

ANNUAL REPORT

Development of a Nationwide Network for Technology Transfer

Covering

**The Principal Activities in Which
LFW Management Associates, Inc.
Was Engaged from July 1, 1986 through June 30, 1987
Under Contract NASW-4128**

**Louis B. C. Fong, Program Director
Paul R. Brockman, Program Manager**

Submitted to:

**Technology Utilization Division
Office of Commercial Programs
National Aeronautics and Space Administration**

June 30, 1987

by

**LFW Management Associates, Inc.
P.O. Box 25167
Alexandria, VA 22313-5167**

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INTRODUCTION

The winter and spring of 1987 have seen the cooperative nationwide network for technology transfer translated from concept to reality. On the one hand, NASA and the Federal Laboratory Consortium agreed to network their respective outreach activities. On the other hand, by June 30, 26 states had state-sponsored industry technology assistance programs which were based in or regularly drew on the regional Industrial Applications Centers in behalf of their clients. Negotiations in process made a projection of 40 or more such cooperating states by June 1988, a realistic one. In recent months, new opportunities for further networking have arisen, far in advance of earlier expectations.

LFW Management Associates, Inc. is privileged and pleased to have had a role in identifying these opportunities, and in helping to facilitate their realization. This report summarizes in a few pages the most obvious of the network relationships which have been developed or which are anticipated. As synergisms occur in the conduct of these relationships, variations can be expected in order to meet the needs of users.

The principal performance of LFW Management Associates look forward to that dynamism. After all, the objective of the network is not to provide a network. The objective is to help assure that every U.S. business (wherever it may be) which has the capacity to exploit, or the need to obtain new technology in any form, has access to the technology it needs or can use (wherever that technology may be). As a federal-state-local-private-public-university-government cooperative effort, rather than as a Federal program or any tool of a "national industrial policy," its primary characteristic is the sharing of access for those who have the initiative to use it.

Annual Report on the Development of a Nationwide Network for Technology Transfer Covering the Principal Activities in Which LFW Management Associates, Inc. Was Engaged from July 1, 1986 through June 30, 1987, Under Contract NASW-4128

Following a year of widespread continuing informational activities and negotiations, the latter months of 1986 and the first half of calendar year 1987 brought a significant expansion in participation in the cooperative nationwide network for technology transfer. With the NASA-sponsored Industrial Applications Centers (IACs) serving as hubs of regional cooperation, the number of states having participating, state-sponsored industry assistance programs had risen to 26 (Table 1) and serious discussions were in progress in 17 additional states (Table 2). Furthermore, cooperative programs in technology transfer involve four NASA Field Centers with their "home" states (Table 3). Since three of these four states did not have an established IAC link, the total number of states cooperating with the NASA TU program stood at 29 in June 1987. With the 1986 winter signing of the NASA-Federal Laboratory Consortium (FLC) memorandum of understanding, providing the IAC outreach network to the rest of the Federal Research and Development laboratories, and with numerous major state and private universities involved in the cooperating state programs, the nationwide dimension of this network for technology transfer had become a virtual reality. Even in six of the seven states in which initial discussions had yielded no immediate opportunities (Table 4), indications were that additional network participants might be identifiable later in 1987 or in 1988. This possibility is strengthened by awareness of additional avenues for NASA TU state cooperation, beyond IAC-state-sponsored industry technical assistance efforts.

The major new opportunity for new NASA TU-state program relationships, confirmed early in 1987, is in the co-funding of advanced design and development on some NASA spinoff technologies. The funding which NASA provides, on a leveraged basis, for its Applications Engineering projects is roughly parallel to the seed capital funds which have been established by a number of states. In cooperation with the Director of the NASA Technology Applications Team (TAT), the Program Manager for network development for LFW Management Associates began exploring possible scenarios for state co-funding of NASA Applications Engineering projects. The Director of the TAT also has initiated state co-funding discussions. Table 5 gives a list of states in which senior officials had been approached by June 1987. Plans call for prompt continuing expansion of these discussions to all states having seed funds.

