agency that requires such data for regulatory or other official governmental purposes. Any such dissemination will include a statement that the technical data are controlled by the Department of Defense in accordance with this Directive.

5. The authority provided herein may not be used to withhold from public disclosure unclassified information regarding DoD operations, policies, activities, or programs, including the costs and evaluations of performance and reliability of military and space equipment. When such information does contain technical data subject to this Directive, the technical data shall be excised from that which is disclosed publicly.

6. This Directive may not be used as a basis for the release of "limited rights" or "restricted rights" data as defined in subsections 9-201(c) and 9-601(j) of the DoD Federal Acquisition Regulation Supplement (reference (h)) or that are authorized to be withheld from public disclosure under the Freedom of Information Act (FOIA) (reference (i)).

7. This Directive may not be used to provide protection for technical data that should be classified in accordance with E.O. 12356 and DoD 5200.1-R (references (j) and (k)).

8. This Directive provides immediate authority to cite 5 U.S.C. 552(b)(3) (reference (i)) as the basis for denials under the FOIA (reference (i)) of technical data currently determined to be subject to the provisions of this Directive.

E. PROCEDURES

All determinations to disseminate or withhold technical data subject to this Directive shall be consistent both with the policies set forth in section D., above, and with the following procedures:

1. Requests for technical data shall be processed in accordance with DoD Directive 5230.24 and DoD Instruction 5200.21 (references (l) and (d)). FOIA (reference (i)) requests for technical data subject to this Directive shall be handled in accordance with the procedures established in DoD 5400.7-R (reference (e)). Such FOIA requests for technical data currently determined to be subject to the withholding authority effected by this Directive shall be denied under reference (i), citing the third exemption to mandatory disclosure, and the requester shall be referred to the provisions of this Directive permitting access by qualified U.S. contractors.

2. Upon receipt of a request for technical data in the possession of, or under the control of, the Department of Defense, the controlling DoD office shall determine whether such data are governed by this Directive. The determination shall be based on the following:

a. The office's finding[3] that such data would require an approval, authorization, or license for export under E.O. 12470 (reference (b)) or the Arms Export Control Act (reference (c)), and that such data may not be exported pursuant to a general, unrestricted license (section 379.3, EAR (reference (f)) (see enclosure 3) or exemption (section 125.11, ITAR (reference (g)) (see enclosure 4).

b. The office's judgment that the technical data under consideration disclose critical technology with military or space application. For purposes of making this determination, the Militarily Critical Technologies List (MCTL) (reference (m)) shall be used as general guidance. The controlling DoD office may request assistance in making such a determination from the Office of the Under Secretary of Defense for Research and Engineering (OUSDR&E) in accordance with procedures established by that office.

3. The controlling DoD office shall ensure that technical data determined to be governed by this Directive are marked in accordance with DoD Directive 5230.24 (reference (l)).

4. The controlling DoD office shall authorize release of technical data governed by this Directive to currently qualified U.S. contractors only, as defined in subsection C.2., above, unless one of the apply:

a. The qualification of the U.S. contractor concerned has been temporarily revoked in accordance with subsection E.5., below; or

b. The requested data are judged to be unrelated to the purpose for which the qualified U.S. contractor is certified. When release of technical data is denied in accordance with this subsection, the controlling DoD office shall request additional information sufficient to explain the intended use of the requested data and, if appropriate, request a new certification (see subsection C.2., above) describing the intended use of the requested data; or

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[3] May require consultation with the Department of State or the Department of Commerce, as appropriate.

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c. The technical data are being requested for a purpose other than to permit the requester to bid or perform on a contract with the Department of Defense or other U.S. Government agency, in which case the controlling DoD office shall withhold such data if it has been determined by the DoD Component focal point (see paragraph F.5.c., below) that the significance of such data for military purposes is such that release for purposes other than direct support of DoD-approved activities may jeopardize an important technological or operational military advantage of the United States.

5. Upon receipt of credible and sufficient information that a qualified U.S. contractor has (a) violated U.S. export control law, (b) violated its certification, (c) made a certification in bad faith, or (d) made an omission or misstatement of material fact, the DoD Component shall revoke temporarily the U.S. contractor's qualification. Such revocations having the potential for compromising a U.S. Government investigation may be delayed. Immediately upon such revocation, the DoD Component shall notify the contractor and the OUSDR&E. Such contractor shall be given an opportunity to respond in writing to the information upon which the temporary revocation is based before being disqualified. Any U.S. contractor whose qualification has been revoked temporarily may be reinstated upon presentation of sufficient information showing that the basis for such revocation was in error or has been remedied.

6. When the basis for a contractor's temporary revocation cannot be removed within 20 working days, the DoD Component shall recommend to the OUSDR&E that the contractor be disqualified.

7. Charges for copying, certifying, and searching records rendered to requesters shall be levied in accordance with DoD Instruction 7230.7 (reference (n)). Normally, only one copy of the same record or document will be provided to each requester. Any release to qualified U.S. contractors of technical data controlled by this Directive shall be accompanied by a notice to the recipient as set forth in enclosure 5.

8. Qualified U.S. contractors who receive technical data governed by this Directive may disseminate such data for purposes consistent with their certification without the prior permission of the controlling DoD office or when such dissemination is:

a. To any foreign recipient for which the data are approved, authorized, or licensed under E.O. 12470 (reference (b)), or the Arms Export Control Act (reference (c)).

b. To another currently qualified U.S. contractor (as defined in subsection C.2., above, including existing or potential subcontractors, but only within the scope of the certified legitimate business purpose of such recipient.

c. To the Departments of State and Commerce, for purposes of applying for appropriate approvals, authorizations, or licenses for export under the Arms Export Control Act (reference (c)) or E.O. 12470 (reference (b)). Any such application shall include a statement that the technical data for which such approval, authorization, or license is sought are controlled by the Department of Defense in accordance with this Directive.

d. To Congress or any Federal, State, or local governmental agency for regulatory purposes, or otherwise as may be required by law or court order. Any such dissemination shall include a statement that the technical data are controlled by the Department of Defense in accordance with this Directive.

9. A qualified U.S. contractor desiring to disseminate technical data subject to this Directive in a manner not permitted expressly by the terms of this Directive shall seek authority to do so from the controlling DoD office.

10. Any requester denied technical data, or any qualified U.S. contractor denied permission to redisseminate such data, pursuant to this Directive, shall be provided promptly a written statement of reasons for that action, and advised of the right to make a written appeal of such determination to a specifically identified appellate authority within the DoD Component. Appeals of denials made under DoD 5400.7-R (reference (e)) shall be handled in accordance with procedures established therein. Other appeals shall be processed as directed by the OUSDR&E.

11. Denials shall cite 10 U.S.C. 140c (reference (a)) as implemented by this Directive, and, in the case of FOIA (reference (i)) denials made in reliance on this statutory authority, 5 U.S.C. 552(b)(3) (reference (i)). Implementing procedures shall provide for resolution of any appeal within 20 working days.

F. RESPONSIBILITIES

1. The Under Secretary of Defense for Research and Engineering (USDR&E) shall have overall responsibility for the implementation of this Directive and shall designate an office to:

a. Administer and monitor compliance with this Directive.

b. Receive and disseminate notifications of temporary revocation in accordance with subsection E.5., above.

c. Receive recommendations for disqualification made in accordance with subsection E.6., above, and act as initial disqualification authority.

d. Provide, when necessary, technical assistance to DoD Components in assessing the significance of the military or space application of technical data that may be withheld from public disclosure under this Directive.

e. Establish procedures to develop, collect, and disseminate certification statements and ensure their sufficiency, accuracy, and periodic renewal, and to make final determinations of qualification.

f. Ensure that the requirements of this Directive are incorporated into the DoD Federal Acquisition Regulation Supplement (reference (h)) for optional application to contracts involving technical data governed by this Directive.

g. Develop, in conjunction with the General Counsel, Department of Defense, guidelines for responding to appeals.

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h. Develop procedures to ensure that DoD Components apply consistent criteria in authorizing exceptions under subsection E.9., above.

i. Establish procedures and appropriate mechanisms for the certification of qualified U.S. contractors, pursuant to subsection F.1.e., above, within 60 days of the effective date of this Directive. During this 60-day period, requests for technical data governed by this Directive shall be processed in accordance with procedures in effect before the promulgation of this Directive.

j. Take such other actions that may be required to ensure consistent and appropriate implementation of this Directive within the Department of Defense.

2. The Under Secretary of Defense for Policy shall:

a. Develop and promulgate, as required, policy guidance to DoD Components for implementing this Directive.

b. Develop procedures with the Departments of State and Commerce to ensure referral of export cases involving technical data governed by this Directive to the Department of Defense.

3. The Assistant Secretary of Defense (Public Affairs) shall:

a. Monitor the implementation of provisions of this Directive that pertain to DoD 5400.7-R (reference (e)).

b. Provide such other assistance as may be necessary to ensure compliance with this Directive.

4. The General Counsel, Department of Defense, shall:

a. Assist in carrying out the provisions of this Directive by advising DoD Components with respect to the statutory and regulatory requirements governing the export of technical data.

b. Advise the USDR&E regarding consistent and appropriate implementation of this Directive.

5. The Heads of DoD Components shall:

a. As the delegated authority, have the option to redelegate the authority to withhold technical data in accordance with this Directive.

b. Disseminate and withhold from public disclosure technical data subject to this Directive in a manner consistent with the policies and procedures set forth herein.

c. Designate a focal point to (1) ensure implementation of this Directive; (2) identify classes of technical data the release of which is governed by paragraph E.4.c., above; (3) act on appeals relating to case-by-case denials of technical data; (4) suspend a contractor's qualification pursuant

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to subsection E.5., above; (5) receive and evaluate requests for reinstatement of a contractor's qualification; and, when appropriate, (6) recommend disqualification to the OUSDR&E.

d. Promulgate and effect regulations to implement this Directive within 180 days.

e. Disseminate technical data governed by this Directive in the manner prescribed herein, to the extent feasible, during the period after which certification procedures have been established under paragraph F.1.i., above, but before DoD Components have issued implementing regulations under paragraph F.5.d., above. However, if such dissemination is not feasible, the DoD Component may process requests for such data in accordance with procedures in effect before the promulgation of this Directive.

G. EFFECTIVE DATE AND IMPLEMENTATION

This Directive is effective immediately. Forward two copies of implementing documents to the Under Secretary of Defense for (Research and Engineering) within 180 days.

Caspar W. Weinberger
Secretary of Defense

Enclosures - 5
1. References
2. Definitions
3. Pertinent Portions of Export Administration Regulations (EAR)
4. Pertinent Portions of International Traffic in Arms Regulations (ITAR)
5. Notice to Accompany the Dissemination of Export-controlled Technical Data

REFERENCES, continued

(d) DoD Instruction 5200.21, "Dissemination of DoD Technical Information," September 27, 1979
(e) DoD 5400.7-R, "DoD Freedom of Information Act Program," December 1980, authorized by DoD Directive 5400.7, March 24, 1980
(f) Export Administration Regulations
(g) International Traffic in Arms Regulations
(h) DoD Federal Acquisition Regulation Supplement, authorized by DoD Directive 5000.35, "Defense Acquisition Regulatory System," March 8, 1978
(i) Public Law 89-487, "Freedom of Information Act," as amended (5 U.S.C. 552(b)(3) and (4))
(j) Executive Order 12356, "National Security Information," April 2, 1982
(k) DoD 5200.1-R, "Information Security Program Regulation," August 1982, authorized by DoD Directive 5200.1, June 7, 1982
(l) DoD Directive 5230.24, "Distribution Statements on Technical Documents," November , 1984
(m) Militarily Critical Technologies List, October 1984
(n) DoD Instruction 7230.7, "User Charges," June 12, 1979

DEFINITIONS, continued

1. Controlling DoD Office. The DoD activity that sponsored the work that generated the technical data or received the technical data on behalf of the Department of Defense and therefore has the responsibility for determining the distribution of a document containing such technical data. In the case of joint sponsorship, the controlling office is determined by advance agreement and may be either a party, a group, or a committee representing the interested activities or DoD Components. (The controlling DoD office is identified on each export-controlled document in accordance with DoD Directive 5230.24, reference (l).)

2. Critical Technology. Technologies that consist of (a) arrays of design and manufacturing know-how (including technical data); (b) keystone manufacturing, inspection, and test equipment; (c) keystone materials; and (d) goods accompanied by sophisticated operation, application, or maintenance know-how that would make a significant contribution to the military potential of any country or combination of countries and that may prove detrimental to the security of the United States (also referred to as militarily critical technology).

3. Other Legitimate Business Purposes. Include:

a. Providing or seeking to provide equipment or technology to a foreign government with the approval of the U.S. Government (for example, through a licensed direct foreign military sale).

b. Bidding, or preparing to bid, on a sale of surplus property.

c. Selling or producing products for the commercial domestic marketplace or for the commercial foreign marketplace, providing that any required export license is obtained.

d. Engaging in scientific research in a professional capacity.

e. Acting as a subcontractor to a concern described in (a) through (d) above; or

f. Selling technical data subject to this Directive in support of DoD contractors or in support of the competitive process for DoD contracts, provided such sales are limited solely to DoD contractors or potential DoD contractors who also are qualified U.S. contractors and provided such technical data are related to the purpose for which the qualified U.S. contractor is certified, or selling technical data to foreign contractors or governments overseas after receiving the required export license or approval by the U.S. Government.

4. Potential DoD Contractor. An individual or organization outside the Department of Defense declared eligible for DoD information services by a sponsoring DoD activity on the basis of participation in one of the following programs:

a. The Department of the Army Qualitative Requirements Information Program.

b. The Department of the Navy Industry Cooperative Research and Development Program.

c. The Department of the Air Force Potential Contractor Program.

d. The DoD Scientific and Technical Information Program; or

e. Any similar program in use by other DoD Components.

5. Public Disclosure. Making technical data available without restricting its dissemination or use.

6. Technical Data with Military or Space Application, or Technical Data. Any blueprints, drawings, plans, instructions, computer software and documentation, or other technical information that can be used or be adapted for use to design, engineer, produce, manufacture, operate, repair, overhaul, or reproduce any military or space equipment or technology concerning such equipment.

7. United States. For the purpose of this Directive, the 50 States, the District of Columbia, and the territories and possessions of the United States.

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PERTINENT PORTIONS OF EXPORT ADMINISTRATION REGULATIONS (EAR)

The following pertinent section of the EAR is provided for the guidance of DoD personnel in determining the releasability of technical data under the authority of this Directive.

Export Administration Regulations Section 379.3

"General License GTDA: Technical Data Available to All Destinations

"A General License designated GTDA is hereby established authorizing the export to all destinations of technical data described in § 379.3(a), (b), or (c), below:

"(a) Data Generally Available

"Data that have been made generally available to the public in any form, including -

"(1) Data released orally or visually at open conferences, lectures, trade shows, or other media open to the public; and

"(2) Publications that may be purchased without restrictions at a nominal cost, or obtained without costs, or are readily available at libraries open to the public.

"The term 'nominal cost' as used in §379.3(a)(2), above, is intended to reflect realistically only the cost of preparing and distributing the publication and not the intrinsic value of the technical data. If the cost is such as to prevent the technical data from being generally available to the public, General License GTDA would not be applicable.

"(b) Scientific or Educational Data

"(1) Dissemination of information not directly and significantly related to design, production, or utilization in industrial processes, including such dissemination by correspondence, attendance at, or participation in, meetings; or

"(2) Instruction in academic institutions and academic laboratories, excluding information that involves research under contract related directly and significantly to design, production, or utilization in industrial processes.

"(c) Patent Applications

"Data contained in a patent application, prepared wholly from foreign-origin technical data where such application is being sent to the foreign inventor to be executed and returned to the United States for subsequent filing in the U.S. Patent and Trademark Office. (No validated export license from the Office of Export Administration is required for data contained in a patent application, or an amendment, modification, supplement, or division thereof for filing in a foreign country in accordance with the regulations of the Patent and Trademark Office 37 CFR Part 5. See § 370.10(j).)"

PERTINENT PORTIONS OF INTERNATIONAL TRAFFIC IN ARMS REGULATIONS (ITAR)

The following pertinent section of the ITAR is provided for the guidance of DoD personnel in determining the releasability of technical data under the authority of this Directive.

International Traffic in Arms Regulations Section 125.11
"General Exemptions

"(a) Except as provided in § 126.01, district directors of customs and postal authorities are authorized to permit the export without a license of unclassified technical data as follows:

"(1) If it is in published[4] form and subject to public dissemination by being:

"(i) Sold at newsstands and bookstores;

"(ii) Available by subscription or purchase without restrictions to any person or available without cost to any person;

"(iii) Granted second class mailing privileges by the U.S. Government; or,

"(iv) Freely available at public libraries.

"(2) If it has been approved for public release by any U.S. Government department or agency having authority to classify information or material under Executive Order [12356], as amended, and other applicable Executive Orders, and does not disclose the details of design, production, or manufacture of any arms, ammunition, or implements of war on the U.S. Munitions List.

"(3) If the export is in furtherance of a manufacturing licence or technical assistant agreement approved by the Department of State in accordance with Part 124 of this subchapter.

"(4) If the export is in furtherance of a contract with an agency of the U.S. Government or a contract between an agency of the U.S. Government and foreign persons, provided the contract calls for the export of relevant unclassified technical data, and such data are being exported only by the prime contractor. Such data shall not disclose the details of development, engineering, design, production, or manufacture of any arms, ammunition, or implements of war on the U.S. Munitions List. (This exemption does not permit the prime contractor to enter into subsidiary technical assistance or manufacturing license agreements, or any arrangement which calls for the exportation of technical data without compliance with Part 124 of this subchapter.)

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[4] "The burden for obtaining appropriate U.S. Government approval for the publication of technical data falling within the definition in § 125.01, including such data as may be developed under other than U.S. Government contract, is on the person or company seeking publication.

"(5) If it relates to firearms not in excess of caliber .50 and ammunition for such weapons, except technical data containing advanced designs, processes, and manufacturing techniques.

"(6) If it consists of technical data, other than design, development, or production information relating to equipment, the export of which has been previously authorized to the same recipient.

"(7) If it consists of operations, maintenance and training manuals, and aids relating to equipment, the export of which has been authorized to the same recipient.[5]

"(8) If it consists of additional copies of technical data previously approved for export to the same recipient; or if it consists of revised copies of technical data, provided it pertains to the identical Munitions List article, and the revisions are solely editorial and do not add to the content of technology previously approved for export to the same recipient.

"(9) If it consists solely of technical data being reexported to the original source of import.

"(10) If the export is by the prime contractor in direct support and within the technical and/or product limitations of a 'U.S. Government approved project' and the prime contractor so certifies. The Office of Munitions Control, Department of State, will verify, upon request, those projects which are 'U.S. Government approved,' and accord an exemption to the applicant who applies for such verification and exemption, where appropriate, under this subparagraph.[6]

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[5] "Not applicable to technical data relating to Category VI(d) and Category XVI.

[6] "Classified information may also be transmitted in direct support of and within the technical and/or product limitation of such verified U.S. Government approved projects without prior Department of State approval provided the U.S. party so certifies and complies with the requirements of the Department of Defense Industrial Security Manual relating to the transmission of such classified information (and any other requirements of cognizant U.S. Government departments or agencies).

"(11) If the export is solely for the use of American citizen employees of U.S. firms provided the U.S. firm certifies its overseas employee is a U.S. citizen and has a 'need to know.'[7]

"(12) If the export is directly related to classified information, the export of which has been previously authorized to the same recipient, and does not disclose the details of design, production, or manufacture of any arms, ammunition, or implements of war on the U.S. Munitions List.

"(b) Plant visits. Except as restricted by the provisions of § 126.01 of this subchapter:

"(1) No license shall be required for the oral and visual disclosure of unclassified technical data during the course of a plant visit by foreign nationals provided the data [are] disclosed in connection with a classified plant visit or the visit has the approval of a U.S. Government agency having authority for the classification of information or material under Executive Order [12356], as amended, and other applicable Executive Orders, and the requirements of section V, paragraph [41(d)] of the Industrial Security Manual are met.

"(2) No license shall be required for the documentary disclosure of unclassified technical data during the course of a plant visit by foreign nationals provided the document does not contain technical data as defined in § 125.01 in excess of that released orally or visually during the visit, is within the terms of the approved visit request, and the person in the United States assures that the technical data will not be used, adapted for use, or disclosed to others for the purpose of manufacture or production without the prior approval of the Department of State in accordance with Part 124 of this subchapter.

"(3) No Department of State approval is required for the disclosure of oral and visual classified information during the course of a plant visit by foreign nationals provided the visit has been approved by the cognizant U.S. Defense agency and the requirements of section V, paragraph [41(d)] of the Defense Industrial Security Manual are met."

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[7] "Classified information may also be exported to such certified American citizen employees without prior Department of State approval provided the U.S. party complies with the requirements of the Department of Defense Industrial Security Manual relating to the transmission of such classified information (and any other requirements of cognizant U.S. Government departments or agencies). Such technical data or information (classified or unclassified) shall not be released by oral, visual, or documentary means to any foreign person.

NOTICE TO ACCOMPANY THE DISSEMINATION OF EXPORT-CONTROLLED TECHNICAL DATA

1. Export of information contained herein, which includes, in some circumstances, release to foreign nationals within the United States, without first obtaining approval or license from the Department of State for items controlled by the International Traffic in Arms Regulations (ITAR), or the Department of Commerce for items controlled by the Export Administration Regulations (EAR), may constitute a violation of law.

2. Under 22 U.S.C. 2778 the penalty for unlawful export of items or information controlled under the ITAR is up to 2 years imprisonment, or a fine of $100,000, or both. Under 50 U.S.C., Appendix 2410, the penalty for unlawful export of items or information controlled under the EAR is a fine of up to $1,000,000, or five times the value of the exports, whichever is greater; or for an individual, imprisonment of up to 10 years, or a fine of up to $250,000, or both.

3. In accordance with your certification that establishes you as a "qualified U.S. contractor," unauthorized dissemination of this information is prohibited and may result in disqualification as a qualified U.S. contractor, and may be considered in determining your eligibility for future contracts with the Department of Defense.

4. The U.S. Government assumes no liability for direct patent infringement, or contributory patent infringement or misuse of technical data.

5. The U.S. Government does not warrant the adequacy, accuracy, currency, or completeness of the technical data.

6. The U.S. Government assumes no liability for loss, damage, or injury resulting from manufacture or use for any purpose of any product, article, system, or material involving reliance upon any or all technical data furnished in response to the request for technical data.

7. If the technical data furnished by the Government will be used for commercial manufacturing or other profit potential, a license for such use may be necessary. Any payments made in support of the request for data do not include or involve any license rights.

8. A copy of this notice shall be provided with any partial or complete reproduction of these data that are provided to qualified U.S. contractors.

April 2, 1982
NUMBER 5230.9

ASD(PA)

Department of Defense Directive

SUBJECT: Clearance of DoD Information for Public Release

References: (a) DoD Directive 5230.9, "Clearance of Department of Defense Public Information," December 24, 1966 (hereby canceled)
(b) Acting Assistant Secretary of Defense (Health Affairs) Memorandum, "Public Affairs Procedures," August 7, 1970 (hereby canceled)
(c) DoD Directive 5400.7, "DoD Freedom of Information Act Program," March 24, 1980
(d) through (l), see enclosure 1

A. REISSUANCE AND PURPOSE

This Directive reissues reference (a), cancels reference (b), establishes policies and procedures, and assigns responsibilities governing the review and clearance of information proposed for publication or public release by the Department of Defense and its personnel.

B. APPLICABILITY AND SCOPE

1. This Directive applies to the Office of the Secretary of Defense, the Military Departments, the Organization of the Joint Chiefs of Staff, the Unified and Specified Commands, and Defense Agencies (herein referred to as "DoD Components") and their personnel.

2. Retired military personnel, former DoD employees, and non-active duty members of reserve components are not subject to the provisions of this Directive, but they may use the review service (section E., below) to ensure that information they propose to publish or disclose does not compromise classified information or otherwise violate security.

3. For provisions governing:

a. Availability of records to the public, DoD Directive 5400.7 and DoD 5400.7-R (references (c) and (d)) apply.

b. Review of transcripts of testimony, prepared statements and other material provided to congressional committees that may be included in the published records of the Congress, DoD Directive 5400.4 (reference (e)) applies.

c. Review of information before publication or disclosure by DoD contractors, DoD Directive 5220.22 and DoD 5220.22-M (references (f) and (g)) apply.

C. POLICY

It is the policy of the Department of Defense to:

1. Provide the American people with maximum information about DoD operations and activities.

2. Ensure that the release of information to the public is limited only as necessary to safeguard information requiring protection in the interest of national security and in accordance with DoD Directive 5200.1 and DoD 5200.1-R (references (h) and (i)), or as authorized by DoD Directive 5400.7 and DoD 5400.7-R (references (c) and (d)). Limitations and policies concerning the transfer of technology as set forth in the Department of State International Traffic in Arms Regulations (ITAR) (reference (j)) shall also be adhered to.

3. Ensure that official information cleared for public release is consistent with established DoD and national policies and programs.

D. RESPONSIBILITIES

1. The Assistant Secretary of Defense (Public Affairs) (ASD(PA)) shall:

a. Establish policies and procedures within the Department of Defense for the review and clearance of information proposed for release to the public.

b. Provide for security review of all material proposed for public release and publication originated by the Department of Defense, including testimony before congressional committees, or by its contractors, DoD personnel as individuals, and material submitted by sources outside the Department of Defense to ensure the material does not contain information classified under the provisions of E.O. 12065 (reference (k)).

c. Provide for policy review of official speeches and other information originated within the Department of Defense for public release, or similar material submitted for review by other federal agencies. This review shall be made to determine if any conflict exists with established policies or programs of the Department of Defense or of the U.S. Government.

2. Heads of DoD Components shall implement the provisions of this Directive by:

a. Issuing instructions necessary for the internal administration of the requirements prescribed herein.

b. Forwarding information proposed for publication or public release to the ASD(PA) for clearance, as prescribed in subsection E.1. of this Directive, and including specific recommendations regarding the material being forwarded.

c. Reviewing and clearing information for public release as prescribed in section E.

E. PROCEDURES

1. Clearance Requirements.

a. Information proposed for publication or public release that concerns or affects the plans, policies, programs, or operations of the Department of Defense or the U.S. Government, and that is prepared by DoD personnel either in an official or private capacity, shall be submitted to the Assistant Secretary of Defense (Public Affairs), Attention: Director, Freedom of Information and Security Review (DFOISR), for review and clearance prior to disclosure if the information:

(1) Originates or is proposed for publication or release at the seat of government; or

(2) Meets any of the following criteria (if in doubt, submit):

(a) Is or has the potential to become an item of national or international interest or has foreign policy or foreign relations implications.

(b) Concerns high level military or DoD policy; or U.S. Government policy.

(c) Concerns subjects of potential controversy among DoD Components or with other federal agencies.

(d) Concerns the following subject areas:

1 New weapons or weapons system or significant modifications or improvements to existing weapons or systems, equipment, or techniques.

2 Military operations, operations security, potential operations, and significant exercises.

3 National command authorities and command posts.

4 Military applications in space; nuclear weapons, including nuclear weapons effects research; chemical warfare; defensive biological and toxin research; and high-energy lasers and particle beam technology.

5 Material, including that submitted by Defense contractors, involving critical military technology.

6 Communications security, signals intelligence, and computer security.

7 Others as the ASD(PA) may designate.

b. For information not specified under paragraph E.1.a. above, heads of DoD Components have clearance authority which they may delegate to the lowest echelon competent to evaluate the content and implications of the information.

c. A speech, article, or paper being submitted for review shall be initialed by the speaker or author to indicate approval of the text.

d. Speeches shall be forwarded through channels in triplicate to reach DFOISR not less than 5 working days before the date that clearance is desired. Other material shall be submitted in triplicate, allowing a review time over 5 days commensurate with the volume of the documents and complexity of the subject matter.

e. The full and final text of material requiring review, including any supplemental audiovisual material, shall be submitted.

f. Notes, abstracts, or outlines shall not be cleared as substitutes for a complete text. Abstracts to be published in advance require clearance, although clearance of an abstract may not obviate a commitment to submit the full text before its clearance. If an abstract is cleared in advance, that fact, together with the DFOISR case number, shall be noted on the transmittal when the full text of the article or paper is submitted.

g. Material for review shall be submitted together with DD Form 1910, "Clearance Request for Public Release of Department of Defense Information."

2. Security and Policy Review.

a. Material submitted in compliance with the requirements of this Directive shall be cleared for public release only after is has been reviewed and necessary amendments made to ensure that it does not compromise classified national security information, and that it is consistent with established DoD and other U.S. Government policies and programs.

(1) Security Review. Material submitted for review shall not contain information known by the office of origin to be classified. Review by DFOISR is to ensure that the material does not contain information classified under the provisions of E.O. 12065 (reference (k)) or which may otherwise be exempt by law.

(2) Policy Review. As a safeguard against potentially adverse impact upon the conduct of government, material submitted by senior DoD officials is cleared for public release only after it is determined that is is consistent with established DoD and national policy and programs. However, officials appearing before congressional committees may, in response to questions, state their personal views. Material submitted by other personnel will be reviewed for policy commensurate with the author's rank and level of responsibility.

b. Material shall not be denied clearance because its public disclosure might reveal administrative error or inefficiency.

c. DFOISR has no responsibility for correcting errors of fact in material submitted for review. However, obvious errors identified during review may be noted either for the attention of the submitter, or corrected.

d. All DoD Components shall cooperate with DFOISR by providing prompt guidance and assistance when their recommendations are requested in the review of material proposed for clearance. When necessary to expedite review and clearance actions, the Director, DFOISR, is authorized to contact directly any echelon of the Department of Defense or other federal agencies.

3. Effect of Review Actions and Appeals.

Material reviewed shall be returned to the submitter with an indication of "as amended" or "recommended" changes. Amendments are binding upon the speaker or author, except that he or his designee may appeal the action through DFOISR to higher authority.

4. Writing for Publication.

DoD military and civilian personnel may write and sign articles for publication under the following circumstances:

a. If such action (1) does not delay the public's receipt of prompt and complete information on government activities through the usual public information media; (2) is not contrary to law; (3) is consistent with proper ethical standards and is otherwise compatible with the responsibilities of DoD personnel as outlined in DoD Directive 5500.7 (reference (l)).

b. If they write for publication not in connection with their official duties, DoD personnel shall ensure that the subject matter is not in conflict with DoD Directive 5500.7 (reference (l)), that the writing is not done during normal working hours, or with the use of DoD facilities, property, or personnel. In addition, such writers shall not use information from official sources that is not available to outside writers.

c. In the interest of academic freedom and the advancement of national defense-related concepts in the DoD school environment, DoD personnel shall be given the widest latitude to express their views, normally restricted only by security considerations. DoD student personnel who prepare manuscripts for publication in a private and unofficial capacity shall submit the material through appropriate channels for security clearance prior to release to any publisher. Submitters shall ensure that appropriate disclaimers accompany all publications they authorize in a private capacity. An appropriate disclaimer is as follows:

> "The views expressed in this article are those of the author and do not reflect the official policy or position of the Department of Defense or the U.S. Government."

d. DoD personnel shall make no commitments to furnish manuscripts other than to DoD publications until the manuscripts have been cleared or ASD(PA) approval for commitment has been granted.

F. EFFECTIVE DATE AND IMPLEMENTATION

This Directive is effective immediately. Forward two copies of implementing documents to the Office of the Assistant Secretary of Defense (Public Affairs) within 120 days.

Frank C. Carlucci
Deputy Secretary of Defense

Enclosures - 2
1. References
2. DD Form 1910

REFERENCES, continued

(d) DoD 5400.7-R, "DoD Freedom of Information Act Program," December 1980, authorized by DoD Directive 5400.7, March 24, 1980
(e) DoD Directive 5400.4, "Provision of Information to Congress," January 30, 1978
(f) DoD Directive 5220.22, "DoD Industrial Security Program," December 8, 1980
(g) DoD 5220.22-M, "Industrial Security Manual for Safeguarding Classified Information," July 1981, authorized by DoD Dirctive 5220.22, December 8, 1980
(h) DoD Directive 5200.1, "DoD Information Security Program," November 29, 1978
(i) DoD 5200.1-R, "Information Security Program Regulation," October 1980, authorized by DoD Directive 5200.1, November 29, 1978
(j) Department of State, "International Traffic in Arms Regulations (ITAR), February 1976
(k) Executive Order 12065, "National Security Information," June 28, 1978
(l) DoD Directive 5500.7, "Standards of Conduct," January 15, 1977

CLEARANCE REQUEST FOR PUBLIC RELEASE OF DEPARTMENT OF DEFENSE INFORMATION

TO: Assistant Secretary of Defense (*Public Affairs*)

ATTN: Director, Freedom of Information & Security Review, Rm. 2C757, Pentagon

SEE INSTRUCTIONS ON REVERSE

(This form is to be used in requesting review and clearance of DoD information proposed for public release in accordance with DoDD 5230.9.)

1. DOCUMENT DESCRIPTION

a. TYPE	b. TITLE
c. PAGE COUNT	d. SUBJECT AREA

2. AUTHOR/SPEAKER

a. NAME *(Last, First, MI)*	b. RANK	c. TITLE
	d. OFFICE	e. AGENCY

3. PRESENTATION/PUBLICATION DATA

ORIGINAL PAGE IS
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4. POINT OF CONTACT	5. PRIOR COORDINATION
a. NAME *(Last, First, MI)*	a. OFFICE
b. TELEPHONE NUMBER *(Include Area Code)*	b. AGENCY

6. REMARKS

7. RECOMMENDATION OF SUBMITTING OFFICE/AGENCY

a. The attached material has Department/Office/Agency approval for public release (qualifications if any, are indicated in Remarks Section) and cleara
open publication is recommended under provisions of DoDD 5230.9. I am authorized to make this recommendation for release on behalf of:

____

b. Clearance is requested by ____________________ *(YYMMDD).*

c. NAME *(Last, First, MI)*	d. TITLE	e. SIGNATURE
f. OFFICE	g. AGENCY	h. DATE *(YYMMDD)*

DD FORM 82 MAR 1910

PREVIOUS EDITION IS OBSOLETE.

DOD 3200.12-R4

DEPARTMENT OF DEFENSE

DOMESTIC TECHNOLOGY TRANSFER PROGRAM REGULATION

APRIL 1985

OFFICE OF THE UNDER SECRETARY OF DEFENSE
FOR RESEARCH AND ENGINEERING

FOREWORD

This Regulation is issued under the authority of DoD Directive 3200.12, "Defense Scientific and Technical Information Program," February 15, 1983. This Regulation applies to all DoD Components that perform or fund research and development efforts leading to the development of new technologies that may be appropriate for transfer to state and local governments and to the private sector.

This Regulation establishes the DoD Domestic Technology Transfer Program and responds to the requirements of Public Law 96-480, the Stevenson-Wydler Technology Innovation Act of 1980, to ensure the full use of the Nation's Federal investment in research and development, stimulating improved utilization by State and local governments and the private sector.

The Domestic Technology Transfer Program is separate and distinct from international technology transfer control programs, and nothing in this Regulation is intended to modify or rescind any of the responsibilities and procedures for technology transfer control set forth in other DoD Directives, Instructions and Publications.

This Regulation is effective immediately and is mandatory for use by all DoD Components. Head of DoD Components may issue supplementary instructions when necessary to provide for internal administration of this Regulation within their respective Components.

Send recommended changes to the Regulation through channels to:

Director, Office of Research and Laboratory Management
Office of the Deputy Under Secretary of Defense (Research and Advanced Technology)
Office of the Under Secretary of Defense for Research and Engineering
The Pentagon
Washington, DC 20301

DoD Components may obtain copies of this Regulation through their own publication channels. Other federal agencies and the public may obtain copies from Director, U.S. Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, Pennsylvania 19120.

James P. Wade, Jr.
Under Secretary of Defense
for Research and Engineering

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REFERENCES

(a) Public Law 94-480, "Stevenson-Wydler Technology Innovation Act of 1980," October 21, 1980

(b) DoD Directive 2040.2, "Control of International Technology, Goods, Services and Munitions Transfer," January 17, 1984

(c) DoD Directive 5230.24, "Distribution Statements on Technical Document," November 20, 1984

DEFINITIONS

Application Assessment. A summary emphasizing the potential application of each technological development from DoD Research and Development (R&D) projects that has potential usefulness to State and local governments or private industry.

Center for the Utilization of Federal Technology(CUFT). An element of the Department of Commerce established by PL 96-480 to:

a. Serve as a clearinghouse for collecting, disseminating, and transferring technical information having potential for use by the private sector and civilian agencies.

b. Coordinate the activities of the Offices of Research and Technology Applications (ORTAs) of the Federal laboratories.

c. Implement other assistance and coordination functions.

Federal Laboratory Consortium (FLC) for Technology Transfer. An organization of Federal Research and Development Laboratories and Centers formed to identify and mobilize the necessary resources to provide the environment, the organization, and the necessary technology transfer mechanisms required to facilitate the fullest possible utilization of Federally sponsored research and development results by both public and private sector potential users.

Office of Research and Technology Applications (ORTA). A function established in each DoD R&D activity to coordinate the Domestic Technology Transfer Program and to perform the actions specified in PL 96-480 (reference (a)) and other actions as outlined in this Regulation.

CHAPTER 1

THE DOMESTIC TECHNOLOGY TRANSFER PROGRAM

A. Policy

In order to achieve the maximum national benefit from DoD scientific and technical efforts, it shall be DoD policy to:

1. Encourage the dissemination of scientific and technical information, data, and knowhow developed by or for the Department of Defense to state and local governments and to the private sector, consistent with the requirements of U.S. national security.

2. Promote the sharing of technology that fosters the advance of science or that has commercial potential and thus should be employed to best advantage for the security and socio-economic well-being of the United States.

3. Support coordination between the industrial, academic, and government research and development activities of the U.S. by cooperating in the sharing of plans for future research efforts and the sharing of facilities as appropriate.

4. Support cooperative efforts to stimulate industrial innovation, especially in small businesses.

5. Support and encourage the exchange of scientific and technical personnel among academia, industry, and the DoD laboratories.

6. Support the domestic technology transfer process as an integral part of the research and development effort and incorporate domestic technology transfer objectives into the mission of each appropriate R&D activity.

7. Ensure that domestic technology transfer functions do not compete substantially with similar services available in the private sector.

8. Ensure that the Domestic Technology Transfer Program does not conflict with Export Control Regulation, policies governing militarily critical technology, or any of the responsibilities and procedures for technology transfer control set forth in DoD Directives, Instructions and Publications. Control policies are addressed in reference (b) and (c).

B. Responsibilities

1. The Under Secretary of Defense for Research and Engineering (USDR&E) shall:

a. Establish, policies and procedures for domestic technology transfer.

b. Monitor compliance with this Regulation.

c. Coordinate interservice activity under the Domestic Technology Transfer Program.

d. Cooperate with other Federal agencies, particularly the Department of Commerce and the National Science Foundation, to maximize the effectiveness of federal domestic technology transfer efforts.

2. Heads of DoD Components shall:

a. Establish an Office of Research and Technology Application (ORTA) at appropriate laboratories and other activities to perform, as a minimum, the domestic technology transfer function specified in this regulation. Each ORTA shall:

(1) Perform the following functions as specified in PL 96-480 (reference (a)).

(a) Prepare an application assessment of each research and development project which has potential for successful application in State or local government or in private industry.

(b) Provide and disseminate information on federally owned or originated products, processes, and services having potential application to State and local governments and to private industry.

(c) Cooperate with and assist the Center for the Utilization of Federal Technology and other organizations that link the research and development resources of that R&D activity and the Federal Government as a whole to potential users in state and local government and private industry.

(d) Provide technical assistance in response to requests from State and local government officials.

(2) Serve as primary representative for their activity and provide appropriate support to the Federal Laboratory Consortium for Technology Transfer.

(3) Initiate contacts and maintain liaison with State and local government, and the private sector. Participate in appropriate activities of the public and private sector that provide the opportunities to achieve technology transfer objectives; e.g., local government meetings or small business conferences.

(4) Assist program managers and technical department heads in identifying technologies suitable for transfer and for which application assessments need to be developed.

(5) Coordinate domestic technology transfer activities with patent counsel to determine rights to tactical data, patent and licensing implications, and the commercial potential of patentable technology.

(6) Ensure that no domestic technology transfer functions substantially compete with similar services available in the private sector.

