Mr. WALGREN. It does affect our deficit situation, though.

Mr. CARPENTER. In that it could go back into the U.S. Treasury, do you mean, sir?

Mr. WALGREN. Yes.

Mr. CARPENTER. Yes.

Mr. WALGREN. I wanted to explore—how they are going to give you this grade. How do they measure that grade? It has to be on something other than the good will between the field officer and the personnel involved in that.

Mr. CARPENTER. Right.

Mr. WALGREN. What are you, as a student, asked to produce to the field officer for that grade?

Mr. CARPENTER. Well, there is every attempt made by the Department of Energy to make it an objective, quantifiable, measurable series of activities.

They do count, they ask us to count the number of publications, the number of invention disclosures, the number of patent applications, the number of workshops. Are they up or down?

Ms. Joseph mentioned the IR 100 Awards. That is an element that we are graded on.

I am happy to say that we have just learned that we got five IR 100 Award—we had five IR 100 Award winners this year. That is yet to be announced by the IRI organization. But those are things, and there are several dozen things that we are measured on.

And, of course, there is, finally, some subjective element as well.

Mr. WALGREN. I wonder if you could give the Congress some guide to how you would measure other technology transfer efforts if you were in the position of taking a snapshot, and that is essentially what you're involved in in Congress——

Mr. CARPENTER. Yes.

Mr. WALGREN [continuing]. What aspects would you take a snapshot of?

Mr. CARPENTER. Licenses placed and royalties generated are, if they are well-negotiated placements, are a fair indication, I believe, sir, of the commercial value of the activity that is taking place.

There are others as well. You are, perhaps, oversimplifying a little bit, but those are a couple of the things I would look at particularly.

Mr. WALGREN. Then we look at the history of these other Federal laboratories. In terms of royalties, here is Oak Ridge developing 70 percent of the royalties over the last x number of years, and the other Federal laboratories are zeroing out.

Mr. CARPENTER. I am not acquainted with those figures. Those were figures that Mr. Constant gave you. But I can say that, although we believe that we do a great job of technology creation here, there are other laboratories that are very competitive and the technology yield is very significant out of those laboratories. I cannot speak to the 70-percent figure, sir.

Mr. WALGREN. It is my understanding that the numbers are pretty dramatic, and I wish there were a way to follow up on it to try to tell what differently is done under these circumstances than is done elsewhere. The ability to grant these patents, we are almost close to having that authority in DOE now. DOE could give you a blanket advance patent authority if they wanted to at this point.

So, there is nothing in the law that is stopping them from doing that. In fact, that certainly was the thrust if not the letter of the President's directive. Is that true?

Mr. CARPENTER. Yes; you are speaking of the Executive order in February of 1983? Yes, sir.

Mr. WALGREN. And it still hasn't happened. You still come before the Congress saying that you have commercial people walking away from you because you are unable to do for them in terms of assurances in that area what they feel necessary to develop that niche.

Mr. CARPENTER. We will be able to be a lot more productive when we do get some general ownership of the patents, sir, yes.

Mr. WALGREN. It would be interesting to measure the—if we do get that authority, it would be interesting to measure the post- as opposed to the preexperience——

Mr. CARPENTER. Yes, it will.

Mr. WALGREN. I hope you look at that in some way that you can tell us that something really good happened when that happened so that we can know that that was a policy worth developing.

Mr. CARPENTER. There will be no modesty about that, Mr. Walgren. [Laughter.]

Mr. WALGREN. But again I would like to emphasize that it is your feeling, and broadly held, that DOE can give you that authority now, that there is nothing more for them to wait for except their own inertia.

Mr. CARPENTER. I wouldn't use the word inertia. It is a—I can appreciate that it is a large change that must be approached with great deliberation, but we see no intrinsic inhibitor for going ahead, you know, right.

Mr. WALGREN. I see.

As I understand it, Argonne is building in a separate corporate structure just for technology transfer. I suppose within your corporation you are the separate corporate structure at that point, or your office. It really doesn't happen without that.

Mr. CARPENTER. Somebody has to own the patent. That must be a legal entity.

Mr. WALGREN. I see. So that is why they are setting it up at a separate corporate——

Mr. CARPENTER. Well, I believe we are going to hear from them. That is one reason why we decided to separately incorporate our subsidiary of Martin Marietta Energy Systems so they could be a property holder as a corporation.

Mr. WALGREN. I see. So it wasn't so much the focus at that point that you were after but the legal entity for holding?

Mr. CARPENTER. Both. Yes.

Mr. WALGREN. Do you see any insurmountable obstacles in the reservations that DOE has raised with Martin Marietta to get this blanket patent policy in place?

Mr. CARPENTER. No, sir, I don't. I don't see any insurmountable issues, unless there are some that I've been made unaware of, or unless their position is—now, you know we've not had the opportunity to negotiate directly with DOE headquarters. But in terms of the party we are negotiating with, Oak Ridge Operations, we think we've got all the issues knocked down.

Mr. WALGREN. Is that right?

Mr. CARPENTER. Yes, sir.

Mr. WALGREN. And you are not expecting much resistance at headquarters level at that point?

Mr. CARPENTER. I don't know——

Mr. WALGREN. Maybe that is an unfair question. I don't mean to get involved in your negotiations. I just would hesitate or would not want to take the opportunity to raise the focus of our record something which then later on becomes some terrible stumbling block that could have been removed by someone knowing that this committee and those involved in the Congress are very interested in seeing this happen.