In May 1987, another new opportunity for network extension presented itself, in the form of the American Economic Development Council's interest in technology transfer to support local "existing industry" retention efforts. The first steps were taken toward acquainting local economic development leaders with the technological resources available through the nationwide network and with techniques for accessing those resources. An updated version of the information paper prepared for the AEDC in May, attached as Appendix A, should be developed in July for use by AEDC for widespread, prompt distribution. This paper also was shared with state legislators from across the country in June, and was given to the IAC Directors in June with a request for their proposed editing and revisions.

Appendix B is a copy of our April 22, 1987 letter to the COTR presenting LFW's views as to some major future programming implications for other elements of the TU programs and for space commercialization of these networking activities.

Appended to this report, as Appendix C, is a Directory of Current Key State Contacts in the networking effort. This is a "dynamic" listing, subject to frequent changes.

In the course of his involvement in the above activities, the Program Manager for LFW made on-site visits in 19 states, and met face-to-face with key officials from 13 additional states at various meetings and conferences (see Table 6). He visited six of the IACs and attended two state-participant meetings sponsored by a seventh IAC (Table 7), as well as taking part in the NASA TU "family conference." In support of cooperation with the FLC, he made five trips (Table 8). All of these were supplemented with frequent telecommunications. In addition, LFW personnel attended sessions sponsored by several relevant national associations (Table 9).

In addition, the Program Director attended a working group of the National Conference of State Legislatures held in Boston, Massachusetts, June 4 through 6, 1987. Attendees at this meeting were apprised of NASA's current efforts to effect a nationwide technology transfer network between the IAC's regional centers and the states. While LFW has been working closely with the executive branches in the states, it became clear that these members of the State legislatures who pass on the establishment and funding of science and technology programs for economic development -- and who are interested in this topic -- were not well informed within their states as to these cooperative NASA-state efforts. Plans to continue and extend that informational activity need to be developed in the near future.

Work on an inventory of state-sponsored centers of excellence in science and technology was slowed by a lack of response from the state sponsors to our request for information. This inventory should continue, at least to determine the fields of science and technology being addressed. Early indications, from available information, show a wide and uneven range of depth and capability in these centers from state to state. The strongest are, clearly, in Massachusetts, New York, New Jersey, Pennsylvania, Ohio, Michigan, Mississippi, New Mexico and Utah -- at least in terms of resources and program focus.

The only major changes to the strategy and plan recommended by LFW Management Associates to NASA in June 1986 are these:

1. To capitalize on local economic development agency interests, and further extend the cooperative network;
2. To take steps to assure education and information of supporting policy makers; and
3. To focus on cooperative "seed capital" investment in NASA spin-offs as a target of opportunity.

Table 1

Nationwide Network for Technology Transfer

Industrial Applications Center - State Cooperation (Active)

(as of June 1987)

NASA Industrial Applications Center, Pittsburgh

- Vermont
- Pennsylvania
- West Virginia

North Carolina Science and Technology Research Center

- Virginia
- North Carolina

Southern Technology Applications Center

- South Carolina
- Georgia
- Florida
- Alabama
- Tennessee
- Arkansas

University of Kentucky - Technology Applications Program

- Kentucky
- Council of State Governments

Aerospace Research Applications Center

- Indiana
- Illinois
- Missouri

Central Industrial Applications Center

- Oklahoma
- North Dakota

NASA Industrial Applications Center, University of Southern California

- Washington
- Oregon
- Idaho
- Montana
- Colorado
- Nebraska
- Iowa
- Hawaii

Technology Applications Center

- New Mexico

Table 2

Nationwide Network for Technology Transfer

States in Discussion with Industrial Applications Centers
(As of June 1987)

New York

New Jersey

Ohio

Maryland

Michigan

Minnesota

Wisconsin

Kansas

Texas

Mississippi

Louisiana

Wyoming

Utah

Nevada

Arizona

Alaska

California

Table 3

NASA Field Center TU - State Program Cooperation
(as of June 1987)