(7) Ensure that no domestic technology transfer functions conflict with Export Control Regulations, policies governing militarily critical technology, or any of the responsibilities and procedures for technology transfer control set forth in DoD Directives, Instructions and Manuals.

b. Specify the appropriate R&D activities that may require a full-time individual to be responsible for performing the ORTA functions.

c. Support the policies set forth in this regulation.

d. Designate a headquarters point of contact for domestic technology transfer activities.

e. Develop appropriate goals or corporate plans to accomplish the objectives of the Domestic Technology Transfer Program.

f. Encourage and cooperate with the establishment of technical volunteer programs as a resource to complement and support domestic technology transfer activities.

g. Establish a system for collecting and forwarding Technology Application Assessments to the Center for the Utilization of Federal Technology of the Department of Commerce.

h. Establish a mechanism for coordinating domestic technology transfer efforts with the Small and Disadvantaged Business Utilization Specialists for the purpose of stimulating commercialization of appropriate technologies by small business.

i. Establish a mechanism to provide appropriate security review of domestic technology transfer efforts.

CHAPTER 2

REPORTING

As specified in PL 96-480 (reference (a)), a biennial report summarizing the domestic technology transfer activities performed by the DOD and its laboratories is due to the Department of Commerce, Center for the Utilization of Federal Technology by 1 November in even-numbered years. Specific guidance will be provided by USDR&E for each biennial report no later than 60 days prior to the due date.

APPENDIX II-B

More than National Defense!

FACILITATING DOMESTIC TECHNOLOGY TRANSFER

U.S. DEPARTMENT OF THE ARMY
Mr. E.J. Kolb, DARCOM/DRCLD
5001 Eisenhower Ave.
Alexandria, VA 22333

FEDERAL LABORATORY CONSORTIUM
Dr. T.J. Maher, Executive Director
USDA Extension Service
3865 South Bldg.
Washington, D.C. 20250

DOMESTIC TECHNOLOGY TRANSFER
FROM
THE U.S. DEPARTMENT OF THE ARMY

More than National Defense!

1775

More than National Defense!

DOMESTIC TECHNOLOGY TRANSFER FROM FEDERAL LABORATORIES

Domestic technology transfer applies the technology initially developed for federal government use to domestic needs. Federal laboratories, working within their specific missions, conduct and monitor research programs covering a very large number of subjects. Much of the resulting knowledge can be applied to the needs of state and local government and private sector business. A coordinated technology transfer program can help integrate this new technology and knowledge into our domestic economy, resulting in a continuing benefit for the entire country.

THE FEDERAL LABORATORY CONSORTIUM FOR TECHNOLOGY TRANSFER - NETWORK

The objective of this Network is to effectively apply the vast resources of our national research and development efforts to state and local governments and our domestic industry. This network represents over 300 of the largest Federal laboratories and research centers from 11 agencies. With assistance from a network, such as the FLC, gaining access to specific technology needed can be greatly enhanced since the large number of organizations and locations involved can be confusing. The FLC Network provides access through a single contact.

1775

YOUR PARTNERSHIP WITH THE US DEPARTMENT OF THE ARMY

The Department of the Army is committed to making appropriate Army technology available for domestic use. Army Laboratories form a vital link with the FLC National network for domestic technology transfer. Scientists and engineers from the Army laboratories and centers are involved in virtually every aspect of scientific work. Technology Transfer experts within each laboratory provide the brokerage functions necessary to apply this resource beyond the Army's primary mission of supporting our national defense. Valuable knowledge is available for your use in research areas such as medical, dental, food, clothing, engineering and public works, electronics, fire control, chemistry, aviation, fuels and lubricants, environmental protection, materials management and communication as well as many other specific subjects.

TAKE THE FIRST STEP!

The FLC and Army Laboratories have proven their ability to help you locate specific information that is timely and directly applicable to your technology requirements. To be successful you must take the first step to allow us to establish a person-to-person contact with you. Once established, this linkage will allow us to serve your domestic technology transfer needs. Army laboratory contacts dedicated to serving you are listed, along with the FLC Executive Director and Department of the Army Technology Transfer Coordinator. Give your laboratory representative a call and see how your US Army is *much* more than national defense!

Participating Laboratories and Facilities

FLC NORTHEAST REGION

**US ARMY COLD REGIONS
RESEARCH & ENGINEERING LAB**
Dr. Andrew Assur
HANOVER, NH 03775
(603) 646-4237

**US ARMY COMMUNICATIONS &
ELECTRONICS COMMAND**
Mr. John Boyle
FT. MONMOUTH, NJ 07703
(201) 554-3178

**US ARMY ELECTRONICS R&D
COMMAND**
Dr. Walter S. McAfee
FT. MONMOUTH, NJ 07703
(201) 554-4131

**LARGE CALIBER WEAPONS
SYSTEMS LAB
US ARMY ARMAMENT
R&D CENTER**
Dr. Paul Marinkas
DOVER, NJ 07801
(201) 724-6111

**US ARMY MATERIALS &
MECHANICS RESEARCH CENTER**
Mr. David W. Seitz
WATERTOWN, MA 02172
(617) 923-5527

US ARMY NATICK R&D CENTER
Mr. Gary Olejniczak
NATICK, MA 01760
(617) 651-4351

**US ARMY ARMAMENT RESEARCH
& DEVELOPMENT CENTER**
Mr. Dave Rosenblum
DOVER, NJ 07801
(201) 724-7954

**US ARMY RESEARCH INSTITUTE
OF ENVIRONMENTAL MEDICINE**
Col. Brendon E. Joyce
NATICK, MA 01760
(617) 622-5126

**FIRE CONTROL & SMALL
WEAPONS SYSTEMS LAB
US ARMY ARMAMENT
R&D CENTER**
Mr. Henry Opat
DOVER, NJ 07801
(210) 724-6019

FLC MID ATLANTIC REGION

**US ARMY BALLISTICS
RESEARCH LAB**
Mr. Arthur D. Coates
ABERDEEN PROVING GROUND,
MD 21005
(301) 278-6854

**US ARMY ENGINEER
TOPOGRAPHIC LABS**
Mr. Richard N. Foreman
FT. BELVOIR, VA 22060
(703) 664-5303

**US ARMY INSTITUTE OF
DENTAL RESEARCH**
Dr. Gino C. Battistone
WASHINGTON, D.C. 20012
(202) 576-3254

**US ARMY MEDICAL
BIOENGINEERING R&D LABS**
Dr. Howard T. Bausum
FT. DETRICK, MD 21701
(301) 663-7635

**US ARMY MEDICAL RESEARCH
INSTITUTE OF
CHEMICAL DEFENSE**
Ms. Susan K. Luckan
ABERDEEN PROVING GROUND,
MD 21010
(301) 671-3653

**MEDICAL RESEARCH INSTITUTE
OF INFECTIOUS DISEASES**
Mr. William C. Patrick
WASHINGTON, D.C. 20012
(202) 576-3552

**US ARMY HUMAN
ENGINEERING LAB**
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MD 21010
(301) 278-5946

US ARMY BELVOIR R&D CENTER
Ms. M. (Connie) Harrisson
FT. BELVOIR, VA 22060
(703) 664-1068

**US ARMY NIGHT VISION &
ELECTRO-OPTICS LAB**
Mrs. Marguerite McFarland
FT. BELVOIR, VA 22060
(703) 664-2463

**US ARMY RESEARCH INSTITUTE
FOR BEHAVIORAL &
SOCIAL SCIENCES**
Dr. David M. Promisel
ALEXANDRIA, VA 22333
(202) 274-8683

US ARMY CHEMICAL R&D CENTER
Mr. Richard Dimmick
ABERDEEN PROVING GROUND,
MD 21010
(301) 671-2031

HARRY DIAMOND LABORATORY
Mr. Clifford E. Lanham
ADELPHI, MD 20783
(202) 394-2296

**WALTER REED ARMY INSTITUTE
OF RESEARCH**
Mr. Peyton R. Williams, Jr.
WASHINGTON, D.C. 20307
(202) 576-3814

**US ARMY SIGNAL WARFARE
LABORATORY**
Dr. Royal H. Burkhardt
WARRENTON, VA 22186
(703) 374-6464

FLC SOUTHEAST REGION

**US ARMY AEROMEDICAL
RESEARCH LAB**
Ms. Sybil Bullock
FORT RUCKER, AL 36362
(205) 255-6907

**US ARMY ENGINEER WATERWAYS
EXPERIMENT STATION**
Mr. Joseph V. Dawsey, Jr.
VICKSBURG, MS 39180
(601) 634-2767

US ARMY MISSILE COMMAND
Mr. Howard Race
REDSTONE ARSENAL, AL 35898
(205) 876-5449

US ARMY RESEARCH OFFICE
LTC Rodney McCormick
RESEARCH TRIANGLE PARK,
NC 27709
(919) 549-0641

FLC MID WEST REGION

**US ARMY CONSTRUCTION
ENGINEERING RESEARCH
LABORATORY**
Dr. Gilbert R. Williamson
CHAMPAIGN, IL 61820
(217) 373-7206

**US ARMY TANK-AUTOMOTIVE
COMMAND**
Mr. Robert J. Hostetler
WARREN, MI 48090
(313) 574-6505

FLC MID CONTINENT REGION

**US ARMY ATMOSPHERIC
SCIENCES LAB**
Mr. Robert E. Northrup
WHITE SANDS MISSILE RANGE,
NM 88002
(505) 678-5236

**US ARMY AVIATION
SYSTEMS COMMAND**
Mr. Roy J. Warhover
ST. LOUIS, MO 63120
(314) 263-1082

**US ARMY INSTITUTE OF
SURGICAL RESEARCH**
Col. Basil A. Pruitt, Jr.
FT. SAM HOUSTON, TX 78234
(512) 221-2720

FLC FAR WEST REGION

**LETTERMAN ARMY INSTITUTE
OF RESEARCH**
Mr. Jack Keller
PRESIDIO OF SAN FRANCISCO
CA 94129
(415) 561-2641

APPENDIX II-C

U. S. ARMY

DOMESTIC TECHNOLOGY TRANSFER

Work Management Plan

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January 1985 - July 1986

AMCLD

T2+ PROGRAM TASKS

TASK #	PAGE #
1. Lab Structure Charts	
2. Lab Activity/Vitality	
3. Lab Reports, Brochures & News	
5. Lab Posture Reports or Equivalent	
6. Funding to Labs for T2+	
7. Work Unit (1498 File)	
8. Regulation Revision	
9. Army Patents	
10. ORTA/Public Affairs Coord	
11. Semi-Annual ORTA Meetings	
12. Recognition for T2+ Effort	
13. Guidance Statement & Letter	
14. Joint Dir. of Labs	
15. IG Reviews	
16. P.L. 96-480 Review	
17. Industry/Army T2+ Comms.	
18. T2+ Society	
19. Funding to FLC	
20. FLC/Army Functions	
21. Regional FLC Meetings	
22. Annual Spinoffs Pub	
23. Facilities Pub	
24. "Talents" (Expertise) Pub	
25. NASA Method of T2+ Operations	
26. State & Local Government	
27. Follow-Up System Options for Documenting Successful T2+ Efforts	
28. Army Developed Technology Commercialization for Direct Cost Benefit	
29. Technical/Medical Libraries Role in T2+	
30. Army Technology Source Identification	
31. Army ORTA Intercommunications Net and Army/FLC Net Links	
32. Army Small Business/T2+ Program Communications	
33. Army/JPL T2+ Service Support	
34. Army ORTA/Export Control Awareness	
35. Army T2+/Production Management Coordination	

In December 1984 the CG, AMC, tasked AMCLD to:

- "Work up a plan to make the Domestic Technology Transfer program better"--
- "Enable the Army to get credit for what it does in this area"
- "Rejuvenate publicity"
- "Tell industry, the public, the rest of the Army"
- "Ask industry how well we are doing this"
- "Tout accomplishments"
- "Integrate outreach efforts with all labs"
- "Institutionalize the T2+ program"

The Army has been heavily involved in Domestic Technology Transfer for over ten years. This effort, mandated by public law and Army Regulation is sponsored by the office of the Deputy Chief of Staff for Research and Development (DCSRDA-AR) and executed by the Army Materiel Command (AMCLD).

Extensive work in Army Domestic Technology Transfer has been performed over the past ten years; however, no formal plan, no work assignments, no objectives and no milestones have been established.

To begin an organized structure of objectives, work assignments and to target progress, twenty-six issues were identified. On the following pages these objectives and the approaches to fulfill the objectives are defined.

A one-year work assignment to pursue these objectives is charted to enable many of the laboratories to directly participate in the total Army program in addition to their individual lab responsibility.

This is meant to be the start of a "living" document which will be modified, enhanced and/or altered as experience dictates. Each year tasks may be added or completed. Each of the 35 laboratories will be made aware of this effort to plan and "institutionalize" the T2+ program. A state of the Army T2+ program report will be developed annually and will provide resource information for defining succeeding year objectives.

Unless otherwise directed, the work of this document will proceed.

AMCLD Army Domestic Technology Transfer Coordinator

Responsible Action Office	DEC 84	JAN 85	FEB 85	MAR 85	APR 85	MAY 85	JUN 85
DCSRDA			1-Lab Struc Charts			10-ORTA/PAO Coord(via Reg)	8-AR Reg Revision
AMCLD	Brief CG	Prepare T2 Plan		14-Joint Dir of Labs	Update ORTA List	20-Spring FLC Mtg	
		13-Prep CG Guid Stmt			16-Congress Hearings	11-Army ORTA Mtg	
BRDC		Prepare Manuscript		15-IG Reviews			
HDL					18-T2 Society		
CERL						21-Regional Mtgs	
TACOM						3-Lab Reports Brochures & PAO News	
NVEOL				25-NASA Meth			
WES					4-Lab Tech Assessments		
AMMRC						17-Industry/Army T2 Comms	

Responsible Action Office	JUL 85	AUG 85	SEP 85	OCT 85	NOV 85	DEC 85
DCSRDA			19-Consortium Funding			
AMCLD			6-Lab T2 Funding			21-Fall FLC Mtg
			20-FLC Participation			11-Army ORTA Mtg
MICOM		23-Facilities Pub				
HDL	2-Lab Act/ Vitality	7-Work Unit File				
AVSCOM		24-Talents/ Expert Pub				
CERL			26-State/ Local Gov			
CECOM		12-Recog T2 Effort				
NVEOL			22-Army Spinoffs			
ETL						5-Lab Posture Reports
NRDC	9-Army Patents					

Responsible Action Office	JAN 86	FEB 86	MAR 86	APR 86	MAY 86	JUN 86	JUL 86
CERL	28 - Tech Commer.						
AEROMED LAB			29 -Tech/ Med Lib				
WES		30-Source Ident					
BRL			31 Orta Comm Net				
CRDC		32 - Small Business					
AMC	33 - JPL Support			34 - Orta Export Contr		35 - Prod Mgmt Coord	

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1. LABORATORY STRUCTURE CHARTS

Objective:	To assure that the organizational structure of each laboratory clearly indicates the existence and location of the ORTA to enable easy access to the point of contact.
Approach:	A compendium of laboratory organizational structure charts is assembled and distributed annually. The letter of request to the laboratories to submit their updated chart will include a paragraph requesting the ORTA location, name of "Point of Contact" and telephone number be included in the revised edition of their organization chart.

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2. LABORATORY ACTIVITY/VITALITY

Objective:	To assure that all of the Army's laboratories participate in the domestic technology transfer program with at least equal intention, support, vitality and activity through development of indicators.
Approach:	Develop performance indicators, measures of effectiveness, and reportable activity/functions to enable laboratory "relative" scoring. Rank order the laboratories for T2 + vitality and provide support-counsel to low scoring labs to assure program understanding and appropriate participation potential.

---

3. LABORATORY REPORTS, BROCHURES AND PAO NEWS RELEASES

Objective:	To assure that technical documentation and publications of each laboratory (not accessioned into DTIC) are known and accessable to each Army ORTA.
Approach:	The laboratories develop brochures, technical notes, news releases and leaflets describing specific technical detail and/or capabilities. These are not indexed, abstracted, cataloged or accessioned. There is therefore a limited potential life and/or service to be fulfilled by these publications. Each ORTA will be responsible to maintain an active file of these resources for technology transfer and to contribute this information to a central file. Information that is of interest to the public and/or the DA/DoD community will be conveyed to the local Public Affairs Officer.

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4. LABORATORY TECHNOLOGY ASSESSMENTS

Objective: To assure information describing Army developed technology is made available to the U. S. Government's central repository and public distribution point for this information.

Approach: The ORTA of each Army laboratory will develop a laboratory "Technology Assessment Report" for each appropriate and unclassified definable technology. These reports are to be forwarded (at least annually) to the Center for the Utilization of Technology (CUFT) of the Department of Commerce. (A file copy is to be retained by the laboratory ORTA.)

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5. LABORATORY POSTURE REPORTS OR EQUIVALENT ANNUAL REPORTING

Objective: To assure an element of accountability for each laboratory's participation in Domestic Technology Transfer.

Approach: Each laboratory will be required to include Domestic Technology Transfer activity in their annual performance reporting. AMC Regulation 70-11 (7 Oct 82) or an equivalent reporting requirement will be updated to reflect this issue.

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6. FUNDING TO LABORATORIES FOR T2+ ACTIVITY

Objective: To provide partial financial support for T2+ projects to requesting laboratories to encourage participation in Domestic Technology Transfer (and minimize diluting technical project funding).

Approach: Annually submit program funding requests to the budget cycle to enable partial funding of laboratory costs for specific preapproved technology transfer efforts. Equal opportunity for this funding should be shared among all 35 laboratories and therefore should be established and distributed on an approved "fairness" basis.

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7. WORK UNIT (1498 FILE)

Objective: To optimize the potential for domestic technology transfer by the use of the Work Unit level reporting form DD1498 (includes a data block to indicate to the reader that the project described in the form has a potential for domestic technology transfer).

Approach: The Form 1498 file is the smallest reportable unit of work which is funded at all laboratories. An individual requesting funding support must submit and/or revise this form annually to the sponsor and to the Defense Technical Information Center. A data element on the form is checked if the project is considered potentially transferrable to domestic use. The entire Army submission of these forms will be reviewed at least annually and a separate Army Form 1498 file of potentially transferrable technology will be maintained. (All ORTAs will be knowledgable about and have access to this file to supplement overt transfer efforts.)

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8. REGULATION REVISION

Objective: To assure Army doctrine regarding Domestic Technology Transfer is formally documented, current and fully disseminated throughout the laboratories.

Approach: Army Regulation 70-57 dated 15 May 1983 is the authoritative resource defining the Army role in Domestic Technology Transfer. Some issues of Army interest have emerged since the regulation publication thus prompting revision in 1985.

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9. ARMY PATENTS

Objective: To optimize the potential for commercializing Army developed patents.

Approach: Develop a machine retrievable Army patents file with reference to those which are not yet licensed and those which do not have an assigned exclusive license. Make this information available to all Army ORTAs to impart to industry contacts.

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10. ORTA/PUBLIC AFFAIRS OFFICE/ACTIVITY COORDINATION

Objective: To assure that the objectives and activities of the "Office of Research and Technology Applications" and the "Public Affairs Office" are appropriately coordinated to mutual advantage and productivity.

Approach: The revisions of Army Regulations prescribing Domestic Technology Transfer and Public Affiars will include appropriate cross reference to each of these functions. Further steps will be taken to assure these two functions complement each other and make optimum use of the resources of each other at each laboratory and at sponsoring commands.

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11. SEMI-ANNUAL ORTA MEETINGS

Objective: Optimize the management and coordination of all Army domestic technology transfer activity through semi-annual laboratory representatives meetings.

Approach: Most Army ORTA representatives attend a semi-annual Federal Laboratory Consortium (FLC) meeting. As an economy measure the Army holds an ORTA-reps meeting as an "add-on" to the FLC meeting. The full agenda, the high participation and the apparent productivity are evidence of the success of this management method. These will continue to be held and the non participating Army labs will be contacted and encouraged to become active.

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12. RECOGNITION FOR ARMY T2+ EFFORT

Objective: To encourage productivity of the Army Domestic Technology Transfer program through recognition of exceptional accomplishments.

Approach: Establish performance indicators, criteria for judgement of success and measurement of activity in the Army Domestic Technology Transfer Program. Develop feedback mechanisms and awards for notable accomplishment of Army personnel. Consider including T2+ activity in the criteria for the "Lab of the Year" award.

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13. PREPARE GUIDANCE STATEMENT AND LETTER

Objective: To inform all Army that the Domestic Technology Transfer Program is a prime initiative of the CG, AMC, for 1985 and to enjoin full support from all laboratories.

Approach: Prepare a Commander's Guidance Statement indicating his full support to this program and expressing expectations from the laboratories. Prepare a letter to each lab director indicating the established ORTA structure and informing of the management structure.

14. JOINT DIRECTORS OF LABORATORIES (JDL)

Objective: To assure the domestic Technology Transfer Program, the mandate for the program, the total Army support and committment to the program, and the high pay-off benefits from the program are made known to all directors of laboratories.

Approach: Present the T2+ program to a meeting of the JDL with explanation of the cost benefit, the potential for recurring benefit from future spinoffs, the relationship between Defense cost and industry/public gain and the pervasiveness of Army developed technology in American public life. This is to assure total committment to the program from all directors of laboratories.

15. INSPECTOR GENERAL REVIEWS

Objective: To provide supplemental support to periodic monitoring of the T2+ activity of the laboratories via an existing function.

Appraoch: Representatives of the inspector general (IG) office make regular visits to all Army laboratories. The purpose of these visits is to obtain organizational performance information. These visits can also be used to detect and convey problems and to reveal needs. The IG function can thus be used to obtain information regarding the performance of the T2+ activity.

16. PUBLIC LAW 96-480 STEVENSON-WYDLER ACT APPROPRIATIONS REVIEW

Objective: To assure the Army's interest in the Stevenson-Wydler Act is protected as the Act is reviewed in 1985 hearings.

Approach: Congressional committees will hear testimonies of the T2+ activities of government agencies in the spring of 1985. An Army representative will possibly be summoned to testify. All of these hearings will be closely monitored by the Army T2+ coordinator and some ORTA representatives to protect the Army interest.

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17. INDUSTRY/ARMY T2+ PROGRAM COMMUNICATION

Objective: To assure that U. S. Industry is fully cognizant of the technology developed by the Army which may be applicable to improving industrial processes and/or may be applicable to commercial development.

Approach: Obtain the list of (over 1000) industry registrants to the Army Industrial Liaison Office (TILO) and of the registrants to the Army Small Business Innovation Research Program. Develop a cost effective method to impart information regarding the Army Domestic Technology Transfer Program to these points of contact.

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18. TECHNOLOGY TRANSFER SOCIETY

Objective: To determine if the effectiveness of the Army domestic technology transfer program can in any way be enhanced or improved through interaction with or participation in the technology transfer society.

Approach: Review the mission, functions and record of activity of the Technology Transfer society for the past five years. Determine if the Army ORTAs can function more effectively by participation or membership in this organization.

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19. FUNDING TO THE FEDERAL LABORATORY CONSORTIUM

Objective: To provide the Army share of financial support to the management, operation and special Army projects of the Federal Laboratory Consortium (FLC) for Technology Transfer.

Approach: Annually develop program planning information to document financial needs for the Army support to the FLC. Develop requirements for specific FLC support to Army needs and continually review the productivity of the FLC activity.

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20. FEDERAL LABORATORY CONSORTIUM FOR DOMESTIC TECHNOLOGY TRANSFER

Objective: To support the Federal Laboratory Consortium (FLC), the activities of the consortium, and to optimize the use of the consortium in fulfilling the mission of the Army Domestic Technology Transfer Program.

Approach: Encourage participation in the consortium from all Army laboratories, attend FLC functions and financially support the consortium needs. Apply the resources of the consortium to continually improve the Army T2+ effectiveness.

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21. REGIONAL FLC MEETINGS

Objective: To pursue the regional FLC meetings as a conduit to "get the Army word out" and to assure regional problems are made known to appropriate Army laboratories.

Approach: Assure Army participation in regional meetings. Assure the Army "voice" is heard at these meetings and assure all regional elements are knowledgable regarding the Army's interest in the domestic technology transfer program.

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22. ARMY ANNUAL SPINOFFS PUBLICATION

Objective: To annually communicate the significant Army technical accomplishments which may be applied to non-Army needs especially to public good.

Approach: Annually publish a high quality, illustrated, unclassified compendium of examples of current Army developed technologies. This publication (sometimes referred to as spinoffs) will provide tangible detailed awareness to the public of the Army technologies which have potential for civilian application.

23. "FACILITIES" PUBLICATION

Objective: To develop an Army "internal" reference publication or data base to enable any Army ORTA to know what facilities are available at Army laboratories which could be used by others (with appropriate arrangements).

Approach: Many Army labs have unique equipment, facilities and/or capabilities which could serve non-Army needs. Universities, industry or state and local governments could access these laboratory attributes by contacting the ORTAs. A directory of Army laboratory facilities will enable efficient access to this information. (MICOM lab facilities directory could serve as a model.)

24. "TALENTS" (EXPERTISE) PUBLICATION

Objective: To develop an Army "internal" reference publication or data base to enable any Army ORTA to access Army experts in specific fields of science and technologies.

Approach: The Army has an extensive and pervasive cadre of experts in many fields of science and technology. Many of these people have been identified for "experts" coordination of the Military Critical Technologies List (MCTL) and/or the COCOM list (exports control). This listing could be extended beyond the 17 categorie of the MCTL and made available to the Army ORTAs. The list could include categories beyond job related areas of expertise and be extended to "talents" or skills areas which may also serve non-Army needs.

25. NASA METHOD OF OPERATIONS

Objective: To enable the Army to benefit from the extensive experience of the space agency in their Technology Utilization Program and to emulate their annual publication, "spinoffs".

Approach: A primary mission of the space agency is to promote extensive activity in the public use of their technology. Their two and a half decades of success has resulted in well developed and matured methodology. This task is to become familiar with techniques and "lessons learned" to enable the Army to benefit from the activity of the space agency technology utilization program. A further approach will involve the annual publication of an Army spinoffs publication similar to the annual NASA spinoffs book.

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26. STATE AND LOCAL GOVERNMENT

Objective: To assure the Army developed technology is made known to state and local government technical points of contact and the technical problems of these elements are made known to the Army laboratory ORTAs.

Approach: Develop and maintain a network of points of contact for "technology responsibility" in the state and local government, a data file of technical problems looking for Army laboratory solutions, and resource file of Army capabilities applicable to state and local government use.

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27. FOLLOW-UP SYSTEM OPTIONS FOR DOCUMENTING SUCCESSFUL T2+ EFFORTS

Objective: Establish procedures to develop authentic discriptive records and cost benefit evidence of successful T2+.

Approach: Develop a follow-up system to provide statistical information on costs of producing a given Army technology versus pay-back benefits of successfully transferred technology. (Use the Pennsylvania Technology Assistance Program (PENNTAP) as a model resource)

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28. ARMY DEVELOPED TECHNOLOGY COMMERCIALIZATION FOR DIRECT COST BENEFIT

Objective: To develop and document unique methodology for commercializing certain Army originated technology.

Approach: Some technologies developed by the Army have commercial/industrial applications which are obvious at the outset. It would be prohibitively expensive for the Army to bear total development cost. The Army could, however, gain significant advantage by codevelopment sponsorship with industry. A method for accomplishing this "real time technology transfer" will be developed, documented and tested.

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29. TECHNICAL/MEDICAL LIBRARIES ROLE IN T2+

Objective: To identify the potential for appropriate active participation of the Army technical/medical libraries in the Army Domestic Technology Transfer (T2+) Program.

Approach: Assess the current and potential activities and methods of operation of a representative sample of the Army technical/medical libraries. Determine the feasibility and economy of establishing an Army wide role they can perform to enhance the Army T2+ Program.

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30. ARMY TECHNOLOGY SOURCE IDENTIFICATION

OBJECTIVE: To identify Army organizational elements (in addition to laboratories), which may develop transferrable technology or have unique technical transferrable expertise.

Approach: Review the Army organization and structure to identify potential resources of technology or expertise. (The program to date has only pursued laboratories.) Pursue training functions, schools and Depots as candidate resources. Review contractors as a resource.

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31. ARMY ORTA INTERCOMMUNICATIONS NET AND ARMY/FLC NET LINKS

OBJECTIVE: To establish and maintain efficient reliable methods of contacting knowledgable representatives of sources of technology throughout the Army and the Federal Government.

Approach: Establish and maintain individual points-of-contact at each Army Laboratory. Publish and distribute (at least yearly) a list of these contacts. Assure these contacts receive (at least yearly) a list of Federal Laboratory Consortium points of contact to enable access to technical linkages outside the Army. Pursue the development of automating the inter-Army and then the Army-to-others intercommunications netting of these T2+ points of contact.

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32. ARMY SMALL BUSINESS/T2+ PROGRAM COMMUNICATION

Objective: To assure that "small business" is promptly and regularly informed regarding potential opportunities for accessing appropriate Army developed technology.

Approach: Coordinate the activities of the laboratory ORTAs (and other Army sources of technology) with Army personnel responsible for the Small Business Innovation Research Program. Assure that business and industry (not qualifying for Fortune 500 listing) are informed regarding Army developed technology and expertise.

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33. ARMY / JPL T2+ SERVICE SUPPORT

OBJECTIVE: To support the Army T2+ Program by providing services in conjunction with an existing service support contract with the Jet Propulsion Laboratory (JPL).

Approach: Use the services of JPL to develop a report to the Army addressing such issues as:

- Improved industrial awareness of Army Technology
- Transferrable Army resources
- Examples of Army Successes
- Methods for transfer of technology
- Identifying dorment Army patents
- Payback criteria

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34. ARMY ORTA / EXPORT CONTROL AWARENESS

Objective: To assure those responsible for fostering the transfer of Army developed technology to the public are cognizant of and sensitive to the requirements for limiting the export of certain unclassified but controlled technology.

Approach: Distribute lists of points-of-contact for Export Control of technology to those responsible for Domestic Technology Transfer and vice versa. Periodically brief each group on the operations of the others (as appropriate). Assure that the needs and objectives of each are met with a minimum of conflict and compromise.

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35. Army T2+ / Production Management Coordination

Objective: To assure that the manufacturing technology developed by the Army is made available to industry and other US business sources.

Approach: Coordinate the appropriate operations of the Production Management (manufacturing technology) element of the Army with the Domestic Technology Transfer Program functions. Assure that the Army developed manufacturing technology is made known to appropriate industry and small business to enable "spin-off" use of manufacturing methods as well as product manufacturing.

US ARMY LABORATORIES

Construction Engineering Research Laboratory, Champaign, IL 61820
Cold Regions Research and Engineering Laboratory, Hanover, NH 03755
Engineering Topographic Laboratory, Ft. Belvoir, VA 22060
Waterways Experiment Station, Vicksburg, MS 39180
US Army Research Institute for Behavioral and Social Sciences, Alexandria, VA 22333-0
Medical Bioengineering Research and Development Laboratory, Ft. Detrick, MD 21701
Medical Research Institute of Chemical Defense, Aberdeen Proving Ground, MD 21010
Medical Research Institute of Infectious Diseases, Ft. Detrick, MD 21701
Aeromedical Research Laboratory, Ft. Rucker, AL 36362
Walter Reed Army Institute of Research, Washington, DC 20012
Institute of Surgical Research, Ft. Sam Houston, TX 78234
Institute of Dental Research, Washington, DC 20012
Research Institute of Environmental Medicine, Natick, MA 01760
Letterman Institute of Research, Presidio of San Francisco, CA 94129
US Army Armament, Munition & Chemical Command, Rock Island, IL 61299
US Army Troop Support Command, St. Louis, MO 63120
US Army Belvoir R&D Center, Ft. Belvoir, VA 22060
US Army Materials and Mechanics Research Center, Watertown, MA 02172
US Army Missile Command, Redstone Arsenal, AL 35898
US Army Natick R&D Center, Natick, MA 01760
US Army Communications & Electronics Command, Ft. Monmouth, NJ 07703
US Army Tank-Automotive Command, Warren, MI 48090
US Army Human Engineering Laboratory, Aberdeen Proving Ground, MD 21005
US Army Research Office, Research Triangle Park, NC 27709
US Army Aviation Systems Command, St. Louis, MO 63120
US Army Armament R&D Center, Dover, NJ 07801-5001
Large Caliber Weapons Systems Laboratory, Dover, NJ 07801
Fire Control and Small Caliber Weapons System Laboratory, Dover, NJ 07801
Ballistic Research Laboratory, Aberdeen Proving Ground, MD 21005
Chemical R&D Center, Aberdeen Proving Ground, MD 21010
Combat Surveillance and Target Acquisition Laboratory, Ft. Monmouth, NJ 07703

US ARMY LABORATORIES (continued)

Night Vision and Electro Optics Laboratory, Ft. Belvoir, VA 22060
Atmospheric Sciences Laboratory, White Sands Missile Range, NM 88002
Signals Warfare Laboratory, Vint Hill Farms Station, Warrenton, VA 22186
Harry Diamond Laboratories, Adelphi, MD 20783

APPENDIX II-D

US Army Corps of Engineers
Construction Engineering
Research Laboratory

Fact Sheet

P.O. Box 4005
Champaign, Il 61820

Public Affairs Office
Phone (217) 352-6511
Toll Free 800-USA-CERL

January 1985

TECHNOLOGY TRANSFER TO THE PRIVATE SECTOR

The transfer of laboratory developed technology to potential users is sometimes a more difficult process than the development of the technology itself. This is due to the fact that both technological complexity and human drama are involved. For this reason, success is achievable only if a transfer mechanism is in place. This mechanism or process must include a set of activities designed to effectively link or couple the source of the needed knowledge with its eventual user.

Within the Corps, the transfer process is the primary responsibility of OCE and the technical monitors who have been involved in the research. Official publications, training, and demonstration projects are used as appropriate. Within DA this technology transfer process works.

To speed the process of transferring technology developed at Federal laboratories to the private sector, Congress passed the Stevenson-Wydler Innovation Act of 1980. This Act has mandated that all Federal laboratories develop active programs for transferring technology to State and local governments and the private sector. The mechanism for accomplishing the goals of Stevenson-Wydler is a prerogative of the individual labs. But whatever the mechanism, it must involve a laboratory "push" and a user "pull." By incorporating this philosophy and working within the confines of the Stevenson-Wydler Act, USA-CERL has developed a very aggressive program for the transfer of USA-CERL-developed technology to State and local governments and the private sector.

The technology transfer program at USA-CERL is probably the most successful of any Army laboratory. The following is a brief description of some of USA-CERL's more notable accomplishments.

1. The transfer of the Pavement Maintenance Management System (PAVER) to the American Public Works Association (APWA) has been completed. After successfully field testing it at six cities, APWA is offering it to cities all over the country. There are now over 40 cities and counties currently using PAVER through the APWA efforts. PAVER is a computerized system that provides the engineer with a practical decision-making method for identifying cost-effective maintenance and repair on roads, parking lots, and airfields.

2. Building Loads and System Thermodynamics (BLAST). This system, which performs energy usage analysis and HVAC system simulation, was transferred to the private sector several years ago. Over 45 firms are presently using it. USA-CERL continues to provide updates to these users.

3. The USA-CERL PORTAWASHER, a unit for cleaning trash dumpsters, now has a fourth company manufacturing them.

4. The Environmental Technical Information System (ETIS) is now being offered to users both in and out of government by the Bureau of Urban and Regional Planning, University of Illinois. ETIS is being accessed over 300 times per month, with many users being State and local governments and private firms.

5. A new product being made available to the public this year is the Computer Evaluation of Utility Plans (CEUP). This program assists master planners and designers in evaluating existing utilities with respect to planned new construction. Over 25 A/E firms have received copies of the code and instructional materials from USA-CERL.

6. Another new product recently made available to the public is a computer program called Solar Feasibility Determination (SOLFEAS). This system provides the building designer with a quick, simple, and inexpensive procedure for making an initial assessment of the feasibility of using solar for any particular application. This system is also offered through Boeing Computer Services and is now being used by A/E firms.

7. The USA-CERL invented Weld Quality Monitor (WQM) and the ceramic anode (CERANODE) have been transferred to the general public by granting exclusive licenses to two different manufacturers.

As a result of technology transfer, research products originally developed for use by the Army are finding widespread use throughout the private sector. Their use has resulted in increased productivity, improved performance with lower costs, and the creation of jobs for the economy. The manufacturing of government-developed products by the private sector, as expected to be the case for the ceramic anode and weld quality monitor, not only ensures their availability for public use, but also ensures their availability for government procurement.

USA-CERL POC is Dr. Gilbert Williamson at COMM 217-373-7206, FTS 958-7206, AUTOVON through Chanute AFB, or toll-free 800-USA-CERL (Outside Illinois), 800-252-7122 (Within Illinois).

Fact Sheet

US Army Corps of Engineers
Construction Engineering Research Laboratory

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Public Affairs Office
Phone (217) 352-6511
Toll Free 800-USA-CERL

February 1985

TECHNOLOGY TRANSFER MECHANISMS: INVOLVEMENT OF PRIVATE AND NONPROFIT ORGANIZATIONS

The Army finances research and development (R&D) in support of its construction operations and maintenance missions. The R&D products are incorporated into the military facility predominantly through the civilian construction industry. Approximately 80 percent of the architectural/engineering (A/E) services required are provided by civilian A/E's; 100 percent of the construction is provided by civilian contractors. Thus for the Army to benefit from its R&D products, it is essential that the civilian providers of services and equipment use those products, in supporting military needs. When an R&D product is a prototype hardware device, it must be manufactured in the private sector for later procurement to support the Army's construction effort. Under the Stevenson-Wydler Technology Innovation Act of 1980 and the Department of Defense (DOD) Domestic Technology Transfer Program regulation, the Army is authorized to make its research products available to State and municipal governments. Non-government organizations with similar needs to those of the Army's can also use Army R&D products. Clearly, the civilian construction industry plays a vital role in the Army's efforts to benefit from R&D products. USA-CERL has used several mechanisms to aid the industry in performing this role.

Exclusive Licensing Agreements. This mechanism is for R&D products which have been patented by the USA-CERL research staff. The Department of the Army has entered into an exclusive five-year licensing agreement with two firms to complete product development, manufacturing, and marketing of two inventions patented by USA-CERL. These inventions are the weld quality monitor and the ceramic anode. The firm bears the entire cost of the manufacturing and marketing effort. USA-CERL provides consulting and technical assistance to the firm on a cost-sharing basis during the initial tooling-up process. USA-CERL's involvement in this stage is to insure that the final product meets quality and performance standards required by the Army. The Federal Government receives a royalty--in these cases five percent--based on the gross sales of the product. The licensing agreement for the WQM includes provisions for a continuing joint research effort between the firm and USA-CERL to further improve the capabilities of the invention.

Use of Designs for R&D Products. This mechanism is for products which have been developed by USA-CERL, but which can not be patented. USA-CERL will provide designs of its non-patentable R&D developments to firms with the technical expertise and interest in furnishing the product to the Army. USA-CERL has provided designs for the PORTAWASHER--a machine for cleaning dumpsters in place--and control panels which can be retrofitted onto heating, ventilating, and air-conditioning (HVAC) systems in Army facilities. USA-CERL reviews and tests prototypes to compare performance versus military standards to insure production models meet Army needs. The designs are provided to the firms at no cost. The firm bears all production and marketing costs.

Adoption of R&D Products. This mechanism is for a professional society or trade association which chooses to make a non-patentable product developed by a USA-CERL researcher available to its constituents. The American Public Works Association (APWA) has assumed sponsorship of USA-CERL's Pavement Maintenance Management System (PAVER). USA-CERL provided the PAVER program to APWA at the cost of reproducing both the program and documentation. APWA modified the program to meet civilian needs using its own resources and paid USA-CERL consultant fees to assist in this effort. APWA makes PAVER available to member cities, counties, and consultants for a cost developed by the APWA. (APWA is currently investigating USA-CERL's Voice-Activated Inspection System and may sponsor the use of that system among its members.)

Support Center Arrangements. This mechanism is to support Army and civilian sector A/E's in use of products developed by USA-CERL researchers on military facilities. A center can also support the use of the technology for non-military applications via private arrangements with the center management. Support centers have been established at the University of Illinois at Urbana-Champaign (UIUC) to assist military and non-military users of USA-CERL R&D products. Centers have been established for the Environmental Technical Information System (ETIS), Building Loads Analysis and System Thermodynamics (BLAST) program, facilities space management planning and the use of microcomputers for managing the physical plant at an Army installation. The sponsoring academic department of UIUC responds to phone requests on using these computer systems, maintains and updates data files used in the programs, handles users fees, provides training sessions, and assists USA-CERL in continuing research on the system. Support centers are funded by the Army and by users fees from non-military users.

Commercial Computer Vendors. This mechanism is for putting computer programs developed by USA-CERL researchers into the public domain. Several USA-CERL computer programs can be accessed by users through commercial computer timesharing systems. BLAST, the Solar Energy Feasibility Program (SOLFEAS), and the Computerized Evaluation of Utility Plans (CEUP) are some of the USA-CERL products currently available from commercial vendors. Some of these programs were developed on the computer systems in which they reside. Other programs were made available to vendors by USA-CERL for the cost of duplicating the program. Users pay computer timesharing costs as outlined by the vendor, but use of the program is free. Some vendors provide support to users as part of their normal service to customers.