Mr. CARPENTER. I don't know of any issues where there is fundamental disagreement. The issue of conflict of interest that we believe we are clean on, the interest of liability to the Government, we believe that we can put them in a good position.

The third issue, of cost of administering the program, we believe the Government is already in the control position on that, in that, you know, they authorize our contract expenditures and can limit us in many ways. So, I don't see anything that we are heading for trouble on that I know of. It is just a matter of completing it.

Mr. WALGREN. Well, we are very interested in your progress and I want it to be clear to those that are involved in DOE's aspect in this, that there will be direct public concern how they dispose of this. And by that I mean they are not going to be making that decision and no one is going to think about it again. If it doesn't happen, there are those in Congress who will be asking publicly why it didn't happen. And we don't want simple closed mindedness to prevent something from happening that ought to happen in the public interest.

Well, thank you very much, Madam Chairman.

Ms. LLOYD. Thank you very much, Mr. Walgren and Mr. Carpenter. Thank you.

We wish you well.

Dr. Harvey Drucker is our next witness. Dr. Drucker is the Assistant Director of the Argonne National Laboratory, which is outside of Chicago. Among his responsibilities, which are many, are technology transfer related activities at the lab.

We certainly appreciate your making the trip, Dr. Drucker. I hope everyone has given you a good dose of southern hospitality. And since your appearance gives us a DOE laboratory frame of reference, we are especially happy to have you here. Please proceed with your testimony. Your complete statement will be made part of the record. You may summarize as you wish.

STATEMENT OF DR. HARVEY DRUCKER, ASSOCIATE LABORATORY DIRECTOR, BIOMEDICAL AND ENVIRONMENTAL RESEARCH, ARGONNE NATIONAL LABORATORY, ARGONNE, IL

Dr. DRUCKER. First off, I should point out that Argonne is a Government-owned contractor-operated laboratory in which a university, the University of Chicago, is the contractor; a not-for-profit organization is the contractor.

Argonne is involved in four kinds of activities that we hope will lead to technology transfer. As of July 1, all those were combined into one office, which we call ARTECH, which reports to me.

The four kinds of activities are major initiatives. These are activities that involve an entire industry, industrial contacts, contacts involving single companies, patent development and dispersal, not just the making of a patent but getting it to the marketplace.

Education and aid to staff into small businesses and inventors in our area relative to the process of technology transfer. In about three of these cases a vehicle is needed for the facile dissemination of technology; for example, it's not just enough to have an inventor, you have to have an entrepreneur. You have to be able to move the technology from a gleam in the eye to commercial process. And that requires someone who knows something about the business of business.

Let me briefly discuss our activities.

In major initiatives, we have been party to development of two, one involving the steel industry, and one involving the off-road vehicle industry. Off-road vehicles are agricultural vehicles and vehicles used in heavy construction. The process used on both of these is about the same, so I will go through it just very briefly.

Essentially, Argonne upper management has contacted in both cases upper management of the respective industries and determined that there was a need, an economic need, that is, that these people felt, the management felt that breakthroughs in research would lead to new competitive edges for these industries. After this a series of workshops or meetings of working groups were held. In order to lay out specific research that could be done—pardon me. In order to advise Argonne and other participants, I should say, that Oak Ridge National Laboratory, the National Bureau of Standards, and university laboratories have been involved in these.

These workshops essentially lay out what the industry is doing and what they think might be of benefit to them in terms of research programs and provide a first cut at what the laboratories involved think they can do in terms of ameliorating problems. Based on this, a steering group was set up. The steering group sets priorities and essentially decides what research proposals should be written. Proposals have been written and with some luck research and development begins.

In the case of the steel issue, we believe we are, hopefully, fiscal year 1986 away from startup. In the case of off-road initiative, we are at the point where the steering committee is meeting and deciding what proposals should be produced.

In the area of industrial contacts, Argonne and many other national laboratories have been involved in the Industrial Research Institute. Through this vehicle, we have held two major conferences, one called Spotlight on Argonne; one in the area of materials, materials conference involved Argonne and a number of universities. In the written testimony you will find further mention of what we have done, so I won't go through it here.

On an individual basis, that is contacts by staff, or contacts by companies to staff, we have had some 60 contacts over the past 3 years. Those are the ones we know about that resulted in some

form of action: a proposal from the laboratory to the industry, a proposal from the industry to the laboratory.

In the area of patent development and dispersal, Argonne produces some 50 invention reports per year resulting in some 35 patents per year. We, at the moment, are in the process of trying to develop a vehicle whereby the University of Chicago would get blanket waiver to patents that we feel may have some market.

As such, we really needed a system such that we could go through our invention reports and patents and pick those that have some degree of marketability. We developed a system called the ASPIRE system, and I think that in itself says something about how we feel about intellectual property. It stands for the Argonne System for Patent and Invention Report Evaluation. However, it also shows we have a lot of physicists, because physicists love acronyms like that.

What ASPIRE did was take about 150 patents and through its process select about 40 for first cut, which we hope to cut to about 6 or 12 that will go to, when the AR–CH Corporation is created, to AR–CH.

The ASPIRE process, very simply, consists of peer evaluation of invention, for two things: one, feasibility, and, two, market. We ask the peer reviewers to tell us if at all possible if they see other applications of the invention. And I should say to this committee that in many cases the applications that an inventor sees are not the most important applications of an invention.

It took some 20 years for the laser to do what people in commerce wanted it to do; that is, to make money. And its application is at your friendly local drug store and super market, an application probably that the inventors of the laser would have never imagined.