Existing Relationships

| | |
|-----------------------|---------------|
| Lewis Research Center | - Ohio |
| NSTL | - Mississippi |
| Johnson Space Center | - Texas |
| Kennedy Space Center | - Florida |

Discussions in Process

| | |
|-----------------------------|--------------|
| Langley Research Center | - Virginia |
| Goddard Space Flight Center | - Maryland |
| Jet Propulsion Laboratory | - California |
| Ames Research Center | - California |

Table 4

Nationwide Network for Technology Transfer

Initial Discussions Held, Re: State Program Participation

Reevaluation Required
(as of June 1987)

Maine

New Hampshire

Massachusetts

Rhode Island

Connecticut

Delaware

South Dakota

Table 5

Applications Engineering - State Seed Fund Cooperation

States With Which Discussions Have Been Initiated
(as of June 1987)

Pennsylvania

New Jersey

Virginia

North Carolina

Ohio

Michigan

Illinois

Mississippi

Minnesota

North Dakota

Iowa

Missouri

Kansas

Colorado

Utah

Table 6

NASA TU - State Program Cooperation

State Visits, July 1986 - June 1987, by LFW

On-Site (19)

Maine

Massachusetts

Rhode Island

Connecticut

Maryland

Virginia

North Carolina

Kentucky

Ohio

Mississippi

Michigan

Minnesota

Missouri

North Dakota

Colorado

Utah

Washington

Oklahoma

Texas

Key Personnel At Meetings (13)

Pennsylvania

Wisconsin

Kansas

Nebraska

Wyoming

Oregon

Alaska

Hawaii

Idaho

Florida

Iowa

Illinois

Arkansas

Table 7

NASA TU - State Cooperation

LFW Program Manager Visits to IAC or IAC-Sponsored Meetings

IACs

Pittsburgh-NIAC

North Carolina/STRC

U. Kentucky/TAP

ARAC

CIAC

TAC

NERAC

Meetings

USC-NIAC

Note: Also participated in NASA TU "family conference" and was at several other meetings with the directors of most of the IACs.

Table 8

NASA - FLC Cooperation

Meetings and Working Sessions Attended by LFW's Project Manager

July 1986 - June 1987

Re: Development of agreement

- Richland, Washington, August

Re: Implementation of agreement

- Lexington, Kentucky, February
- Albuquerque, New Mexico, March
- Lexington, Kentucky, May
- Washington, D.C., June

Table 9

National Association-Sponsored Sessions Attended by

LFW Management Associates, for NASA

July 1986 - June 1987

National Governors' Association

National Conference of State Legislatures

American Economic Development Council

National Business Incubator Association

National Association of Management and Technical Assistance Centers

Technology Transfer Society (not at NASA expense)

**A COOPERATIVE NATIONWIDE NETWORK
FOR TECHNOLOGY TRANSFER**

**A BACKGROUND PAPER ON
ITS DEVELOPMENT AND PRESENT STATUS**

**Paul R. Brockman
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Alexandria, Virginia 22313**

May 26, 1987

Of the landmark events in the history of technology transfer in the United States, three stand out in terms of their focus on marshalling the availability of broad technological resources for the benefit of all U.S. industry.

The first of these was the establishment of NASA's Technology Utilization program in 1962, in response to the 1958 mandate of the Space Act that the results of NASA's efforts to carry human activity into the atmosphere and outer space be given the "widest practicable dissemination". The Agricultural Extension Service; NASA's predecessor, National Advisory Committee on Aeronautics (NACA); and the Atomic Energy Commission had focused their technology transfer efforts on the specific industries and other clientele they were originally intended to serve, albeit "in the national interest." NASA's program, initially directed by Louis B. C. Fong under strong leadership by the then NASA Administrator James Webb, was the first to have all of U.S. industry as its clientele.

The second landmark was the establishment of the Federal Laboratory Consortium in the mid-1970's, to provide for the transfer of technology from most of the major Federal R and D laboratories to U.S. industry, generally.

The third landmark has been the proliferation, in this decade of the 1980's, of state-government sponsored programs to help make emerging technology available in support of economic and industrial growth and development.