For additional information on these technology transfer mechanisms, contact Dr. Gil Williamson, at COMM 217-373-7206, FTS 958-7206, AUTOVON through Chanute AFB, or toll-free 800-USA-CERL (Outside Illinois) or 800-252-7122 (Within Illinois).

APPENDIX II-E

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report describes the Naval Surface Weapons Center Technology Transfer Program and presents narrative summaries of related projects performed during FY83/84. Technology Application Assessments and a listing of patents/Navy cases for this time period are also presented.

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OF POOR QUALITY**

FOREWORD

The Naval Surface Weapons Center (NSWC) Technology Transfer Biennial Report (FY83/84) has been prepared in accordance with the format and content currently specified by the Chief of Naval Material for Navy inputs in meeting the reporting requirements of the Stevenson-Wydler Technology Innovation Act of 1980 (Public Law 96-480).

The objectives of Navy technology transfer are (1) to disseminate non-critical technology, originally developed in support of military applications, for potentially alternative uses in the public and private sectors; and (2) to promote joint cooperative development programs that address problems of mutual concern to the Navy and other agencies or organizations. In pursuit of these objectives, the Navy transfers technical expertise to other Federal Government agencies; state and local governments; small and large businesses; nonprofit organizations; and such public service organizations as schools, hospitals, and foundations. In addition, technologies that have direct impact on the Navy mission and programs are transferred within, or into, the Navy. Transfers of hardware, software, management practices, and expertise are made in diverse fields, such as analysis and testing, communications, energy, environment, transportation, and marine technology. The Navy Technology Transfer Program provides unique services not available from the private sector and not in competition with that sector. The underlying philosophy and approach is to promote domestic technology transfer activities of non-militarily critical technical material that is approved for public release.

A substantial portion of the information in the Appendices of this report was contributed by NSWC technical staff members engaged in Center technology transfer tasks. Questions or requests for additional information should be referred to NSWC, Code D21, Mr. Ramsey D. Johnson, (301)394-1505 or Autovon 290-1505.

Approved by:

D.N. Dick

D. N. DICK
Advanced Planning Staff

APPENDIX II-F

From: Air Force Potential Contractor Program (program announcement)

INTRODUCTION

The Air Force Potential Contractor Program (PCP) was established to certify and register non-government activities for access to scientific and technical information on Air Force needs, requirements, work and accomplishments associated with research, development, test, and evaluation. The PCP provides non-government agencies the opportunity and means to obtain current scientific and technical information needed to maintain their capabilities as developers and producers of military equipment. This information enables such contractors and potential contractors to:

o Discover and assess Air Force applications for their current products and services.

o Plan future independent research and development efforts synchronized with stated Air Force requirements.

Under the PCP, the Air Force will sponsor qualified and eligible organizations for access to planning and technical information on USAF requirements and existing research and development from the Air Force Information for Industry Office (AFIFIO), and for access to the scientific and technical data banks in the Defense Technical Informaton Center (DTIC). Access to such data will be limited to subject categories related to a participant's capabilities. To receive classified information under this program, the organization must possess a valid facility clearance on file at DTIC.

Firms, individuals, or activities with a demonstrable capability of performing research/development with a reasonable potential for eventually receiving a contract with the USAF are invited to participate in the PCP. Qualified nongovernment activities choosing to participate in the PCP will enter into a policy agreement with an appropriate PCP Manager resident in the AFIFIO. The agreement will define the conditions for the exchange of information between the participant and the Air Force.

The Policy Agreement will be executed by officers of the potential contracting agency, and, when properly executed, authorizes potential contracting activities entry into the PCP. Policy Agreements are filed in the AFIFIO and are effective for three years.

Although participation in this program is available to all contractors, it is specifically aimed to assist the contractors who do not have an active DOD contract, but have a demonstrable capability to perform work for the USAF. Participation will be granted after an evaluation of capabilities (experience, personnel, facilities) is made and a policy agreement is signed.

No contractual obligation or commitment to a future contract is assumed or implied on the part of the Air Force in furnishing documents and information under a PCP agreement. Participation in the PCP and subsequent receipt of Government documents in no way obligates an organization to furnish articles, services or proposals to the Air Force nor constitutes a basis for a claim against the Government.

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APPENDIX II-G

Bureau of Mines
Technology Transfer

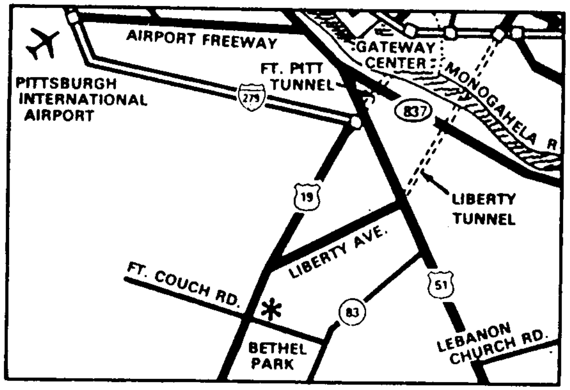
Industry Meeting
on
Water-Jet Assisted Cutting

June 21, 1984
Pittsburgh, PA

United States Department of the Interior,
Bureau of Mines

Meeting Location

Pittsburgh, PA
June 21, 1984



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Technology Transfer Group
Bureau of Mines
2401 E Street, N.W.
Washington, D.C. 20241

Industry Meeting
on
Water-Jet Assisted Cutting

/ater-jet assisted cutting is an old technology that has ecently grown into a useful, cost-effective new method of ining. The technique employs water under high pressure to ine various minerals. This new technology has the otential to increase health, safety, productivity and rofitability of underground coal mining.

he Bureau of Mines will sponsor a one-day industry eeting on water-jet assisted cutting on June 21, 1984, in ittsburgh, PA, at the Sheraton Inn-South. The meeting will onsist of technical presentations describing new research n the optimization of water-jet assisted cutting on mining quipment, its use in tunnel boring, and its effect on echanical cutting. Results of investigations concerning duced bit forces, reduced rates of bit wear, and reduction dust generated through use of water-jet assisted cutting ill be discussed.

the end of the meeting, interested attendees will be ansported to the Bureau's Pittsburgh Research Center in uceton, PA, to see actual demonstrations of water-jet ssisted cutting.

ureau of Mines technical personnel will be available to nswer any questions or to discuss the research further. The eeting is free to anyone interested.

ease take a moment to review the agenda, and if you ould like to attend the briefing and demonstration, please out the attached card and return it to the Bureau of Mines o later than June 8, 1984. Further information about the eeting may be obtained from:

Donald E. Ralston, Chief
Branch of Technology Transfer
Bureau of Mines
2401 E Street, NW
Washington, D.C. 20241
Telephone: 202/634-1224

AGENDA

8:00 a.m.	Introduction *John N. Murphy*, U.S. Bureau of Mines
8:10 a.m.	Water-Jet Assisted Cutting—Present State-of-the-Art *Michael Hood*, University of California
8:35 a.m.	Analysis of Mechanical Tool Force Reductions When Using Water-Jet Assist *Robert J. Evans*, U.S. Bureau of Mines
9:00 a.m.	Experience of Applying High Pressure Water-Jet Assistance to Mechanical Cutting *Arthur Morris*, National Coal Board
9:25 a.m.	Development Work for Coal Winning Technology *Egon Henkel*, Bergbau-Forschung
9:50 a.m.	The Water-Jet Plow *David Summers*, University of Missouri-Rolla
10:15 a.m.	BREAK
10:30 a.m.	Performance Review of Jarvis Clark Jet Bolter *William Griffiths* and *Jarvis Clark*
10:55 a.m.	Water-Jet Assisted Tunnel Boring *Levent Ozdemir*, Colorado School of Mines
11:20 a.m.	Investigation of Optimizing Traverse Speed of Water-Jet Assisted Drag Picks *Robert J. Evans*, U.S. Bureau of Mines
11:45 a.m.	Optimization of Water-Jet Systems of Mining Equipment *Jim Reichman*, Flow Industries
12:10 p.m.	LUNCH
2:00 p.m.	Bus will depart from Sheraton Inn-South to Bureau of Mines
2:30 p.m.	Bus arrives at Bureau of Mines—Demonstrations will be conducted on Water-Jet Assisted Cutting
4:00 p.m.	Bus departs from Bureau of Mines to Sheraton Inn-South
4:30 p.m.	Bus departs from Sheraton Inn-South to Airport
5:30 p.m.	Bus arrives at Airport

I/We plan to attend the Bureau of Mines Industry Meeting on Water-Jet Assisted Cutting on June 21, 1984, in Pittsburgh, PA.

Name(s): ____________________

Company: ____________________

Address: ____________________

City: ____________ **State:** ______ **Zip:** ______ **Telephone:** ______

☐ **I/We will need Bureau transportation from the hotel to the demonstration site and return.**

APPENDIX II-H

Technology News

From the Bureau of Mines, United States Department of the Interior

Technology News describes tested developments from the Bureau of Mines Research Programs. It is published to encourage the transfer of this information to the minerals industry and its application in commercial practice. Mention of company or product names is for documentation only and does not imply government endorsement of a specific firm or product.

Bureau of Mines research is performed and reported under mandate of the United States Congress. **For a free subscription to Technology News, write to: Technology Transfer Group, Bureau of Mines, 2401 E St., NW, Washington, D.C. 20241.**

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No. 197, March 1984

Headgate to Tailgate Cutting Lowers Longwall Shearer Operators' Dust Exposure

Objective

Reduce dust exposure of longwall shearer operators by keeping them upwind of the primary cutting drum.

Approach

Use a different coal cutting sequence by cutting from headgate-to-tailgate, making the cleanup pass from tailgate-to-headgate.

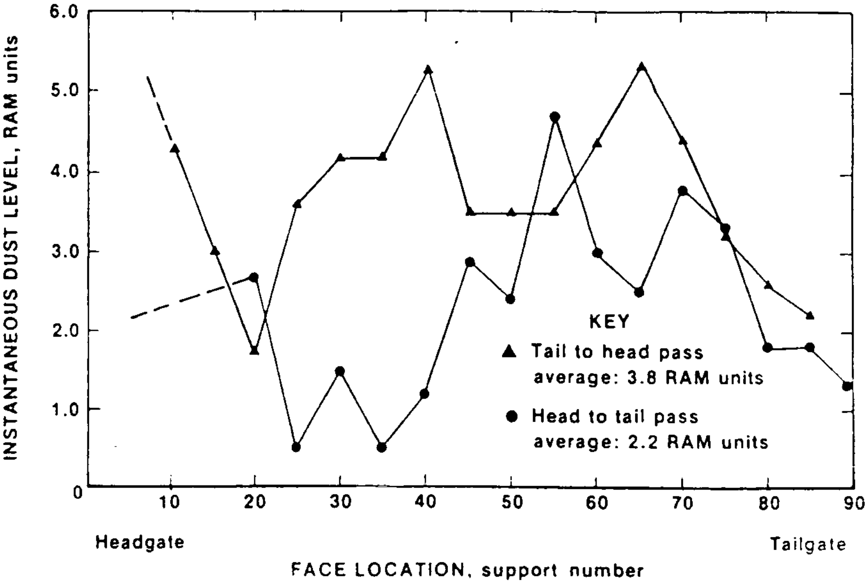
How It Works

The cutting action of the shearer drum is usually the primary source of respirable dust at longwall shearer faces. Dust exposure of the shearer operator is determined by his position relative to the lead drum, which is normally in the raised position taking a full sump. On longwall faces where the cut pass is taken from tail-to-head, against the primary airflow, the shearer operators must remain at their controls, on the return-air-side of the primary dust source, to maintain proper control.

A simple method to lower shearer operators' dust exposures is to extract the primary coal from head-to-tail, thus positioning the operators upwind of the lead cutting drum. The bottom coal is then cut, and the floor cleaned by the trailing drum during the tail-to-head cleanup pass. This sequence places the primary dust source, the cutting action of the shearer drums, on the return-air side of both shearer operators, except when cutting out at the longwall headgate.

Underground Test Results

Dust surveys were conducted on fourteen longwall faces as part of the Bureau's research program designed to study the relationship between cutting direction and the shearer operators' respirable dust exposure. Of the fourteen faces surveyed, six cut unidirectionally from head-to-



Comparison of dust levels at midpoint of shearer, showing effect of cutting sequence and location of lead drum. Average dust level during head-to-tail pass was 2.2 RAM units, while average dust level during tail-to-head pass was 3.8 RAM units, a 42% increase.

tail, four cut unidirectionally from tail-to-head and four cut bidirectionally. The average dust level measured at the midpoint of the shearer while cutting from head-to-tail was 2.0 mg/m³, while the average for the tail-to-head cuts was 3.6 mg/m³. These values reflect only the average amount of dust generated by the shearer during the actual cutting operation, and as such may not be directly related to an 8-hour shift average. However, the data does illustrate the effects of cut direction. The average shearer operator's exposure when cutting tail-to-head was 44% greater than when cutting head-to-tail.

It is important that mine operators examine their cutting sequence and implement mining practices that allow face workers to remain upwind of the lead drum during most of the mining cycle. A Bureau of Mines survey of six longwalls with better-than-average compliance records has shown that in all cases design of the cutting sequence was a significant factor in contributing to lower dust levels.

Minimize Impact on Production

One of the problems in cutting from head-to-tail is cut material blocking the underframe of the shearer. When the leading drum is located on the return end of the machine most of the coal and any large lumps caused by face spalls must pass through the shearer underframe. Several shearer manufacturers offer machines with higher underframe clearance as well as lump breakers on the return end of the shearer. An alternative to consider when designing the longwall panel is to cut the coal and direct the primary airflow in the same direction—from tailgate-to-headgate. This allows the shearer operators to be positioned upwind of the lead drum and minimizes the amount of coal passing through the shearer's underframe. In addition, any dust generation caused by spalling of the coal ahead of the leading drum occurs downwind of the shearer operators.

Support movement must also be considered when selecting the optimum cutting sequence. When possible, support advance should be on the return-air side of the shearer during the tail-to-head cleanup pass. On some longwall faces, the dust levels from support movements will be higher than those generated by the shearer. Thus, if geological conditions require immediate support of the exposed roof, a tail-to-head cut with support advance on the return-air side of the shearer may be required.

It is easy to evaluate the effect of the cutting sequence on shearer operators' dust exposures. The standard gravimetric personal dust sampler can be used to determine the dust level at the midpoint of the shearer on a pass-to-pass basis.

For More Information

Research on mining cycle modifications is being performed under contract to the Bureau of Mines. Several other *Technology News* describing various methods developed by the Bureau of Mines to control longwall dust are available. For free copies of these issues or for a list of titles, please contact the Bureau of Mines, Branch of Technology Transfer, 2401 E Street, NW, Washington, D.C. 20241. For answers to technical questions concerning the research described in this *Technology News*, contact Mr. Robert Jankowski of the Bureau's Pittsburgh Research Center, P. O. Box 18070, Pittsburgh, PA 15236 or telephone (412) 675-6691.

APPENDIX II-I

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**           WELCOME TO           **
* THE EXTENSION A&E SYSTEM **
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   1T              New State Impact Studies
   1B              Impact Studies - Reports
   2A              Accomplishment Reports - FY 81
   2B              Accomplishment Reports - FY 82
   2C              Accomplishment Reports - FY 83
   3               Four Year Program
                   and Evaluation Plans
   3T              New Major Programs
   4               Analyst Briefs
   5               A & E Training Materials
   6               Research Results
   8A              Overview Statements - Updated
   9A              FTE Tables - Updated

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1 SEPTEMBER 04, 1984
RS582   (Released 8/84)  Selection for high protein wheats
           from bulk populations using a solution flotation procedure