After this review, all patent reports, all invention reports are subject to review by upper management, an invention review panel which consists of all the associate laboratory directors, the director of the laboratory, and our key—pardon me, a number of senior technical staff. And final recommendations are made as to what will be done; for example, will the university seek waivers, should we request that the inventor do something further, are there industries we should advise?

In the area of education and aid, we have a number of people both within Argonne and outside the Argonne community who are interested in development of invention to commercial practice. We felt that a clearinghouse was needed in which people could obtain information on things like the small business innovation research program, both the Federal program and, in our case, there is a state program, information about SBA loans, Small Business Administration loans, information about how one goes about starting businesses, and, further, a place where they could seek some help, some aid, some counsel from people who have something to do with processes of technology transfer.

All this now leads me, hopefully, to a short description of the AR–CH Corp. That stands for Argonne-Chicago Corp. Starting under the aegis of Stevenson-Wydler and the Dole-Bayh bill of 1980, we began a process of negotiation with the Chicago Operations Office of DOE, relative to obtaining a blanket waiver for the

University of Chicago on Argonne inventions. This process went very well. And, approximately in the summer of last year, we worked out all policies and procedures that we felt needed to be worked out.

They were brought to Washington and there was agreement in principle that we were ready to move, whereupon the Dole bill of 1984 passed. And we're really not sure exactly what we will be facing. We are now reading the regulations which I understand from this meeting should be coming soon.

In the process of waiting for these regulations, we've gone ahead with the development of the AR-CH Corp. Simply, it takes patents and intellectual property from both the University of Chicago and Argonne National Laboratories. The University of Chicago is providing financial support to this organization. Argonne will be providing payment-in-kind, lawyers, Xerox machines, accountants. This intellectual property will be essentially the stock in trade, this plus the inventors, hopefully, will be the stock in trade of AR-CH. We hope to obtain interest on the part of two different sets of people, the investment community and industry, in AR-CH properties. From this interest, we hope further research or development will be done, as appropriate, yielding licenses, yielding new businesses.

Let me just stop for a minute and give you a very short personal precis on what I see as the issues in this area.

First of all, I don't think it is enough myself just to reward the inventor. You have to reward every part of the system. Because I can assure you, as a scientist and an administrator, that the system can be a very frustrating thing to work with if one is not really assured that doing a good job on technology transfer is going to result in some form of award or recognition.

Second, I think there is a need for long-term policies and practices in this field. You can't keep changing. That is a source of utter frustration to the laboratories, and, worse, it is a source of frustration to the inventors.

I have heard university inventors say, "I am never going to file for a patent again. They just keep changing rules on me and policies, practices, da da da da." That is exactly what you don't want to have happen. So, it is very, very important that we want to have consistent long-term policies and practices in this field.

Third, inventions, that is, hardware, are not the only things that national labs and inventors are now wont to do. They occasionally come up with software that can be the basis for new processes, process controls, new ways of juggling computers. At this point there is no protection as far as DOE and the national labs are concerned. That is, there is no copyright granted to such software. If industry is to become interested in further development of software generated by national labs, it appears to me anyway that something needs to be done in that particular area.

We also need to recognize that there is a fair amount of advice and counsel that we present, and inventors of all kinds, or scientists present to industry. Much of this goes unnoticed. We are trying, as a national lab, to notice it and to award it, but it should be made mention of more than by just Argonne management.

Finally, one should recognize, in any set of policies and practices, that the national labs are all very different creatures. Some are more applied, some are more basic. Some measure their success in terms of publications, in terms of members in the National Academy of Science, in terms of potential Nobel laureates, some in terms of patents and in terms of profitability—pardon me, in terms of technologies developed. Both missions are commensurate with the nation needs, and both need to be recognized. And any policy you make should really encompass the needs of both sorts of institutions.

Thank you.

[The prepared statement of Dr. Drucker follows:]

Written Statement Provided to the
Subcommittees on Energy Research and Production
and Science Research and Technology

Relative to
"Technology Transfer and Patent Policy:
DOE and Other Perspectives"

July 15, 1985
Oak Ridge, Tennessee

Provided by:

Harvey Drucker
Associate Laboratory Director
Argonne National Laboratory

I. INTRODUCTION

In the past decade, technology transfer at Argonne National Laboratory has involved four functionally different but related activities. These are:

A. Research programs involving other national laboratories, a broad cross-section of a given industrial sector, and federal agencies. I will refer to these as "major initiatives."

B. Contacts with single private companies initiated by Argonne staff or by the corporate personnel which may/may not result in tangible research projects. I will refer to these as "industrial contacts."

C. Patent development and dispersal. This involves a process, called ASPIRE (Argonne System for Patent and Invention Report Evaluation), of patent analyses developed and deployed at Argonne for the past year. We are in the process of developing a not-for-profit corporation, as recommended by the Dole Amendment of 1984, for the purposes of facilitating commercial development of Argonne inventions. I will refer to this as the AR-CH Corporation (Argonne/University of Chicago Corporation).

D. Education and informal advice and counsel to staff and the small business community relative to the process(es) of technology development and transfer. I will refer to this as "Education and Aid."

In the body of this testimony, I will describe the organization, purposes, and status of these activities. I will also present my personal views on the issues and opportunities for institutions such as Argonne and the U.S. Department of Energy inherent in the transfer of technology, and the potential benefits and problems that may accrue to the public and private sector as this process of making discovery into new products and services unfolds.