Recognizing the significance of the state initiatives, and authorized by the Space Act "to cooperate with related scientific and technical activities" of other public and private entities, NASA contracted in 1985 with LFW Management Associates, Inc. to develop a strategy and plan for networking its own industry outreach and access activities with those of the states. NASA had already developed a limited number of these linkages in states where the opportunities were most readily available. LFW's recommendations, submitted to NASA in June 1986, stressed a concept which one of the key state leaders in science and technology for economic development has since termed "mutual leveraging." LFW's report, Strategy and Plan for A Nationwide Technology Transfer Network (June 30, 1986), will be available in 3 to 4 months from the National Technical Information Service (NTIS), Sills Building, 5285 Port Royal Road, Springfield, VA 22161.

The focal points for the first phase of this networking between NASA and the states have been:

--for NASA, its own network of Industrial Applications Centers (one of several major elements of the NASA Technology Utilization Program); and

—for the states, their technology oriented, university-based industry assistance centers.

The first NASA Industrial Applications Centers (IACs) had been established to make aerospace technology available to industry in areas remote from NASA's Field Centers and its contractor concentrations. Early in their experience with non-aerospace firms, the IACs learned that their acceptance and effectiveness lay in their ability to provide "best response" to client needs and interests, regardless of the source of the technology. NASA quickly agreed to let them draw on non-NASA technology resources as well as on NASA's program results. In doing so, they have made extensive use of the commercially available technical data bases. Based in universities, these IACs proceeded to develop over a 15 to 20 year span as a set of nine unique third-party intermediaries in transferring advanced technology to industry. Yet, these nine IACs were not themselves evenly distributed across the nation, and have experienced some limitations in serving firms which are remote from their bases of operations.

Thus, when many of the states began developing industry technical assistance centers, or sought to provide a strong technical component for their business assistance centers, opportunities for cooperation between the NASA IACs and the states soon became apparent. Both sets of institutions were seeking to serve the same industry base. Both, in order to do that most effectively, would need to be able to draw on the broadest possible base of technology. On the one hand, the IACs had established systems not only for accessing all of the major technological data bases, but also for arranging for access to technologists in support of their clients' needs; and the IACs had become expert in working with clients to sharpen problem analyses, to develop efficient search strategies, and to interpret and apply the results of their searches. On the other hand, the state-sponsored centers were in most cases carefully tailored to the needs of firms in their service areas and were geographically far closer to much of U.S. industry than were the IACs. At the same time, many were limited by the particular technical capabilities of their host university. By adding electronic communication in all its forms, as it exists today, the essential elements existed for a nationwide network.

The development of that network began in the Southeast and has been built around the Southern Technology Applications Center (STAC) headquartered at Gainesville, Florida. That IAC already had "area offices" at Florida's regional universities. As state-sponsored centers in Alabama, Georgia, South Carolina, Tennessee, and Arkansas have joined its network, they have been adopted as new "area offices" of STAC.

In the West, the NASA Industrial Applications Center at the University of Southern California (USC-NIAC) had become the most

vigorous of the IACs in developing remote telecommunications capability. It had to, since its region stretched across much of the Rockies and along the Pacific ran from California to Alaska while reaching out to Hawaii. USC-NIAC pioneered in the installation of a remote interactive search system (RISS), through which a client may sit at his or her personal computer and watch as the USC-NIAC representative discusses the client's needs over a parallel telephone line and formulates the problem and a response strategy on the USC-NIAC terminal. Then they can both see the preliminary search results at the same time, revise the search if needed and be well on their way to getting the client the specific help the client needs from the best source. State-sponsored centers in Washington, Idaho, Colorado, Nebraska and Iowa have added this resource to their service capabilities and have been designated as "NASA Industrial Applications Center Affiliates". Similar centers in most of the western states are expected to join the network soon.