  AUGUST 21, 1984
RS514 (Released 8/84) Honey Bee Colony Performance in Relation to
        Supplemental Carbohydrate Source (High fructose corn syrup vs.
        sucrose)
```

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3 JULY 25, 1984
ARS438      (Released 7/84) The Determination of Individual Simple Sugars in
            Aqueous Solution by Near Infrared Spectophotometry


4 JULY 25, 1984
ARS412      (Released 7/84)  Book Report:  Progress in Pesticide Biochemistry,
            Volume 2


5 JUNE 6, 1984
ARS232         (Released 5/84)  Book review of "Pests, Diseases and Disorders
               of the Sugar Beet"


6 MAY 2, 1984
ARS148   Storage of Sweet Sorghum Biomass (using propionic acid, SO2,
         and NH3 as preservatives)   (Released 4/84)


7 APRIL 4, 1984
ARS71          Amino Acid Content in Selected Breakfast Cereals (first report of
               quantity and quality differences in 11 brands)  (Released 3/84)


8 APRIL 4, 1984
ARS71          Amino Acid Content in Sele
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RESEARCH RESULTS
FRIDAY     APRIL 4, 1984

ARS71          Amino Acid Content in Selected Breakfast Cereals (first report of
               quantity and quality differences in 11 brands)  (Released 3/84)

Protein content and concentration of 17 amino acids were determined in 11
breakfast cereals.  Protein levels ranged from 4.81% (Kellogg's Sugar Frosted
Flakes) to 21.18% (Special K).  Amino acid content was very different among th
different cereals.  This was due to the different formulations used in the
manufacturing of the food products.  The nutritional quality (protein) of the
breakfast cereals was poor to very low in quality.  Since breakfast cereals ar
eaten by many people, especiallly children, an improvement of the protein
quality would enhance the nutritional value of this important food.  This type
of food information is not available in the scientific literature; therefore,
this information is needed by government agencies preparing nutritional food
tables and by professional nutritionists and consumers preparing special diets
or requiring special diets.
*KEYWORDS
Wheat, Rice, Oats, Corn
*CONTACT
Filmore I. Meredith
USDA, ARS, Russell Res. Ctr.
P.O. Box 5677
Athens, GA  30613
404-546-3150
FTS 250-3150
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AGRICULTURAL RESEARCH SERVICE
TECHNOLOGY TRANSFER AUTOMATED RETRIEVAL SYSTEM

New Research Results for Principal User: NOAA

Covering the period from 2/1/85 to 6/30/85

WEATHER SIMULATION FOR CROP MANAGEMENT MODELS

Interpretive Summary:

Weather has a major influence on the production of most crops. Recently mathematical models have been developed that can be estimate the growth and production of specific crops and to evaluate alternative crop and management strategies. Most of these models require weather data. Historical weather data can be used to make these assessments. However, for many locations weather data are not available. In this paper a procedure for generating synthetic weather data is evaluated as a substitute for actual weather data. The generated weather data, when used with a crop model, are shown to result in equal crop yield estimates as actual weather data for a specific site. Weather generation coupled with a crop model provides a cost-efficient method of estimating crop yields and evaluating the risk of crop production with a specific management strategy.

Technical Abstract:

Daily weather data generated with a weather generation model (WGEN) were evaluated as a substitute for actual weather data as input to a selected crop model (CERES-Wheat). Wheat growth characteristics and annual wheat yields obtained using generated data were not significantly different from that obtained using actual data. Two simplified weather options were evaluated as input to the CERES-Wheat model. Mean daily solar radiation values by month produced the same wheat yield distributions as daily solar radiation data. Mean daily maximum and minimum temperature over estimated wheat yields compared to maximum and minimum temperature data that contained the day-to-day variations in temperature.

PRECIPITATION, TEMPERATURE, SOLAR RADIATION, CROP MODEL, WHEAT
SYNTHETIC WEATHER DATA, S/A, ENGINEERING

Richardson , Clarence W.
USDA-ARS
P.O. Box 748
Temple, TX 76503 (817)774-1201 FTS 736-1201

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APPENDIX II-J

Request to Submit Manuscript for Publication

[redacted]

6/21/85

OF PERSON SUBMITTING REQUEST
Ralph G. Spomer

TELEPHONE NO.
(712) 825-5549

3. MANUSCRIPT HAS BEEN-
Peer reviewed ☒ Yes -- attach all ARS-533's.

Cleared by Cooperative Agency(s) or Institute(s)
☒ Yes ☐ Not Applicable

OR(S) NAME (Last, first, initial)
Spomer, Ralph G.
Mahurin, Robert L.
Piest, Robert F.

MODE CODE
3802-015
"

EMPLOYER (if non-ARS)
ARS
ARS
Retired ARS

TIST TO CONTACT FOR ADDITIONAL INFORMATION (Name and)

Ralph G. Spomer
USDA-ARS-WRU
Rm. 318, Federal Office Bldg.
P.O. Box 896
Council Bluffs, IA 51502

TELEPHONE NO.
☒ FTS ☐ Commercial
864-5549

6. ARS PROGRAM PROVIDING BASIS
CRIS No.
3802-20800-013-00

ARS Strategic Plan No.
1.1.01.1.a

OF MANUSCRIPT (Limit to 180 characters). Is this the first formal report of these research results other than as an abstract? ☒ Yes ☐ No

Erosion, Deposition and Sediment Yield: Dry Creek Basin, Nebraska

ORDS - Include commodity, if applicable (Limit each word to 30 characters)

Soil loss
Sediment deposition
Sediment accounting
Sediment balance

Channels
Gullies

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IAL OR EQUIVALENT TO WHICH MANUSCRIPT
submitted (Give full name)

Transactions, American Society
of Agricultural Engineering

Was previously submitted, if any
N/A

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tension Service
oducer or Producer Group
her (Specify):

04 ☒ USDA Action Agency (Identify)
Soil Conservation Service

05 ☒ Other Gov't. Agency - Federal, State, Local (Identify)
U.S. Corps of Engineers
U.S. Geological Survey

06 ☐ Industry (Name or description)

11. HAS THIS MANUSCRIPT BEEN REVIEWED FOR PATENT POTENTIAL?
☐ Yes, and it is/was
☐ Not Patentable ☐ Pending ☐ Granted

NUMBER

Note: Application for a patent must be filed at the U.S. Patent Office within 1 year from the publication date.

☒ No

RPRETIVE SUMMARY
ot required ☒ Recorded on reverse

12. TECHNICAL ABSTRACT
☐ Previously prepared copy is attached ☒ Recorded on reverse

APPROVED BY
(Research Leader, Location Leader, Laboratory/Center Director as applicable)

TITLE	SIGNATURE	DATE
search Leader	Allen T. Hjelmfelt Jr.	6/21/85
7/11/85 5Ge		
Area Director	Charles W. Alexander	JUL 03 1985

RS-115 (11/84) Previous editions are obsolete J-1 USDA-ARS

INTERPRETIVE SUMMARY *(Required only for original scientific papers.) (Limit to 20 lines of 70 spaces.)*

Historic and contemporary landscape changes, based upon a long-term accounting of soil erosion, redeposition in and movement from a watershed, had not been possible for agricultural-size watersheds. Previous sediment-accounting estimates were based on data from very small 40.5 m^2 (0.01 a) plots and large drainage areas over geologic time.

Measurements of erosion sources, deposition sites, and sediment yield were made on the 51.8 km^2 (20 mi^2) Dry Creek Basin in Nebraska from 1951 through 1981. These historic and current measurements of channel erosion and deposition, gully encroachment into upland fields, and Universal Soil Loss Equation computations of cropland soil losses, were combined to derive a complete disposition of soil movement within and out of the basin.

This information will be useful to action agencies as they assess amounts, types and locations of soil erosion and deposition. Additionally, this information should be useful in model development and verification.

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TECHNICAL ABSTRACT *(Limit to 20 lines of 70 spaces.)*

Historic and current measurements of channel erosion and deposition and gully encroachment into upland fields, along with USLE-computed soil losses (Universal Soil Loss Equation), were utilized to attempt a total accounting of sedimentation (erosion and deposition) processes in the Dry Creek Drainage Basin, Nebraska. Such accountings have previously been extrapolated from information at extreme ends of time/space reference frames, i.e. for very small 40.5 m^2 (0.01 acre) plots on an annual basis or for large basins over geologic time. In order to improve conservation designs, better information on the dynamics of soil erosion, transport, delivery and deposition is needed. Long-term average annual sediment yields of 10.5 Mg/ha (4.7 t/a) from the 51.8 km^2 (20 mi^2) drainage area of Dry Creek were contributed from cropland soil losses [23.1 Mg/ha (10.3 t/a)], catstep erosion of rangeland [41.9 Mg/ha (18.7 t/a)], sheet-rill erosion from rangeland [1.1 Mg/ha (0.5 t/a)], trenching of valley bottom main channels [2 Mg/ha (0.9 t/a)], and knickpoint gullying into upland areas [0.9 Mg/ha (0.4 t/a)]. Deposition rates averaged 5.8 Mg/ha·y (2.6 t/a·y), with 0.7 Mg/ha·y (0.3 t/a·y) filling the middle channel reaches of Dry Creek, 4.5 Mg/ha·y (2.0 t/a·y) accumulating on the flat floodplain, and the remaining 0.7 Mg/ha·y (0.3 t/a·y) deposited on the same general location from which it was eroded.

APPENDIX II-K

ARS Patent Committees
Beginning October 1, 1984

Committees will meet when the Patent Advisor determines it necessary based upon his workload. Cases previously docketed but not yet acted upon by the Patent Advisor (PA) may be reconsidered.

A. PA will make a brief preliminary patentability determination before meetings.

B. PA will circulate a copy of the invention report with Abstract to each member prior to the meeting.

NOTE: Committee members do not make patentability determination--only offer information concerning current state of the art.

Criteria for Patent Committees to use in assisting PA in evaluating invention reports:

1. The importance of the patent in furthering agricultural goals such as increasing available food supply, control of harmful pests, etc., and impact on agricultural production;
2. The comparative value of the invention to agriculture, commerce, and to the public in relation to other pending patent disclosures;
3. The potential impact of the invention in improving agricultural technology or in generating new or expanded markets for agricultural commodities for which ARS is responsible; and
4. The relationship of the invention to the mission of ARS and to national goals.
5. The PA's estimate of patentability based upon general knowledge and the prior art available at the time. The patentability criteria applied at this and other stages of the process are those set forth in the Patent Law, specifically 35 USC 100-104 (copy attached);
6. The effect of the invention in fulfilling a technological need;
7. The sufficiency of the data, particularly in relation to the breadth of the disclosure and claims they will support; and
8. A speculation of the advancement of the state of the art shall be made but shall not be the only determining factor.

APPENDIX II-L

FOREST SERVICE MANUAL
WASHINGTON

August 1984

TITLE 1300 - MANAGEMENT

Amendment No. 75

POSTING NOTICE. Amendments to this title are numbered consecutively. Check the last transmittal received for this title to see that the above amendment number is in sequence. If not, order intervening amendments at once on form 1100-6. Do not post this amendment until the missing one(s) is received and posted. After posting retain this transmittal until the next amendment to this title is received. Place it at the front of the title.

Page Code	Superseded (Number of Sheets)	New
(Entire chapter)		
1320 thru 1320.7	5	
1320 thru 1324		4

Digest:

1320 - Overall, edited and simplified policy and direction for Washington Office and the field in line with manual review project.

1320.3 - More clearly defines Forest Service policy.

R. MAX PETERSON
Chief

TITLE 1300 - MANAGEMENT

CHAPTER 1320 - TECHNOLOGY TRANSFER

Contents

*-1320.1	Authorities
1320.2	Objective
1320.3	Policy
1320.4	Responsibilities
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1320.42	Technology Transfer Council
1320.43	Technology Transfer Staff
1320.44	Washington Office Staffs
1320.45	Regional Foresters, Station Directors, and Area Director
1320.45a	Regional Foresters
1320.45b	Station Directors
1320.45c	Area Director
1321	RESEARCH WORK UNIT CONTACTS
1322	FIELD COORDINATION
1323	REPORT
1324	FUNDS

-FSM 8/84 AMEND 75-

TITLE 1300 - MANAGEMENT

CHAPTER 1320 - TECHNOLOGY TRANSFER

*-1320.1 - Authorities. The authorities for technology transfer are:

1. Forest and Rangeland Renewable Resources Planning Act of 1974 (88 Stat. 476 as amended; 16 U.S.C. 1601).

2. National Forest Management Act of 1976 (90 Stat. 2949; 16 U.S.C. 1600).

3. Forest and Rangeland Renewable Resources Research Act of 1978 (92 Stat. 353; 16 U.S.C. 1600).

4. Cooperative Forestry Assistance Act of 1978 (92 Stat. 365; 16 U.S.C. 2101).

5. Technology Innovation Act of 1980 (94 Stat. 2311; 15 U.S.C. 3701).

1320.2 - Objective. To promptly and efficiently apply useful knowledge and technology in the protection and management of the Nation's forests, forest land resources, and associated rangelands.

1320.3 - Policy. The Forest Service line and staff officers shall inform and assist potential users in the application of research findings as well as to encourage users to participate in technology transfer activities. Line officers should provide feedback to researchers on the use of the technology. Staff and line officers should develop plans for transfer of technologies to better budget funds for the implementation and also to document the transfer. The plans also commit personnel and time to the transfer process and provide a measure for evaluation.

1320.4 - Responsibilities

1320.41 - Deputy Chiefs. Deputy Chiefs shall provide leadership, coordination, and support.

*- 1320.42 - Technology Transfer Council. The council, comprised of an Associate Chief from each Deputy Area, establishes or recommends policies. The Associate Deputy Chief for State and Private Forestry chairs the council.

1320.43 - Technology Transfer Staff. Located in Washington Office, Cooperative Forestry, the Technology Transfer Staff assists Deputy Areas and provides leadership, coordination, and support to the Washington Office and field units in carrying out assigned technology transfer responsibilities. In particular:

1. Serves as the national focal point for coordination of internal and external activities as well as liaison with the Department, and other Government Agencies. Works with Regions, Stations, and the Area.

2. Serves as the Office of Research and Technology Applications (ORTA), as mandated by Public Law 96-480, Section 11. Also represents Forest Service on the Federal Laboratory Consortium for Technology Transfer, as well as interacts with other National Technology Transfer Organizations.

1320.44 - Washington Office Staffs. National Forest System and State and Private Forestry shall:

1. Keep informed of new technologies and assist in developing plans to assure the transfers.

2. Budget funds for technology transfer projects in concerned program areas.

Research and National Forest System shall, where appropriate, develop procedures to ensure that project leaders, program managers, and managers of development projects involve National Forest System and State and Private Forestry field personnel and other users in project proposals and technology transfer planning efforts.

*- 1320.45 - Regional Foresters, Station Directors, and Area Director. The Regional Foresters, Station Directors, and Area Director shall have a technology transfer coordination committee or similar process to handle technology transfer. Designate Regional and Area Research coordinators. Assign individuals to serve as contacts with specific research work units.

1320.45a - Regional Foresters. The Regional Foresters shall ensure that applicable research findings and technologies are used effectively to upgrade the protection, management, and utilization practices on National Forest System lands and State and private forestry lands in the Western and Southern Regions. They also shall provide Station Directors information on the use of research results and indicate any problems that may limit or impair use.

1320.45b - Station Directors. The Station Directors shall promptly disseminate forestry research results to Regions, Area, and State and private users in ways to encourage acceptance and use. They shall also provide Washington Office Technology Transfer Staff with assessments of research ready for transfer as required by PL 96-480, Section 11.

1320.45c - Area Director. The Area Director shall ensure that applicable forestry research findings are made available to State and local governments and to the private sector in the Northeastern Area.

1321 - RESEARCH WORK UNIT CONTACTS. Individuals serving as designated contacts between Regions, Area, and Research work units shall communicate annually and meet as necessary to:

1. Review current and planned research.

2. Report to Regional Foresters, Station Directors, and Area Director on research being used and problems resulting from or impeding its application.

3. Provide field and information user input to the research process.

*

* 4. Identify and discuss application opportunities.

5. Keep secondary contacts informed.

6. Recommend and participate in the development of technology transfer plans.

1322 - FIELD COORDINATION. Field Coordination should be handled by a committee composed of Regional and Area research coordinators and Station Assistant Directors for Planning and Application, or a similar process, to accomplish the following:

1. Review user problems and available technologies and recommend priorities for research application needs.

2. Encourage the development of technology transfer plans and followup on existing plans.

3. Update subject-matter specialists' assignments to Research work units.

4. Exchange information on identified problems that need to be considered in research program development and technology transfer needs and opportunities.

1323 - REPORT. Regions, Stations, and Area shall provide the Chief with a progress report FS-1300-W, Evaluation of Technology Transfer Activities, each October 1 for the fiscal year just ended. This report, in summary form, should cover items such as: how technology transfer is being managed; uses made of new technologies; any problems encountered in the use of the technologies; and identification of projects for next fiscal year. The report should also include examples of case histories of research transferred. See exhibit 1 for case history format. *

*- Exhibit 1

TECHNOLOGY TRANSFER REPORT

Case History

Case: DFSIM (Douglas-Fir Stand Simulator)

A. What was transferred: DFSIM - a computer program which generates estimates of growth and yield of coastal Douglas-fir region of Western Cregon and Washington.

B. When was it transferred: Started in 1981.

C. Where was it transferred: Primarily in the Douglas-fir region of Western Oregon and Washington.

D. How was it transferred: Program was given to users requesting it. A user manual (GTR PNW-128, 1981) and yield tables with interpretive information (GTR PNW-135, 1982) were published. A series of talks and workshops were given in 1982-83 to the R-6 Silviculture Institute and other groups. RWU 1207 continues to provide assistance to users with questions concerning operation of the program and its application.

E. To whom was it transferred: Since 1981, DFSIM has been transferred directly to 30 public and private land managing organizations, universities, and consulting firms. Those using it include silviculturists, forest managers and planners, research foresters, and university teaching staff. It has also been placed in the computer network (AGNET) by cooperative Extension at Washington State University.

F Why was it transferred: DFSIM answers a need for information on growth and yield for use in timber management planning, silvicultural prescriptions, improvement on DFIT, a model developed in the late 1970's to provide interim guides for predicting growth and yield in managed stands. DFSIM is also useful as a teaching tool in forestry.

*

*-Exhibit 1 -- Continued

G. Result of transfer: DFSIM is now widely used by R-6, USDA, Forest Service, and other public and private land managing organizations in the coastal Douglas-fir region. It is the state-of-the-art in growth and yield estimation for managed stands of Douglas-fir on the Westside of the Cascade Range in Oregon and Washington and is being used by all the largest forest land managing organizations in the area. It is also being used as a teaching tool in several universities.

H. Feedback: Feedback has been generally favorable. The major criticisms are with shortcomings of DFSIM. Users want the capability to generate estimates of growth and yield for wide initial spacings (now presently only to 300 stems per acre) and to estimate the number of trees by diameter class. Efforts are underway to try to remedy both shortcomings as a result of concern from users.

1324 - FUNDS. See FSM 6510, 6520 for direction. *

APPENDIX II-M

Guide to Help Develop a Technology Transfer Plan

Preface

This guide is designed to help persons interested in getting technology transferred to users. The elements offered result from a mixture of experiences and established practices. They are not absolute, but provide guidance in developing actual technology transfer plans. You can test, reshape, or add to the guidelines as you need to plan your particular transfer. Our intended purpose is to stimulate your interest, increase your awareness and show you how a technology transfer plan may be developed. Its main use is as a tool to help you get technology transferred to users, and to have a document from which to work.

This guide was developed by H. G. Marx, T. T. Group, Forest Service, U.S.D.A.

Plan Development

Actual development of the technology transfer plan can involve most or all of the following seven elements:

Message

* the **Message** (what is being transferred).

This element is concerned with development of the technology, or information, that is to be transferred to users. It is best to keep it simple and direct. Clarity of message will aid in transfer and evaluation. Details can be worked out later in the actual implementation of the plan.

For example:

- Sawmill operators can increase profits and reduce waste by using the BOF (Best Opening Face) method of sawing.
- Proper shade tree management, such as reducing decay in trees, can increase property value to homeowners.
- Use of plastic tubing to collect maple sap can increase yields for the sugar bush operator.
- Improved harvesting techniques can reduce logging residues for timber operators.
- Forest fertilization will increase growth rate.

Objective

* the **Objective** (expected accomplishments).

The purpose of this element is to define as exactly as possible what is expected to be accomplished by the transfer of technology. The statement should be simple and should establish time and content limitations.

The objective can be developed by looking at the message and the intended audience, and then determining what realistically can be accomplished. Be direct. An elaborate presentation is unnecessary and can be confusing. Clear objectives lead to better transfer evaluation.

Some examples of objectives:

- to motivate 50 average woodlot owners in the South to regenerate a stand of pines within a year by direct seeding.
- to motivate East Coast wood importers to treat products to eliminate beetles before shipping.
- to get 50 timber contractors to use improved harvesting techniques within a year.

Team

* the **Team** (persons helpful in the transfer).

The purpose of this element is to get wide support for the transfer process, to get commitment in plan development and implementation, and to utilize the talents and expertise of many persons. One single link alone doesn't make a chain.

For example, a plan aimed at transferring a silvicultural process may involve a practicing forester, an extension forester, an information officer, and a scientist. A method for managing forest insects may have on the transfer team entomologists, arborists, State employees, an information person, and an administrator.

Remember, seek help when needed. Look for expertise. Involve as many concerned individuals as feasible. This can range from as few as two (the technology developer and a transfer agent) to 20 or 30. The team's size will depend a lot on the project, the size of the audience, and availability of help.

Audience

* the **Audience** (potential user).

This element is concerned with identifying the user, or users of the technology. Who are they? Where are they? What are their characteristics? What are their needs? It's a profile of the intended user. It will provide data in developing the varied approaches needed to transfer the technology to the users. It is important that the primary users be pinpointed and interacted with. Know your audience, otherwise how will you know if the transfer has succeeded. It will also help you set realistic tasks and goals.

The team should help to identify the audience as well as to help in developing the media.

Media

* the **Media** (mechanisms for transferring technology).

This is the element that pinpoints how the transfer takes place. It helps to focus on methods for reaching the user. There's the one-on-one method. There are workshops, symposiums, show-me trips, publications — both technical and how-to-do-it — audio visuals, posters, etc. The key to selecting the media is in knowing where the audience is and in deciding the best way to reach the audience to get action.

For example, a silvicultural practice may be transferred by show-me trips, workshops, one-on-one, handbooks, or manual direction. A program to protect wood-in-use from decaying may be conveyed to intended users through popular publications, leaflets, posters, slide-tapes, and TV spots, or through extension sources.

When searching for the right media to transmit the technology, it can be helpful for you to work with the team. Remember that each project may require a different approach. Be aware of the advantages and disadvantages of each method. Choose those methods that will zero-in on your primary users. For smaller, more specific audiences, use media that can directly reach the user, such as one-on-one, workshops, demonstrations, and how-to-do-it publications. For large general audiences, the mass media, such as radio, television, newspaper articles, etc., may be beneficial.

Some questions to consider in selecting the media to use may be:

Where will the transfer take place? Will illustrations help in the transfer? Is the audience large or small, or does it have special characteristics? Is the technology understandable? Does it need interpretation and if so, how much? Are there several ways of reaching the users? Should others be made aware of the technology?

Timeliness can be very important in getting the technology accepted. For example, producers of maple sap are more receptive to knowledge of sap production just before the season starts. Timber managers may adopt a residue technology if it is presented before timber sales are made. The pest control agent may look favorably upon a new pest management program if he or she has the data in hand when planning the next year's program.

Cost

* the **Cost** (the budget).

A successful technology transfer plan does cost in dollars and manpower. An estimate should be made, and if time permits, budgeted. Experiences have shown that most costs can be supported by current programs. However, whenever possible, there should be a budget item that specifically addresses the technology transfer plan. Then when the need arises for funds, they are there to be used. A plan may be useless for lack of "seed" money to get the initial phases underway.

Just be aware that some funds will be needed. Explore all sources of funding. A plan involving several functions or agencies has better chance of getting funds from a variety of sources than a plan involving only one function.

Evaluation

* the **Evaluation** (assessment of the program).

The technology transfer plan should have an evaluation element to determine what was accomplished. There are numerous ways to evaluate the program. Search out these methods and use the ones you feel will give you an insight into the success or failure of the transfer. An outside contractor might be helpful in doing the evaluation.

You should also work to build a response system into the transfer plan—some way the user can reply. A record of inquiries or requests for assistance are valuable assessment tools. The number of users is also an indication of acceptance.

There are other direct and indirect ways to evaluate a program. For example, go directly to the user and see what he is doing. Is it helpful? Indirectly, measure response to requests for publications, visits, numbers at workshops, etc. This measures impact.

The direct approach is more positive. You can relate with the user how effective the technology was or was not. You can also determine whether the technology was communicated in a manner which the user understood.

Complete evaluation involves not only a measure of user change in response to the technology transferred, but also some method to determine how much change was directly due to the technology alone.

Examples of TT Plans

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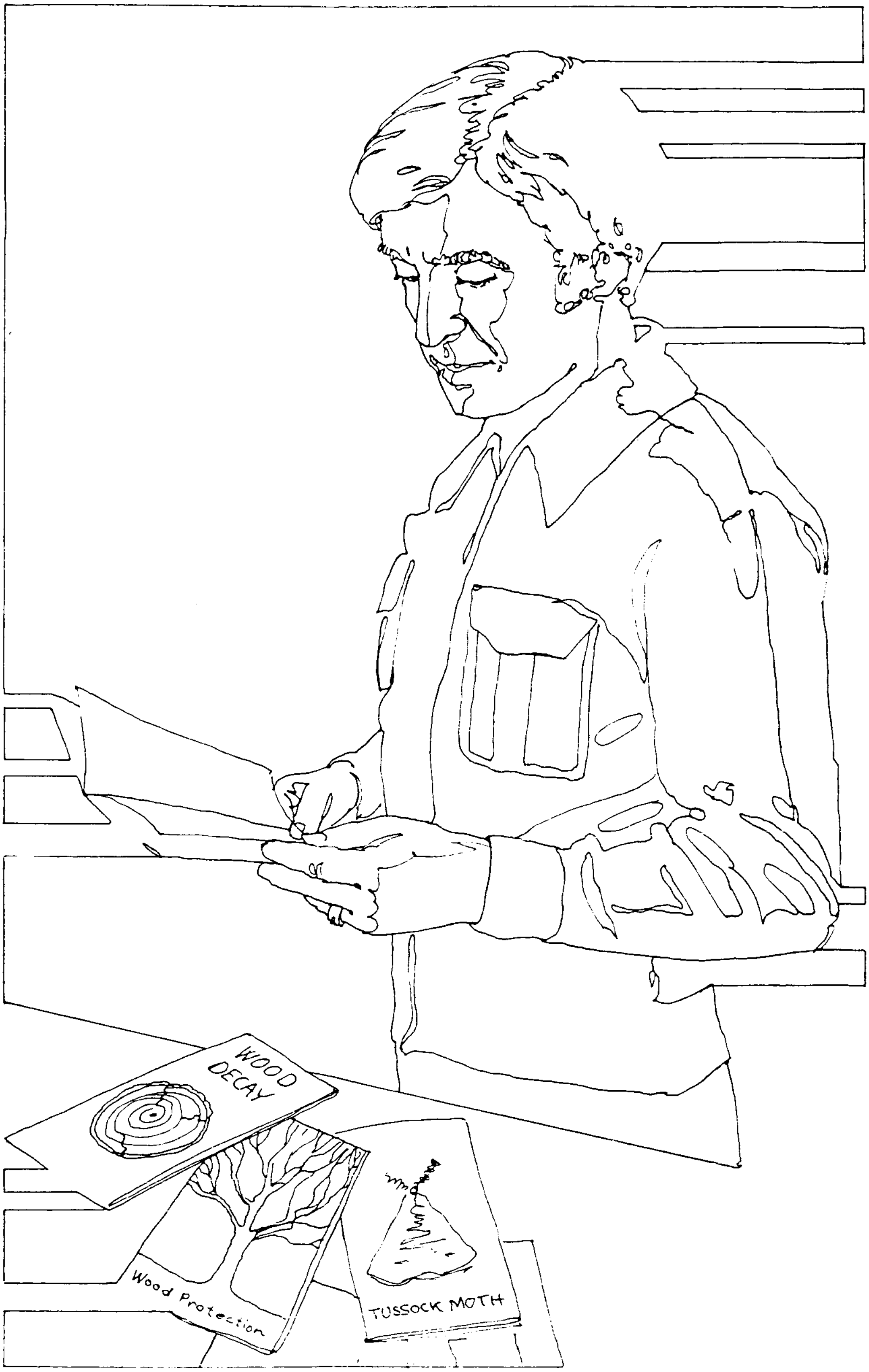

Examples of TT Plans

1 Wood Decay Technology Transfer Plan

Message

A major cause of problems to all species of trees all over the world is decay associated with wounds. Damage caused by tree decay has been recognized for centuries. Studies on tree decay over a hundred years ago served as the basis for the science of tree pathology. Over the years many researchers added valuable information on decay, and many attempts were made to control decay. But decay seemed overwhelming and came to be accepted as a natural phenomenon that we just had to live with.

However, we have learned that there is a succession of micro-organisms in decay processes. This is new! Then when the micro-organisms do invade, the tree forms a second line of defense: the tree walls off, limits, or compartmentalizes the invaded tissues. This expanded decay concept, with host response to wounding, successions of micro-organisms, and compartmentalization of defects, gives some new hope for better methods to control decay.

It is necessary to take the next step and give this information to the people who need it. Also, the limitations and conflicting evidence must be fairly presented.

Audience

General Public
Professional Tree Workers
Timber Managers
Students and Educators

Objective

To package new research results in combination with well-known facts in such a way that people who need the information can get it easily. It is necessary to find more effective ways to package research information. Often the research information is there, but not in an understandable, useful form. Therefore, the technical information will be transferred in easily understood and attractive packages. The words will be simple. The message will be clear. And artwork will be utilized to explain the message.

Team

Information Officer
Researcher
Artist

Cooperation with the Northeastern Area of State and Private Forestry, the Northeastern Forest Experiment Station, and Visitor Information Service, Washington Office (all USDA Forest Service).

Media

Artwork, 4-color publications, workshops.
Audio visual presentations, posters.

All will be designed to reach the intended users listed under “Objective.”

Evaluation

Worldwide recognition of the program became known through:

- Distribution of booklets.
- A regular part of many classes in universities.
- More than 2,000,000 posters in use.

- Over 1,000 slide-tapes in use.
- Many magazine and newspaper articles.
- TV and radio coverage of material.
- Material has served as the basis for hundreds of talks.
- Many tree care procedures have changed as a result.

The following type of feedback also provides a useful tool in evaluating a project:

"It is a most successful booklet in bringing art, science, and education together in a very interesting and useful package . . . I am sure that you have set a pattern which we should all study and modify to meet the needs of our particular field." (Dean, College of Life Sciences and Agriculture.)

"I feel this would be the ideal type of material to be presented to selected school teachers who are concerned about environmental damage which is occurring especially in campgrounds, State parks, and heavily used recreational areas." (Area Forester, State Agency.)

"This is an outstanding example of what can be done to present complex research findings to the public at large, as well as to our professional colleagues." (Administrator, Research.)

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2 Example
Better Protection of Wood-in-Use Technology Transfer Plan

Message

Throughout the Nation, termites and decay fungi cause at least two billion dollars worth of damage in homes each year. Estimates of losses occurring in farm and commercial buildings, posts, poles, and lumber in storage are incomplete, but survey data indicate that these losses are also large.

Replacement costs, which must be borne by the consumer public, represent an unnecesary economic loss. Biodeterioration represents an unnecessary waste of the Nation's valuable wood resource.

Why is it unnecessary? Because the Forest Service and the Extension Service have scientifically based knowledge and delivery systems to provide wood users with the information needed to prolong the life of wood. Knowledge is currently available to prevent the ravage of wood by termites and decay.

Audience

Homeowners (current and prospective)
Farmers
Lending Institutions
Appraisers
Building Inspectors
Building Associations
Pest Control Operations
Retail Lumber Yards
Do-it-yourself Vendors
Architects
Educational Institutions

Objective

To increase public awareness of termite and decay problems and what can be done to prevent or remedy them.

This effort can result in extending the useful life of wood through (1) improving construction techniques to minimize biodeterioration; and (2) correcting biodeterioration problems in existing homes and other situations.

Team

Scientists
Information Officers
S&PF Specialists
Assistant Director for Planning and Application
Extension Service

Media

The key to this program is the multi-media packaging process. Underlying the approach is the fact that an individual must hear and see a message in different forms via many different types of media before he acts. One exposure, even two or three, usually is not enough to stimulate action. This program, therefore, will incorporate the following as a minimum:

Publications distribution, e.g., brochures, leaflets, magazine articles.
Radio and television spot announcements and interview programs.
Key group presentations, e.g., workshops, training sessions, speeches.
Newspaper features and releases.
Slide and slide-tape programs.
Displays at point of sale: building material dealers, building and loan associations, banks, etc.
Billboards.
Direct mail: banks, telephone company, utilities, lending agencies.

Evaluation

A plan for the evaluation process was developed by the Cooperative Extension Service. Evaluation included studies of the effectiveness of all planned campaign actions as well as the overall program impact on the homeowner and the extension of the Nation's wood resource. Emphasis was put not only on how many people received the message, but on how many were stimulated to take action.

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3 Example
Protection Western Forests from the Douglas-Fir Tussock Moth Technology Transfer Plan

Message

From 1971 to 1974, the Douglas-fir tussock moth damaged more than 800,000 acres of valuable fir and Douglas-fir timber in the Western United States. DDT was applied, after the Environmental Protection Agency granted a special exemption for its use. The outbreak ended amid controversy over use of the banned chemical.

One result was the launching of the USDA Expanded Douglas-fir Tussock Moth Research and Development Program, funded from late 1974 through late 1978. It's mission was to find both short-term and long-term methods to reduce damage from this pest.

Many answers to various aspects of the tussock moth problem have been found since the program got underway in late 1974. Application of the new knowledge will help land managers protect valuable timber stands from tussock moth damage. Even though there is no current outbreak of the Douglas-fir tussock moth threatening large areas of valuable timber, this information will be vital in the almost certain event of another destructive outbreak.

Audience

Western forest land managers, their staffs, and others who must deal with the tussock moth problem, including:

- USDA Forest Service (Regions 1-6)
    State and Private Forestry
    National Forest System
- Bureau of Land Management (State Offices)
- Bureau of Indian Affairs (Washington and Oregon)
- National Park Service
- State Departments of Forestry or Natural Resources
- Private Timber Companies and Industrial Associations

Other audiences must also be reached, including:

- Cooperative State Extension Service
- Universities and Colleges with forestry and entomology curriculums (students and instructors)
- Small woodlot owners
- City parks managers (and others protecting ornamental plantings)
- General public

Objective

To quickly and conveniently transfer new knowledge, techniques, and technologies for preventing or lessening tussock moth damage to appropriate users so that it can be put into effect promptly where needed. The ultimate objective is to see forests grow in the West over the coming centuries with little significant damage from the Douglas-fir tussock moth.

Team

The people listed below have primary responsibility for disseminating information and new technology resulting from the tussock moth program. Their counterparts in other areas of the West may be called upon to assist, especially if the threat of another outbreak appears:

Douglas-fir Tussock Moth

- Program Manager
- Deputy Program Manager
- Applications Coordinator
- Integrator

(For overall guidance, policy decisions, review of publications and other written materials, coordination and arranging of subject matter specialists from ranks of investigators for workshops and training sessions, and coordination with other agencies in and out of USDA.)

Pacific Northwest Forest and Range Experiment Station
- Information Officer
- Information Specialist
- Editor

(To produce publications, including writing, editing, layout, pasteup, typesetting, and printing when necessary; to disseminate public information on the program to appropriate outlets; to distribute printed materials; to create audio-visual materials; to assist with workshops and training sessions as needed.)

State and Private Forestry
- Director, Forest Insect and Disease Management (FI & DM)

(To plan and organize workshops and reporting sessions, distributing announcements, developing attendance and invitation lists, etc.; to work with private timber companies and woodlot owners to help them apply new tussock moth knowledge.)

Representatives from:
  State Forestry Departments
  Extension Services
  Private Industry

Media

How-to Handbood Series
State-of-Art Compendium
Program Accomplishments Brochure
Technical Publications
Special Training Sessions
DFTM Reporting Session
Audio-Visual Production
Press Releases and Conferences

APPENDIX II-N

United States
Department of
Agriculture

Forest Service

**Forest
Products
Laboratory**

Madison, Wisconsin

Technology Transfer Opportunities

Fiscal Years 1985-1986

Technology Transfer Opportunities: F.Y. 1985-86

Forest Products Laboratory (FPL)

Madison, WI

Introduction and Responsibilities

The primary goal of the Forest Service Technology Transfer (TT) Program is to put applicable knowledge, methodology, and technology in use as soon as possible. The Agency's responsibility for TT program functions is described in several recent Federal Laws:

- Forest and Rangeland Renewable Resources Research Act of 1978.
- Cooperative Forestry Assistance Act of 1978.
- Stevenson-Wydler Technology Innovation Act of 1980.

One of the major opportunities we have for enhancing the effectiveness of the FPL's National Wood Utilization Research mission lies in our ability to improve the communication of completed research and related technical information. The development of well thought out TT plans will enable us to link timely and useful technologies with people who need it. Cooperative efforts among industry, university and other government officials will help derive maximum benefit from the various TT activities we plan and implement.

The TT planning team for the Forest Products Laboratory includes the Assistant Directors for Research, the Manager of Energy from Wood Research, the S&PF field specialists, the National Wood Products Extension Programming Specialist, and the Group Leader for Information Services. It is the responsibility of the Assistant Directors to provide leadership, support and budgeting for TT activities. It is the responsibility of the Group Leader, Information Services, to provide assistance in preparation and review of TT plans and to monitor and evaluate the Laboratory's overall TT program. The Deputy Director shall provide final review and approval for all TT plans produced by Laboratory staff.

Plan Approach

The Technology Transfer Opportunities plan for FPL will embrace a two-year period. The plan will be reviewed and up-dated annually by the TT planning team. The corresponding TT activities will be categorized into three levels of emphasis as follows:

High Level--

TT activities under this level will be given top priority. Corresponding information programs will generally utilize a wide range of communication techniques and A/V media. Detailed TT plan will specify what is to be done; by whom, and when. Funds and manpower necessary to perform this work will be allocated on a case-by-case basis.

Medium Level--

Under this level, activities will be recognized as being fairly important, but may be temporarily deferred or set aside if work is needed on one or more of the high priority programs (TT activities will usually be rather modest in scope and may be limited to only a few basic communication techniques and A/V media.) Detailed TT plans will normally not be prepared. Funds and manpower to do this work will be covered by adjustments in program budget as priority dictates.

Low Level--

Only occasional activities will be done periodically during year. The number and extent of these events will be determined by availability of existing funds and manpower. As such, there may be some jobs which will not get fully developed or implemented. Emphasis will be placed on accurate scheduling and integration of the smaller jobs with other higher priority work. Almost all work under this category will be carried out within allocated financing and staffing.

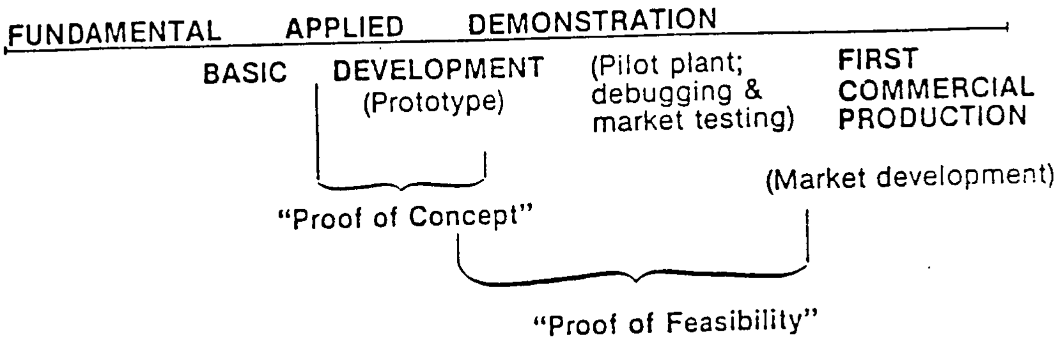
The three activity levels above describe the relative emphasis and requirements that are needed to accomplish scheduled tasks. One must keep in mind, however, that Technology Transfer is a variable and dynamic process, often resulting in unexpected surges and declines. It is very likely that some of our planned TT activities will undergo significant changes at certain stages during the plan period. For example, low level emphasis activities such as the disk separation and the MyCoR process could be escalated upwards and given high priority almost over night if specific industry involvement occurs and one-on-one contacts result in an active agreement. Conversely, some other medium/high level activities might remain relatively inactive for periods of time with little emphasis given because needed catalytic factors are not present. Thus, this plan is not intended to be a rigid mandate, but merely a guide of how we can logically proceed toward accomplishment of some desired TT activities.

Subsequent development of more detailed TT plans that involve other FS units, i.e. North Central and Northeastern Stations, Northeastern Area S&PF and Region 9, will be handled in accordance with the coordinating guidelines established by joint supplement, FSM 1320.3-.7, June 1984.

Research and Development Spectrum

The path to commercial production is rarely sequential. There is often an oscillation between research, development and pilot studies. Industry cooperation in late phases of research and in the development and pilot study is essential for successful technology transfer. Comprehensive state-of-the-art workshops, symposia, summary publications and economic analysis augment our technological knowledge and provide more likely basis for encouraging commercial adaptation.

In most instances, industry will be reluctant to adopt new technologies, particularly those just emerging from the laboratory that are yet untried technically and economically. This is the stage where prototype development on new products or processes is involved. It is also the stage when proof-of-concept for the scientist often merges with proof-of-feasibility for the industry. At this point, the active involvement of industry should be considered seriously.



While it is true our research should emphasize programs at the fundamental end of the spectrum, it is not true that we should refrain from involvement at the other end. Any discoveries by FPL scientists recognized as having valuable, practical applications should be pursued to the point where industry can take over at an appropriate level of risk. Our primary objective, however, is to release or transfer research to application at the earliest stage of the R&D spectrum.

F.Y. 1985-1986
TT Activities/Levels of Emphasis

Research Program(s)	Level of Emphasis		
	High	Medium	Low
Process and Protection	Adhesive Symposium Exterior Wood Finishing Publication	Steam Injection Pressing Double Diffusion (Alaska) Oak Identification Waterfront Treatments	Termite Bait Block Alternative Preservatives Treated Wood Products for Export
Engineering and Economics	Saw, Dry and Rip Wood Frame House Construction(AH 73) Wood Handbook(AH 72)	Solar Drying for Developing Countries Timber Bridges Computer Model: Unbleached Kraft Paperboard Production Process	Moisture Control Veneer Mill Improvement Program Economic Analysis: Wood and Bark for Fuel
Chemistry and Paper	Compression Test Device for Paperboard Compression Symposium	Press Dry Papermaking (Pre-Press Technique)	MyCoR Process Disk Separation
Energy from Wood	Alcohol Production Project w/TVA	Two-Stage, Dilute Sulfuric Acid Hydrolysis of Wood Alcohol Forum	Kinetics of Single Particle Combustion

NOTE: Detailed TT plans will be prepared for high level activities only.

RESEARCH PROGRAM(S)	Primary Technology Transfer "Linkers"																REMARKS
	Level of Emphasis	Professional Organization	Industry Association	Private Industry	Industry Task Force	University	Extension Service	S&PF	NFS	F.S. Research	Federal Lab Consortium	Other Federal Government	State/Local Government	Scientific Journal	Trade Magazines	Popular Media	
Process and Protection																	
o Adhesive Symposium	H	x															Set for 5/85 in cooperation w/FPRS.
o Exterior Wood Finishing	H					x	x										Cooperative endeavor w/Purdue University.
o Steam Injection Pressing	M				x												Follow-up by CORE, subcommittee on panel products.
o Double Diffusion (Alaska)	M							x									Targeted specifically for application in Alaska.
o Oak Identification	M						x	x									General interest throughout East. U.S.
o Waterfront Treatments	L										x						High potential for military and municipal use.
o Termite Bait Block	L			x			x							x			
o Alternative Preservatives	L			x			x					x					
o Treated Wood Products for Export	L		x	x								x					
Engineering and Economics																	
o Saw, Dry and Rip	H		x	x		x	x	x	x	x		x	x				National initiative.
o Wood Frame House Construction	H		x							x		x					Multi-Agency Cooperator (Rev. AH 73)
o Wood Handbook	H									x							Major Revision (AH 72)
o Solar Drying	M											x					Targeted for use in developing countries.
o Timber Bridges	M						x	x	x			x	x				National initiative.
o Computer Model: Unbleached Kraft Paperboard Production	M			x													
o Moisture Control	L						x								x	x	
o Veneer Mill Improvement Program	L						x	x									
o Economic Analysis: Wood and Bark for Fuel	L			x			x										
Chemistry and Paper																	
o Compression Test Device	H			x											x		
o Compression Symposium	H									x							Set for Fall 1985.
o Press Dry Papermaking	M			x										x			Expand technology to Pre-Press Process.
o MyCoR Process	L			x		x						x	x				Lead taken by N.C. State University.
o Disk Separation	L			x		x											
Energy from Wood																	
o Alcohol Project w/TVA	H											x					Proto-type Pilot Plant Project.
o Two-Stage Hydrolysis	M											x					Technical State of Art Update.
o Alcohol Forum	M					x						x					
o Kinetics of Single-Particle Combustion	L					x											

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APPENDIX II-0

Putting Federal Technology To Work For Industry . . .

- Current Awareness Fact Sheets
- Technology Resources
- Federal Laboratory Technology
- Government Inventions Available for Licensing

Covering . . .

Biotechnology,
Civil Engineering.

Chemical Processes,
Communication,

Computers,
Electrotechnology,
Energy,

Materials,
Manufacturing,
Physical Sciences.

Testing & Instrumentation

PR-734-B
1/84

Presenting the Center for the Utilization of Federal Technology

U.S. DEPARTMENT OF COMMERCE
National Technical Information Service

Federal Technology Having Commercial or Practical Potential

A new organization has been established within the National Technical Information Service (NTIS) of the U.S. Department of Commerce to alert U.S. industry to selected Federal technology having immediate practical value. It is the *Center for the Utilization of Federal Technology* (CUFT), and it was established in response to the recently enacted Stevenson-Wydler Technology Innovation Act. CUFT is working with Federal agencies and their laboratories to select and highlight new technologies with potential commercial or industrial applications.

Starting with the thousands of U.S. companies that are customers of NTIS, the Center is drawing upon NTIS' resources to especially alert the rest of industry to this *selected* technology. It is expanding the announcement of Government inventions available for licensing, increasing the technology fact sheets in its Tech Notes service, and preparing new special current awareness catalogs, directories, and services.

The Thrust of the CUFT program:

- Develop programs for introducing industry to appropriate technology
- Encourage agency technology evaluation efforts
- Improve online access to this selected technology
- Promote Federal laboratory technology
- Encourage the licensing of Government inventions

About the Stevenson-Wydler Technology Innovation Act

The Stevenson-Wydler Technology Innovation Act was enacted to encourage the transfer of Federal technology to the U.S. economy. It requires each Federal agency conducting R&D and its major laboratories to identify technology having potential commercial or practical application and to take steps to encourage the transfer of this technology. As part of this effort, agencies and their laboratories have established Offices of Research and Technology Assessment (ORTA) to locate and identify potential practicable technologies. Along with the establishment of these offices, the law also created the *Center for the Utilization of Federal Technology* (CUFT). The Center will be working with the Offices of Research and Technology Assessment to receive and disseminate information on their newly developed technologies.

CUFT was established within the National Technical Information Service (NTIS) of the Department of Commerce because, as a national technical information clearinghouse and a cornerstone of the technology publishing structure in the United States, NTIS is a key participant in the development of advanced information products and services for the achievement of U.S. productivity and innovation goals in the 1980's. NTIS is the central source for the public sale of U.S. Government-sponsored research, development, and engineering reports and computer software.

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Products & Services For Industry

A variety of products and services has been planned and developed to improve industry access to practical Government technology. Some of these include:

1. Tech Notes
A monthly subscription service is available which alerts readers to the latest Federal technology. Called *Tech Notes*, this service provides one- or two-page fact sheets describing new processes, equipment, materials, and techniques chosen to have potential commercial or practical application. The 80 to 100 fact sheets announced monthly are offered in ten different subject categories. (Check *Tech Notes* on the request form)

2. Federal Technology Catalog
This annual catalog offers a compilation and index to more than 1,200 new technologies. These technologies represent some of the best Government research and engineering efforts for the year. Brief summaries of technologies are arranged into 24 subject categories to allow a reader to browse easily. These summaries not only describe the technology but more importantly give a source for further information. A comprehensive subject index is included. The annual *Federal Technology Catalog* is provided free to subscribers of *Tech Notes*. (Check *Federal Technology Catalog* on the request form)