II. ORGANIZATION FOR TECHNOLOGY TRANSFER AT ARGONNE NATIONAL LABORATORY

As of July 1, 1985, all of the technology transfer activities at ANL have been centralized in one office (Figure 1), referred to as the Argonne Technology Transfer Office (ARTECH). This office reports to one of the four associate laboratory directors assigned major technical program responsibilities--in this case the Associate Laboratory Director for Biomedical and Environmental Research, Harvey Drucker. If and when the AR-CH Corporation comes into being, I (Harvey Drucker) would serve as liaison between the Director of the Corporation relative to patents and invention reports considered to be of potential commercial value by Argonne. All of these activities, including those involving AR-CH Corporation interaction, will be overviewed by the Laboratory Director, Alan Schriesheim.

III. FUNCTIONAL COMPONENTS OF TECHNOLOGY TRANSFER AT ARGONNE

A. Major Initiatives

Argonne has been involved in two initiatives involving major sectors of American industry, other national laboratories, and government. It appears to our staff

and our colleagues from other involved institutions that such programs, focused on technical issues of general concern to the industrial participants, may be of benefit to all involved. In particular, these programs may permit:

- Facile dissemination of newly developed techniques, methodologies, and apparatus to the concerned industry for specific application to the products/activities of individual companies within the industry.
- Appreciation of industrial problems and perceptions by the involved national laboratories.

A number of actions will, we hope, encourage the flow of discovery to commercial practice. In example, we expect that reports and publications will advise all participants of status of individual technical programs. Appropriate policies and practices commensurate with patent protection of invention are in process of development. Staff of industrial participants may work at Argonne and at other involved national laboratories, and national laboratory staff may spend time at facilities of involved companies.

The two present examples of major initiatives involve the steel industry and the off-road vehicle industry. The steel initiative is well along and Dr. John Roberts of our Laboratory will be presenting testimony relative to this initiative to the Energy Development and Applications Subcommittee and Science Research and Technology Subcommittee on Wednesday, July 17, 1985. If desired, we will be glad to provide copies of this testimony at a later date.

Briefly, the initiative involves a number of companies (Bethlehem, LTV, National Steel, ARMCO, U.S. Steel, and Inland Steel), three national facilities (Argonne and Oak Ridge National Laboratories and the National Bureau of Standards) and the Federal Government. Specific technical proposals have been prepared by participants for funding in FY 1986. A split of 80% government funds/20% industrial funds will be

employed and federal funding has been proposed at the level of $6M for Department of Energy-Conservation and $2.4M for National Bureau of Standards by the House Science and Technology Committee. Subsequently, the House Appropriations Subcommittee of the Interior appropriated $10M for the Department of Energy, which we believe has been confirmed by the full Committee.

The off-road initiative is in an earlier stage of development. It began with contacts between Laboratory management and technical staff and the management and staff of companies involved in the production of vehicles involved in agriculture and construction. A workshop, intended to describe general problems and research potentially capable of solving such problems, was held at Argonne on March 13-14, 1985.

A steering committee, which may consider the next round of specific recommendations and actions, includes representatives from the following industrial organizations: DICKEY-john, Ford, John Deere, J.I. Case, Vickers, FIEI (Farm Industry Equipment Institute), and CIMA (Construction Industry Manufacturing Association). National laboratory and federal agency participants are: Argonne National Laboratory, Ames Laboratory, U.S. Department of Energy, National Bureau of Standards, and Oak Ridge National Laboratory.

We expect, in the future, that ARTECH will serve as a focal point for information and expertise in development of major initiatives and, in so doing, encourage staff to be involved in/initiate new ventures of this sort.

B. Corporate Contacts

Prior to development of ARTECH, Argonne's activities in technology transfer were reported and, in many cases, initiated by its Office of Industry Interaction and Technology Transfer (OIITT). This Office sought to fulfill its function by

(1) Outreach--contacts with industry groups involving Argonne management and staff. In some cases, conferences were held to acquaint industry with Argonne capabilities and to advise Argonne of industrial research and problems.

(2) Specific industrial contacts initiated and/or reported by OIITT or requests from specific companies to Argonne for information. These may involve specific research efforts funded by a particular company and/or staff exchange between Argonne and the specific company.

In the area of outreach, Argonne is involved with the Industrial Research Institute (IRI), an organization that seeks to facilitate contacts between national laboratories and industry through publications, laboratory visits, and informational exchanges with government on issues/opportunities in technology transfer. The industrial composition of the IRI Task Force instrumental in the development of the above activities is provided in Table 1.

Argonne has held a number of conferences/meetings with industry. Two examples are "Spotlight" on Argonne and the Illinois Materials Conference. Organizations participating in "Spotlight" on Argonne are given in Table 2. It may be of some interest to note that 41 industrial firms attended "Spotlight" on Argonne; of the 41, 25 were involved in further joint meetings/collaborations/proposed research efforts with the Laboratory.

The Illinois Materials Conference involved seven Illinois universities, Argonne, and seven private companies in its planning and preparation. The Conference, held in October of 1983, was attended by 186 people, approximately half from industry and half from participating institutions. Again, a number of follow-on activities involving Argonne and attending companies resulted.

Relative to specific industrial contacts, some 60 companies have either initiated meetings with Argonne staff or have been contacted by Argonne staff relative to matters in technology transfer. Since these actions and their sequelae are recorded in Argonne reports to the U.S. Department of Energy as required by the Technology Transfer Act of 1980 (P.L. 96-480), I will not provide detail here.