The Central Industrial Applications Center (CIAC), Durant, Oklahoma, is adding a similar capability this year and will offer it to the rest of the Plains states from Texas through the Dakotas. The Aerospace Research Applications Center (ARAC) at Indianapolis, Indiana, has developed a network linkage with Missouri's own internal network, and is in discussions with leaders in other Midwestern states. The NASA IAC at the University of Pittsburgh (Pitt-NIAC) is linked with one of Pennsylvania's Ben Franklin centers and has developed a cooperative program with Vermont that targets on industrial segments of concern to that state.

As of May 1, 1987, NASA was cooperating with 22 states in these efforts and was in active discussion with all of the rest which have shown an interest. Consistent with the prevailing Federal policy that economic development is primarily a state and local and private responsibility, the discussions leading to each of the NASA IAC-state linkages have begun in the Office of the Governor of the state or have been cycled through that office at an early state. Thus, the resulting Federal-state cooperation is "cooperative Federalism" at work.

Following legislative recognition of the Federal Laboratory Consortium (FLC) in the Stevenson-Wydler Act of 1980, the FLC began a period of significant development which led to its specific "establishment" in the Federal Technology Transfer Act of 1986. During this period, NASA's Technology Utilization Program leaders began discussing with the FLC leadership steps which could be taken to link the appropriate NASA program elements with the laboratory-centered activities of the FLC. In January 1987, the two programs signed an agreement which made the NASA IACs available as an outreach avenue for the non-NASA FLC member Federal laboratories. Conversely, it provided for industry access to appropriate Federal laboratories through the IACs. The implementing systems for this extension of the network are being developed on a regional basis,

consistent with the diversities of the IACs, the laboratories, the involved state-sponsored centers, and the industry and population for whose economic health the system exists.

The bottom line is that, today, a nationwide network for technology transfer exists. It offers, to U.S. industry, access to virtually all published technological information and to much of the current technological expertise of the nation. It is a network, not a "program", and not a single institution. It has no single nerve center and no single underlying legislative authority. It draws on Federal government, state government, university and industry as resources and participants — and it serves all of these sectors. It is open, in that new clients and new participants can be accommodated. It is not "free." While its base costs are partially subsidized by the cooperating Federal agencies and laboratories, by state government, and by participating universities, it requires some fees for its services. These are paid either by the user or by other Federal, state or local business assistance programs in behalf of the user. In some states, SBDCs pay for services from this network for their clients. Some of the state-sponsored centers also draw support for complementary services from the Economic Development Administration of the U.S. Department of Commerce.

The major consequence of this network, for governmental policy makers at all levels and in all areas, is that programs and institutions to strengthen the technological base of U.S. industry do not need to be formulated or implemented in a vacuum. They can be started modestly and then be grafted into a system that opens nationwide, even worldwide, technological resources to any U.S. firm in any locality, regardless of its size, its strength, or its existing technical capabilities.

NASA has contracted with LFW Management Associates, Inc. to facilitate the development of this network under NASA's authority to "cooperate with related" programs in providing for the "widest practicable dissemination" of NASA's R and D results to U.S. industry. Inquiries or expressions of interest as to participation in this network may be addressed to the manager of this effort for LFW:

Mr. Paul R. Brockman
Director, Commercial and Industrial Development
LFW Management Associates, Inc.
P.O. Box 25167
Alexandria, VA 22313
(703) 684-6331

All communications will either be answered by Mr. Brockman or referred to an appropriate existing network participant for follow through. A Directory of current and known prospective participating state-sponsored organizations will be available in July 1987. Will

Rogers once observed that, when we Americans have a problem we either "pass a law or take a course." He missed one. Sometimes, we just work together, cooperatively, and solve it. That is what is happening in the development and operation of this network.

April 22, 1987

Mr. Leonard A. Ault, Deputy Director
Technology Utilization Division (IU)
Office of Commercial Programs
NASA Headquarters
Washington, D. C. 20546

Dear Len:

This responds to your request for advice on possible program changes or augmentations for FY 1989.