3. Catalogs of Government Patents
Government inventions comprise technology meeting patent office requirements of novelty and utility. This catalog series provides easy access to the technology covered by these inventions. Therefore, it serves two functions: (1) to encourage the licensing of Government inventions (sometimes on an exclusive basis) and (2) to present the technology of these inventions in an easy-to-use format. Each annual catalog contains more than 1,300 summaries of both patents and patent applications arranged into broad application categories for easy browsing. Inventor and subject indexes are included. (Check *Catalogs of Government Patents* on the request form)

4. Government Inventions for Licensing Abstract Newsletter
A weekly subscription newsletter summarizes more than 1,300 Government-owned inventions annually. Each issue divides inventions into eleven subject disciplines and provides a summary of each. When appropriate, a drawing of the invention is also included. Since many of these inventions are available for licensing, sometimes on an exclusive basis, this bulletin offers a valuable service for transferring Federal technology to industry. The previously mentioned *Catalogs of Government Patents* are provided free to subscribers of this *Abstract Newsletter*. (Check *Government Inventions for Licensing Abstract Newsletter* on the request form)

5. Directory of Federal Technology Resources
This directory, for large and small businesses which are technology oriented, describes special technical resources provided by Federal agencies and their laboratories. These resources include unique equipment for sharing, technical information centers, laboratory contacts available for technology interchange, software sources, and information analysis centers, as well as other services which will allow industry to become more productive by

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taking advantage of existing Federal facilities and "know-how" (Check *Directory of Federal Technology Resources* on the request form)

6. **Federal Technology Transfer-Online. A Reference Guide**
This free guide provides online computer searchers with an easy to use reference. It describes both *Tech Notes* and Government inventions and explains both the value of these two collections and the ease in searching them. Online computer searching is the most effective means of providing easy access to this applied Federal technology. (Check *Federal Technology Transfer-Online* on the request form)

CUFT also provides other services. One mechanism to strengthen the link between industry and Federal technology involves special industry association visits to Federal laboratories. Previous group meetings and tours have proved effective and of mutual interest to both industry and Government.

Government Interactions

Although CUFT's major role is that of a clearinghouse to facilitate dissemination of technology to industry, none of this can occur without the involvement of Government agencies and their laboratories. CUFT works closely with these agencies to encourage their assessment of technology and selective highlighting of the most practical items. Many agencies already have strong technology transfer programs. Through close cooperation, CUFT serves to provide further referral and coordination.

For Further Information, Write To—

National Technical Information Service
U.S. DEPARTMENT OF COMMERCE
Center for the Utilization of Federal Technology
Room 8R
Springfield, VA 22161
Phone (703) 487-4838

Name ______________________________
(Please Print)

Title ______________________________

Organization ______________________________

Address ______________________________

City ______________________________

State ZIP ______________________________

Phone ( ) ______________________________

Size of company (employees)
☐ Under 100 ☐ 100–1,000 ☐ over 1,000

My area of interest is:

☐ Biotechnology
☐ Chemical processes
☐ Communication
☐ Computers
☐ Electronics
☐ Energy
☐ Manufacturing
☐ Materials
☐ Optics
☐ Testing
☐ Transportation
☐ Other
____
____

Yes, I Would Like More Information About The Following

☐ Tech Notes (PR-365)
☐ Federal Technology Catalog (PR-732)
☐ Catalogs of Government Patents (PR-735)
☐ Government Inventions for Licensing Abstract Newsletter (PR-750)
☐ Directory of Federal Technology Resources (PR-746)
☐ Federal Technology Transfer-Online (PR-725)
☐ NTIS General Catalog of Information Services (PR-154)

APPENDIX II-P

NOAA Technology

APPLICATION ASSESSMENT ABSTRACT

Assessment of the potential for non-Federal applications of technologies developed in Federal laboratories or other R&D facilities is required by Section 11, of P.L. 96-480 (Stevenson-Wydler Act). The purpose of this form is to provide information on NOAA technologies to the NOAA/NESDIS Office of Research and Technology Applications (ORTA). Further dissemination of the information requires approval of the laboratory director and appropriate NOAA Line Organization.

1. NAME AND ADDRESS OF SUBMITTING LABORATORY/R&D FACILITY/PROJECT OFFICE
   line organization ______________________________
   lab/facility/office ______________________________
   routing code ______________________________
   address ______________________________
   ____
   telephone:(comm) ______________ (FTS) ______________

2. R&D PERFORMED BY (in house organization and/or grantee/contractor)
   ____

   principal investigator:
   name ______________________________
   telephone:(comm) ______________ (FTS) ______________

3. TITLE OF TECHNOLOGY: ______________________________

4. BRIEF DESCRIPTION OF TECHNOLOGY AND NOAA APPLICATIONS:

OTHER POSSIBLE APPLICATIONS:

(continued on other side)

5. PUBLICATIONS OR REPORTS THAT CAN BE MADE AVAILABLE TO THE PUBLIC, AND THEIR SOURCE (please include copies if possible):

6. TECHNOLOGY STATUS (please check one):

☐ complete and being used by NOAA (and if known, please identify other non-Federal users and/or manufacturers)

☐ still in R&D phase but useful information and/or techniques have been developed and information should be disseminated

☐ other (please explain)

7. PATENT POTENTIAL:

☐ check this box if you think the technology may be patentable (if checked the NOAA ORTA will contact PI with information on patent procedures).

OTHER COMMENTS:

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APPENDIX II-Q

NOAA Technology Brief

DEPARTMENT OF COMMERCE
UNITED STATES OF AMERICA

National Oceanic and Atmospheric Administration
National Ocean Service
Systems Planning and Development Office

ENZYME POLLUTION BIODETECTION SYSTEMS 82/NOS/008

Development of a Field Instrument

Purpose

This is an R&D project on the use of enzymes as the detection agent in a field instrument for detecting and monitoring toxic materials in marine waters. The project is being conducted by the Midwest Research Institute on a contract with NOAA's National Ocean Service. Such an instrument would offer significant advantages in cost, detection time, ship use time and laboratory analysis time over current methods of laboratory assays of living organisms.

Theory

Since enzymes are catalysts in biological reactions, materials which inhibit the enzyme function will cause a change in reaction rate which, in turn, can be measured. The change in reaction rate will be an indication of the amount of toxic material present.

Status

MRI has conducted a literature search for enzymes reported inhibited by materials on the EPA priority pollutant list (2475 references). Ten enzymes were chosen for laboratory tests considering such factors as commercial availability and cost, stability, previous documentation and ease of measuring toxic material effects. Classes of pollutants used in the tests were metals, organochlorine pesticides and phenols. Four enzymes which seemed practical for incorporation into a field instrument were chosen for field testing. The enzyme G6PD which showed sensitivity to seven of the 13 priority pollutant metals was incorporated into a prototype instrument sensitive to metal ions (tests have been conducted at concentrations of 10^{-4}M). Problems involving stabilizing enzyme and instrument properties appear to have been solved in the laboratory. Actual field testing awaits additional project funding.

Directions for Further Research

Development of other enzymes for use in detection/warning systems.

FOR ADDITIONAL INFORMATION CONTACT:

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System Planning and Development Office
National Ocean Service
6010 Executive Boulevard
Rockville, Md. 20852
(301) 443-8444

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Midwest Research Institute
425 Volker Boulevard
Kansas City, MO 64110
(816) 753-7600

NOAA Technology Brief

National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Office of Industry Service
Saltonstall-Kennedy Act Grant

85/NMFS/088

Selection Guide Increases Assurance of Product Quality

Designed for use by vessel owners wishing to evaluate and/or upgrade refrigeration capabilities, Selection Guide - Refrigeration and Insulation Systems for Mid-Atlantic Fishery Vessels was produced by ABIC International Consultants, Inc. under a Saltonstall-Kennedy Act grant through the Mid-Atlantic Fisheries Development Foundation, Inc. The Guide contains discussion and evaluation of mechanical refrigeration and chilled seawater systems, blast freezing equipment, immersion and plate freezing systems and fish hold insulation. Each method is described separately. Topics include principle, equipment needed, equipment operation, installation, cost, and recommendations. Procedures for financial evaluation of the various refrigeration systems are included.

The Guide is of particular use in two areas. Mid-Atlantic fishing vessels have access to new fishing gear methods which allow them to catch more fish. However, if refrigeration and/or insulation systems on-board these vessels are not adequate, the catch will not be high quality when landed. Fishing for underutilized fish species has been encouraged by the Mid-Atlantic Fisheries Development Foundation. Such species include whiting, squid, dogfish, and mackerel. Some of these species spoil very quickly and the only way to maintain high quality of these fish species is to improve the refrigeration and/or insulation systems on-board the fishing vessel. The Guide describes refrigeration and insulation methods and equipment for 40 foot to 100 foot fishing vessels.

Examples of benefits seen when improved refrigeration/insulation methods are employed are:

Upgrade insulation and/or install mechanical refrigeration to reduce ice melt-off.

- Ice expenses reduced
- Fuel expenses reduced (less ice, less weight)
- Effective capacity of fish hold increased
- Length of fishing trip may be increased

Install chilled seawater/refrigerated seawater bulk tanks to chill fish.

- Vessel able to handle larger catches with same crew
- Quality of fish landed may be improved
- Length of fishing trip may be increased

Install freezing equipment to freeze fish (instead of using ice).

- * Length of fishing trip increased
- * Fuel and ice expenses reduced
- * Capacity of fish hold increased

This Selection Guide was developed to provide assistance to commercial fishermen in the Mid-Atlantic Region. However, the findings can be applied to any commercial fishing activity. For a copy of the Guide or information concerning Saltonstall-Kennedy (S-K) Grants please contact the NOAA Office of Research and Technology Applications, FB#4, Room 3316, Suitland, MD 20233 telephone 301/763-2418. This NOAA Technology Brief is the first in a series of Briefs which will be available describing S-K grant research.

APPENDIX II-R

THE TOWN MEETING FOR TECHNOLOGY

The Maturation of Consensus Conferences

Fitzhugh Mullan, M.D.
Secretary for Health and Environment
State of New Mexico

Itzhak Jacoby, Ph.D.
Acting Director
Office of Medical Applications of Research
National Institutes of Health

March 26, 1985

Note: References are from a revised vision printed in the Journal of the American Medical Association, August 23/30, 1985, Volume 253, pp. 1068-1072.

THE TOWN MEETING FOR TECHNOLOGY:
The Maturation of Consensus Conferences

During the past 7 years, the National Institutes of Health (NIH) has sponsored 50 consensus development conferences assessing a wide diversity of important biomedical topics.

The first five years of this new effort was a time of experimentation. Formats and approaches of these first generation conferences changed to some extent with new topics. Gradually, however, a set of common principles emerged for conducting a consensus conference effectively. Starting in 1982, the second generation of consensus conferences were held in conformance with these principles. Careful assessment of these more recent experiences stimulated plans for a new approach to this effort, involving formal methods for data synthesis. At the onset of a new generation of consensus conferences, it is worthwhile to examine the evolution of the consensus development process to its current status and its potential for further growth as a part of the complex decision-making apparatus of our health care system.

The purpose of consensus development conferences was originally enunciated by the then-director of the NIH, Donald S. Fredrickson, when he informed the Senate Subcommittee on Health:

> It seems clear that in the future, the NIH and the rest of the scientific community must assume more responsibility for the effect of research on the quality of the health care delivered. The need for accelerating the transfer of new technology across the "interface" between biomedical research and the health care community and systems is a major issue.[1]

Dr. Fredrickson documented his view of the directions that NIH technology assessment and transfer should take in his 1977 position paper, "The Responsibilities of NIH at the Health Research/Health Care Interface," which included in its recommendations a call for the establishment of an office "at an appropriate organizational level, for example, the Associate Director level, to denote the importance and priority which the NIH attaches to this issue."[2]

This new NIH entity, the Office of Medical Applications of Research (OMAR), joined with the various NIH institutes in coordinating and jointly sponsoring the original consensus conferences (commencing in September 1977). To ensure a proper foundation for the conferences, the consensus process borrowed from three models: (1) the judicial process, where evidence is heard by knowledgeable but impartial judges or by juries of peers; (2) the scientific meeting, where experts discuss their work with peers in a collegial manner; and (3) the town meeting, where a forum is provided for all interested persons to express their views. Further grounding of the consensus development concept can be found in Janis[3] and in the "science court experiment" proposed in 1976 by a Presidential Advisory Committee.[4] The conferences were envisioned at the outset primarily as a vehicle for ensuring public exposure at an early juncture to emerging technologies that, in the opinion of some, were tending to remain too long in investigative circles. Technology dissemination, in fact, was an important ingredient of early consensus conferences. Almost from their inception, however, the conferences were seen to present an opportunity for clarifying issues and amassing the best current knowledge on all therapies, whether new or existing, on which some new information has become available.

Beginning with the Breast Cancer Screening Conference in September 1977, 50 Consensus Development Conferences have been conducted under the auspices of the NIH and OMAR. The sponsor, subject and dates of each conference are listed chronologically in Figure 1. This experience has provided OMAR and the NIH Institutes with a refined and proven method of systematically assessing the safety and efficacy of complex medical technologies.

As recently as 1982, however, no document existed that recorded the process for conducting a consensus conference. Thus, the procedures employed for presenting scientific information, debating pre-posed questions relating thereto, and arriving at group conclusions varied somewhat from conference to conference. Although the period immediately prior to 1982 produced an evolution toward a more formalized structure--including a clear division between the program presenters and the consensus panel charged with weighing the evidence advanced--no written guidelines existed to describe the deliberative process or to assure uniformity and consistency for each exercise. Through gradual refinement of "lessons learned" in conducting several dozen conferences, this codification--to be described below--was effected in 1982.

Other Factors Impinging on Consensus Evolution

Political and economic events outside the confines and control of NIH were also destined to have an impact on the evolving consensus process. Late in 1978, P.L. 95-623 established a National Center for Health Care Technology (NCHCT) within the Public Health Service to provide an institution and a forum through which the Federal Government could play a role in the assessment of new biomedical technologies (i.e., procedures, devices, drugs). The mandate of the NCHCT, in fact, went well beyond the specified scope of the NIH consensus conferences (which were limited to safety and efficacy considerations) to embrace all aspects of medical technologies including their economic, ethical, legal, and social implications.

It was envisioned that the Center and NIH would collaborate in rendering comprehensive consensus judgments, possibly by holding consecutive meetings considering all aspects of the same topic; however, the intended dual assessment process involving NIH and NCHCT did not have an opportunity to fully mature since the Center was abolished by budget cuts in 1981. Its demise has left the NIH Consensus Development Program as the most visible, federally mediated, medical technology assessment activity in existence.

Another external variable that has affected the field of technology assessment is the continued growth of health care expenditures as a percentage of the Gross National Product. While enthusiasm for new technologies and their rapid dissemination have governed the atmosphere in which the consensus process was born, concern (justified or not) over the impact of technological innovations on ever-escalating medical costs became a critical issue in the early 1980's. The enactment of prospective payment legislation for Medicare in 1983 strengthened the role of technology assessment because, to enter the marketplace as a reimbursable commodity, a technology would not only have to be established as safe and effective but also as cost-effective when competing against alternative therapies. With this requirement, technology assessment would no longer be viewed as an impediment by the various industries involved (as, for example, representing another regulatory delay or layer of approval required prior to marketing a new technological product). Rather, submitting new technologies to careful assessment would be likely to become a necessary component of the practice of medicine.

Codification of the Consensus Process

In 1982 OMAR undertook to refine and document the procedures governing the conduct of consensus development conferences. With experience gained from the approximately 30 conferences held, OMAR sought to incorporate these insights gained into a set of guidelines for future endeavors. Thus OMAR, working with a committee comprising representatives of all constituent NIH institutes, developed and recorded a set of formal principles that now generally governs the nature and conduct of consensus conferences.[5]

Unlike the rationale for the majority of NIH activities, aimed at the biomedical research community, the principles established for consensus specifically acknowledge that the primary audience of the process is the community of medical practitioners. Moreover, the role of NIH as the convener and facilitator of consensus conferences, but not as a regulator of science policy or clinical practice, is underlined by the independence assured consensus panels in the 1982 guidelines.

The five basic principles of consensus conferences enunciated in that document are as follows:

1. Independent Panel. An independent, broad-based panel is assembled for each consensus conference to give balanced, objective, and knowledgeable attention to the topic. The panel is selected by a planning committee convened separately for each conference that comprises the meeting coordinator from OMAR's staff, the meeting coordinator from the sponsoring Institute's staff, and representatives from outside the NIH expert in the chosen topic.

2. Meetings. The panel meets in public session for the presentation of all data, commentary, and discussion and in executive session when preparing the consensus statement.

3. Previously Posed Questions. The principal job of the panel is to develop responses to a number of specific questions that serve to determine the scope and direction of the conference. These questions are developed in advance, widely circulated, and known to all participants at the conference.

4. The Consensus Statement. At the close of the conference, the draft statement is prepared by the panel in executive session and is presented in plenary session. Following public discussion and any amendments deemed appropriate by the panel, the statement is adopted formally and stands as the record of the conference.

5. Dissemination of the Consensus Statement. Wide dissemination of the consensus statement is sought in an effort to achieve maximum impact of the statement on health care practice.

A basic tenet of any technology assessment exercise is clearly to select topics that are timely, relevant, and lend themselves to consensus assessment and, it is hoped, resolution. While the original emphasis was on selecting newly emerging technologies for assessment, topic selection from the beginning has included both emerging and existing technologies; the latter are considered when new scientific information concerning their use has come to light.

The current policy for subject selection rests upon three tests that are applied to any potential topic. First, the subject under consideration must be medically important and have the potential to affect significant numbers of people. Second, the topic should be surrounded by sufficient scientific uncertainty that the consensus approach can clarify the key issues and/or narrow the gap between current knowledge and practice. Third, any topic under consideration must be backed up by an adequately defined and available base of scientific data that renders it amenable to expert scrutiny. Other issues that enter into the selection of a consensus topic include its timing, public health importance, health care cost impact, preventive potential, and public concern and interest. In one instance, early in the process of conference planning, threatened litigation contributed to cancellation of the conference; in general, however, every effort is made to shield the process of selecting and conducting a conference from the influences of legal issues or political pressures.

Conferences, which are always co-sponsored by OMAR and one or more of the NIH institutes, are currently organized by a small planning committee that meets to develop the key questions to be posed and answered by the conference, to select the speakers who will present the scientific evidence, and to choose individuals to constitute the consensus panel. The planning committee, in fact, is viewed as one element of the triad of forces intimately and ultimately responsible for the final consensus product--the other two being the speakers and the panelists. The separation of authority between these three groups to the greatest extent possible stands as a governing principle of the current process. Although planning committee members, for the most part experts in the field of discussion, can (in the absence of any other qualified presenter) at times reappear as speakers, the general principle is that one group of individuals should design the conference (the planners) while a second supplies the evidence (the witnesses or speakers) and a third deliberates and concludes (the jury or panel). OMAR has been rigorous in applying this principle so as to avoid both the fact and the appearance of undue influence by one interest group or another.

The role of speakers in consensus conferences has been relatively clear and consistent since the earliest meetings. Speakers appear as experts giving testimony and, upon occasion, advocating strong and sometimes contrary points of view. Panel members, however, play quite a different role, their involvement having been clarified by the 1982 guidelines. Panelists are above all selected for their broad knowledge and expertise; however, while a majority should be well-versed in the field under discussion, care is exercised not to select researchers whose primary concern, and possibly vested interest, is the topic at hand. As with a jury, panelists are asked to arrive with an open mind and to listen impartially to the scientific data presented by the speakers. Panelists are primarily drawn from four basic categories in selecting the 10 to 15 individuals that make up a typical consensus panel; these are basic researchers, clinical practitioners, methodologists (epidemiologists and biostatisticians), and public representatives.

The importance of maintaining a balance between the panel's need to be impartial on the issue being discussed and the need for some collective expertise on the subject, which may introduce bias, was demonstrated in an experiment abroad. In this experiment, planners excluded from the panel any individuals with training or expertise in the topic of the conference. The consensus statement produced by this group was immediately attacked by expert participants in the conference on the basis of misunderstanding of the science. Selection of the panel must both lend credibility to the process and minimize the chance of the statement being vulnerable because of factual error.

In the past, the format of the consensus conference has varied considerably. The inherent tension in designing a conference resides between the need to provide ample time for scientific exposition, public discussion, and the panel deliberations, on the one hand, and the limited time available to devote to this process by all participants, on the other. Currently, most conferences are held over a 2-1/2 day period, the first 1-1/2 days of which are devoted to scientific presentation and discussion. On the afternoon and evening of the second day, the panel works in executive session to draft the consensus statement (in the form of recommendations) and, on the morning of the third day, this draft is presented to the plenary session, and discussed.

During the executive session following this discussion, the panel makes modifications in the statement as necessary. Panels have made significant changes in the statement during this executive session. At a recent meeting, a major element of the statement was developed during that session rather than during the main writing session as a result of participants' contributions. Comments from the floor do make a difference.

Extensive pre-conference planning and an executive orientation session on the eve of the conference have helped to ensure a smoothrunning event. Nevertheless, the process of constructing a mutually acceptable consensus statement is unarguably an intense one; in order not to avoid confrontation, panelists are required to remain in executive session on the evening of the second day of the conference, until the initial version of the statement is completed. Since the panel produces several drafts of the statement, this session usually runs well past midnight. Experience has shown, however, that such confinement and commitment are necessary to craft a good statement. The participants have come to recognize and appreciate this fact, and the great majority respond most favorably about both the experience and the process when queried in post-conference questionnaires.

In fact, the synergistic effects of the consensus building have at times produced a dynamic outcome from the panel deliberations--a recent trend has been for panelists to introduce some changes that have strengthened consensus statements during a review cycle which follows the meeting. One evaluation[6] found that the "consensus statement does evolve over the course of the evening session" and that "disagreements among panelists tend to be moderate, and when they occur they are viewed as somewhat constructive." The study also found from interviewing participants that "the outcome of this process, the consensus statement, is evaluated quite positively." Despite the grueling night session, the statement, as it has emerged at the close of the conference, has held up well under later review. Although changes may need to be made after the close of the conference, these modifications have not been necessitated by errors of fact.

A number of other evolutionary modifications have been introduced to streamline the consensus process and make its end product--the consensus statement--more effective. These include the careful selection and orientation of a conference chairperson well acquainted and in accord with the consensus principles enunciated earlier. The chairperson will work with the planning committee, convene and oversee the plenary sessions, and chair the consensus panel. A book of abstracts of conference papers and background information on the selected subject is prepared for each conference and mailed to panelists well in advance of the meeting date. As discussed earlier, the panel is convened the evening prior to the conference and several times during the scientific presentation to begin their deliberations and individual and group writing assignments. A consensus statement format using an abstract-like introduction and conclusion has been developed to make the final statement conform to the needs of its varied audiences. While in no way intended as regulatory, the recommendations advanced should have utility to both the practitioners who must implement the technology and those patients who choose to avail themselves of the statement.

To ensure that the intended message is communicated and received, extensive contacts with the lay and medical press are maintained and the press conference immediately following each meeting is generally well attended by representatives from the print and electronic media. Final consensus statements are distributed to a mailing list of over 21,000--including continuing medical education directors, medical libraries, participants in previous conferences, and other individuals who have requested such information. In addition, almost all recent consensus statements have been published by the Journal of the American Medical Association (JAMA). The intent is to continue to submit the statements to JAMA, which provides them with a broad exposure. Many other general and controlled circulation medical journals print the panel recommendations in whole or in part, and satellite and cable opportunities for expanding conference participation or improving dissemination of its outcome are currently being tested.

Telephone surveys suggest that up to 40 percent of targeted audiences are aware of consensus meetings related to their specialties. Penetration for all physicians was found to be between 15 to 20 percent.[7] These results suggest that much remains to be done to enhance dissemination. In this regard, the efficacy of direct mail is being examined.

An extensive survey by the Rand Corporation involving some 2,500 physicians and chart audits in 10 hospitals is under way. Results, which will be forthcoming in 1986, will provide much information about the impact of the consensus development program on medical practice.

Discussion

As a technology assessment process, consensus conferences have evolved and matured considerably since their early days. Consensus statements themselves have become more uniform and useful than in the past, and inconsistencies in approach and quality have been reduced to a great extent. Utilizing the results of a Rand Corporation content analysis of consensus statements[8] commissioned in 1983, OMAR is encouraging panelists to strive for statements that are a) concrete (recommending specific actions); b) differentiating (dividing patients into subclasses); and c) didactic (offering practical, straightforward advice to the clinician as to how and on which patients precise techniques should be used). OMAR continues to explore concepts for additional evaluations, possibly based upon measures of change in physician knowledge or behavior, to determine the recognition of, and attitudes toward, the consensus process. Further refinements will no doubt stem from these analyses.

One area in which NIH can help to promote awareness and involvement in the process is, of course, in the selection of topics. Identifying areas of broad public appeal--as has been done in such cases as the liver transplantation, prevention and treatment of osteoporosis, cholesterol, health implications of obesity, and prevention and treatment of travelers' diarrhea conferences (among others)--aids greatly in focusing the attention of the medical profession, the Congress, and the public on the consensus process as a medium for technology assessment. The process is open by intent; broad and balanced participation is its cornerstone.

The NIH Consensus Development Program has been emulated by a number of European countries (e.g., Sweden, England, Denmark), and is under consideration in several more. In March of 1982, the NIH held a consensus conference on total hip joint replacement. In May of that year, a similar conference was held in Sweden. The Swedish conference, however, dealt with one additional area: how available the procedure is in Sweden. This consideration is beyond the scope of the NIH consensus development program, which is always limited to issues of safety and efficacy. The similarities and differences between the two meetings and resulting statements were discussed in a JAMA editorial.[9] Aside from the additional question, the conclusions were found to be similar. This analysis suggested that the process is rather robust and can function well in quite different settings.

Over the past 7 years, the program has demonstrated an innovative process whereby biomedical scientists, medical practitioners, and the public can engage constructively and conclusively in a democratic context over the often complicated issues of emerging and established technologies that make up the medical landscape today. The process is not a static one, nor should it be.

This paper has traced the refinement and evolution of the consensus development process from naissance to codification. Doubtless, the next decade will see it modified still further, culminating perhaps in its widespread acceptance and adaptation by other institutions here and abroad for similar use in the rapidly expanding field of technology assessment. Perhaps, too, it can serve as a model for group decision-making processes in other sectors that must balance the complexity of issues with the constraints of time.

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Figure 1

NIH CONSENSUS DEVELOPMENT CONFERENCES

Office for Medical Applications of Research (OMAR)

Sponsors	Title	Dates Held
NCI	Breast Cancer Screening	Sept. 14-16, 1977
NCI	Educational Needs of Physicians and Public Regarding Asbestos Exposure	May 22, 1978
NIDR	Dental Implants: Benefit and Risk	June 13-14, 1978
NCI	Mass Screening for Colorectal Cancer	June 26-28, 1978
NIA	Treatable Brain Diseases in the Elderly	July 10-11, 1978
NINCDS	Indications for Tonsillectomy and Adenoidectomy: Phase I	July 20, 1978
NIAID	Availability of Insect Sting Kits to Non-Physicians	Sept. 14, 1978
NCI	Mass Screening for Lung Cancer	Sept. 18-20, 1978
NIGMS	Supportive Therapy in Burn Care	Nov. 10-11, 1978
NIAMDD	Surgical Treatment of Morbid Obesity	Dec. 4-5, 1978
Interagency Cmte. on New Therapies for Pain and Discomfort (Organizer)	Pain, Discomfort, and Humanitarian Care	Feb. 16, 1979
NICHD	Antenatal Diagnosis	March 5-7, 1979
NHLBI	Transfusion Therapy in Pregnant Sickle Cell Disease Patients	April 23-24, 1979
NHLBI	Improving Clinical and Consumer Use of Blood Pressure Measuring Devices	April 26-27, 1979
NCI	The Treatment of Primary Breast Cancer: Management of Local Disease	June 5, 1979

NIH CONSENSUS DEVELOPMENT CONFERENCES (continued)

Sponsors	Title	Dates Held
NCI	Steroid Receptors in Breast Cancer	June 27-29, 1979
NEI	Intraocular Lens Implantation	Sept. 10-11, 1979
NIA	Estrogen Use in Postmenopausal Women	Sept. 13-14, 1979
NIAID	Amantadine: Does It Have a Role in the Prevention and Treatment of Influenza?	Oct. 15-16, 1979
DRS	The Use of Microprocessor-Based "Intelligent" Machines in Patient Care	Oct. 17-19, 1979
NIDR	Removal of Third Molars	Nov. 28-30, 1979
NHLBI	Thrombolytic Therapy in Thrombosis	April 10-12, 1980
NINCDS	Febrile Seizures	May 19-21, 1980
NCI	Adjuvant Chemotherapy of Breast Cancer	July 14-16, 1980
NCI, NIA, NICHD	Cervical Cancer Screening: The Pap Smear	July 23-25, 1980
NIAMDD	Endoscopy in Upper GI Bleeding	Aug. 20-22, 1980
NICHD	Cesarean Childbirth	Sept. 22-24, 1980
NCI	CEA as a Cancer Marker	Sept. 29-Oct. 1, 1980
NHLBI	Coronary Artery Bypass Surgery: Scientific and Clinical Aspects	Dec. 3-5, 1980
NINCDS, NIAID, NIAMDD, NICHD, NIEHS, DRS	The Diagnosis and Treatment of Reye's Syndrome	March 2-4, 1981
NINCDS, NCI	Computed Tomographic Scanning of the Brain	Nov. 4-6, 1981
NIAID	Defined Diets and Childhood Hyperactivity	Jan. 13-15, 1982

NIH CONSENSUS DEVELOPMENT CONFERENCES (continued)

Sponsors	Title	Dates Held
NIADDK	Total Hip Joint Replacement	March 1-3, 1982
DRS	Clinical Applications of Biomaterials	Nov. 1-3, 1982
CC	Critical Care Medicine	March 7-9, 1983
NIADDK	Liver Transplantation	June 20-23, 1983
NHLBI	Treatment of Hypertriglyceridemia	September 27-29, 1983
NCI	Precursors to Malignant Melanoma	October 24-26, 1983
NIMH	Drugs and Insomnia	November 15-17, 1983
NIDR	Dental Sealants in the Prevention of Tooth Decay	December 5-7, 1983
NICHD	Diagnostic Ultrasound Imaging in Pregnancy	February 6-8, 1984
NIADDK	Analgesic-Associated Kidney Disease	February 27-29, 1984
NIADDK	Treatment and Prevention of Osteoporosis	April 2-4, 1984
NIMH	Mood Disorders: Pharmacologic Prevention of Recurrences	April 24-26, 1984
NHLBI, FDA	Fresh Frozen Plasma: Indications and Risks	Sept. 24-26, 1984

Consensus Development Conferences for FY 1985

Topic	Sponsor	Date
Limb Sparing Treatment of Adult Soft Tissue and Osteogenic Sarcomas	NCI	Dec. 3-5, 1984
Lowering Blood Cholesterol to Prevent Heart Disease	NHLBI	Dec. 10-12, 1984
Traveler's Diarrhea	NIAID	Jan. 28-30, 1985
Health Implications of Obesity	NIADDK, NHLBI	Feb. 11-13, 1985
Anesthesia in the Dentist's Office	NIDR	April 22-25, 1985
Electroconvulsive Therapy	(NIMH)	June 10-12, 1985
Adjuvant Chemotherapy for Breast Cancer	NCI	September 1985

APPENDIX II-S

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D A
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FOOD AND DRUG ADMINISTRATION
U.S. Department of Health and Human Services
Public Health Service 5600 Fishers Lane Rockville, Maryland 20857

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T83-14
April 4, 1983, as updated September 27, 1985

Carolyn Laubach
(301) 443-3285

FDA'S ELECTRONIC BULLETIN BOARD

FDA is offering an electronic version of agency press releases (in English and Spanish), the Enforcement Report's listing of recalls and legal activities, drug and device approval lists, FDA Federal Register summaries, articles from the FDA Consumer and FDA Drug Bulletin, medical device and radiological health bulletins, Congressional testimony and speeches via an "electronic bulletin board."

Started in January 1983, the system enables the public, for a fee, to access the most up-to-date FDA news through communicating word processors such as IBM, Lanier, Lexitron, Wang, Xerox and Digital or any type of computer system, including those designed for home use by Apple, Atari, Commodore, Texas Instruments and Radio Shack.

The program is a spin-off of FDA's success using electronic mail. That system currently utilizes services provided by ITT-Dialcom Inc., a computer firm heaquartered in Silver Spring, Md. For people to obtain FDA information via the electronic bulletin board, they must be subscribers to the ITT-Dialcom service. FDA personnel with access to the ITT-Dialcom electronic mail system can get the bulletin board by simply typing "FDA" at the system prompt.

The bulletin board is easy to learn and use. Upon calling up the system, users are presented with a "menu" listing all of the available categories followed by a "help" instruction for additional information. To locate a particular document, users can search a file using keywords or scan the documents within a file by title. An additional aid allows users to mail any document within the bulletin board to another ITT-Dialcom mailbox, eliminating the need for several people within one organization to search for the same document. Also, a "user guide" is available from Carolyn Laubach in the press office upon request.

Since all information on the bulletin board is in the public domain, it is available for redistribution, both electronically and in hard copy. FDA is responsible for the accuracy of information directly available from ITT-Dialcom, while any company which redistributes information from the bulletin board is responsible for the accuracy of the redistributed text.

Persons wishing to subscribe to the bulletin board or other services offered by ITT-Dialcom Inc. should contact ITT-Dialcom representative Linda Reid, 600 Maryland Ave. S.W., Washington, D.C. 20024, telephone (202) 488-0550.

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APPENDIX II-T

U.S. Department of Housing and Urban Development
Office of Policy Development and Research

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Recent Research Results

ROMOTING FAIR HOUSING

cing discrimination in housing has a continuing national goal involving nches and all levels of government. ies to fight discriminatory housing ces have included, on the national enactment and implementation of ousing laws, funding of statistical rch to uncover patterns and trends st discrimination, and promotion of ative affirmative action in local ng markets.

nt Research Results (*RRR*) an- ces the publication of a comprehen- eport on a HUD conference that ssed one of the most potent weapons st subtle forms of illegal discrimina- -fair housing testing. This issue of also highlights other recently pub- d reports on fair housing.

HUD Conference on Fair Housing Testing—Final Summary Report

by Kathleen G. Heintz
The Urban Institute
1985. 92pp.
Available from HUD USER,
PDR-988

A key event in Federal promotion of fair housing, the HUD Conference on Fair Housing Testing, took place December 6 and 7, 1984. Approximately 250 representatives of fair housing groups and staff of Federal, State, and local fair housing agencies attended. In the course of the 2-day conference, 36 people spoke on a range of topics relating to testing techniques and the use of testing results to ensure equal opportunities in housing. Fair housing tests are designed to reveal and document discrimination on the part of realtors, agents, property managers, or other housing providers.

A full summary report of the conference, prepared by the Urban Institute, has now been issued by HUD's Office of Policy Development and Research. The report provides an overview of the principal issues and reports the major findings, drawing on the presentations of the main speakers and ensuing general discussions.

The conference had three principal goals:

- To encourage the use of testing evidence by State and local fair housing agencies.
- To promote the development of testing programs that are valid, credible, and meet high standards of objectivity and professionalism.
- To offer experts in fair housing testing an opportunity to examine the state of the art in testing, explore new testing uses and methods, and share information about programs and activities.

The report outlines the three types of testing addressed by conference participants. These include testing to gather evidence to support individual complaints, systemic testing to uncover patterns and practices of discrimination against a class of homeseekers, and research testing (or auditing), a variant of systemic testing that provides information about the type and level of discrimination existing in a given market.

The conference raised legal issues in testing, with fair housing attorneys sharing

continued on page 2

cent Research Results (RRR) is prepared by HUD USER, the information service sponsored by HUD's Office of Policy Development and Research (PDR), to provide ady access to research information. RRR contains short summaries of [illegible] published under the auspices of PDR. RRR [illegible] data base mplete reference and [illegible] dissemination services, and [illegible] HUD USER, P.O. Box [illegible] MD [illegible] one (301) 251-5154

OTHER FAIR HOUSING REPORTS

Four studies dealing with fair housing were announced in 1984 in *Recent Research Results*. Copies of each publication are available at a handling charge.

Recent Evidence on Discrimination in Housing

by Harriet Newburger
Office of Policy Development and Research, U.S. Department of Housing and Urban Development
1984, 24pp.
Available from HUD USER, PDR-786

Documentation is provided for existing discrimination against minority homeseekers, using information from four sources: the 1977 Housing Market Practices Survey, which conducted 1,609 rental audits and 1,655 sales audits nationwide; a 1979 Dallas study focusing on discrimination against Mexican-Americans; a 1981 study of discrimination against blacks in Boston; and a 1982 Denver study comparing the treatment of Hispanic, black, and white homeseekers.

The report offers compelling evidence that minority homeseekers are often turned away from the housing of their choice through deliberate misinformation. It indicates that the fair housing audit is a unique tool that can uncover subtle discriminatory practices.

The Baltimore Plan for Affirmative Marketing in Real Estate

by the Office of Policy Development and Research, U.S. Department of Housing and Urban Development
1983, 127pp.
Available from HUD USER, PDR-746

This account of a unique 5-year partnership between a private fair housing group and two Baltimore realtor organizations reports the successes—and difficulties—encountered in planning and implementing new approaches to affirmative marketing.

The fair housing advocates and realtors tried a number of approaches—setting affirmative advertising guidelines, telling minority buyers about types of mortgages, and advertising in various media.

The Fair Housing Enforcemen Demonstration

by the Office of Policy Development and Research, U.S. Department of Housing and Urban Development
1983, 73pp.
Available from HUD USER, PDR-750

Over a 2-year period (1980-81), HUD funded fair housing tests by fair housing associations in nine metropolitan areas. The tests revealed evidence of blatant and unlawful discrimination.

This report describes how participants were selected and trained, how testing was conducted, and how complaints were processed. It is designed to help local officials improve their own efforts at fair housing enforcement.

Selected Reference Guide to Fair Housing

by HUD USER
1984, 19pp.
Available from HUD USER, "Fair Bib

This bibliography describes reports, manuals, and guidebooks that deal with severa aspects of the fair housing issue. It is divided into four sections that address the extent of discrimination in today's housing markets, auditing studies to uncover unfair practices, innovative national and local programs to combat discrimination, and fair housing law.

Several documents deal with special types of discrimination against blacks, Hispanics, women, and families with children. The section on testing includes reports of testing in Boston, Denver, Houston, Phoenix, and Dallas.

For each document, the reference guide presents an abstract and complete information for obtaining a copy of the full text.

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continued from page 1

information on new cases and legal strategies. The report covers the legal basis for testing, together with challenges that have been raised. The conference participants concluded that the legality of testing is clearly affirmed, and that while lawsuits are still possible, they are unlikely to be successful when testers have been trained and supervised properly.

Of all topics covered at the conference, one generated more interest than others: how to develop a capability to conduct systemic testing. Most participants concluded that systemic testing, even though costly, appears to be the best available tool for identifying and prosecuting fair housing offenders.

Although not a "how to" manual, the report provides details of testing techniques and references existing manuals and guidebooks developed by fair housing groups across the country. It also contains abstracts of many of the papers, critiques, and written remarks prepared specifically for the conference. A list of all of the papers presented at the conference appears on page 4. Individual conference papers are available from HUD USER at the prices listed there. To order your copies please refer to the ordering information on pages 3 and 4.

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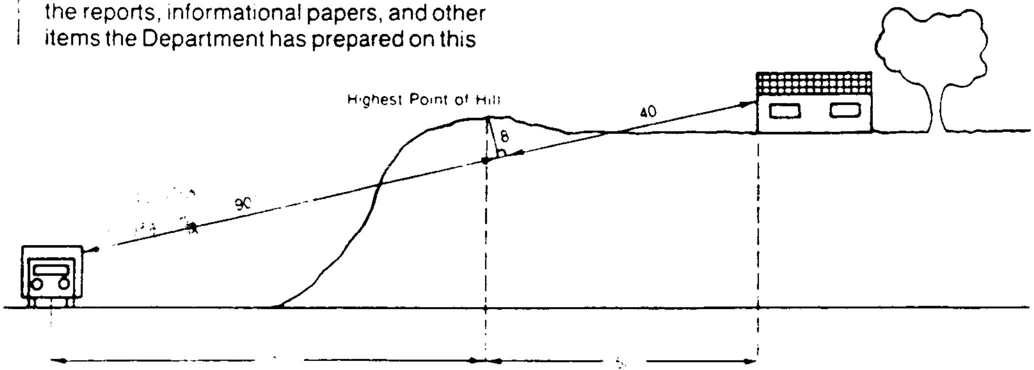
HE NOISE GUIDEBOOK

ıe U.S. Department of Housing and
an Development, Office of
ronment and Energy
5, 105pp.
ilable from HUD USER, CPD-953

ording to the 1979 Annual Report of the
ıncil on Environmental Quality, "nearly
the U.S. population is regularly ex-
ed to levels of noise that interfere
ı...normal activities," and about "1 in
.are exposed to noises of duration and
nsity sufficient to cause a permanent
ıction in their ability to hear."

ıough no Federal legislation specifically
rges one governmental department
ı regulating noise, many agencies have
eloped regulations regarding the com-
ity noise level associated with their
ı programs. Several legislative actions.
uding the Housing and Urban Develop-
nt Act of 1968 and the Noise Control Act of 1972, require HUD to be aware of the noise problem and to take positive steps to protect residential and other sensitive land uses from high noise levels.

This guidebook is the basic reference document for all HUD field staff responsible for implementing the Department's noise policy. It brings together in one place all the reports, informational papers, and other items the Department has prepared on this subject in recent years and presents new information as well. It contains both basic background material and detailed instructions, including charts, illustrations, and quizzes. The publication incorporates the *Noise Assessment Guidelines* (PDR-735) published separately and a *Noise Assessment Guidelines Workbook*.



An exercise from The Noise Guidebook

CONFERENCE PAPERS

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- ☐ Address by Samuel R. Pierce, Jr., Secretary, Department of Housing and Urban Development, no charge

Session 1. Developing Support for Public Agency Testing

- ☐ Presentation by Homer Floyd, Pennsylvania Human Rights Commission, $2.50
- ☐ Presentation by Joan M. Thompson, New York City Commission on Human Rights, $2.50
- ☐ Presentation by Carol F. Schiller, California Department of Fair Employment and Housing, $2.50
- ☐ Remarks by John Knapp, HUD General Counsel, no charge

Session 2. Workshop on Testing Techniques: Individual Complaints

- ☐ Testing Techniques and the Testing Process, by F. Willis Caruso and Shirley Lambert, Leadership Council for Metropolitan Open Communities, Chicago, $5.00
- ☐ Evidentiary Standards: Testing Case Law and Standards of Proof, by F. Willis Caruso, Legal Action Program, Chicago, $1.00
- ☐ Testing, by Mary Sigler, Metropolitan Fair Housing Council, Oklahoma City, $1.00
- ☐ Testing for the Complainant, by Lee Porter, Fair Housing Council of Northern New Jersey, $1.00
- ☐ Individual Complainants Discussant Paper, by Michael F. Dennis, Maryland Human Relations Commission, $2.50

Session 3. New Testing Techniques

- ☐ Development of New Testing Techniques, by Karla Irvine, Housing Opportunities Made Equal (HOME) of Greater Cincinnati, $2.50
- ☐ Some Recent Developments and Trends in Fair Housing Testing, by Kent Willis, HOME of Richmond, $2.50
- ☐ New Testing Techniques, by Marcia Borowski, Metro Fair Housing Center, Atlanta, $1.00
- ☐ Critique of the New Techniques Session, by Avery S. Friedman, Attorney, Cleveland, $1.00

Session 4. Evidentiary Standards in Fair Housing Testing

- ☐ Legal Issues in Testing, by Sara L. Pratt, Rights Advocates Training Services, Inc., Louisville, $2.50
- ☐ Standards of Proof in Systemic Fair Housing Testing Cases Before the Massachusetts Commission Against Discrimination, by Shary E. Dreyer, Massachusetts Commission Against Discrimination, $2.
- ☐ Remarks by Kenneth Holbert, HUD/FHEO, no charge

Session 5. Workshop on Systemic Testing Techniques

- ☐ Designing and Conducting a Systemic Testing Program (with attachments), by Laurie F. Rubin et al., Massachusetts Commission Against Discrimination, $8.00