In the future, ARTECH will serve as a "clearing house" for all information, contacts, and follow-up actions involving corporate contacts. We expect to be able to "match" industrial requests and interests with Argonne capabilities/intellectual property and to be able to follow all contacts from inception through conclusion.

C. Patent Development and Dispersal

Argonne staff produce an average of 35 patent applications and 50 invention reports per year. In the past, these inventions were processed through the U.S. Department of Energy and were primarily focused on energy production, utilization, or conservation. With the passage of the Stevenson-Wydler Act (P.L. 96-480) and the 1980 Bayh-Dole Act (P.L. 96-517), the Laboratory felt that some sort of review process, which would provide a first cut at commercial feasibility, new application, and marketability of an invention, was required if Argonne's Contractor, The University of Chicago, were to seek title to the invention. In the summer of 1983, the ASPIRE process was initiated.

Briefly, ASPIRE requires that all invention reports be analyzed by peer review; the peers are selected on the basis of their knowledge in the field of the invention but their identity is not revealed to the inventor. Peers are asked to comment on feasibility, state of appropriate prior and present art, market for the invention as described, and potential new applications for revealed concepts. Inventions are then prioritized by reviewers and staff assigned more permanent responsibility for ASPIRE. Category I inventions are those considered worthy of further development (University of Chicago should seek waiver, inventor should consider suggested new applications, etc.); Category II are those which do not appear, based on feasibility, marketability, or limited application, appropriate for further effort on the part of University of Chicago or the Laboratory. All inventions are presented to a Patent Review Board, consisting of the Laboratory Director, Patent Counsel, the Associate Laboratory Directors, ASPIRE staff, and other senior technical staff as appropriate. This group decides further action (seek

waivers, attempt further technical development, discard) on both Category I and Category II patents and invention reports. The proposed vehicle for further development of inventions in Category I (the AR-CH Corporation) will be described later in this document. Category II inventions can be waived to the inventor, further developed by the U.S. Department of Energy, or discarded. Records of all invention reports, patents, and ASPIRE reports are maintained for reference.

The ASPIRE process has reviewed some 150 patents and invention reports in the past 15 months. These analyses covered inventions from 1983 to present. About 40 of these inventions were selected for further development, grouped as to fields of application, and descriptions provided to interested institutions/individuals. A further review process is underway which will result in some 6-12 inventions selected as first choices for commercialization.

D. Education and Aid

A number of Argonne staff, area small businesses, and technical professionals outside Argonne have demonstrated interest in vehicles for technology development such as federal and state Small Business Innovation Research (SBIR) Programs, small business loans, firms offering financial or technical aid, etc. It is difficult for a single individual to find all relevant information in one place. We will provide, within the offices of ARTECH, a reading room containing application forms for SBIRs, SBA loans, reports, magazines, reference materials appropriate for this purpose. The ARTECH staff will be available to provide information as appropriate to interested parties. We hope, through this activity, to encourage inventors with entrepreneurial interests in further development of their invention. It should be noted, in this regard, that institutional analyses of inventions does not necessarily select for commercial success. Fervid inventors, in many cases, have turned inventions that appeared as little more than curiosities into industries.

IV. A PROPOSED VEHICLE FOR TECHNOLOGY TRANSFER: THE AR-CH CORPORATION

After passage of the Bayh-Dole Act (P.L. 96-517) which allowed The University of Chicago to seek waivers to selected inventions, Argonne and The University of Chicago staff and counsel entered into negotiation with the U.S. Department of Energy-Chicago Operations staff and counsel to develop appropriate policy and practices for a blanket patent waiver to The University. A first set of mutually acceptable guidelines were presented to relevant Department of Energy Headquarters staff in the fall of 1984 and were all well received. Immediately after this presentation, the Dole Act (P.L. 98-620) was passed which provided for patent waivers to non-profit contractors of government-owned, contractor-operated facilities. Specific regulations for the Act were to be provided later.

In the interim between bill passage and regulation, Argonne and its Contractor decided to continue development of vehicles and practices appropriate to the development of Argonne inventions. In particular, a proposal was made to The University of Chicago describing a not-for-profit corporation which will undertake further development of inventions from both Argonne and The University. This proposal was accepted for further consideration. The proposed corporation is called AR-CH (Argonne/University of Chicago Corporation). The corporate purpose is to apply invention/discovery at The University of Chicago and Argonne National Laboratory to the development of commercial technologies. Any financial profit derived from this purpose will be returned to The University and/or Argonne for purposes appropriate to their missions, to inventors, and to the agencies involved in funding/expediting this process of technology transfer.

The organization proposed for AR-CH is provided in Figure 2. At this point, The University has indicated that it will provide funds to the Corporation for 3-5 years.

Argonne will provide service and in-kind aid (office, use of office equipment, services of support staff such as attorneys, accountants, etc.). Argonne's contributions will be recorded and costed at full-cost recovery rates, as will The University of Chicago contributions. A search for an appropriate director is underway, and a potential Board of Directors for AR-CH has been suggested. This Board will include the Director of Argonne and the Vice President for Research of The University of Chicago in addition to other individuals knowledgeable in various aspects of technology development, finance, and commercialization.

We expect that application will be made to the State of Illinois seeking not-for-profit status for AR-CH. It is also our expectation that all policies and procedures of AR-CH will be commensurate with all relevant legislation and regulation and with the policy and practices of the U.S. Department of Energy. Since the beginning of this concept, a useful dialogue between all concerned parties (U.S. Department of Energy, Argonne National Laboratory, and The University of Chicago) has been maintained, and we are confident that this dialogue will continue during the course of further development of the AR-CH concept.