1. Technology Dissemination

It appears that most of the readily developable linkages between the Industrial Applications Centers (IACs) and state-sponsored technology assistance centers will be in place by the end of FY 1988. There will be changes and "marginal incremental" additions beyond that point, and a few linkages probably will fall by the wayside, due to changing state priorities. Conditions vary widely from state to state and region to region, as to the nature and degree of support needed from NASA and the IACs to make these relationships work effectively in reaching industry. Some budgeting flexibility needs to be preserved for these efforts in the interest of a dynamic network. The one aspect of this effort that will need strengthening is that of the Technology Counselors in the Field Centers. Consideration should be given to a major augmentation of their support.

2. Applications Engineering

The need and opportunity for the most significant augmentation is in the Applications Engineering (AE) program. In one sense, this program is very much like a seed capital fund. Whether or not it is politic to stress this aspect, the fact is that the program has the ability to leverage investments of what are openly acknowledged to be private and state-sponsored seed capital dollars. By 1988, the various state-backed programs in science and technology for economic development will have addressed much of the pre-existing backlog in university and private investor demand for these funds, a backlog that they have been chipping away at for up to five or six years. Increasingly, they are looking for additional sources of technology for their technological entrepreneurs, and the ranks of capable entrepreneurs are growing as a result of targeted training programs. Several experimental or pilot approaches to mutually leveraging state and NASA funds in Applications Engineering projects are being developed (New Jersey, Mississippi, Pennsylvania, Virginia and North Carolina), and other states are known to be interested (i.e., Maryland, Ohio, Missouri, Illinois, Iowa, Colorado, and undoubtedly others). Furthermore, the Technology Transfer Act of 1986

authorizes Federal Laboratories to enter into consortia with industry and universities at this stage of technology development. Pressure can be expected to be placed on NASA and its Field Centers to enter into such consortia, in selected areas, as other agencies already are starting to do. Applications Engineering seems to be one logical funding line item, since the scope and focus of its activities are already consistent with those of such consortia.

We cannot stress too greatly that this augmentation can and should be viewed and treated as an instrument for leveraging greater investment from private and other public sources in the adaptation of advanced aerospace technology for non-aerospace products and services. It has significance for the international competitiveness of U.S. industry, as well as for the resolution of widespread problems in society which are amenable to "technology fixes."

Since we are in the early stages of defining working protocols for such leveraging, it is difficult to predict the potential interest in quantitative terms. Our best estimates at this point are that the NASA share should be in the \$25,000 to \$100,000 range (in addition to the base technology), that it should be matched at least 1:1 from the state source and that these two combined should be overmatched from other sources (industry, VA, HHS, NIH, etc.). A "market" of from 20 to 40 such projects might be possible by FY 1989, with something over 50 beyond that year. At an average of \$75,000 per project, that would amount to a reasonable use for an augmentation of between \$1,500,000 and \$3,000,000 in FY 1989 for the AE portion of the TU program. Some additional effort on the part of the Applications Team may be needed to help coordinate these efforts. We also would see relatively more of our efforts going into this side of state-program cooperation, as it builds and as the IAC-based relationships mature.

3. Space Commercialization

While our contract does not call for us to address NASA-state cooperation in the area of space commercialization, we note that:

- (a) Five of the first nine NASA-supported Centers for the Commercial Development of Space had state support, in the context of the states' S&T for economic development programs.
- (b) The Technology Transfer Act of 1986 authorizes NASA Field Centers to take a more active part in consortia than is the existing practice in the CCDSs. Consideration should be given to doing this, if it isn't underway already.
- (c) An OSTP spokesman (Dr. Huray) told the NGA working group on applied research, on April 9, that the CCDS program is being given consideration for expansion under the international economic competitiveness initiative. It is the only NASA program he mentioned, although his remarks were wholly in the context of "centers of excellence" or joint industry-university-government consortia.

Paul Brockman and I hope these suggestions will be helpful to you as you plan for FY 1988 program implementation and the FY 1989 budget submission. We will restate these in, or append a copy of this letter to, our June 30 progress report. In the meantime, please call us to discuss them further, based upon your needs and convenience.

Sincerely,



LOUIS B. C. FONG
President