Session 6. Audit-Based Research

- ☐ The Miami Housing Audit Study, by Larry Bivins, *Miami Herald*, $1.00
- ☐ The Multiple Uses of Audit-Based Research: Evidence from Bostor by Judith Feins and William Holshouser, Abt Associates, Cambridge, MA, $2.50
- ☐ Measuring Racial and Ethnic Discrimination With Fair Housing Audits by John Yinger, University of Michigan, $2.50
- ☐ The Statistics of Fair Housing Audits, by John Yinger, University o Michigan, $2.50
- ☐ Options for Audit-Based Research, by Raymond J. Struyk, Urban Institute, Washington, DC, $2.50
- ☐ A Discussion of Three Papers on Fair Housing Audit-Based Researc by Joe T. Darden, Michigan State University, $1.00
- ☐ Comments on Audit-Based Research, by Dorothy J. Porter, Colorado Civil Rights Division, $2.50

Session 7. Testing at the Federal Level

- ☐ Fair Housing Testing in the Federal Sector, by Lt. Col. Ellsworth E. Wiggins, Office of the Deputy Assistant Secretary of Defense, $2.50
- ☐ Testing at the Federal Level, by Glenn E. Loney, Federal Reserve Board, $2.50

Session 8. Testing and the Real Estate Industry

- ☐ Testing and the Real Estate Industry, by Anne E. Schreuder, Calvin College, MI, $2.50
- ☐ In Response to Anne E. Schreuder's Paper: "Testing and the Real Estate Industry," by Candace Tapscott, Arlington, VA, $1.00
- ☐ The Role of Testing in a Comprehensive Enforcement Program, by William Wynn, Deputy Assistant Secretary for Enforcement and Compliance, HUD FHEO, no charge

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APPENDIX II-U

TECHNOLOGY TRANSFER: ACTIVITIES, ISSUES, AND OPPORTUNITIES*

Robert J. Betsold, Director
Office of Implementation
Federal Highway Administration

There is "without doubt an unnecessary and undesirable time-lag between the conclusion of research work, resulting in findings that should be put into practice, and the actual widespread utilization of such information." This was a 1968 conclusion by the Special Committee on Utilization of Research Findings for the American Association of State Highway and Transportation Officials (AASHTO). The Committee further stated that highway officials were aware of the problem but ineffective in correcting it for the following reasons:

- Researchers do not present their findings in the form or language that can be immediately translated into the media of practice.
- Researchers do not fully understand the needs of practicing engineers and others whose problems are seldom communicated in terms of research need.
- Practicing engineers are frequently suspicious of the findings from research and are hesitant to take the lead in trying something new.
- Practicing engineers seldom have time to study the research work that led to conclusions that may be applicable.
- The research program frequently does not provide funds for the comprehensive test and evaluation at the field level necessary to generate confidence in the results.[1]

The Committee concluded that an organized approach to the research implementation process was needed, and recommended the assignment of full-time professional generalists to provide the missing link between research and operations.

Since that time, many organizations, programs and activities have been created to address these problems and to fill the missing link. The general term technology transfer (T^2) has been applied to describe these efforts. The Federal Highway Administration has defined T^2 as the process by which existing research, knowledge, and new technology are transferred into useful processes, products and programs.[2]

Promotion of innovative technology is centered around four technology transfer efforts of three offices within FHWA: the Office of Implementation, the National Highway Institute, and the Office of Highway Operations' Demonstration Projects Division. The specifics of the various efforts are:

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*Excerpted from a paper which appeared as "Technology Transfer: Activities, Issues, and Opportunities," Public Roads, Volume 49, Number 3, December 1985, pp. 69-77.

- Office of Implementation--In this office, research findings are translated into a form which is more readily understood by a practicing engineer or highway official. Using the research findings as a base, field tests and evaluations, when needed, are conducted in cooperation with various State highway agencies. If the technology proves useful in the field, user manuals, technical advisories, videotapes and/or slide-tape presentations are developed to ease and promote the adoption of this technology by potential users. Other activities include sponsorship of workshops, seminars, and industry disclosure meetings to encourage face-to-face exchange of new technology.

- National Highway Institute (NHI)--This activity was established under Section 321 of Title 23 USC for the express purpose of developing and presenting training in new highway technology to State and local highway personnel. Activities include presentation of courses in state-of-the-art technologies, techniques, and procedures relating to highway planning, environmental factors, acquisition of rights-of-way, engineering, construction, maintenance, contract administration, and inspection. In addition to the training courses, the NHI conducts a college curriculum program, maintains a lending library of highway training materials, publishes information exchange bulletins, and administers fellowship and scholarship programs in highway safety technology.

- Office of Highway Operations, Demonstration Projects Division--This Office administers two technology transfer programs, the Demonstration Projects Program and the Experimental Projects Program.

  The Demonstration Projects Program includes those successful research results and innovative technologies which can best be promoted through actual on-site demonstrations. Three promotional techniques are used in this activity: hands-on demonstrations, workshop training seminars, and construction of pilot demonstration installations at appropriate locations.

  The Experimental Projects Program determines whether previously researched, field tested, or documented materials, techniques or equipment can be adopted for practical use in highway construction. Experimental features are incorporated in Federal-aid highway construction projects to determine the suitability of the features as regular construction items. Both proprietary and non-proprietary items of innovative technologies are included in this effort. Here is where the private sector can introduce their new discoveries into the market. Performance of these experimental features is monitored and reported on a national basis. Results of the field evaluations are published in The National Experimental Projects Tabulation.[3]

In addition to the technology transfer activities described above, there is substantial technology exchange and assistance provided in the highway planning area administered by the Associate Administrator for Planning and Policy Development. Some of the planning technology, including computer software, is prepared in cooperation with the Urban Mass Transit Administration.

Another area of T^2 and promotion of innovative technology is coordinated by the Office of Direct Federal Programs. Through three Direct Federal Divisions in the field, new technology is tested and/or demonstrated on Direct Federal construction projects and provided to other Federal agencies such as the National Park Service, Forest Service, and Bureau of Indian Affairs. Technology transfer is also provided by Direct Federal engineers when requested by the State Department to developing countries for special problems.

Technology transfer is also considered an important function in the FHWA regional and division offices. In FY 1983, technology transfer was selected as a Program Emphasis Area in the FHWA and received special attention. Specific T^2 responsibilities have been assigned in each FHWA field office, and some of the offices have T^2 committees which review available innovative technology and determine appropriate application and promotion. In addition, the field offices arrange T^2 workshops and conferences in selected areas of new technology.

In addition to the T^2 efforts described above, which are principally directed to State highway agencies, FHWA launched a new program aimed at reaching the thousands of local highway agencies through a new Federal-State-University concept. Although some States already provide technology and assistance to local agencies, many have neither the mandate nor the resources to do the job. Working with the States, FHWA selected 28 colleges and universities throughout the country to serve as technology centers to promote and distribute technology to local agencies. The centers, in addition to being the contact point and maintaining a stock of new technology reports and other materials, publish and distribute newsletters, give advice on technology available for specific local problems, and make presentations of short courses.

State Highway Agencies

Responding to strong encouragement from the FHWA, and internally generated support, the State highway and transportation agencies are increasing their participation in T^2 activities. Most States have appointed department coordinators and many have involved local highway agencies in the program.

As reported in the recent National Cooperative Highway Research Program (NCHRP) Synthesis Report 113, Administration of Research, Development, and Implementation Activities in Highway Agencies, a 1983 survey by the Washington State Department of Transportation indicated that 41 of the State highway agencies included T^2 activities with their research programs.[4] Reported activities included distribution of research reports, preparation and distribution of newsletters, personal contacts with potential research users, presentation of seminars and workshops, circulation of research lists and summaries, scheduling and notification of demonstration and experimental projects, and searches of the Transportation Research Information Service (TRIS).

Organizationally, the States range from a single individual assigned T^2 as a collateral duty, to well staffed units with adequate budgets and other resources (such as libraries, audio-visual production capabilities, and microcomputers). Some of the smaller States, which have a limited research program or a focus on materials testing, have assigned T^2 coordinators to glean needed technology from FHWA, Transportation Research Board, and other States.

Another major T^2 activity performed by the States is the field trial and evaluation of research findings from the governmental sector and evaluation of new products and materials from the private sector. Under Task Orders issued by the FHWA, most States have been involved in the field test and evaluation of findings from the FHWA research program. In addition, the FHWA Special Experimental Features Program encourages construction and evaluation of promising experimental features which have a limited performance record. The FHWA program finances the evaluation work and the findings are reported in the periodic National Experimental Projects Tabulation which is published in hard copy and accessible by computer terminals. Finally, the performance of a wide range of special highway products is tested through a joint effort of FHWA and the AASHTO Subcommittee on Materials. The latest edition of the Special Product Evaluation List contains over 4,000 evaluations conducted by 38 States and the FHWA and provides information on who made the tests or accepted the material.[5]

CURRENT T^2 ISSUES

In the past 15 years, substantial progress has been made in the efforts to get highway research into practice. A 1985 FHWA report to the Senate Committee on Appropriations (Report on the Status of Innovative Cost Saving Technologies Promoted by the Federal Highway Administration) describes 16 recent innovative technology items which have received varying degrees of acceptance by the State highway agencies.[6] Estimated construction and operating cost savings from these items total several hundred million dollars. However, despite these resounding successes, there are problems and constraints which should be recognized in the highway T^2 programs. These issues can be categorized as they relate to (1) Resources and (2) Process and Procedures.

People and Institutions

People: As stated in the introduction, the AASHTO Committee report which initiated the highway T^2 programs recommended the assignment of full-time professional generalists to provide the missing link between research and operations. Particular attention must be given to the selection of these "professional generalists" because the necessary characteristics and skills are often quite different from those of the average scientist or engineer. As stated by Dr. John S. Toll, President of the University of Maryland, "The transfer of technology requires a special type of talent not always present even in the best of scientists...A successful transfer program must seek out the rare individual with the capacity for looking across disciplines and conventional scientific categories."[7] Locating appropriate people with the necessary skills can be difficult; keeping such people is even more difficult since good technology transfer professionals have high visibility and possess skills which are in high demand in any highway agency.

Resources: Adequate financial resources are essential for a T^2 program. In the FHWA, the support for the T^2 program has been excellent. Approximately \$15 million per year is provided for the T^2 program activities. This includes 20 percent of the R&D funds allocated to the Implementation Program as well as other funding for the Demonstration and Experimental Projects, National Highway Institute and Rural Technical Assistance Programs. At the State level, about 35 States use T^2 line items in their annual Highway Planning and Research Program (HPR, Part II) to finance a wide variety of T^2 activities. In future years the Federally assisted HPR program will also be an eligible source of support for the T^2 to Local Centers which have been established to provide technology to local highway agencies.

Commercial production of new technology: Although government sponsored research may produce new products which have public benefits and commercial potential, it can be difficult to obtain production by highway related industries. Several factors must be considered here, with patent and proprietary rights questions heading the list. Lacking exclusive rights to commercialize a new technology, many companies have been reluctant to spend the substantial funds required to refine, manufacture, promote and sell a new product. Recent Congressional attention and legislation has been designed to solve many of the patent and proprietary rights problems which precluded commercial development in the past. It must also be recognized that the highway program presents a diverse and difficult market place. Most materials are acquired through competitive bids (with few provisions for life-cycle cost considerations) and the supplier faces a myriad of specifications and special requirements which vary with the 50 State highway agencies and the nearly 39,000 other governmental units which have some form of bridge or highway responsibility.

Process and Procedures

Head start activities: In many government agencies and programs, the people involved in T^2 are introduced to the new technology after the research is completed. In some cases, and particularly for outputs from basic research projects, it can be difficult to identify potential users for the technology. These conditions seldom exist in highway research where the predominant activities involve applied research and the majority of the potential users are highway engineers and officials. In addition, most highway research programs have developed mechanisms to involve operational officials and policy makers in the initial selection of the program of activities. This is a prominent feature of the FHWA administrative contract research program and the NCHRP. In addition, the Washington State survey showed 43 of the 50 States using research committees to develop and/or monitor their highway research programs.[4] This early involvement in the research program significantly improves the later acceptance and implementation of the research findings.

Identifying implementable technology: Despite the applied nature of the highway research program, all studies do not result in implementable technology. Substantial screening is necessary to determine the appropriate use of the research findings and to identify implementable technology. In the FHWA R&D program an initial assessment is performed by the researchers for each research study report, and the assessment is generally verified with the T^2 program managers. If the reported findings have no implementation potential, few copies of the report are produced and the distribution is limited to researchers known to be working in the topic area. A wider distribution is given to research reports with some implementation potential, and a broad distribution made of reports with immediately implementable findings. As cited in NCHRP Synthesis Report 113, the following are some of the questions which should be asked in determining the implementation potential for research findings:

1. Will the innovation cost more than can be justified?
2. Will a lower-cost product produce a lower level of service than can be justified?

3. Is performance too sensitive to workmanship for the innovation to be practical?
4. Will the frequency and cost of maintenance be greater than can be justified?

For best results, these types of questions should be asked in a forum which includes the researchers (to explain the technology), operating personnel who are potential users (to identify constraints and compare with current practice), and those who will be responsible for the T^2 activities (so they can determine what field trials will be necessary and how to package and present the material for effective transfer).

Selecting appropriate delivery methods: When the research is completed and implementable outputs have been identified (and field tested, if necessary), the next step in the T^2 process involves selection of appropriate techniques for presenting the new technology to potential users. Many methods are available and the T^2 plan should be prepared with consideration of the following factors:

o Audience--Who are the potential users and what is their typical level of technical knowledge?

o Perceived need--Do the users recognize the problem and want a solution, or must they be convinced that change is needed?

o Difficulty--Is the technology simple or complicated? Does it require an adaptation of current practice, or learning a whole new subject area?

o Cost--Do the expected benefits from implementation of the technology justify higher cost T^2 efforts?

Considering the answers to these questions, the T^2 managers can select from a long list of methods for disseminating the technology. By major categories these include:

o Written materials--Distribution of the research report, or executive summaries of the report; compilation of research abstracts, reviews, summaries and newsletters; preparation of synthesis reports, user manuals and guides, technology sharing documents and implementation packages; distribution of typical plans, specifications or standards (preferably with AASHTO endorsement); preparation of training manuals or guides, and articles in commercial publications or professional journals.

o Audiovisual materials--Poster board displays and photographs; slide presentations with script and/or taped narrative; videotapes and 16 mm motion pictures.

o Meetings--Seminars, workshops and conferences with formal sessions devoted to the technology and informal opportunities for discussion and exchange of experiences.

o Demonstrations--Person-to-person, hands-on opportunities to actually see the technology applied by knowledgeable persons in a controlled setting.

- Training courses--Short courses on selected topics (such as traffic signal controllers) or longer-term training in technical areas which have substantial technological advances (pavement management or materials).

A recent report prepared for the FHWA, Methods of Effective Transfer and Implementation of Highway Maintenance Technology, presents an evaluation of the techniques for T^2 and a Technique Selection Guide which rates each technique according to relative cost, immediacy, adaptability, rigor and suitability for various types of audiences.[8] In addition, a study by Paine obtained data on the usefulness of dissemination strategies used by 17 program developers.[9] The following lists 11 strategies by declining order of usefulness in the Paine study:

- Demonstration and training centers
- Long-term training
- Short-term training
- Word of mouth
- Nonprint media
- Commercial publications
- Publication list
- Conference presentations
- Professional communications
- In-house materials
- Professional publications

As might be expected, the most costly T^2 techniques are also considered the most effective, or, stated simply, you get what you pay for.

Maintaining T^2 linkages: Technology transfer programs were established to bridge the gap between research and practice. However, unlike traditional bridges, the T^2 process is not a rigid structure. Instead it resembles a chain, with successive links from researchers to transfer agents to practitioners. For highway technology developed at a Federal level, the chain can be rather long and, consistent with the rule that a chain is only as strong as its weakest link, breakages do occur.

Unfortunately, the breaks in the chain are not immediately evident and, considering the time required for new technology to be put into practice, may not be discovered for some time.

Another chain problem also occurs: one cannot push a chain. The most effective T^2 occurs when the chain is pulled from the field, by users who need the technology.

Feedback and evaluation: Estimates by the Transportation Research Board place annual highway research expenditures in the United States in the range of $70 to $75 million.[10] The obvious question asked by highway administrators and legislative appropriation committees is: What benefits result from these expenditures? A general answer is given in the report of the Strategic Transportation Research Study which states, "Every aspect of highway design, construction, maintenance and operation has benefited from the past stream of highway research."[10] The report further lists a wide variety of technologies which have been developed through the highway research programs and incorporated into the highway system. In addition, the TRB has collected and publicized brief case histories of research studies that have produced tangible payoffs for the sponsors and the public. These have appeared as articles in TR News and in a booklet titled Research Pays Off--The Return on Investment in Research and Development.[11]

While lists of successful research products and selected case histories are useful, they do not provide the detailed information which is necessary to determine the bottom line success of the research program and the associated T^2 process. To get the necessary information, the FHWA has initiated a multistage program evaluation effort. The desired result is a system which will improve feedback from the field offices regarding (1) the value of the T^2 activities, (2) the acceptance of new technology by the State highway agencies, (3) actual usage of the technology, and (4) identification and measurement of benefits from the technology as determined by the actual users.

The program evaluation effort began with a series of T^2 process reviews in the spring of 1984. The reviews were conducted by teams of senior program managers from the Office of Implementation, the National Highway Institute and the Demonstration Projects Division. Site reviews were conducted in each FHWA regional office and in two FHWA divisions and State highway agencies in each region. This approach followed Langbein's advice that process evaluations should precede or accompany outcome evaluations. This is necessary since processes can actually affect outcomes, and evaluators should not ignore issues of process even when they employ measures of success based on program outcomes.[12] During these reviews, and in subsequent tri-regional T^2 meetings involving Federal, State and T^2 Center officials, the program evaluation issues were discussed and several conclusions were reached:

- The trial and adoption of new technology for operational use may take several years.
- It is difficult to establish the impact of a single T^2 item or activity.
- Adoption of new technology results from a combination of T^2 program efforts rather than from a single item.
- Program evaluators should focus on a topic area rather than on a single T^2 item.
- Select a topic area where FHWA has promoted the technology for an extended period of time.
- Identify available FHWA technology transfer items/packages in the selected topic area.
- Determine the States' degree of acceptance and/or use of the technology.
- Request readily available information on identifiable benefits or cost savings.
- Keep the evaluation form simple.

The final point was emphasized by many participants since neither the FHWA divisions nor the State highway agencies had the personnel or resources to make extensive surveys or fill out voluminous forms on a countinuing basis.

Using these guidelines the FHWA selected five items for evaluation in 1985, one from each of the five categories in the Federally Coordinated Program for Research and Development. The items were:

- Safety Through Highway Work Zones
- Time Based Signal Coordinators
- Noise Barrier Cost Reduction Program
- Hot Mix Recycling of Asphalt Concrete Pavement
- Improved Design Practices for Culverts

Field responses are still being received and analyzed, but the early returns have already provided useful information. For example, weak links in the T^2 chain are apparent in some instances. Further investigation will be needed to determine whether the problems are caused by communication breakdowns, existence of gatekeepers at the division or State level, or other reasons. It is also obvious that the survey form for the topic of Improved Design Practices for Culverts was not sufficiently specific to separate the desired technolgoy (improved designs for culvert inlets) from other recent T^2 items in the hydraulics area. Additional efforts to pretest future evaluation forms will be necessary.

After the results of the evaluation survey have been analyzed, a summary report regarding State application of the technology and identified benefits will be prepared and returned to the field. The FHWA will also use this information and experience as a base for future efforts to establish a feedback and evaluation system.

Opportunities for Innovation

Current R&D programs are seeking better, longer lasting and more efficient ways to construct, operate and maintain our highway systems. The proposed Strategic Highway Research Program is a sharply focused, concentrated effort to develop new technology to solve many of our most critical pavement and structural problems. Recognizing the current problems in T^2, we also need new efforts and technology to deliver the results of the research program.

Recent advances in technology, particularly in the microcomputer, video and telecommunications areas, offer new opportunities to overcome T^2 problems and improve the delivery systems. Following are some examples of new technology applications for T^2.

Microcomputers: Availability and use of microcomputers is growing rapidly. Many analysis programs which were formerly available only through mainframe computers have been converted for micros. New programs have been written specifically for micros, particularly in the areas of traffic operations, hydraulics and pavement and structural design. Software centers, with user support services, have been established to make the new technology readily available to, and usable by, highway agency personnel.

Videotapes/laser disks: Videotapes are frequently used to transfer information about new highway technology or special applications. However, this media, and the more versatile laser disk, can be linked with a microcomputer to provide interesting, visually attractive, and easy-to-use programmed instruction training. Such training can be provided at the employee's office, as time permits, and removes the need for travel to a training site. Use of this training approach may be particularly applicable to the highway maintenance area. New or improved maintenance procedures could be taught to the workers during periods of inclement weather or other slack periods, and the maintenance supervisor would retain full control over the timing and duration of the training.

Teleconferencing: During the 1964 annual meeting of the TRB, a session on Microcomputer Applications in Transportation was telecast live via the Westar IV and SATCOM 4 satellites to about 20 States. The linkage included one-way video to all receivers and two-way audio communication with preselected sites. Less expensive options include use of audio only, and enhanced audio conferencing. The enhanced audio method has several options. These include use of facsimile terminals to transmit graphic and textual information for the conferences, use of slow-scan video or freeze-frame video, and use of electronic blackboards. Helpful advice and cost information is presented in a pamphlet prepared by the U.S. General Services Administration titled Executive Guide to Teleconferencing.

Computer based information systems: Most highway researchers are familiar with the Transportation Research Information System (TRIS) operated by the TRB. A more recent resource is the Demonstration Projects Information System established in 1983 to provide on-line access to information about available Demonstration Projects as well as data from the National Experimental Projects Tabulation. This system is now being expanded with the addition of the FHWA Implementation Catalog, NHI course offerings and Rural Technical Assistance Program products. This FHWA T^2 Information System will provide one-stop shopping for all T^2 material and resources developed by the FHWA. When completed, this system will be linked with the new Highway Technology Information Management System (HTIMS) now under development for the FHWA Offices of Research, Development, and Technology. Both the initial T^2 system and the HTIMS will be accessible to field users.

To determine efficient and appropriate uses of these emerging technologies in the T^2 program, FHWA has established a new Technology Laboratory at the Turner-Fairbank Highway Research Center. In addition to the necessary microcomputers and other electronic equipment, the laboratory has classrooms for presenting pilot training and conducting demonstration presentations under controlled conditions. Other features will include the capability for high quality computer generated graphics, videotaping facilities and an extensive slide library. Plans for the future include addition of video transmission capabilities for the auditorium adjacent to the laboratory.

As the Nation's highway research programs are accelerated to solve the most critical problems, it is essential that the T^2 systems be enhanced to efficiently and effectively deliver the products of that research.

CONCLUSION

Substantial progress has been made since the AASHTO Committee report in 1968. Formal programs have been established at the Federal, State and local levels. Reams of material have been written about the generic process of T^2, and the volume of highway-specific material is growing.

Congressional legislation has placed new T^2 requirements on Federal laboratories and, at the same time, made T^2 a legitimate function of the Federal government. New T^2 coordinators or offices have been formed in most State highway agencies and the T^2 to Locals Program has provided a new resource base for local highway agencies.

Despite these advances, there are still problems to be solved, and opportunities for innovation. The current problems are being addressed at many governmental levels and the entire highway community has focused on the need for innovative technology. With microcomputers in wide use and rapid advances in video- and telecommunications, the opportunities for improving the transfer of technology are limited only by the imagination of the decision-makers and their ability to provide the resources to get the job done.

At this point we have completed the circle. The 1968 report which started the highway T^2 effort focused on the people problems which prevented research from getting into practice. People are still the greatest challenge. In a recent presentation at the North American Pavement Management Conference, Dr. Thomas Larson, Secretary of the Pennsylvania Department of Transportation, cited a speech by Dr. Eric Walker titled "Undertakers, Caretakers and Innovators." As the thesis was explained by Dr. Larson, "We have too many undertakers. They're the folks who do a job and do it so poorly that it dies under them. We generally have a surplus of caretakers--people who do the job neither adding nor subtracting anything from it. But innovators, the people who can unlock the doors leading to breakthroughs leading to the kind of quantum leaps that the public has come to expect in transportation, we don't have enough of these kinds of people."[13]

This leads to the crucial question in the efforts to get research into practice; a question which must be asked of those who develop the technology, those who transfer it, and those who are expected to use it. What role will you play--undertaker, caretaker or innovator?

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APPENDIX II-V

U.S. Department of Energy
Washington, D.C.

ORDER

DOE 5800.1

3-25-82

SUBJECT: RESEARCH AND DEVELOPMENT LABORATORY TECHNOLOGY TRANSFER PROGRAM

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1. PURPOSE. To establish the policy and responsibilities for the management of the Department of Energy (DOE) Research and Development (R&D) laboratory technology transfer program.

2. SCOPE. The provisions of this Order apply to all elements of the Department which are involved in the administration, management, and support of the DOE laboratories.

3. REFERENCES.

   a. DOE 5000.1, INSTITUTIONAL PLANNING PROCESS, of 6-25-80, which establishes policy and responsibilities for administering the DOE multiprogram laboratories.

   b. DOE 5600.1, MANAGEMENT OF THE DEPARTMENT OF ENERGY WEAPON PROGRAM AND WEAPON COMPLEX, of 6-27-79, which establishes policy and responsibilities for management of the weapon complex and program.

   c. Public Law 96-480, The Stevenson-Wydler Technology Innovation Act of 1980, which requires technology transfer by federally funded R&D laboratories.

4. POLICY AND OBJECTIVES.

   a. Policy. It is DOE policy that technology transfer activities as required by Public Law 96-480 are legitimate functions of the R&D laboratories and will be conducted, as appropriate, at those laboratories specified in this Order.

   b. Objectives.

      (1) To establish a Department policy and R&D laboratory technology transfer program responsive to the requirements of Public Law 96-480.

      (2) To require the conduct, as appropriate, of technology transfer activities at the R&D laboratories.

      (3) To assure the application of consistent assumptions and procedures in the planning and conduct of technology transfer activities at the R&D laboratories.

DISTRIBUTION:
All Departmental Elements

INITIATED BY:
Director of Energy Research

(4) To assure appropriate and effective administration and management of the technology transfer program by the cognizant Secretarial Officers assigned responsibility for the R&D laboratories.

(5) To assure the timely and accurate collection of data and information about technology transfer for the purpose of describing the overall DOE effort in the technology transfer program.

5. DEFINITIONS.

a. Technology Transfer. The transformation of R&D into processes, products, and services that can be applied to State and local government and private sector needs. The R&D laboratory technology transfer program emphasizes personal interaction between the technical staff of the R&D laboratories and representatives of the public and private sectors. The R&D laboratory technology transfer program includes the following activities:

(1) Assessment of R&D projects for applicability to the needs of the private sector and State and local governments.

(2) Application and/or adaptation of research or technology into processes, products, and services for use by the private sector and State and local governments.

(3) Technical assistance to the private sector and State and local governments in adapting federally developed technology for use.

(4) Cooperation with technology transfer brokers to move technology from the laboratories to the private sector and State and local governments.

(5) Licensing of DOE-owned patented technology for commercial use.

b. Technology Transfer Brokers. Any institution or organization which provides linkage between the R&D source and the public or private sector utilizing the R&D.

c. Cognizant Secretarial Officers and R&D Laboratories. Attachment 1 identifies the cognizant Secretarial Officers and the DOE R&D laboratories under their purview.

6. RESPONSIBILITIES AND AUTHORITIES.

a. The Secretary establishes DOE policy and overall guidance for the R&D laboratory technology transfer program. In so doing, the Secretary is supported by the Director of Energy Research.

Vertical line denotes change.

b. Director of Energy Research.

(1) Provides staff recommendations to the Under Secretary regarding policy for the conduct of the technology transfer program by the R&D laboratories.

(2) Provides annual schedule and guidance to cognizant Secretarial Officers for the DOE R&D laboratory technology transfer program. The technology transfer program will include the approval of an annual 5-year technology transfer program plan by the cognizant Secretarial Officers and the submission of an annual technology transfer program report by each laboratory. The development of the guidance will be coordinated with the cognizant Secretarial Officers.

(3) Coordinates the technology transfer program as part of the institutional planning process.

(4) Provides guidance regarding the incorporation of the technology transfer program functions into the existing institutional planning process for multiprogram laboratories. For those R&D laboratories not included in the existing institutional planning process provides guidance regarding utilization of applicable elements of that process so as to avoid creating any new duplicative process or paper requirement.

(5) Coordinates the preparation of an annual technology transfer program report.

(6) Provides an interagency coordination point for technology transfer programs at DOE laboratories as appropriate.

(7) The Laboratory Management Division, Office of Field Operations Management, ER-42, is the focal point for coordinating the technology transfer program and for interagency coordination as appropriate.

c. Cognizant Secretarial Officers.

(1) Assure that the technology transfer program is incorporated into the activities of the R&D laboratories under their responsibility to the extent appropriate and consistent with overall DOE policy.

(2) Coordinate with the Director of Energy Research regarding general policies, assumptions, definitions, and procedures affecting the technology transfer program.

(3) Administer the technology transfer program for the R&D laboratories for which they are responsible.

C-4

(4) Incorporate the technology transfer program into the existing institutional planning process for multiprogram laboratories and utilize applicable elements of the institutional planning process for R&D laboratories not now included in that process.

(5) Provide guidance through the appropriate operations office, as applicable, for the R&D laboratories under their responsibility regarding the development and implementation of the technology transfer program consistent with the schedule and guidance issued by the Director of Energy Research.

(6) Approve annual 5-year technology transfer program plan for the R&D laboratories under their responsibility, utilizing the institutional planning process where appropriate.

d. Assistant Secretary, Management and Administration provides support for the technology transfer program at R&D laboratories as appropriate.

e. Assistant Secretary for Defense Programs provides security classification guidance on new areas of information as appropriate.

f. Assistant Secretary for Congressional, Intergovernmental, and Public Affairs provides recommendations to the Under Secretary regarding policy for conduct of and effectiveness of the technology transfer program at the R&D laboratories in regard to State and local governments.

g. Assistant General Counsel for Patents.

(1) Administers patent licensing program of DOE, including granting of licenses to qualified applicants.

(2) Negotiates patent licenses, including charging of royalties where appropriate.

(3) Coordinates with operations offices and R&D laboratories to provide technical assistance to patent licenses when appropriate.

h. Deputy Assistant Secretary for Naval Reactors.

(1) Establishes procedures for all technology transfer concerning Naval reactors information at R&D laboratories.

(2) Approves all technology transfers concerning information in the Naval reactors program.

i. Managers of Operations Offices.

(1) Overview laboratory compliance with the guidance provided by the Director of Energy Research and the cognizant Secretarial Officers concerning the technology transfer program at R&D laboratories under their purview.

(2) Advise and concur in the individual R&D laboratory technology transfer program annual 5-year plans and annual reports.

William S. Heffelfinger
Assistant Secretary
Management and Administration

R&D LABORATORIES AND RESPONSIBLE COGNIZANT SECRETARIAL OFFICERS [1/]

1. Director of Energy Research.

    a. Ames Laboratory

    b. Argonne National Laboratory

    c. Brookhaven National Laboratory

    d. Lawrence Berkeley Laboratory

    e. Oak Ridge National Laboratory

    f. Fermi National Accelerator Laboratory

    g. Princeton Plasma Physics Laboratory

    h. Stanford Linear Accelerator Center

    i. Bates Linear Accelerator Facility

    j. Center for Energy and Environment Research

    k. Environmental Measurements Laboratory [2/]

    l. Inhalation Toxicology Research Laboratory

    m. Laboratory for Energy Related Health Research

    n. Laboratory of Biomedical and Environmental Sciences

    o. Laboratory of Radiobiology and Environmental Health

    p. Michigan State University (MSU)-DOE Plant Research Laboratory

    q. Notre Dame Radiation Laboratory

    r. Oak Ridge Associated Universities

    s. Radiobiology Laboratory

    t. Savannah River Ecology Laboratory

    u. University of Rochester Biomedical Laboratory

[1/] R&D laboratories are contractor-operated except where noted.
[2/] Government-owned, Government-operated laboratory.

2. Assistant Secretary for Defense Programs.
    a. Lawrence Livermore National Laboratory
    b. Los Alamos National Laboratory
    c. Sandia National Laboratories
    d. New Brunswick Laboratory 2/
    e. Savannah River Laboratory
    f. Idaho National Engineering Laboratory

3. Assistant Secretary for Nuclear Energy.
    a. Pacific Northwest Laboratory
    b. Bettis Atomic Power Laboratory
    c. Hanford Engineering Development Laboratory
    d. Knolls Atomic Power Laboratory
    e. Energy Technology Engineering Center

4. Assistant Secretary for Fossil Energy.
    a. Bartlesville Project Office
    b. Morgantown Energy Technology Center 2/
    c. Pittsburgh Energy Technology Center 2/

5. Assistant Secretary, Conservation and Renewable Energy: Solar Energy Research Institute

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2/ Government-owned, Government-operated laboratory.

APPENDIX II-W

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ited States Government **Department of Energy**

emorandum

DATE: April 10, 1985

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LY TO
N OF: ER-42

JECT: General Guidance for R&D Laboratory Technology Transfer Program

TO: Laboratory Directors
hru: Operations Office Managers

The attached guidance is for your use in conducting the R&D Laboratory Technology Transfer Program which the Department has established in response to the Stevenson-Wydler Technology Innovation Act of 1980 (P.L. 96-480).

Last year I encouraged you to seek initiatives to improve technology transfer to the domestic private sector and to develop an interactive climate among the national laboratories, universities, and industry. In response, some laboratories have reported on initiatives that appear quite effective. Recent patent legislation could certainly further facilitate laboratory-industry interactions, and I would be interested in seeing how this new opportunity is reflected in your plans.

The Department has established technology transfer as a fundamental role of the laboratories which should be implemented so as to reinforce rather than constrain the primary laboratory technology missions. All laboratories are required to maintain an Office of Research and Technology Applications function, identify technologies with potential for transfer, and assertively pursue technology transfer activities. The technology transfer program conducted at nonmultiprogram laboratories may not warrant a formal technology transfer annual report as described in the attached guidance. In these cases you may, at your option, submit instead a brief letter report.

Alvin W. Trivelpiece
Director, Office of
Energy Research

Attachment

cc:
Donna Fitzpatrick, CE-1
Martha Hesse Dolan, MA-1
William Vaughan, FE-1
Jan Mares, IE-1
James Vaughan, NE-1
William Hoover, DP-1
R&D Laboratory Technology Transfer
Program Contacts

SCHEDULE AND GENERAL GUIDANCE
FOR R&D LABORATORY
TECHNOLOGY TRANSFER PROGRAM

Laboratory Management Division, ER-42

March 1985

Foreword

The DOE R&D Laboratory Technology Transfer Program, managed by the Office of Energy Research, was implemented in response to the Stevenson-Wydler Technology Innovation Act (P.L. 96-480). The program establishes the institutional policy framework for technology transfer to the domestic public and private sectors. Each laboratory has full flexibility to implement the activities in the most suitable fashion for its own mission and organizational circumstances.

The purpose of the technology transfer program is to stimulate improved utilization of federally-funded technology developments by State and local governments and the private sector to strengthen the United States industrial base and competitive position in the international marketplace.

The DOE policy is established by a Departmental Order which reflects the intent and provisions of the legislation to ensure that technology transfer was integrated into the operations of each R&D laboratory. The Order, DOE 5800.1 (Research and Development Laboratory Technology Program), states: "It is DOE policy that technology transfer activities as required by Public Law 96-480 are legitimate functions of the R&D laboratories and will be conducted, as appropriate, at those laboratories specified in this Order." The Order details the objectives of the program and the responsibilities and authorities of relevant Departmental elements and requires a technology transfer report each year from participating laboratories to communicate achievements and identify issues.

The Secretary of Energy has stated in policy guidance to the multiprogram laboratories that a fundamental role of the laboratories is to provide for and encourage the transfer of technology developed at the laboratories to the public and private sectors and facilitate an interactive climate among the national laboratories and industry. The encouragement for technology transfer does not imply a change in the fundamental mission nature of the laboratories.

The Director of Energy Research has the Departmental responsibility for the implementation of P.L. 96-480. The Laboratory Management Division, ER-42, is charged with oversight of the R&D Laboratory Technology Transfer Program and is the Headquarters' point of contact for DOE laboratory technology transfer activities.

In order to advance the DOE technology transfer program, the Department and the laboratories must seek means of improving the state of the art of technology transfer from Government-sponsored R&D and pursue better methodologies for more effective laboratory technology transfer. The Department continues to address improvements that can be made in policies relating to work for others, joint ventures, patent licensing, and incentives to technology transfer. The laboratories are encouraged to propose new initiatives to facilitate spin-off of technology developed at the laboratory to domestic industry and to improve the technology transfer process itself.

Offices of Research and Technology Applications (ORTA's)

Each laboratory is required to establish an ORTA. In laboratories with budgets over $20 million/year, it should be staffed by a full-time professional. Small laboratories may add the ORTA function to an existing position. In any event, the person-to-person interactions between laboratory researchers and potential public and private users of the technology are the key to the program's approach. In general, the ORTA:

- Provides a central coordination point in the laboratory for technology transfer.
- Prepares Laboratory Technology Transfer Annual Report.
- Provides support to technology transfer activities of laboratory scientific departments.
- Identifies opportunities to improve technology transfer process and to encourage spin-off of technology developed at the laboratory.
- Facilitates one-on-one interaction between laboratory scientific personnel and technology recipients.
- Provides and disseminates information on laboratory technology having potential application in private industry or State and local governments.
- Ensures that Application Assessment Records (AAR's) are prepared for research projects with potential for application in State or local governments, or in private industry. AAR's and other documents containing technology transfer information (e.g., reports, journal articles, and news releases) are sent to the Office of Scientific and Technical Information (OSTI) for incorporation in DOE data bases and for publication in the DOE Energygram series. OSTI transmits the AAR's to the National Technical Information Service (NTIS).
- Cooperates with Government information clearinghouses that link the laboratory, the Federal Government, and potential users in State and local governments and private industry.
- Provides technical assistance in response to requests from State and local government officials.

Application Assessment Records (AAR's)

The purpose of the AAR is to provide a standardized format for the reporting of information about laboratory R&D with potential for application in other sectors. The legislation requires that laboratories report on technologies which they identify as having potential for application in private industry or State and local governments. The ORTA should send completed AAR's to the DOE Office of Scientific and Technical Information. The format for the AAR's is shown in Appendix I.

R&D Laboratory Technology Transfer Annual Reports

The purpose of the annual report is to inform the Department of the laboratory's activities/accomplishments in technology transfer and issues/barriers encountered in the pursuit of more effective technology transfer. Headquarters can then communicate these accomplishments as required by the legislation, and address potential solutions to issues and barriers. The format for the laboratory annual report is shown in Appendix II.

Reference DOE Orders

5000.1	Institutional Planning Process	December 7, 1983
5800.1	Research and Development Laboratory Technology Transfer Program	March 25, 1982

Schedule

Throughout the year	Laboratories conduct technology transfer activities, including ORTA operations and preparation of application assessments as appropriate, and send Application Assessment Records to DOE Office of Scientific and Technical Information.
February	DOE technology transfer program contacts confer with Director, Laboratory Management Division, ER-42, to review overall program performance, schedule, and guidance.
March	Director, Energy Research, issues annual schedule and guidance for R&D Laboratory Technology Program.
September	Multiprogram laboratories participating in DOE institutional planning process include technology transfer plan summary in Institutional Plan submissions to cognizant Secretarial Officer for approval.

October	Laboratory ORTA directors meet with Director, Laboratory Management Division, ER-42, to assess experience of preceding year, and incorporate improvements into future program activities and reporting formats.
November 1	Laboratories submit Technology Transfer Annual Reports, through the operations office, to Director, Energy Research, attention ER-42 (five copies), and to cognizant Secretarial Officer (one copy).
January	DOE submits waiver of Stevenson-Wydler Act requirements to Congress if necessary.