At some point in the near future, after selection of the AR-CH Director, its Board, and official incorporation of the organization, AR-CH Corporation should begin operations. Its stock-in-trade will be rigorously selected patents and invention reports from both The University of Chicago and Argonne. Initial customers will be industries and elements of the investment community interested in the AR-CH set of intellectual property. In some cases, further funds will be sought from these parties to convert ideas to practice, provide further market analyses, develop new applications of invention. In some cases, the invention may be appropriate for more immediate deployment through license to interested concerns. We would expect that new companies may be formed as joint ventures between AR-CH and industrial/investment community partners where appropriate.

The proposed AR-CH enterprise will provide, we believe, an appropriate avenue for commercial development of federally financed invention. Its operations will, we believe, fulfill the intent and letter of public policies and law seeking the development of new American industries.

V. ISSUES AND OPPORTUNITIES: A PERSONAL VIEW

There are probably as many approaches to the transfer and development of federally funded invention as there are federally funded inventions. It would therefore be presumptuous of me to suggest that I possess "the way to new American Industry," or that I represent in my opinion and views those of the management and staff of Argonne National Laboratory and its Contractor, The University of Chicago. I therefore speak only for myself based on my personal experiences at Argonne and at Battelle Pacific Northwest Laboratories involving invention development and technology transfer. To put this in perspective, I have spent pieces and parts of perhaps four years in such pursuit--not a basis for major expertise, perhaps, but enough time such that I have seen organizational, technical, and institutional devices that resulted in limited success and failure, and made my own judgements as to what was responsible for what. The following list is not in order of priority.

(a) The path to invention is not necessarily strewn with fragrant oils. There is much pain, time, effort, by a number of people in addition to the inventor(s). If it is to be trod successfully, reward and recognition should be available and provided to all involved. From those people in government who provided policy and organizational apparatus to facilitate invention, to laboratory directors, to division directions, to the group or section in which an inventor dwells, to the inventor. These awards must be appropriate and sufficient to encourage others towards the same process. Benefits may take different forms: plaques to administrators, research funds for new development to

divisions, groups, departments involved in invention, financial awards based on profitability of invention to the inventor, etc. Regardless of form, however, a clear signal should be given: We want research organizations to consider invention and technology transfer leading to new American industries as part of their reason for existence.

(b) It takes a very long time to go from gleam in the eye of inventor to gold. Further, what looks like gold may not be, and trash can occasionally become platinum through processes ill-defined. This is by way of saying that all involved should not expect a blizzard of Xeroxes, Zippers, and Mister Coffees emerging from the national laboratories and other federal facilities over any short run. Perhaps a few good valves, some interesting instruments, a comely material. It required some 20 years or so for lasers to become of commercial significance, and it is doubtful that many who considered the laser would have thought that its major role in American life would be to inventory canned peaches and aspirin! Patience is required by all, and all those commodities that go with patience: understanding, good will, continued support.

History says to me that there will be many more failures than successes and that small failures will receive, in some cases, more public attention than small successes. There will be some chicanery (unavoidable in primate species); it should be appropriately discouraged but not used as a basis for destroying much that is good and leading to new and beneficial commerce.

(c) Intellectual property of commercial value can take many forms. Patents for gadgets and processes is but one form. In example, software that can be used for process control, instrument design and manufacture, robotic practice, etc., may be a base for new service enterprises or new, more competitive commercial practices. The time and energy involved in developing software appears to warrant the same sort of rewards and protection involved in gadget and process development. To me, this means that some

form of copyright protection should be provided to new ideas in software, and that there should be the same sort of encouragement to transfer software to commercial practice that there will be for more traditional inventions. Advice, counsel, specific research to solve industrial problems are also, it seems to me, appropriate vehicles for development of new practices and processes, even though they may not involve patent, license, direct profit by institutions or individuals outside a given industry. Again, appropriate encouragement and reward needs to be developed.

(d) I suggest that all involved leave room for diversity of policies and practices. No two laboratories are alike in their personnel, their tribal behavior. Latitude should be given, commensurate with public purpose, perception and need. Please excuse my pontifications. I have welcomed this opportunity to address this hearing and hope that my comments are of some value.

Figure 1

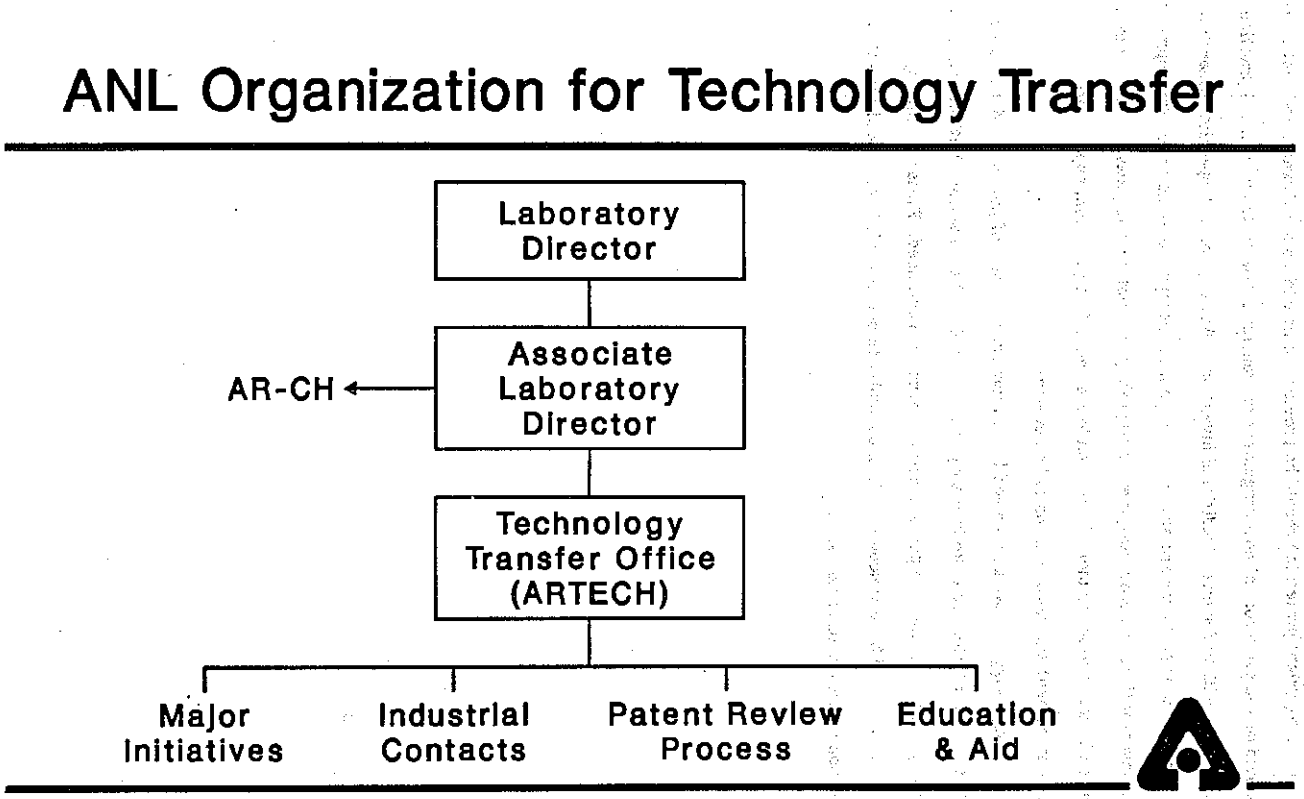

ANL Organization for Technology Transfer
Laboratory Director
Associate Laboratory Director
AR-CH
Technology Transfer Office (ARTECH)
Major Initiatives
Industrial Contacts
Patent Review Process
Education & Aid

Figure 2

Organization for AR-CH Development Corporation

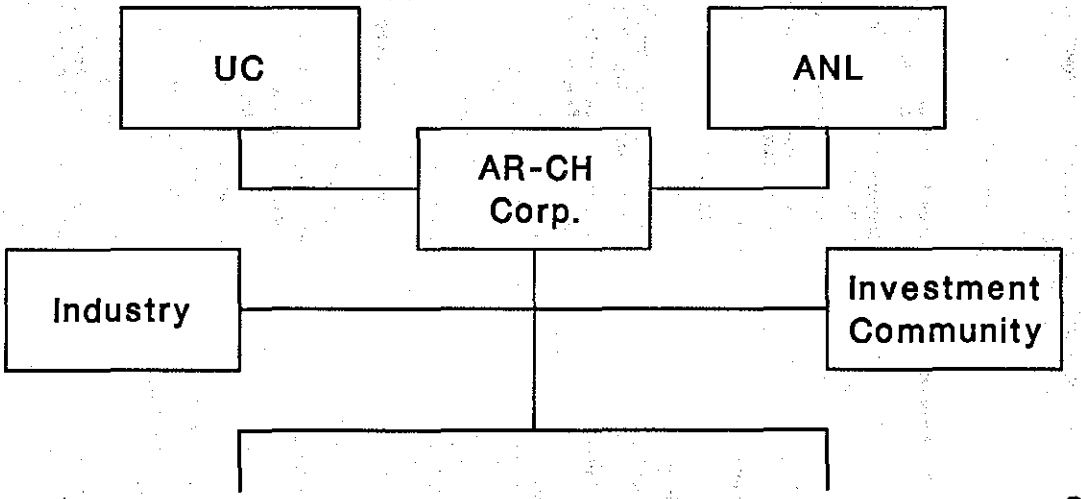


Table 1

INDUSTRIAL RESEARCH INSTITUTE

FEDERAL SCIENCE & TECHNOLOGY COMMITTEE
I.R.I./NATIONAL LABORATORY TASK FORCE

Industry Members

Dr. Philip H. Abramowitz	Vice President & Director of Research & Development St. Joe Minerals Corp.
John Blair	Corporate Director of Research, Raytheon Company
James Graham	Senior Research Associate, Deere & Company
Donald F. Hoeg, Director	R. C. Ingersoll Research Center, Borg Warner Corporation
Milt Hollander	Gulf & Western
A. Jackson	Robertshaw Control Co.
Jared Jackson	Rexnord, Inc.
Horace N. Lander	Senior Vice President Research and Development, AMAX, Molybdenum Division
Charles K. Leeper	Corporate Vice President, Corporate Technology, Combustion Engineering, Inc.
William Prindle	Director, Adm. & Tech Services, R&D Division, Corning Glass Works (IRI Task Force Co-chairman)
Ora Smith	Office of Science & Technology Policy, OEOB
Harry W. Paxton	Vice President, Research, U. S. Steel Corporation
Robert H. Pry	Consultant, Technology Vice Chairman (Ret.) Gould Inc.
Bob Russel	Norton Co.
Roland W. Schmitt	Vice President, Research & Development, General Electric Co.
Eliot Steinberg	Manager, Member Services, Industrial Research Institute
Samuel W. Tinsley	Director of Corporate Technology, Union Carbide Corporation
J. N. Walker	U. S. Gypsum
Tom Weyand	St. Joe Minerals
Roger L. Whiteley	Vice President, Production & Technology, Bethlehem Steel Corporation