April	Distribution of DOE R&D Laboratory Technology Transfer Program Annual Report after review and concurrence by cognizant Secretarial Officers.

Participating Laboratories

Ames Laboratory
Argonne National Laboratory
Bartlesville Project Office
Bates Linear Accelerator Facility
  (Massachusetts Institute of Technology)
Bettis Atomic Power Laboratory
Brookhaven National Laboratory
Center for Energy and Environment Research
Energy Technology Engineering Center
Environment Measurements Laboratory
Fermi National Accelerator Laboratory
Hanford Engineering Development Laboratory
Idaho National Engineering Laboratory
Inhalation Toxicology Research Institute
  (Lovelace Biomedical and Environmental Research Institute)
Knolls Atomic Power Laboratory
Laboratory of Biomedical and Environmental Sciences
  (University of California, Los Angeles)
Laboratory of Energy Related Health Research
  (University of California, Davis)
Laboratory of Radiobiology and Environmental Health
  (University of California, San Francisco)
Lawrence Berkeley Laboratory
Lawrence Livermore National Laboratory
Los Alamos National Laboratory
Michigan State University - DOE Plant Research Laboratory
Morgantown Energy Technology Center
New Brunswick Laboratory
Notre Dame Radiation Laboratory
Oak Ridge Associated Universities
Oak Ridge National Laboratory
Pacific Northwest Laboratory
Pittsburgh Energy Technology Center
Princeton Plasma Physics Laboratory
Radiobiology Laboratory (University of Utah)
Sandia National Laboratories
Savannah River Ecology Laboratory
Savannah River Laboratory
Solar Energy Research Institute
Stanford Linear Accelerator Center

R&D Laboratory Technology Transfer Program Contacts

Appendix I is a list of Headquarters, operations office, and laboratory contacts.

ORIGINAL PAGE IS
OF POOR QUALITY

03/28/85 R & D LABORATORY TECHNOLOGY TRANSFER PROGRAM CONTACTS

ORG.	NAME	TELEPHONE (FTS)	ADDRESS	LOCATION	ZIP
HEADQUARTERS					
ER-42	ALAN B. CLAFLIN	252-9740	3F-091	WASHINGTON - D.C.	20585
ER-42	NORMAN H. KREISMAN	252-9746	3F-091	WASHINGTON - D.C.	20585
DP-3	ROBERT P. KNOPF	252-2290	4B-014	WASHINGTON - D.C.	20585
NE-72	EDWARD F. MASTAL	233-4553	D-432	WASHINGTON - D.C.	20545
MA-7	ELIZABETH BUFFUM	252-8842	1F-045	WASHINGTON - D.C.	20585
CE-312	MARY MARGARET JENIOR	252-2998	5H-047	WASHINGTON - D.C.	20585
FE-10	ROBERT C. PORTER	252-6503	4G-085	WASHINGTON - D.C.	20545
GC-12	RICHARD CONSTANT	252-2802	6D-033	WASHINGTON - D.C.	20585
OSTI	DORA MONEYHUN	626-1303	P.O. BOX 62	OAK RIDGE - TENNESSEE	37831
OPERATIONS OFFICES					
AL	SAMUEL A. MARES	846-5215	P.O. BOX 5400	ALBUQUERQUE - NEW MEXICO	87115
CH	VIRGINIA H. HUMMEL	972-2140	9800 SOUTH CASS AVENUE	ARGONNE - ILLINOIS	60439
ID	CHARLES E. GILMORE	583-1808	550 2ND STREET	IDAHO FALLS - IDAHO	83401
OR	WILLIAM R. BIBB	626-0742	P.O. BOX E	OAK RIDGE - TENNESSEE	37830
RL	JEROLD L. LANDON	444-6952	P.O. BOX 550	RICHLAND - WASHINGTON	99352
SAN	SALLY FISK	536-6420	1333 BROADWAY	OAKLAND - CALIFORNIA	94612
SR	CHARLES L. HALSTED	239-3452	P.O. BOX A	AIKEN - SOUTH CAROLINA	29801
FIELD AND AREA OFFICES					
BATAO	ROBERT WENDT	370-3281	P.O. BOX 2000	BATAVIA - ILLINOIS	60510
BHO	DAVID SCHWELLER	666-3424		UPTON - L.I. - NEW YORK	11973
LBSO	DENNIS NEELY	451-4363	1 CYCLOTRON ROAD	BERKELEY - CALIFORNIA	94720
LLSO	DAVID J. TENCA	543-3020	P.O. BOX 808 (L-57)	LIVERMORE - CALIFORNIA	94550
SSO	DAVID RARDIN	327-1378	1617 COLE BOULEVARD	GOLDEN - COLORADO	80401
MULTIPROGRAM LABORATORIES					
ANL	RICHARD O. IVINS	972-7694	9700 SOUTH CASS AVENUE	ARGONNE - ILLINOIS	60439
BNL	WILLIAM MARCUSE	666-2103		UPTON - L.I. - NEW YORK	11973
INEL	JANE WELCH	583-8318	550 2ND STREET	IDAHO FALLS - IDAHO	83401
LANL	EUGENE E. STARK	843-4960	P.O. BOX 1663	LOS ALAMOS - NEW MEXICO	87545
LBL	ROBERT MORRIS	451-6502		BERKELEY - CALIFORNIA	94720
LLNL	SUZANNE B. MONACO	532-6416	P.O. BOX 808	LIVERMORE - CALIFORNIA	94550
ORNL	JOHN SODERSTROM	624-5953	P.O. BOX X	OAK RIDGE - TENNESSEE	37830
PNL	MARV CLEMENT	509-375-2789	P.O. BOX 999	RICHLAND - WASHINGTON	99352
SNL	ROBERT P. STROMBERG	844-5535	P.O. BOX 5800	ALBUQUERQUE - NEW MEXICO	87185
SINGLE PROGRAM LABORATORIES					
AMES	DANIEL E. WILLIAMS	865-2635		AMES - IOWA	50011
BATES	WILLIAM LOBAR	617-245-6600	P.O. BOX 95	MIDDLETON - MASSACHUSETTS	01949
BETTIS	RICHARD A. GUIDA	557-5564	P.O. BOX 79	WEST MIFFLIN - PENNSYLVANIA	15122
	LOCATED AT 203 CRYSTAL CITY, WASHINGTON, D.C. - 20545				
CEER	ANGEL CALDERON	809-767-0350	CAPARRA HEIGHTS STATION	SAN JUAN - PUERTO RICO	00935
EML	HERBERT L. VOLCHOK	660-3619	376 HUDSON STREET	NEW YORK - NEW YORK	10014
ETEC	GUY ERVIN, III	983-5532	P.O. BOX 1449	CONOGA PARK - CALIFORNIA	91304
FERMI	RICHARD A. CARRIGAN	370-3199	P.O. BOX 500	BATAVIA - ILLINOIS	60510
HEDL	DAVID WATROUS	509-376-3702	P.O. BOX 1970	RICHLAND - WASHINGTON	99352
ITRI	ROBERT K. JONES	844-2502	P.O. BOX 5890	ALBUQUERQUE - NEW MEXICO	87185
KNOLLS	RICHARD A. GUIDA	557-5564	P.O. BOX 1072	SCHENECTADY - NEW YORK	12301
	LOCATED AT 203 CRYSTAL CITY, WASHINGTON, D.C. - 20545				
LBES	WILLIAM J. MOFFITT	793-6762	900 VETERAN AVENUE	LOS ANGELES - CALIFORNIA	90024
LERHR	MARVIN GOLDMAN	453-1341		DAVIS - CALIFORNIA	95616

3/28/85 R & D LABORATORY TECHNOLOGY TRANSFER PROGRAM CONTACTS

ORG.	NAME	TELEPHONE (FTS)	ADDRESS	LOCATION	ZIP
LREH	SHELDON WOLFF	415-666-1636	SCHOOL OF MEDICINE	SAN FRANCISCO - CALIFORNIA	94143
MSUPRL	GARY W. WATSON	353-2270	PLANT BIOLOGY BUILDING	EAST LANSING - MICHIGAN	48824
ANL	CARLETON D. BINGHAM	972-2446	9800 SOUTH CASS AVENUE	ARGONNE - ILLINOIS	60439
NDRL	JOHN BENTLEY	219-239-5362		NOTRE DAME - INDIANA	46556
ORAU	JOHN HAFFEY	626-3150	P.O. BOX 117	OAK RIDGE - TENNESSEE	37380
PPPL	ELLIS SIMON	340-2778	P.O. BOX 451	PRINCETON - NEW JERSEY	08544
[illegible]LU	WALTER STEVENS	801-581-3655	BUILDING 351	SALT LAKE CITY - UTAH	84112
SERI	DANA MORAN	327-7115	1617 COLE BOULEVARD	GOLDEN - COLORADO	80401
SLAC	EUGENE B. RICKANSRUD	461-9300	P.O. BOX 4349	STANFORD - CALIFORNIA	94305
	(ASK FOR EXT. 2217)				
SREL	MICHAEL H. SMITH	239-2472	P.O. DRAWER E	AIKEN - SOUTH CAROLINA	29801
SRL	C. BANICK	239-2606		AIKEN - SOUTH CAROLINA	29801
ENERGY TECHNOLOGY CENTERS					
BPO	C.C. LINVILLE	745-4233	P.O. BOX 1398	BARTLESVILLE - OKLAHOMA	74005
METC	CLAIRE SINK	923-4620	P.O. BOX 880	MORGANTOWN - WEST VIRGINIA	26505
PETC	WILLIAM C. PETERS	723-6251	P.O. BOX 10940	PITTSBURGH - PENNSYLVANIA	15236

Format of the R&D Laboratory Technology Transfer Annual Report

A. OVERVIEW

A brief overview by the laboratory director.

B. ACCOMPLISHMENTS

This section should consist of narrative descriptions of major technology transfer accomplishments for the reporting period. Because most transfers take place over several years, it may be appropriate to describe accomplishments in the context of larger, or longer-term, activities. When describing specific technologies, the narrative should include information such as:

- program area
- technology name or title
- recipients of the technology
- indications of progress/success

Qualitative estimates of the market potential and/or likely national impact of successful commercialization should also be included. Whenever possible, quantitative measures of results should be stated.

Activity that has improved/increased laboratory relations with industry and universities. Report quantitative changes in users facilities activity and nongovernment work for others.

C. ISSUES

This section should describe issues and barriers encountered in technology transfer, and suggest possible actions and remedies, in order to make Headquarters aware of the situation and involve the Department as a possible resource.

D. INITIATIVES

A summary of new initiatives, including:

- initiatives implemented during the report period
- initiatives planned for implementation in the future within current resources
- initiatives requiring special funding or policy support

APPENDIX II

E. APPENDICES

I. Technology Transfer Process

Includes ORTA contact, address, and phone number. Placement of the ORTA within the laboratory management structure. Brief descriptions of the elements of the technology transfer processes should be provided: assessment process; interaction between program offices and ORTA; means of facilitating contacts with laboratory technical people and recipients of laboratory technology; outreach and information networking; relations with State and local governments.

II. Technology Transfer Program Plan

Staffing and Expenditures: An update of the laboratory's resources applied to technology transfer activities should be provided, using the format below. There is no requirement that the estimate of resources be verified by a system of records or accounts. The estimate should take full account of indirect support provided through program or other channels.

Please include a brief program plan which describes your strategy to take advantage of new patent legislation in technology transfer initiatives.

Funding ($ In Thousands - BA)

	FY 84	FY 85	FY 86	FY 87	FY 88	FY 89	FY 90	FY 91
ORTA								
Other (Est.)								
Total Funding								
Staffing (In FTE)								
Professional Staff								
ORTA								
Other (Est.)								
Total Staff								
Support Staff								

II. APPLICATION ASSESSMENT RECORDS (AAR's)

Listing of application assessment records prepared in Fiscal Year.

APPENDIX II-X

THE SECRETARY OF ENERGY
WASHINGTON, D.C. 20585

May 8, 1985

MEMORANDUM FOR Secretarial Officers
Operations Office Managers
Multiprogram Laboratory Directors

SUBJECT: Policy Guidance for
FY 1986-1991 Institutional Planning

I am committed to the effective utilization of our multiprogram laboratories in pursuit of the national security, research, and energy goals assigned to the Department. We all recognize the exceptional quality of these large multidisciplinary research facilities and the unique contractual partnership in which the laboratories' missions are congruent with the Government's missions. In the operation of this partnership, I expect effective technical management and accountability from the laboratory directors, efficient oversight from the operations office managers, and strategic program guidance and effective program management from the Secretarial Officers. I want us to strive for even greater excellence in the quality of our research and in the quality of our management.

The primary role of our laboratories is to carry out the program missions assigned to them by the Department. I expect the work proposed by the laboratories under our management and operating contracts to be dedicated to the assigned missions. These missions, such as nuclear weapons research and support, energy technology development, and basic research are critical to our national security and our future. The secondary role of our laboratories is to carry out the program missions assigned to them by other Government agencies.

Our laboratories have other vitally important secondary roles. The laboratories make their special capabilities available to the domestic private sector on a reimbursable basis and with the approval of the Department. The laboratories contribute, through cooperative programs with universities, to the education of scientists and engineers in the fundamental sciences and energy-related technologies. They provide for and encourage the transfer of technology developed at the laboratories to the domestic private and public sectors. The laboratories may also work with foreign countries under cooperative agreements and with the permission of the Department.

The institutional planning process is used for overall management oversight of the multiprogram laboratories. The institutional plans have developed to the point where they reflect effective planning systems in the laboratories and the process has been enhanced by policies for exploratory research and development funds and laboratory appraisals. This year we will communicate on a longer-term basis with a 15-year strategic view of the laboratories to be included in the plan. I urge the Program Secretarial Officers to provide substantive, strategic guidance to the laboratories for their development of this longer-term view.

John S. Herrington

John S. Herrington

cc:
Institutional Planning
  Officers

APPENDIX II-Y

THE DEPARTMENT OF ENERGY
GEOTHERMAL AND HYDROPOWER
TECHNOLOGIES DIVISION

GUIDANCE FOR DOE-RE MULTI-YEAR TECHNOLOGY TRANSFER PLANS, FY-85 THROUGH FY-1989

OCTOBER 1984

PREPARED FOR

THE DEPARTMENT OF ENERGY
GEOTHERMAL AND HYDROPOWER TECHNOLOGIES DIVISION

BY

DANIEL J. ENTINGH
DEEPAK KENKEREMATH

OF

MERIDIAN CORPORATION
5113 LEESBURG PIKE, SUITE 700
FALLS CHURCH, VIRGINIA 22041

CONTRACT NO. DEAC01-83CE30784
(MERIDIAN CONTRACT NO. 154-CG)

A. GENERAL GUIDANCE:

The Technology Transfer Plan should emphasize the following factors and considerations:

1. The Plan should balance the level of detail devoted to descriptions of: A) Technology to be transferred, B) Target audiences, and C) Approaches and mechanisms for the technology transfer process. You should show that your Program has a good understanding of all of these important factors, and good methods for promoting the transfer of specific technologies to appropriate audiences. Avoid writing a plan that appears to be driven mainly by a "technology push" approach.

2. The Plan should describe both: A) General operating activities, and B) The "strategic" activities through which you seek to improve Program technology transfer effectiveness. Both are important. However, the strategic activities require special attention in the FY-1985 Technology Transfer Plans. The general approach in this Guidance is to describe operational activities (in Section 4.0) separately from strategic activities (in Section 5.0). This is being done to make it clear how the R&D programs are responding to the maturation of specific technologies and to DOE's increased emphasis on technology transfer.

3. The Plan should provide clear descriptions of both: A) Your R&D Program's specific Technology Transfer budget program elements and B) Other major technology transfer activities that are embedded in your Program's R&D activity budgets.

4. Include appropriate justification for: A) Which technologies have high potential for transfer. B) Which audiences are being targetted. C) The "Technology Delivery System". D) The use of specific approaches (mechanisms) for technology transfer activities. E) Your overall budget for technology transfer.

5. Activities for FY-1985 should be presented in detail. Activities for later years may be presented in less detail, provided that major Program technology transfer thrusts and their relationships to Program major decision milestones are made clear.

6. Achieve and present a reasonable degree of consistency between this Plan and your FY-1984 and FY-1985 Program R&D Plans and the results of the MBO Strategy Exercise.

7. Acronyms are acceptable, and useful in this Plan, especially when detailing the use of generic DOE and other Federal technology transfer programs (e.g., TIC, NTIS). If you use acronyms extensively, include an appendix that defines them.

B. THE OUTLINE FOR THE PLAN

1.0 INTRODUCTION

1.1 Purpose of the R&D and Technology Transfer Programs
1.2 Purpose and Scope of this Plan
1.3 Organization of this Report

2.0 TECHNOLOGY TRANSFER STRATEGY AND GOALS

2.1 Needs for R&D and Technology Transfer
2.2 Goals and Objectives of R&D Program
2.3 Technology Transfer Program General Strategy
2.4 Goals and Objectives of Technology Transfer Program

3.0 TECHNOLOGIES AND AUDIENCES

3.1 The Technology Delivery System
3.2 The Transferable R&D Products
  3.2.1 Method for Selecting Transferable Products
  3.2.2 The R&D Products
3.3 The Target Audiences
  3.3.1 Methodology for Audience Selection
  3.3.2 Audiences and Their Information Needs
  3.3.3 Spin-Off Potential

4.0 TECHNOLOGY TRANSFER MECHANISMS AND ACTIVITIES

4.1 Program's Generic Approach to Technology Transfer
4.2 Technology Transfer Mechanisms
4.3 FY-1985 Technology Transfer Activity Descriptions
4.4 Out-Year Activity Descriptions
4.5 Use of Non-Program Generic Technology Transfer Mechanisms

5.0 IMPROVEMENT OF TECHNOLOGY TRANSFER PROGRAM

5.1 Program Monitoring Mechanisms
5.2 How Technology Transfer Methods are Being Refined
5.3 Specific Strategic Activities

6.0 PROGRAM MANAGEMENT

6.1 Management
6.2 Major Milestones
6.3 Resource Requirements

APPENDICES:

APPENDIX A. R&D PRODUCTS -- RECENT AND ANTICIPATED
APPENDIX B. GLOSSARY OF ACRONYMS

C. DETAILED GUIDANCE:

These details are keyed to the recommended outline.

1.0 INTRODUCTION

1.1 Purpose of the R&D and Technology Transfer Programs

First: Describe the general role of the Division technology R&D program within the context of national energy development activities. Denote how the principal technical thrusts of the R&D program mesh with the status of private-sector adoption of the technology being developed by the program.

Second: Describe the general roles of Technology Transfer Program activities in meeting the R&D Program roles and goals. Identify the principal thrusts of the Technology Transfer Program. Some examples of "thrusts" are:

* Primary emphasis on transferring devices and procedures to equipment manufacturers and consulting engineers who show a history of commitments to serving the geothermal industry.

* Working closely with industry associations, particularly the Geothermal Resources Council and the Electric Power Research Institute to ensure that GHTD R&D and Technology Transfer objectives match the needs of industry.

* Emphasis on ensuring that the "resource development" products of geothermal R&D have high enough value to the oil and gas resource industry to induce manufacturers of oil and gas equipment to produce these products for the relatively small geothermal market.

* Using established DOE technology-transfer channels (e.g., TIC, CAREIRS) to promote adoption of products of "geothermal" R&D by non-geothermal industries.

1.2 Purpose and Scope of this Plan

Denote that the Plan is a description of and justification for the technology transfer activities of the R&D Program, but not either:
1) A detailed Technology Transfer status or activities Report, or
2) A methodology for developing a Technology Transfer Plan. Denote that the Plan:

* Is a description of the Program Technology Transfer Strategy General System, and Major Activities,

* Emphasizes activities for FY 1985 that are intended to assist industry in adopting federally-developed technology and to stimulate intra-industry transfer of industry-developed technology, and

* Describes what your program is doing to improve the effectiveness of its technology transfer activities.

1.3 Organization of this Report

Briefly describe the major sections in a way that facilitates the reader's finding materials on:

* Technologies being transferred
* Target audiences
* Your Program's generic approach to technology transfer, and
* Specific technology transfer activities.

2.0 TECHNOLOGY TRANSFER STRATEGY AND GOALS

2.1 Needs for R&D and Technology Transfer

Describe the general kinds of technology being developed by the program, and why a well-managed technology transfer program is needed. Couch this in terms of one or more of:

* Technology maturity
* Industry familiarity
* Current market share
* Unusual economic externalities, or
* Special issues that apply to this Program's technology offerings.

Denote, for example, the degree to which this Program, in general, is focused on relatively basic research, engineering development, etc., and the implications which that focus has on technology transfer agendas. This material must be generally consistent with the results of the MBO Strategy Exercise.

2.2 Goals and Objectives of R&D Program

Describe the technology development objectives of the Technology R&D Program. This is the place to disaggregate the R&D Program's technical goals across either technologies or target audiences' information requirements. Statements such as: " ... intends to reduce the cost of deep geothermal wells by 25 percent by 1989" are entirely appropriate. A Table of major Program objectives, e.g., from the Program Multi-Year R&D Plan, is appropriate here.

2.3 Technology Transfer Program General Strategy

Describe the general strategy and guiding principles for the Technology Transfer Program. Include such considerations as:

* The stage in the R&D process at which technology transfer activities start to play an important role.
* How the program goes about identifying the appropriate target audiences for technology transfer activities. For example, describe differentiation, if any, between the "manufacturing", "technology use", and "energy end use" roles in the Program's target audiences.

- How the program monitors the effectiveness of its technology transfer activities.

Distinguish, here, "Operational" from "Strategic" objectives and activities. Because of the renewed emphasis on Technology Transfer within DOE, most Programs should denote what they are doing to improve day-to-day technology transfer operations. It is therefore important to define the following distinctions here, and then to use them elsewhere throughout this Plan:

> "Operational Activities": Technology transfer activities that diffuse information or devices directly to adopters. These include, e.g., technical publications, advertising, press releases on technical R&D projects, workshops on technology performance and economics, cost-shared R&D to diffuse a federal invention.
>
> "Strategic Activities": Both generic actions and specific Technology Transfer budget program elements that your Program is undertaking to improve the effectiveness of its technology transfer operations in the longer term. These might include, e.g., New surveys of audience receptivity to new technology, development of new measures of Program technology transfer effectiveness, or a reassessment of how best to use DOE generic technology transfer offices.

2.4 Goals and Objectives of Technology Transfer Program

Use level of detail similar to that in Section 2.2. Focus on the near-term technology transfer objectives (1 to 3 years) of the Technology Transfer Program. Be specific about major technology groupings (e.g., electric conversion system improvements) to transfer to major audience groupings (e.g., power plant engineers). Describe both "Strategic" and general "Operational" goals and objectives. Do this at a higher level of abstraction than you will use in Section 3.0.

3.0 TECHNOLOGIES AND AUDIENCES

GENERAL NOTES on Section 3.0:

1) This is the section where the Technology Transfer Program's detailed understanding of the relationships between target audiences and technologies is to be explained. This should be done in sufficient detail to justify the Program's generic technology transfer efforts and most of the specific technology transfer activities that are described in Section 4.0.

2) The bottom line of this Section is a moderately-detailed description of the information needs of the target audiences with respect to various technologies or aspects thereof. It is very important to communicate the sense that the technology transfer activities are:

- Strongly driven by target audience "needs" and "demand", and
- Directed toward successful interaction with the "technology adoption" processes of industry.

3) You may want to split this Section into two sections: (3.0 TECHNOLOGIES and 4.0 AUDIENCES) if your R&D Program comprises a broad mix of technologies. Do so if this makes the writing clearer. If you do this, include the material on the Technology Delivery System in the Section on "Audience".

SPECIFIC NOTES on Section 3.0

3.1 The Technology Delivery System

Describe -- using two diagrams and explanatory text -- the "Technology Delivery System" (TDS) for your Program. The TDS diagram consists of boxes and arrows describing how technology information and money flows from whom to whom. The purpose here is to provide the reader with a general description of how information and money related to new technology flow through a portion of the U.S. economy, and how this flow is affected by DOE Technology Transfer efforts.

The first diagram should show such interactions in the absence of the Federal technology transfer program. The second diagram should show such interactions including the efforts of the DOE technology transfer program.

Exhibits 1 and 2 in Section D, below, provide examples of the types of information and diagrams needed here. Note that these have been taken from a paper that Arthur Ezra presented at the GHTD/RE Workshop on Technology Transfer in late May 1984. The examples are meant to be suggestive, and not constraining on what you present.

3.2 The Transferable R&D Products

3.2.1 Method for Selecting Transferable Products

First, describe the formal or informal processes you use to select the products to transfer. Emphasize such things as: test results, cost analyses, size of markets, apparent economic or other benefits, meeting critical needs. The focus and explanations should combine: 1) technology readiness with 2) the Program's awareness of audience need.

Second, describe how this methodology might need to be refined. Save the details of activities you will undertake to refine the methodology for Section 5.0, STRATEGIC ACTIVITIES.

3.2.2 The R&D Products

List the R&D products you are seeking to transfer. "Products" include:

* Devices
* Methods, Procedures, Handbooks
* Data and Databases
* Applied Scientific Information
* Etc.

Review your Technology R&D Program's FY-1984 and FY-1985 Program Plans for milestones that promise to deliver devices and information. Wherever feasible, report here what your Program is doing to transfer those products. Use a level of detail that is similar to that used in the R&D Program's Multi-Year Program Plan. For example, if you describe a class of drill bits there, describe a class here, but if you describe a specific drill bit there, describe the specific bit here. Include information on:

* Product name
* Brief description of what product is or does
* Potential value of product to adopters
* Who developed it.

You should consider breaking this list into three categories of product readiness, e.g.:

* Products Partially Adopted
* Products Ready for Transfer
* Products Nearly Ready for Transfer.

If you have a large number of technology candidates (say, more than a dozen), break them out here by major types of technology, and then place the specific lists and details into Appendix A. If you have just a few candidates, list and detail them here and omit Appendix A.

3.3 The Target Audiences

3.3.1 Methodology for Audience Selection

Describe methodology for target audience identification and selection, and how the method might need improvement. Save the details about refinements for Section 5.0, STRATEGIC ACTIVITIES.

3.3.2 Audiences and Their Information Needs

Describe the major audiences who have key roles in the technology transfer process for this R&D Program. Disaggregate the audience in a manner that exhibits the Technology Transfer Program's understanding of:

* Who makes major decisions about technology adoption,
* How information flows through the system other than through DOE technology transfer actions,
* What are the major effective points for DOE technology transfer intervention.

Include descriptions of:

* The major audiences who have important roles, as adopters, transfer agents, end users, etc. in the technology adoption and technology transfer process for this Program's products.
* The general role each plays in adopting the relevant technology, including (as appropriate) the general interests, activities, and/or responsibilities of the audience with respect to the technology the Program is developing.
* A sentence or two, for each audience, about the general types of information (e.g., boiler performance specifications, wind energy

systems costs, emissions data) that they need to make informed decisions).

If useful, present a summary table of the above information.

3.2.3 Spin-Off Potential

List "secondary" audiences who might benefit from spin-offs of specific technologies developed (past and future) by your Program. For example, much geothermal technology can be spun off to the oil/gas drilling industry, and some photovoltaics technology can be spun off to more general semi-conductor fabrication industries. Indicate which technologies might be of interest to which spin-off audiences.

4.0 TECHNOLOGY TRANSFER MECHANISMS AND ACTIVITIES

4.1 Program's Generic Approach to Technology Transfer

First, describe how the selected mix of the various "modes" of technology transfer (Active, Semi-Active, Passive - See Exhibit 3 in Section D of this Guidance) are appropriate to the Program's mix of audiences and technologies. Indicate how the Program's use of these modes impacts the choice of specific mechanisms for technology transfer activities (See Exhibit 4 in Section D).

Second, describe how the Program goes about selecting and justifying the use of specific mechanisms ("operational activities") for technology transfer in classes or specific instances of audiences and technology interactions. Describe how proposed initiatives are evaluated and ranked. Include a general statement of how such selection processes might need to be refined, but save the details on how the Program is acting to refine such mechanism for Section 5.0, Strategic Activities.

4.2 Technology Transfer Mechanisms

Describe the mechanisms (information conduits, incentives) the Program uses to transfer inventions and innovations from Program to adopter. Describe these in fairly detailed terms, and perhaps include a descriptive table of mechanisms the Program uses most.

Provide a cross-walk between: A) Audiences, B) Technologies, and C) Mechanisms. Show where the specific Program FY-1985 Technology Transfer line item activities (to be detailed in Section 4.3). This material should be one of the most clearly presented parts of your Plan, since it is an important justification for specific technology transfer operational activities.

One way to do this would be to present an Audience X Technology matrix or table that includes code numbers referring to specific Program Technology Transfer budget program elements for FY 1985.

4.3 FY-1985 Technology Transfer Activity Descriptions

These should be keyed to the presentation in Section 4.2.

List each technology transfer operational activity. Descriptors should include:

* Current activity
* Technologies and audiences affected
* Changes in activity from prior years, with respect to Audience emphasis, Information packaging, and Technical focus
* Level of effort, MY, $K
* Significant dates -- but place the Major Milestones in a chart in the Management Section.

4.4 Out-Year Activity Descriptions

List any new projects, including those contingent on R&D Program "Major Decision" milestones. Include descriptions and explanations of:

* Contingencies.
* General plans for continued activities, and improvement of activities.
* Planned phase-outs, if any.
* New long-range emphases.
* Uncertainties (e.g., Geopressured research results could occasion shifts in emphasis.)

4.5 Use of Non-Program Generic Technology Transfer Mechanisms

Describe the Program's use of DOE, other Federal, and major private sector technology transfer programs, channels, and mechanisms, including:

* Any of the DOE generic Technology Transfer mechanisms (organized DOE Programs) listed in Exhibit 5 of Section D at end of this guidance
* Other Federal Technology Transfer programs
* Major non-federal technology transfer channels used by this Program (e.g., industry associations, press releases, inter-governmental associations, specific technical journals).

5.0 IMPROVEMENT OF TECHNOLOGY TRANSFER PROGRAM

5.1 Program Monitoring Mechanisms

Describe how the Program monitors its technology transfer efforts, using process measures and/or effects measures. Describe how the Program feeds such information back to:

* Adjustment of technology transfer operations
* Fostering improvements in the Technology Delivery System
* Adjustment of technology transfer strategy
* The R&D (Technical) planning process

5.2 How Technology Transfer Methods are Being Refined

Describe special activities the Program is undertaking to improve its technology transfer effort. The types of improvement that might be addressed include:

- * Technology Transfer Operational Procedures
  - Technology assessment and selection for transfer
  - Audience assessment
  - Matching technologies to audiences
  - (Re)-packaging of information
  - Direct information/device transfer actions

- * Technology Transfer Program Management
  - Directing and delegating
  - Measurement and monitoring
  - Cost Control

5.3 Specific Strategic Activities

Include here descriptions of "Strategic" Technology Transfer budget program elements, in a manner similar to the descriptions of "operational activities" provided in Sections 4.3 and 4.4.

6.0 PROGRAM MANAGEMENT

6.1 Management

Describe:

- * HQ (Organization charts)
- * Field Structure, including institutional names of main actors for technology or audience gateways

6.2 Major Milestones

These should track with the major milestones in the Program Multi-Year R&D Plan. Provide:

- * Milestone Chart
  - Number all milestones sequentially
  - Operational activities first
  - Strategic activities second
- * Milestone description list

6.3 Resource Requirements

Show a Table of all Technology Transfer Line Items, with FY-1985 budget, and estimated out-year budgets (where appropriate).

APPENDICES:

APPENDIX A. R&D PRODUCTS -- RECENT AND ANTICIPATED
Omit this Appendix if your Program is transferring just a few technologies. See guidance for Section 3.1.2.

APPENDIX B. GLOSSARY OF ACRONYMS

--- (End of Section C.) ---

D. EXPLANATORY EXHIBITS

EXHIBIT 1. Technology Delivery System in Absence of Technology Transfer Program

EXHIBIT 2. Technology Delivery System including the Technology Transfer Program

EXHIBIT 3. Comparison of Types of Technology Transfer Mechanisms

EXHIBIT 4. Comparative Advantages of Technology Transfer Mechanisms

EXHIBIT 5. DOE Generic Technology Transfer Agencies and Programs

EXHIBIT 1. A Technology Delivery System in Absence of Technology Transfer Program

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Note that this diagram and that in Exhibit 2 were from a paper that Arthur Ezra presented at the GHTD/RE Workshop on Technology Transfer in late May 1984. It is presented here as a suggestive example, and not intended to be highly constraining on how you represent your program's TDS.

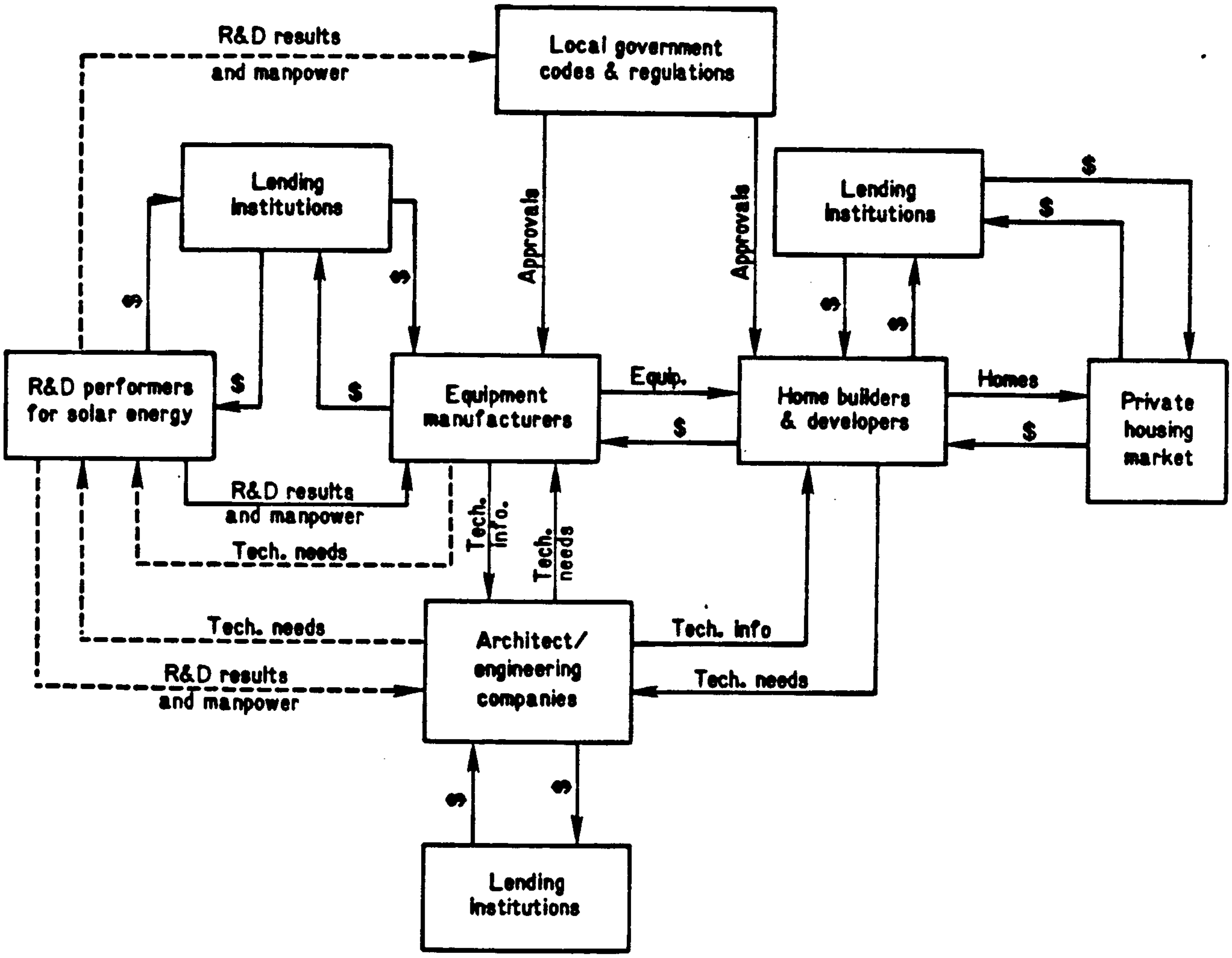

Figure The TDS for the private housing market showing the required interactions between the solar energy R&D performers and the other components. Broken lines indicate the linkages to be established or strengthened.

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EXHIBIT 2. A Technology Delivery System including the Technology Transfer Program

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See note in Exhibit 1.

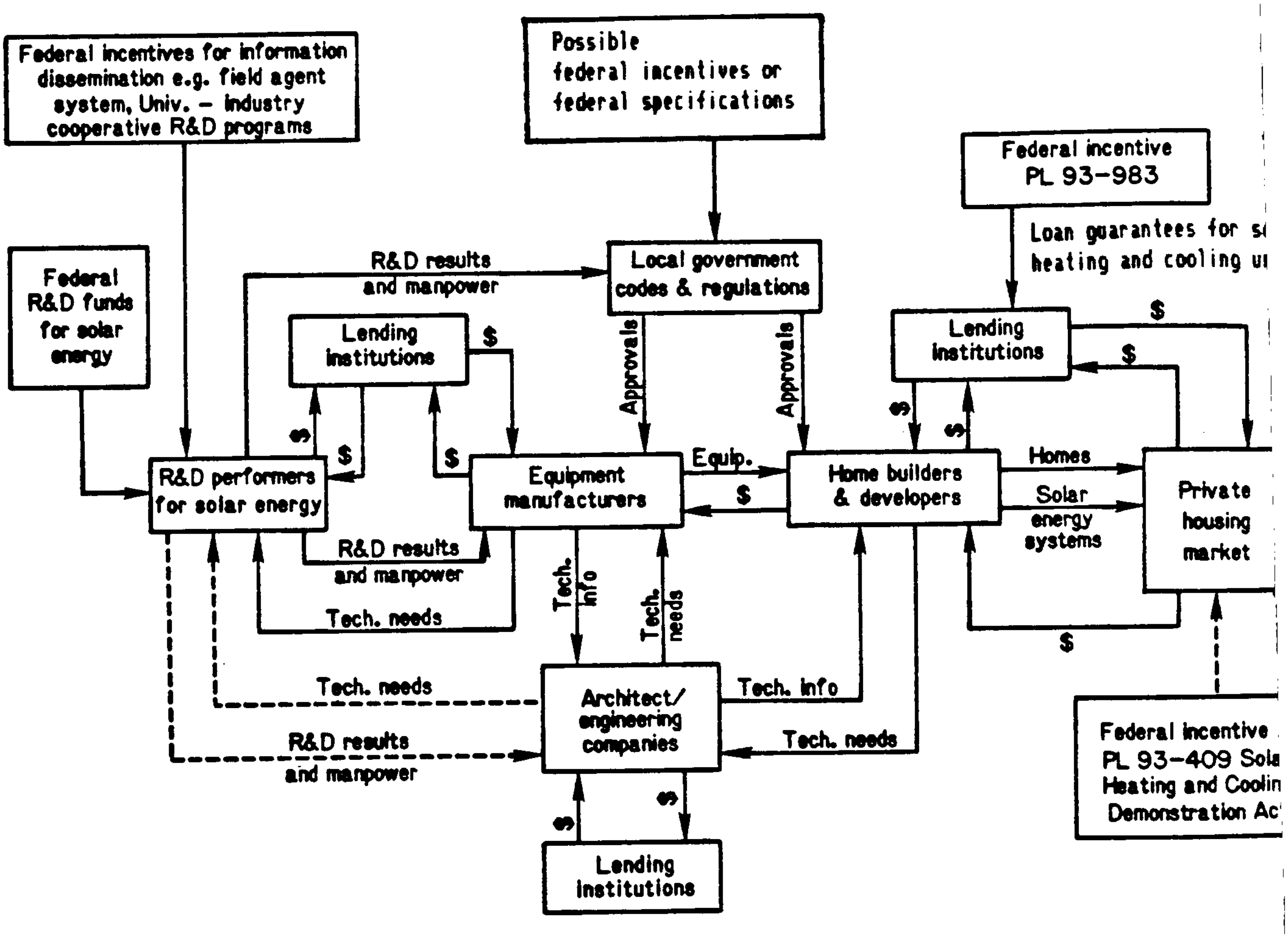

Figure The TDS for the private housing market showing examples of incentives for immediate use or consideration. Broken lines indicate linkages to be established or strengthened.

EXHIBIT 3. Comparison of Types of Technology Transfer Mechanisms

Passive Mechanisms tend to be:	Semi-Active Mechanisms tend to be:	Active Mechanisms tend to be:
"User-driven," and hence cheaper in the short-term by the limited nature of the outreach and coordination with users; an advantage in the short-term, but long-term missed opportunities are difficult to gauge;	Less costly than active mechanisms because the outreach is less aggressive, and thus perhaps less communicative (an advantage and disadvantage alike);	"Source-driven," and thus in a government context, policy-driven; a political rather than technically-objective condition; a disadvantage (nuclear power research demonstrates this tendency);
Less interventionist in market activity, leaving all major decisions to key private sector decision-makers; apart from immediate policy constraints, (an advantage);	Relatively timely, with information presentation given the modest commitment of resources (a modest advantage);	More costly, in the short term, a disadvantage because programs try to do more in reaching their audiences, without focusing on the economy of operation as much as the quality of the exchange or transfer process;
Slower in communicating; (a disadvantage in lost opportunities and potentially misinformed research pursuits).	Interactive with industry and private labs at least at some level; (an advantage.)	More rapid than private sector initiatives because the profit incentive need not be present for the exchange to be perceived to have value;
		More "participatory," or promotes better communication between source and end user. Both groups tend to be highly interactive in the technology transfer process, (an advantage).

Source: DOE Geothermal and Hydropower Technologies Division,
"Geothermal Technology Strategy and Plan, FY-1984"

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EXHIBIT 4. Comparative Advantages of Technology Transfer Mechanisms

MECHANISMS	Advantages	Disadvantages	Appropriate Situati
o Spinoff Industry	o Unexpected benefit of technology transfer o Satisfies existing needs o Timely	o Inherent risks of new industry	o Second generatio technology trans
o Intergovernment Agency Agreements	o Shared risk o Pooling of limited resources o Reduces duplication o Broadens use	o Requires agreement, monitoring and focus o Slower o Requires multiple funding agreements o Reduces individual agency options	o Nationwide application o Several agencies having a common mandate
o Personnel Transfer to/from Industry	o Rapid o No training lag o Minimal agency effort or expense o Shared costs and risks	o Subject to availability of personnel o Short-term loss to agency/industry	o When technology i either at earlies or final stage of development
o Joint Government/ Industry Development and Test	o Early interaction with private sector o Reduces private sector risk o Rapid technology transfer	o Potential private sector interference o Potentially descriminatory to competing companies	o When government a industry goals an needs match o Technology is feasible, yet untest
o Government Development/ Joint Test	o Agency controlled o Reduces private sector risk o Opportunity for private sector input	o Potential private sector interference o Not as responsive to marketplace o Costly	o When the feasibil of a technology m be established
o Tax Incentives/Loan Guaranties	o Reduces private sector risk o Enhances private initiative	o Potential loss to Treasury o Potential drain on development capital o Raises interest rates	o Well developed technology that ha not yet gained pub acceptance
o International Agreements	o Broadens market o Reduces duplication o Promotes cooperation o Shares knowledge o Reduces cost o Promotes cooperation	o Requires negotiation and cooperation o Dilutes single country budgetary control	o When application need is universal
o Agreements with R&D Arm of Public Utility/ Industry	o Promotes government/ industry dialogue o Reduces cost o Promotes government awareness of private sector needs	o May skew or narrow research path o Private sector intervention	o When an end use i clearly defined a a company's R&D c ability is unique
o Technical Assistance/ Education/Training	o Direct and immediate o Promotes second generation technology transfer o Resolution oriented	o Highly selective o Expensive	o When there is a Nationally recognized need

Source: DOE Geothermal and Hydropower Technologies Division, "Geothermal Technology Strategy and Plan, FY-1984"

MECHANISMS	Advantages	Disadvantages	Appropriate Situation
o Industry Advisory Committees	o Promotes government/industry communication o Provides R&D direction o Inexpensive o Easy to administer	o May not address long-term needs o Vulnerable to special interest pressures	o All stages of technology development
o Workshops/Conferences/Seminars	o Inexpensive o Assembles key decision makers o Promotes discussion, interaction	o Too frequently relied upon o Difficult to follow up o Intangible returns	o All stages of technology development
o Technical Meetings/Exchanges	o Topic specific o Rapid information exchange o Minimal cost	o Narrow audience o Vulnerable to personality variables	o When a specific problem has been identified
o Formal Visits	o Key actors meet one-to-one o Minimal cost o Promotes personal interaction o Rapidly accomplished	o Narrow market focus o No sure dissemination or product o Technical discussions likely to be superficial	o When technology is visible or impressive and key actors need convincing
o Informal Interactions	o Technical dialogue excellent o Minimal cost or planning o Promotes personal interaction	o Focus dependent on individuals rather than organizations o No sure dissemination or product	o All stages of technology development
o Liaison with Industry Associations	o Promotes clear understanding of critical industry concerns o Virtually cost-free o Two-way communication	o Government may become influenced by "in group" and not as responsive to new and innovative technology	o When communication needs are immediate and constant
o Publications	o Tangible, permanent documentation promotes referral o Can be tailored to an identified audience o Inexpensive	o Duplicative o May stifle alternative views o Results difficult to measure o No personal contact	o Addressing broad, large audiences at later stages of technical development
o Information Dissemination Centers	o Provide responses quickly "on demand" o Visible information accessable to all o Reference services available	o Passive, must await requests o Quality dependent on collection and currency	o Addressing broad, large audiences at later stages of technical development
o Data Banks	o Are accessable by a broad audience at any time o Search capabilities o Interagency & international capabilities	o Passive, must be accessed o Can be inaccurate or incomplete o Many times are not current	o When a technology is at an active R&D stage and further development is dependent on data assimiliation and analysis
o Direct Mailing	o Quick o Relatively inexpensive o Wide audience o Instant receipt of message	o No proof of impact o Potential for high wastage o Requires a selective mailing list	o When there is a need to communicate with a broad audience quickly
o Media Announcements	o Quick o Wide audience o Heightened impact o Instant receipt of message	o No proof of impact o Impact is likely of short duration o Relatively expensive o Likely to be superficial	o When there is a need to communicate with a very broad audience quickly

EXHIBIT 5. DOE Generic Technology Transfer Agencies and Programs

ACEP	Appliance Consumer Education Program
ATSGS	Appropriate Technology Small Grants Program
CAREIRS	Conservation and Renewable Energy Inquiry and Referral Service
ESD	Editorial Service Branch
EADC	Energy Analysis and Diagnostic Centers
EES	Energy Extension Service
EIFSP	Energy Integrated Farm Systems Program
ERIP	Energy Related Inventions Program
GMTA	Grants Management and Technical Assistance
HC	Hispanic Communications
IEEIP	Industrial Energy Efficiency Improvement Program
ISTUM	Industrial Sector Technology Use Model
ICP	Institutional Conservation Program
NCLDTGMG	New Car and Light Duty Truck Gas Mileage Guide
NEIC	National Energy Information Center
OSTI	Office of Scientific and Technical Information
PREP	Pre-Freshman Engineering Program
RCS	Residential Conservation Service
STIP	Solar Technology Information Program
SECP	State Energy Conservation Program
TICPDD	Technical Information and Communications Product Development and Distribution
U/DLCP	University/DOE Laboratory Cooperative Program
WAP	Weatherization Assistance Program

These are taken from DOE/CE-0023/3 [May 1984], "Comprehensive Program Plan for Federal Energy Education, Extension, and Information Activities: Annual Revision".

APPENDIX II-Z

DOE/CE-0097

National
Passive and
Hybrid Solar
Energy
Program

Five-Year Technology Transfer Plan

1986-1990

August 1984

Division of Passive and
Hybrid Solar Energy

Office of Solar Heat
Technologies

U.S. Department of Energy

EXECUTIVE SUMMARY

In FY 1983, the Passive and Hybrid Solar Energy Division established a technology transfer subprogram element. That action made technology transfer equal in importance to the Division's research subprograms and resulted in the creation of a meaningful and systematic technology transfer program. Since the subprogram was established, significant accomplishments have occurred.

Under the leadership of the Solar Energy Research Institute (SERI) Office of Research and Technology Applications (ORTA), a multiyear technology transfer program plan was prepared with the input of experts in the technology transfer field, researchers, and members of the buildings industry. Using the multiyear plan as a framework, nine buildings industry trade and professional associations developed plans outlining their roles in the technology transfer process. At the same time, the Division prepared a management plan providing strategies and guidelines for administering the program. To better understand the critical linkages and actors in the technology transfer process, the Division initiated case studies of its earlier efforts to transfer first-generation passive solar heating technologies. The insight provided by the case studies is being used to strengthen the program, update the multiyear plan, and develop an evaluation design.

In addition, an experimental University Research Associates Program is in place, and procedures for implementing an Industry Research Associates Program have been developed. Last summer, guidance was issued to the DOE field offices, SERI, and the national laboratories specifying that technology transfer strategies are to be an integral part of research plans and programs and requiring their inclusion in laboratory Field Task Proposals and field office Annual Operating Plans. As a result, the national laboratories were funded to implement specific technology transfer activities. Interactions between researchers and potential recipients of the research results are increasing in number and leading to more effective idea exchanges and research programs.

An initial investigation of passive and hybrid solar energy investment decision-making in nonresidential buildings is nearing completion. A consortium of buildings industry associations is developing and refining a strategy for satisfying its R&D needs using the resources of the Federal government, industry, and universities. Likewise, participation of leading industry practitioners and trade and professional associations in current research is continuing.

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FIVE-YEAR TECHNOLOGY TRANSFER PLAN, 1986-1990: NATIONAL PASSIVE AND HYBRID SOLAR ENERGY PROGRAM

INTRODUCTION

The Federal government sponsors a variety of research and development programs in renewable energy conversion technologies. That public investment is of little value unless the results of such R&D are promptly transferred to the private sector, resulting in processes and products of benefit to society.

Congress addressed this need for technology transfer in the Stevenson-Wylder Technology Innovation Act of 1980. It is the policy of the Federal government, as stated in that Act, to "strive. . . to transfer Federally owned or originated technology to State and local governments and to the private sector." DOE management has endorsed a continuing technology transfer effort through the issuance of DOE Order 5800.1 and support to technology applications development in the R&D programs.

Experience has shown, however, that Federally funded R&D results are not adopted on a timely basis unless the Federal government puts forth a meaningful, systematic effort to make research results available to potential users. Therefore, in FY 1983, the Passive and Hybrid Solar Energy Division established a separate element in its program to provide for the prompt transfer of its technologies to participants in the buildings industry.

In the following pages, the Passive and Hybrid Solar Energy Technology Transfer Program's accomplishments and activities planned for the immediate future and over the longer term are presented.

THE PASSIVE AND HYBRID SOLAR ENERGY PROGRAM AND THE BUILDINGS INDUSTRY

Reducing or eliminating dependence on commonly used energy in buildings is the primary goal of the Passive and Hybrid Solar Energy Program. The passive and hybrid technology needs of residential and nonresidential buildings, both new and existing, are addressed. Research focuses on the development of passive heating, cooling, and daylighting systems and their integration with conventional and nonconventional space conditioning systems. Supporting research is being conducted on new high performance materials and components for storing and transporting thermal energy and for controlling heating and cooling loads. The expected output of this research includes heating, cooling, and daylighting guidelines for use in designing residential and nonresidential buildings, and feasibility and performance studies of advanced building materials and components for use by manufacturers in developing new products for use by the buildings industry.*

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* For the purpose of the Passive and Hybrid Solar Energy Program, a distinction is made among actors according to their roles in the building construction process. <u>Users</u> are those practitioners who receive and put technology into operational practice. They include builders and developers. <u>Suppliers</u> are those who translate research results into operational practices so they can be transferred to users. Suppliers include building products manufacturers, architects, and engineers. <u>Sponsors</u> are those who regulate or control the use of the technology. They include public officials, financiers, real estate agents, and manufacturing firms' investment decision makers.

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Technology transfer traditionally falls within the province of industry where it constitutes an integral part of market development. The buildings industry, however, is an extremely diverse aggregation of developers, builders, engineers, architects, financiers, real estate agents, manufacturers, distributors, public officials, and others. Except for a few large materials and components manufacturers, most participants in the buildings industry do not have the resources to gather and use the results of Division-sponsored passive and hybrid solar energy research. And typically they need information that translates passive and hybrid solar research results into a language that addresses their specific concerns and uncertainties.

Since the buildings industry is so diverse and funds available for technology transfer are limited, the Division is identifying those users, suppliers, and sponsors who are potentially the most influential in the adoption of passive and hybrid solar technology. Its current transfer efforts are aimed at four key groups:

1. Innovators: Innovators seek out new technologies and lead the way in their early adoption and application. They are characterized by self-initiative and judicious risk-taking in their effort to capitalize on new passive and hybrid solar technologies. Members of this group oftentimes seek out the researcher. They may include progressive engineers, architects, builders, developers, and manufacturers. Examples in the use of new technologies provided by these innovators eventually become standard practice.

2. Building materials and components manufacturers: Manufacturers are key to the transfer of passive solar technology through their own development and marketing of products essential to building construction. Many of these manufacturers are able and encouraged to interact directly with Division-sponsored researchers and capitalize on their research in developing such products as glazings, phase change materials, and other devices used for storage and control of solar energy.

3. University faculty: Faculty are essential in passive and hybrid solar technology transfer. It is through their efforts that future professionals gain the appreciation and training necessary to incorporate passive and hybrid solar energy strategies into buildings.

4. Buildings industry trade and professional associations: Since it is neither possible nor desirable for researchers to interact directly with all individual practitioners, the buildings trade and professional associations are the mechanism for (a) identifying the practitioners' needs regarding passive and hybrid solar energy technology and (b) sharing the results of research with their members in ways that are most useful to the individual practitioners.

The Division's technology transfer program relies on its laboratory and contractor researchers and laboratory ORTA's to interact directly with the four key groups.

OVERVIEW OF THE TECHNOLOGY TRANSFER PROGRAM

During FY 1983, a multiyear technology transfer program plan was formulated. It identifies near-term and longer term activities designed to achieve the goals and objectives of the program. The technology transfer program is based on the following guidelines:

1. The technology transfer process must foster and build upon an interactive partnership between Division-sponsored researchers and influential users, suppliers, and sponsors.

2. The process must be an integral part of the Division's research and development plans and programs.

3. The process must be responsive to, and build upon the technology needs of and opportunities available to, the users, suppliers, and sponsors.

4. The process must make effective use of existing Federal and other resources in meeting the industry's technology needs and opportunities.

5. The process must incorporate participants' feedback and future innovations developed by the Division to improve technology transfer.

6. The process must incorporate management features, including an evaluation component, that will assure its continuing integrity and effectiveness.

Program Structure

The technology transfer program is divided into three elements: technology transfer program planning, technology delivery, and evaluation.

Technology Transfer Program Planning

Technology transfer program planning is critical to program success. Its purpose is to determine user, supplier, and sponsor needs and balance these needs with the resources available to satisfy them. The result of the planning phase is an integrated set of activities that will be implemented by the laboratories and research and development contractors in conjunction with complementary efforts by users, suppliers, and sponsors. Planning is augmented by technology transfer research that supports program planning and analysis and lays the groundwork for a more comprehensive and effective technology transfer program in the longer term.

Technology Delivery

Technology delivery is characterized by activities conducted to ensure prompt diffusion of research results to potential users and those who influence users. Technology delivery activities emphasize close interaction between researchers and these groups in order to enhance their understanding of the emerging technology. Technology delivery incorporates the steps in the adoption process. The steps in the process are as follows:

Research and Development Planning. R&D planning is the front end of the technology transfer process. It is the point at which decisions regarding the content of the Passive and Hybrid Solar Energy research and development program are made. The technology transfer program encourages users, suppliers, and sponsors to identify their needs for passive and hybrid solar energy technology and to have them considered by the Division in its R&D planning. The program requires Division-sponsored researchers to identify potential recipients of their research results and to determine with those recipients effective strategies for transferring those results.

Research and Development Performance. R&D is the work that leads to new passive and hybrid solar products and processes, and to their transfer to users, suppliers, and sponsors. The technology transfer program gives users, suppliers, and sponsors the opportunity to become aware of and involved in the Division's research activities. This is done through collaborative research, topical research program reviews, and researcher participation in technical committees and conferences sponsored by buildings industry trade, professional, and technical societies. Hands-on involvement is also provided through seminars, workshops, and research associates programs offered for industry researchers and university faculty. Division research results are also provided to buildings industry organizations for their use in developing information and education programs, and in publications for their members.

Initial Application and Early Replication. This stage of the transfer process involves proof of concept of the new technology. The Division's technology transfer program encourages the involvement of the progressive buildings industry practitioners and trade and professional organizations in such activities. Leading practitioners and organizations are participating in its nonresidential Experimental Buildings Program, its International Energy Agency tasks, and the Residential Building Performance Monitoring and Evaluation Program (Class B Monitoring).

Diffusion. Diffusion is the stage when new technology, having been tested and validated, becomes widely used. The Division relies on the initiatives and resources of the buildings industry professional and trade associations to facilitate diffusion.

Evaluation

Evaluation measures the effectiveness of the technology transfer program in changing the behavior of potential users, suppliers, and sponsors. Feedback from evaluation provides information needed for program planning. It identifies potential improvements in the technology transfer process.

Some Accomplishments and Current Activities

Past and current technology transfer efforts are concentrated on (1) expanding relationships with key organizations within the buildings sector, (2) investigating means of improving the transfer of passive and hybrid technology between researchers and relevant industry participants and participant groups, and (3) identifying the principal actors and decision processes involved in the adoption of passive and hybrid solar energy technologies.

Accomplishments to date are significant. Interactions between program people and industry have increased. The buildings industry is more confident that the Passive and Hybrid Solar Energy Program is responsive to its needs. Some specific accomplishments and activities under way or to be initiated soon are as follows:

Technology Transfer Program Planning

The Division's multiyear program plan for technology transfer. Under the leadership of the SERI ORTA, the multiyear technology transfer program plan has been developed and updated. The plan establishes the near-term and longer term strategies for conducting the technology transfer program and provides for planning, technology delivery, and evaluation activities. This plan has been prepared with input by industry representatives, experts in the field of technology transfer, and researchers. It has been favorably reviewed by a broad representation of the buildings industry, researchers, and specialists in the technology transfer field. This plan is being updated annually.

The Division's technology transfer management plan. This plan has been developed to provide a framework within which to manage the Division's technology transfer program. The plan delineates activities needing to be carried out by the Division; guidelines for executing the various technology transfer strategies set down in the multiyear plan; and the responsibilities of laboratory researchers, field office personnel, and the SERI ORTA.

Case studies of technology transfer within the buildings industry. Systematic studies of earlier Division efforts to initiate the transfer of first-generation passive solar energy technologies are being undertaken in order to identify key actors, linkages, and strategies that have facilitated or impeded the adoption of those technologies. Denver Metro and the Los Alamos design guidelines and handbooks are the first two case studies. These two case studies are already providing a better understanding of the technology transfer process within the buildings industry, what technology transfer strategies have and have not worked and why, and who the critical actors are. The results of these and additional case studies will be used to identify more effective technology transfer approaches to be implemented in future years.

Industry plans for passive and hybrid solar energy technology transfer. Nine buildings industry professional and trade associations jointly identified their technology transfer needs and individually prepared plans for sharing the results of needed research with their members. The associations recommended the development of an active partnership between researchers and industry representatives. Benefits of this partnership include early identification of potential recipients of research results and development of more effective transfer mechanisms.

Investment processes relative to passive and hybrid solar energy technologies. Passive and hybrid solar energy investments in nonresidential buildings are currently being investigated. The purpose is to identify the nonresidential buildings investment process and to determine what factors influence decisions regarding passive and hybrid solar investments. Preliminary results indicate that few developers have adopted passive and hybrid solar technology. This situation appears to stem from the developers' reluctance to adopt any new technology unless significant benefits can be immediately gained (e.g., improved tenant acceptance or marketability of the property). These preliminary findings highlight the need to emphasize this segment of the buildings industry in future technology transfer efforts.

ORTA's. Improving the linkages among laboratory researchers, ORTA's, and key actors may be a way to improve the effectiveness of the Division's technology transfer program. Strategies for improving these linkages are to be identified.

Other resources. Other Federal and non-Federal resources and programs may be useful to the Division in meeting its technology transfer program objectives. The resources and programs will be analyzed to determine their potential. Resources to be examined include the trade and professional associations not currently involved in the Division's program, local and regional chapters of associations, State and local community/economic development and energy offices, and other DOE and Federal programs.

Technology Delivery

Research and Development Planning

Buildings industry assessment of passive and hybrid solar energy technology research and development needs. As a result of the positive atmosphere created by the technology transfer program, a consortium of industry associations is determining industry's passive and hybrid solar technology needs and developing a national strategy for satisfying those needs. The results of this assessment will be made available to the Division for its use in R&D program planning.

Incorporation of technology transfer strategies into Division research plans and programs. The Division developed and issued guidance to the DOE field offices and the laboratories specifying that technology transfer strategies are to be an integral part of research plans and programs. The guidance requires that potential recipients of research results and methods of transferring these results are to be determined during research planning. The transfer methods may include (1) industry participation in the review of research activities, collaborative research, and participation by researchers in buildings industry trade and professional society technical meetings; (2) publications in scientific journals and technical proceedings; (3) materials for incorporation by recipient groups into education programs and practitioner handbooks and standards; and (4) university and industry research associates programs.

Research and Development Performance

Laboratory-industry research exchange meeting. A meeting involving industry representatives, DOE field office personnel, and researchers from SERI and the national laboratories was held to make industry aware of available passive and hybrid solar energy technology and to gain a better understanding of industry's needs for technology. As a result, industry-laboratory interaction is increasing. Both researchers and industry plan to continue and to expand these interactions.

Topical program reviews. Technology users, suppliers, and sponsors and representatives of these groups participate in topical reviews of current research. The Division is currently working to make topical program reviews a more effective technology transfer mechanism. Recently, the Division provided descriptions of its research activities to a broad spectrum of industry groups. These groups are identifying those research activities in which they are interested and indicating the topical program reviews in which they wish to participate. The topical program review process will be continually reviewed and improvements incorporated into the topical review procedures.

Research associates programs. Summer sabbaticals for university faculty members are being provided at each of the laboratories participating in passive and hybrid solar energy R&D. In addition, the SERI, Los Alamos National Laboratory, and Lawrence Berkeley Laboratory ORTA's have developed procedures for implementing an industry associates program.

Diffusion

In order to facilitate the diffusion of research results ready for adoption by a majority in specific professions or trades, the Solar Technical Information Program staff is working with the appropriate professional and trade associations to prepare camera-ready materials which the associations will print and distribute.

Evaluation

A method for evaluating the effectiveness of the technology transfer mechanisms will be developed in the near future. A professional evaluator will develop the design, using the knowledge of the technology adoption process being provided by the case studies.

Representatives of the buildings industry conducted a building energy research workshop February 14-16, 1984, to determine how well industry needs for building energy research were being met by government and industry. Though it is too soon to know how effective the Division's technology transfer program is, this group found it to be the pacesetter among the various Federal programs it evaluated.

FY1986-FY1990 TECHNOLOGY TRANSFER PROGRAM PLAN

Technology Transfer Program Planning

The multiyear technology transfer plan will be updated annually using the results of the evaluation and additional case studies, if needed, and independent advice from the buildings industry, the laboratories, and the DOE Program Offices. The plan will continue to identify the key actors in and methods for facilitating technology transfer. Because an integrated technology transfer program is new, its details can be expected to evolve during the next four or five years. The plan also will continue to take into account the technology transfer activities explicitly and implicitly included in the research program elements.

Technology Delivery

Research and Development Planning

A consortium of interested buildings industry trade and professional associations will annually review its research agenda for passive and hybrid solar technology and formulate strategies whereby these needs can be satisfied through a coordinated use of Federal, university, and industry resources. The results of this review will be provided to the Division for consideration in its R&D program planning.

Research and Development Performance

Topical program reviews. The topical program review process currently under way will continue and improvements will be incorporated into the topical review procedures.

Industry association activities. Participation by laboratory researchers in professional and technical meetings and publication of papers in recognized journals are important to the diffusion of new knowledge developed in the research programs. This activity will provide discretionary funds to the appropriate offices in the laboratories to support the preparation, presentation, and publication of such papers. Funds will be disbursed to the individual researchers based on the potential value of the presentation or publication to the transfer of new technological knowledge.

ASES Passive Solar Conference. The annual Passive Solar Conference, sponsored by the American Solar Energy Society, may be an effective channel for communication between researchers in the Passive and Hybrid Solar Energy Program and early users, suppliers, and sponsors of the technology. It is attended by leading architects and engineers, builders and developers, and representatives of the building products industry. The technology transfer program will continue to provide partial funding for this important and unique annual conference.

Industry Research Associates Program. The Industry Research Associates Program, pioneered by the National Bureau of Standards (NBS), provides for researchers from industry to work in the laboratories for periods of from 12 to 18 months. The guest researcher is able to collaborate with his or her contemporary in the laboratory, taking advantage of the specialized facilities and environment. The collaboration can make a significant contribution to the transfer of new technologies from the laboratory to industry.

University Research Associates Program. Excellence in teaching and in graduate research requires that university faculty be fully aware of, and conversant with, the current status of research and development. Summer sabbaticals will be provided each year for four faculty members, one at each of the laboratories participating in passive and hybrid solar energy R&D. Using the knowledge gained, the faculty members will be able to alter university curricula to incorporate passive and hybrid solar energy design.

Collaborative research. Collaborative research, involving cost-sharing, is of benefit both to the laboratory and to the participating industrial organization, and is an effective means for facilitating the transfer of technology from the laboratory to the private sector. The benefit to the research program is the synergy of work with industry researchers and a reduction in research costs; the benefit to technology transfer is the more rapid adoption of the results by the sharing industrial organizations. Funding of such collaborative research is through the research subprogram elements.

Industry workshops. Workshops at the laboratories for representatives of the building products industry can serve several purposes. Researchers can present to industry new technologies emerging from their studies in a context that allows the interested organizations to obtain in-depth knowledge of possible new products. The workshops provide companies with the opportunity to survey facilities that may be available for use in development programs ("user facilities"). They also offer a forum for discussion of new concepts to determine both the viability and potential "market" for the contemplated technology.

Facilities specifications. There exists at the DOE laboratories and at NBS a variety of specialized test facilities which, if made known and available to industry and universities, could contribute to the more rapid application of new technologies. In cooperation with the Solar Technical Information Program (STIP), and in part funded by that program, specifications for these passive and hybrid research, test, and evaluation facilities will be updated as necessary. The compilation will be distributed to appropriate industry audiences, directly and through trade and professional associations. This compilation will supplement and update the Guide to DOE Laboratory User Facilities being issued by the Office of Energy Research. The specifications also will be distributed to those universities that may want to take advantage of such facilities for collaborative and graduate research.

Patents and licensing. As the Passive and Hybrid Solar Energy Program's materials and components research progresses, patent and licensing policies and procedures may become critical factors in the technology transfer process. An understanding of how to use these procedures to facilitate the development of building products and components by industry is essential.

Initial Application and Early Replication

The case studies completed to date reveal that initial application and early replication are critical steps in the technology transfer process. Alternative means of meeting this need will be identified and evaluated and mechanisms selected for testing.

Diffusion

The program will continue to rely on the trade and professional associations representing the architectural, engineering, building materials, and other elements of the buildings industry. Using these organizations for the diffusion of results from the Federally sponsored R&D programs offers several advantages: (1) they have continuing contact with their members, (2) they have the confidence of those members, and (3) they "speak the language" of those members. The Passive and Hybrid Solar Energy Program already has established cooperative relations with several of these associations.

The diffusion of research program results may be facilitated through the development of camera-ready materials with the appropriate trade and professional organizations. The organizations will be responsible for printing and distribution, thus sharing in the costs. Coordinating the development of such materials with the association will assure that the "language" and presentation are appropriate to the audience. These activities, a continuation of ongoing activities, will be funded through the Solar Technical Information Program (STIP).

Additionally, the technology transfer program may help, on a cost shared basis, industry trade and professional associations to develop workshop and seminar materials, and publications designed to educate their members about passive and hybrid solar technologies.

Evaluation

The objective is to evaluate the various technology transfer mechanisms, identifying those that have been most effective, those that may be improved upon, and those that have not paid off. This activity will be carried out by a professional evaluation contractor, using the evaluation design developed during FY 1984 and FY 1985.

CONCLUSION

Through its technology transfer activities, the Division has successfully initiated working partnerships between its researchers and members of the buildings industry over the past two years. In many ways, its technology transfer program is experimental. The program recognizes that the primary recipients of the individual elements of the research program may differ. In some, the principal recipient will be the developer or builder; for others, the results will see first application in new building products.

Continued implementation of the Passive and Hybrid Solar Energy Technology Transfer Program will result in transfer activities tailored to the technology adoption process unique to the buildings industry. Continued implementation will substantially increase the adoption of passive and hybrid solar technologies and provide substantial benefits to society.

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APPENDIX II-AA

TECHNOLOGY OPPORTUNITY PROFILES

SILICON CARBIDE WHISKERS
TECHNOLOGY OVERVIEW

CURRENT STATUS OF THE TECHNOLOGY:

A process has been developed at Los Alamos National Laboratory to grow single crystal silicon carbide (SiC) fibers (i.e., "whiskers") using a vapor-liquid-solid process. Initial efforts have been made to optimize the process to reliably produce whiskers of uniform size, composition, and optimum strength. Current research is directed toward characterizing the process parameters, improving production yields, and evaluating the product properties. These SiC whiskers are being developed as potential reinforcing materials for high-performance composites.

TECHNOLOGY CHARACTERISTICS:

The Los Alamos SiC whiskers have been shown to have inherent mechanical properties of high strength and elastic modulus that would make them potentially excellent candidates as composite reinforcing materials. By comparing them to a commercially produced continuous SiC fiber (Nicalon), the Los Alamos SiC whiskers appear to be stronger and stiffer, and could offer superior toughening properties.

Major drawbacks to the Los Alamos SiC whiskers technology is that the production currently involves batch processing, rather than continuous or semi-continuous manufacturing and the process is very energy intensive. It is also estimated that these whiskers may be more expensive to produce than other SiC whiskers (either continuous fiber or other, shorter commercially produced whiskers), however, no production cost data has been obtained yet.

By using the vapor-liquid-solid process developed at Los Alamos, the SiC whiskers that are produced are longer than other commercial whiskers. Lengths in the range of 0.5-1.0 cm. are typical, whereas other commercially produced whiskers (by Arco through a rice hull method and Tateho Chemical Industries of Japan) are very short (0.01-0.04 cm. in length). The Los Alamos whiskers, which are longer and stronger, are felt to ultimately provide better physical properties to the composites in which they may be incorporated.

Another aspect of the Los Alamos SiC whiskers is that these materials have a very high purity. This attribute is important in that the impurities, which normally react with the composite matrix, are not present. Therefore, purer whiskers will impart enhanced toughness properties to the composite. The current commercially available fibers are less pure than the Los Alamos whiskers.

TECHNOLOGY POTENTIAL:

Since this technology is in the early stages of development, it will be necessary to develop the technology beyond the laboratory stage to full-scale continuous processing. Therefore, as the process develops, engineering parameters will need to be established for the process. Scale-up for the process has not been demonstrated yet. Two companies (Arco Chemicals, Greer, S.C. and Carborundum Advanced Materials Division, Niagra Falls, N.Y.) are working with Los Alamos to develop full scale production of these whiskers. It is estimated that it might take two to five years for commercial production of these materials to be realized.

Since the Los Alamos whisker process is in the early stages of development, there have been no production cost estimates made. However, prices for commercially available similar materials can provide a target for the Los Alamos product. Current examples of prices for commercially available SiC fiber and whiskers are:

- Nicalon Continuous Fiber: $250 per lb.
- Arco Silag Whiskers: $95 per lb.

It is the current concensus of people in this field that a targeted price for commercially available SiC fibers or whiskers product should be between $30-$50 per pound. This selling price is significantly higher than other commercially available reinforcing fibers, such as carbon or glass, which limit SiC fiber applications to high performance composites.

SILICON CARBIDE WHISKERS
MARKET OVERVIEW

MARKET SIZE, GROWTH AND SEGMENTATION:

The primary markets for these SiC fibers or whiskers would be in high performance composites as reinforcing agents. Ceramics, metal matrix materials and some specialty polymer composites would be application markets for SiC whiskers. Typical markets for these composites would include products requiring high stress resistance in high temperature and/or corrosive environments. Markets for the composites incorporating SiC whiskers or fibers would include: aircraft and aerospace, other defense products, engine and turbine components. Because of the high cost of manufacturing the whiskers, it is currently felt that markets will be limited to specialty, high-performance applications.

Because the main markets for these materials are primarily driven by programs through the Departments of Defense and Energy, it is difficult to estimate the market. Estimates have been made that a current "commercial" market of 10,000 pounds per year exists for SiC whiskers at the high price of $95-$250 per pound. If the price can be reduced to the $30-$50 per pound, then the market could initially be 50,000 to 100,000 pounds per year. Therefore, the initial dollar market for the SiC whiskers would be around $2.5 to $5.0 million per year. It is estimated that this market could expand significantly, but only after experience has been gained in consistantly producing uniform SiC whiskers material by a continuous or semi-continuous process. As with any new technology, there is a significant learning curve in developing this material to a commercial stage and a significant market size.

PRODUCERS AND USERS:

As mentioned earlier, two U.S. firms are working with Los Alamos to develop the whisker technology (Arco Chemicals and Carborundum). In Japan, Tateho and one other company are developing SiC whisker technology. In addition, Tokyo Institute of Technology and Nagoya University are working in conjunction with Japanese industry to develop SiC fibers.

The primary users of these whiskers would be companies engaged in developing high-performance composite matrix materials. These companies are developing components for military applications (aircraft engines) and energy conversion systems (turbines and adiabatic engines). Once SiC whiskers become available in commercial quantities, users need to develop the composites which require additional commercialization time.

COMPETITIVE TRENDS:

There are three competitive products currently being produced commercially:

- Nicalon (Nippon Carbon Co., Japan) continuous SiC fiber
- SiC whiskers (Arco Chemical Co. and Tateho Chemical Industries)

The Nicalon product has the disadvantage of impurities and poor mechanical properties compared to the Los Alamos SiC whiskers. The Arco and Tateho whiskers are much smaller in diameter and shorter in length than the Los Alamos whiskers. Because of this physical limitation, direct mechanical properties measurements of the Arco and Tateho whiskers cannot be made.

Researchers evaluating SiC fibers and whiskers for high performance composite reinforcement desire high purity, length (greater than 1 cm.), and high strength and elastic modulus characteristics in the fibers. Most people working with these materials feel that the Los Alamos whiskers are the best product available today. The key to using these whiskers would be to provide effective toughness to composite materials and reduce catastrophic failure.

OTHER ISSUES:

Legal Protection:

While Los Alamos has some patent rights on the basic vapor-liquid-solid SiC whisker process, there are four other U.S. patents related to the technology. Two similar patents are assigned to North American Phillips and to General Technology Corp., both of whom are not currently developing their patents, and two are assigned to Japanese companies. A major advantage for companies interested in this technology in working with Los Alamos is to gain "hands-on" experience in the technology. A proprietary position could be attained by a company that develops a continuous or semi-continuous process for SiC whiskers based on the vapor-liquid-solid technology.

Regulatory Issues:

The only regulatory issue related to SiC whiskers could be export limitations of reinforced composites containing these whiskers. The Federal Government has export control restrictions on selected products and technologies under the International Traffic and Arms Regulations. This regulation might limit export markets for SiC whiskers produced by U.S. manufacturers.

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APPENDIX II-BB

Veterans
Administration

15-17 March 1985

Department of
Medicine and Surgery

Health Service,
Research and
Development Service

BULLETIN

Research and Development

Health Services Research and Development Service

About the HSR&D Bulletin

The HSR&D Bulletin features research findings that independent reviewers consider valid based on detailed review by means of an evaluation protocol. The Bulletin is targeted to VA staff who could use the information to improve their practice. It is written by a medical writer in a nonacademic style designed to communicate the research findings and their implications for practice.

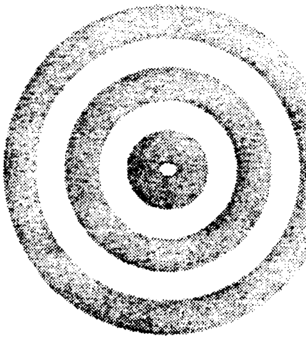
Each year, the HSR&D Service supports numerous research projects that ultimately could help improve veterans' health care. Every research report is reviewed by three non-VA experts. Using a detailed review protocol, these experts assess independently the extent to which study findings and conclusions are substantiated by the research methodology. Differences of opinions are discussed by the reviewers. One reviewer is selected to synthesize the comments. This review process is more rigorous than that used by most refereed journals. If the reviewers conclude that the study findings are substantiated, the HSR&D Service identifies those categories of VA staff that could use the information in their day-to-day practice. A medical writer prepares a draft of the Bulletin. The draft Bulletin is reviewed by the investigator who developed the findings, the non-VA experts who assessed the investigator's report, the VA program officials who identified the target audiences, and the Chiefs of HSR&D Field Programs. The purpose of this review is to ensure the technical accuracy of the Bulletin. The medical writer prepares the final copy based on reviewers' comments.

This Bulletin is provided for your information. It contains findings from an HSR&D project. You may wish to consider these research findings in relation to your practice. Nothing in this HSR&D Bulletin should be construed as VA policy.

For more information, please contact:
Health Services Research and
Development Service (152)
Veterans Administration
Washington, DC 20420
Telephone FTS 389-5254

Chest Pain Diagnosis

An HSR&D Bulletin intended for:



- Chiefs of Staff
- Associate Chiefs of Staff for Ambulatory Care

Chest pain is a common reason for seeing a physician, and coronary-artery disease is often the patient's principal concern. A decision rule to determine whether tests are necessary when a patient complains of chest pain is now in use at a VA medical center's emergency room and drop-in clinic.

The rule is based on a score derived from the patient's responses to questions about his chest pain history. When a patient's chest pain score is below a cut-off value, there is very little risk—less than 1% —that his chest pain is due to coronary-artery disease, and an electrocardiogram (ECG) and serum measurements of creatine phosphokinase (CPK) are usually unnecessary. Triage nurses can reliably use the rule as a screening device to reduce inappropriate use of these tests. The rule is designed to help physicians to estimate the risk of coronary-artery disease, but it does not replace clinical judgement. When a physician is concerned about a low-risk patient, diagnostic tests can be always obtained.

The annual cost savings from using the chest pain rule was $54 per patient, or nearly $44,000, in the VA medical center in which it was tested and is now in use.

Chest Pain Diagnosis

Patients complaining of chest pain comprise four to six percent of the annual workload of VA drop-in clinics and emergency rooms. In most emergency rooms, patients with chest pain are seen first by a triage nurse who often orders an ECG and other diagnostic tests in order to be sure that the patient is not having a myocardial infarction. Many of these patients do not have heart disease. In such patients, an ECG and serum CPK measurement are usually unnecessary because an experienced clinician can often be quite sure of the diagnosis just from taking the history.

A new method, called a chest pain decision rule, has been devised by a VA researcher, Harold C. Sox, Jr., M.D. This rule reduces the diagnostic uncertainty that may lead to findings in the patient's history. The decision rule can be used to predict the value of an ECG and serum CPK measurement in individual patients with chest pain. A report of this research has been published in the Annals of Internal Medicine (1981, volume 95, pages 680-685).

The decision rule can be used to predict the value of an ECG and serum CPK measurement in individual patients with chest pain.

Diagnostic Checklist

The decision rule is used routinely in the emergency room and drop-in clinic at the Palo Alto VA Medical Center. Unless the patient's vital signs or general appearance are indicative of acute myocardial infarction, the triage nurse asks the following questions:

- *Where is the pain located?*
- *Does your pain go anywhere outside your chest?*
- *What activities bring on your pain?*
- *What words best describe what your pain feels like?*
- *When you get pain, can you continue doing the activities you were doing just before the pain began?*
- *What happens when you take a nitroglycerin tablet?*
- *Have you ever had a myocardial infarction?*

The triage nurse records each response on a checklist on which the ten significant predictors appear, each with a numerical coefficient whose value was determined empirically from studying 316 self-referred patients with chest pain. (See box.) Positively weighted findings predict a coronary-artery disease diagnosis. The patient's chest pain score, which is obtained by adding the coefficients of the findings that are present, defines the patient's risk of a coronary-artery disease diagnosis.

Using the history to estimate the risk of coronary-artery disease in patients with chest pain

Clinical Finding	Coefficient
Pain is substernal	+ 3
Pain radiates to the left arm	+ 3
Pain is brought on by exertion	+ 3
Pain episodes cause the patient to stop all activities	+ 2
Pain is characterized as "pressure"	+ 2
Pain is relieved by nitroglycerin within three minutes	+ 7
History of myocardial infarction	+ 6
Pain is brought on by cough or deep breath	− 3
Pain is brought on by moving the arms or the torso	− 3
Pain is characterized as "sharp"	− 2

At the Palo Alto VA Medical Center, if the chest pain score is one or less, the patient is triaged to a nurse performing an ECG or serum CPK. Patients with a chest pain score of two or greater have an ECG prior to being seen by a physician or nurse practitioner.

Positively weighted findings predict a coronary-artery disease diagnosis.

Rule Is Safe

The safety of the chest pain rule was tested in clinical practice at the Palo Alto VA. During the 17 month project, 760 patients were studied, and 253 patients had a chest pain score that placed them in the low risk category. Of the low risk patients, 190 consented to be randomly assigned to have either routine ECGs and serum tests for CPK (as had been common practice) or to have these tests withheld (as appropriate for a patient with a low chest pain score). There were no signs of acute ischemic heart disease in any of these patients. Thus, the VA research team showed that patients with low chest pain scores could be managed without using diagnostic tests, and confirmed that the risk of a coronary-artery disease diagnosis is less than 1% in these patients.

Patients with low chest pain scores could be managed without using diagnostic tests.

Rule Saves Money

Using standard accounting methods, the VA research team calculated that the decision to withhold the ECG and serum CPK would save $54 per patient, when averaged over all chest pain patients. For the patient load at Palo Alto VA Medical Center, the annual cost savings from using the chest pain rule would be $43,740. The researchers point out that if a low risk patient proved to have a myocardial infarction (which has not occurred in over 600 low risk patients seen at Palo Alto VAMC), the costs resulting from missing such a serious disease could exceed the savings from not doing the tests. This occurrence is quite unlikely because (1) the incidence of heart disease is very low in patients whose chest pain score is one or less, and (2) a nurse practitioner or physician examines all low risk patients and can order tests if appropriate.

The importance of the clinician's judgement in a system in which the rule is used for triage is illustrated by a study patient who gave an inconsistent history. When the triage nurse took the history, the chest pain score was −3, but when the physician took the history the score was +8. The physician suspected angina pectoris and obtained an ECG. Thus, in the unusual instance of disagreement between the physician's judgement and the prediction of the chest pain decision rule, the rule should be disregarded. Likewise, other findings may lead the physician to adjust the probability of coronary-artery disease that is indicated by the chest pain rule. Some predictors of coronary-artery disease occur too rarely to be included in the chest pain rule: low blood pressure in addition to chest pain or close relatives who had coronary-artery disease before reaching age 40. In patients with such findings, the physician may choose to order an ECG despite a low chest pain score.

Tests as Treatment

This study had an unexpected finding: the discovery that a diagnostic test can act as a placebo. Although the patients in two study groups both complained of the same type of pain, those who had tests were significantly less disabled three weeks after their visit than patients who did not get tests. This finding shows that tests can have placebo effects. Four month tests improved short-term recovery but had no effect on the ultimate outcome.

Harold C. Sox, Jr., M.D., with a patient in the general medical clinic.

One might ask whether physicians should try to influence the outcome of nonspecific illness by using tests that are not needed for diagnosis. Deliberate use of tests as placebos may be appropriate in selected patients but is not appropriate in routine practice. Dr. Sox's research identified three attributes that describe patients who are least likely to experience a placebo response to the ECG and serum CPK: (1) patients under age 50; (2) patients whose pain did not restrict their activities; and (3) patients who felt generally well prior to their visit to the clinic. Patients with most of these attributes are likely to recover quickly. Patients with few or none of these findings may benefit from the placebo effects of diagnostic tests.

Dr. Sox is currently investigating whether a high level of verbal reassurance will have the same short-term effect as having an ECG and a serum CPK. This research could provide physicians with new understanding of how to influence recovery from nonspecific illness.

HSR&D FIELD PROGRAMS

REGION 1	HSR&D Field Program VA Medical Center 1400 Veterans of Foreign Wars Parkway West Roxbury, MA 02132	William B. Stason, M.D. (152) Director, HSR&D Field Program FTS 837-5013, 5014, 5704 (617) 323-7700 X5705, 5013
REGION 2	HSR&D Field Program VA Medical Center 508 Fulton Street Durham, NC 27705	John Feussner, M.D. (152) Director, HSR&D Field Program and ACOS/Ambulatory Care FTS 629-6657 (919) 286-0411
REGION 3	HSR&D Field Program VA Medical Center 300 East Roosevelt Road Little Rock, AR 72206	C. Rodney Baker, M.D. (152) Director, HSR&D Field Program and ACOS/Ambulatory Care FTS 735-2026 (501) 661-1202
REGION 4	Great Lakes HSR&D Field Program VA Medical Center 2215 Fuller Road Ann Arbor, MI 48105	David Nerenz, Ph.D. (152) Acting Director, HSR&D Field Program FTS 378-2117 (313) 668-2117
District 17	HSR&D Field Program Edward Hines, Jr. Hospital VA Medical Center Hines, IL 60141	John G. Demakis, M.D. (152) Director, HSR&D Field Program and ACOS for Ambulatory Care FTS 387-2414, 3224 (312) 343-7200 (312) 343-2430
REGION 5 District 24	HSR&D Field Program VA Medical Center 500 Foothill Boulevard Salt Lake City, UT 84148	John Williamson, M.D. (152) Director, HSR&D Field Program and ACOS/Education FTS 588-1667 (801) 582-1565
District 23	HSR&D Field Program VA Medical Center Iowa City, IA 52240	Robert L. Ludke, Ph.D. (152) Director, HSR&D Field Program FTS 863-6509, 6279 (319) 353-5940
REGION 6 and Districts 18, 20, 22, 25	Northwest HSR&D Field Program 1660 South Columbian Way Seattle, WA 98108	Thomas S. Inui, M.D., M.Sc. (152) Director, HSR&D Field Program FTS 396-2430 (206) 764-2410

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APPENDIX II-CC

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Research and Development

Municipal Environmental Research
Laboratory
Cincinnati OH 45268

EPA-600/S2-83-102 Feb. 1984

EPA

Project Summary

Development of Standard Procedures for Evaluating Oxygen Transfer Devices

William C. Boyle

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In an effort to obtain consensus standards for the evaluation of aeration devices in both clean and dirty water, the American Society of Civil Engineers (ASCE) established a Subcommittee on Oxygen Transfer Standards. The objectives of the subcommittee were to

1. review and critically evaluate the state-of-the-art of oxygen transfer testing,
2. evaluate and critically review existing standards and identify critical areas of disagreement and uncertainty,
3. develop documentation for recommendations for interim standards and recommended verification methodology, and
4. prepare these standards and submit them for ASCE consensus evaluation.

The full report presents the outcome of this review process and provides recommended procedures for testing of oxygen transfer devices in both clean and dirty water.

This Project Summary was developed by EPA's Municipal Environmental Research Laboratory, Cincinnati, OH, to announce key findings of the research project that are more fully documented in a separate report of the same title (see Project Report ordering information at back).

Introduction

Although considerable effort has been devoted to oxygen transfer technology over the years, unanimity of opinion has not been achieved in developing standard procedures to evaluate oxygen transfer devices. Presently, manufacturers rely on clean water shop tests for describing the oxygen transfer capability of aeration equipment. These capabilities are normally expressed as standardized oxygen transfer rates (SOTR) in clean water at zero dissolved oxygen (DO) at 20°C. Subtle differences in the method of data analysis can produce differences of 10 percent in the clean-water SOTR. Moreover, this uncertainty is further magnified when translating clean-water, test-tank transfer rates to actual plant conditions. Because of differences in wastewater characteristics, tank geometry, wastewater temperature, mixing, and other system characteristics, uncertainties of up to 50 percent may be introduced.

There is little question that a consensus standard is needed for oxygen transfer devices. Although there are several standard procedures, they are concerned primarily with the methodology of experimental measurement and do not deal adequately with the interpretation and application of data to engineering design. Moreover, there is no general agreement among engineers and manufacturers as to which standard procedure or set of procedures to use. Because of this, the wide variety of techniques employed result in substantial variations in test results for the same device in clean-water tests. Even larger variations will be evident in translating these results to full-scale design. Only when standard procedures are developed through consensus agreement among experts in the field will a better degree of uniformity, accuracy, and economy result. Even then, continued updating of the standard will be required.

In January 1977, ASCE established a volunteer Subcommittee on Oxygen Transfer Standards, under the Committee on Environmental Standards (Technical Council on Codes and Standards). The Subcommittee was divided into subgroups with responsibilities for addressing five important areas: (1) oxygen transfer modelling and data interpretation, (2) unsteady-state, clean-water transfer testing, (3) oxygen transfer measurements in respiring systems, i.e., field testing of oxygen transfer devices, (4) corrections for wastewater characteristics and temperature (alpha, beta, and temperature corrections), i.e., translation of clean water data to dirty water performance, and (5) geometry and mixing considerations. Several Subcommittee members were later assigned the tasks for also evaluating methods for power and air flow measurements. The results of the deliberations of this Subcommittee are included within the text of the full report. The proposed interim standard procedures described therein are the outgrowth of several years of study, discussion, and compromise. They represent a group effort based on the experience of experts in the field from industry, government, consulting firms, and universities.

The Subcommittee is satisfied that the interim standard procedures proposed in the full report represent the state-of-the-art today. Such procedures will be of little value to the profession unless they are used and continuously critiqued. Only when standard procedures are developed through consensus agreement will a better degree of uniformity, accuracy, and economy result. Even then, continued updating o the standard will be required. This Subcommittee will continue to function as a standards development and review group under the ASCE Technical Council on Codes and Standards.

The recommended procedures are delineated under the appropriate sections of the report. A brief synopsis of the topics addressed in each section is provided below.

Modelling and Data Interpretation

The basic model used to analyze clean-water unsteady-state test data is expressed as:

$$dC/dt = K_La(C^*_\infty - C) \qquad (1)$$

where:

C = effective average DO concentration in the liquid phase, m/L^3

C^*_∞ = average DO saturation concentration attained at infinite time, m/L^3

t = time, t

K_La= apparent volumetric mass transfer coefficient, t^{-1}

Detailed discussion on the theoretical model for oxygen transfer is described in this section for both completely mixed and compartmentalized systems. The impact of gas side corrections to these models for submerged aeration is discussed, and equations for this system are presented.

Methods to estimate the parameters K_La, C^*_∞, and C_o for unsteady-state, clean-water tests, where C_o is the DO concentration at t= O estimated from the model, are discussed. The full report recommends that the data from these tests be analyzed by nonlinear regression. The model of this analysis is in the exponential form of Equation 1:

$$C = C^*_\infty - (C^*_\infty - C_o)\exp(-K_La\ t) \qquad (2)$$

A secondary method of analysis, where programmable calculators or computers are not available, is a linear regression applied to the logarithmic form of Equation 1:

$$\ln\left(\frac{C^*_\infty - C}{C^*_\infty - C_o}\right) = -K_La\ t \qquad (3)$$

This equation would be used to estimate both the parameters K_La and C^*_∞.

Examples of application of the model to unsteady-state, clean-water test data are presented. Methods of data presentation n a standard format are provided. Translation of test data to field conditions is outlined by way of calculations. Computer programs for the nonlinear least squares method are described and presented in the report appendices in both FORTRAN and BASIC languages.

Unsteady-State, Clean-Water Testing

A recommended unsteady-state, clean-water test procedure for aeration equipment is described. Details are given on advance preparation, geometry and aerator placement, air flow rate and power measurements, water quality and water quality monitoring, deoxygenation chemicals and their addition, system stability, sampling, DO analysis and recording, data analysis, data interpretation, data reporting, and detergent testing. Following these outlined pro dures, an in-depth and referenc discussion follows on each procedu item including a brief literature revi and a discussion of controversial issu

This section has served as the basis a clean water test procedure curren being prepared by the ASCE Subcomm tee on Oxygen Transfer Standards as ASCE Standard.

Field Testing of Oxygen Transfer Devices

A thoretical development is present to assist in properly selecting a evaluating field test methods for aerati devices. A general model is developed f the analysis of a variety of test procedure Important field measurements includi DO, oxygen uptake rate, temperatur and alpha and beta corrections a discussed.

Field test procedures are each discusse in detail with respect to the description the test, the method of data evaluatio example calculations, and test limitation The tests described include

- steady state continuous tests,
- steady state batch tests,
- unsteady state continuous test (including the use of H_2O_2),
- unsteady state batch tests (includ ing the use of H_2O_2), and
- mass balance tests for aerate lagoons.

Brief descriptions of tracer techniques off-gas analysis, and a dual, unsteady state method are also presented.

Translation of Clean Water Data to Dirty Water Performance

The literature dealing with severa factors that influence the translation o clean-water, oxygen transfer test data t field conditions is reviewed. Alpha, beta and temperature corrections are als discussed together with recommenda tions on estimating these parameters fo wastewater, including possible analytica test procedures.

Geometry, Scale-up, and Mixing Considerations

The influence of basin geometry an mixing on the translation of oxyge transfer data from one system to another including information on current experi ence with these physical factors, is briefl described. Rule-of-thumb recommende values related to scale-up are provided.

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s Flow Measurement

detailed analysis of the methods used measure and calculate air flow is sented and includes discussions on nary flow devices, secondary flow vices, selection of proper devices, ails on the setup of primary and ondary devices in a test situation, ubleshooting, dealing with pulsation oblems, additional measurements for flow calculations, standard conditions, nversion of volumetric flow rates from andard to actual conditions, and commended standardization of air flow easurement.

ower Measurement

Standard techniques are recommended r power measurement and measure- ent and calculations of gas power, rbine pump power, and mechanical erator power.

The full report was submitted in ulfillment of Cooperative Agreement No. R805868 by the American Society of ivil Engineers under the partial sponsor- hip of the U.S. Environmental Protection gency.

William C. Boyle is with the University of Wisconsin, Madison, WI 53706.
***Richard C. Brenner** is the EPA Project Officer (see below).*
The complete report, entitled "Development of Standard Procedures for Evaluating Oxygen Transfer Devices," (Order No. PB 84-147 438; Cost: $25.00, subject to change) will be available only from:

National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161
Telephone: 703-487-4650

The EPA Project Officer can be contacted at:

Municipal Environmental Research Laboratory
U.S. Environmental Protection Agency
Cincinnati, OH 45268

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