Table 2

SPOTLIGHT ON ARGONNE - PARTICIPATING FIRMS

[1]Subsequent Meeting(s)
[2]Collaborative Effort
[3]Contract or Proposed Effort

Air Products & Chem. Inc.[1]
American Cynamid Co.
Amoco Oil Co.[1]
ARCO Petroleum Products Co.[1]
Armstrong World Industries
BASF Wyandotte Corp.[1]
Bertrand Goldberg Assoc.
Borg-Warner Research Center[1,2]
Conoco, Inc.
Climax Molybdenum-Amax[1]
Deere & Co.[1,2]
Dow Chemical Co.[1,2]
Dresser Industries
E.I. duPont de Nemours & Co.[1]
Electrical Union #134
ELTECH Systems Corp.
Engelhard Corp.[1]
Exxon Res. & Eng. Co.[1,2]
General Electric Co.[1,2]
Goodyear Tire & Rubber Co.
Gould Inc.[1,2,3]
3M[1,2]
IITRI
Int'l. Chemicals Corp.[1]
Kraft, Inc.
Leeds & Northrup
M & T Chemical
Millikin Research Corp.
Motorola, Inc.[1,2,3]
Polystar Ltd.
Proctor & Gamble
Research Corporation
St. Joe Minerals[1]
Saljas Management[1]
Shell Development Co.[1,2,3]
Sperry Research Center
Standard Oil, California[1]
Standard Oil, Indiana[1]
Standard Oil, Ohio[1,2]
Texas Eastern Corp.[1]
Tosco Corp.[1]
Union Carbide Corp.[1]
U.S. Steel Corp.[1]

1 = 26
2 = 9
3 = 3

Ms. LLOYD. Thank you very much, Dr. Drucker. We have certainly been anxious to hear your testimony.

Do you see anything that you would—is there anything that you would recommend, any policies or programs that you would like to have the Department of Energy to change, that would really help you in your efforts to establish your corporation or would make it more feasible and more practical to transfer technology to the private sector?

Dr. DRUCKER. Nothing in particular, save, as I say, it would be of use to us if, we have, for example, some four different software systems that the inventors would like to see commercialized and feel that some form of protection, for example, copyrights, would be of use.

Other than that, we have found that the people we have been working within DOE have—we have worked very well with them; we have had no problems.

Ms. LLOYD. Well, the Department of Energy, in their very fine statement, stated that they felt that we just needed to implement our laws, that no additional laws on the books at this point would be of great benefit. Do you agree with that statement?

Dr. DRUCKER. From my particular perspective and from Argonne's perspective, yes.

Ms. LLOYD. From your testimony I gather you feel a long-term, consistent, and a streamlined policy would aid in scientists becoming more interested in developing technologies. Are there any down sides to this?

Dr. DRUCKER. Obviously there is——

Ms. LLOYD. I mean, of any significance that you would like to comment on?

Dr. DRUCKER. One of the joys of administering everything is that there are more exceptions than there are rules. We've heard from various people of problems relative to conflict of interest. In a culture really where you have a lot of single inventors, all of whom to a certain extent are doing their thing, the possibilities of conflict are there. They can do all kinds of things without your noticing it. And one can overload rules and regulations with ways to prevent that, would be probably, I would bet, unsuccessful.

There are problems relative to people getting so involved with processes of technology transfer—we haven't had this problem yet; it's one I hope we have—that they lose sight of the mission of the laboratory of their particular projects. That's not a conflict of interest, but, indeed, it does affect the sponsor. And we have got to watch that. Whether that is a matter of setting rules or whether that is a matter of appropriate managerial overview, I will leave to you.

Ms. LLOYD. In other words, they can become so involved in their project that they forget other responsibilities and concerns as well.

Another thing that you mentioned, that you felt that it was sometimes unfair to reward only one scientist or engineer.

Dr. DRUCKER. That is correct.

Ms. LLOYD. How would you restructure that?

Dr. DRUCKER. Well, in part, let me give you one specific example. Argonne has set up a system of awards which the PR people call the Pacesetter Awards, which essentially will allow us to give an

award to the patent attorney, to the finance person, to a group leader, to anybody who has been involved in a successful process of technology transfer. That is not the only thing the awards do. That is one of their major intents, such that someone who aids an invention, even though he or she may not be the inventor, will benefit. Now, this isn't a big benefit. It's a pin and it's a $500 check which after taxes comes to $366.42—and like the "Gong Show"—but it is still something that says, "We want you to help." And I think it is going to be helpful in this regard. And it is just one example of what can be done or should be done, in my opinion.

Ms. LLOYD. Thank you very much. Mr. Morrison.

Mr. MORRISON. Dr. Drucker, I really appreciate your comments. I enjoyed particularly your personal views as you included at the end of your testimony, especially the comment that, "The path to invention is not necessarily strewn with fragrant oils."

Ms. LLOYD. I marked that one, too.

Mr. MORRISON. We have no one here today from Battelle. I am delighted with your background and experience there. In fact, it leads me to the only question I will ask, and that is, since you have also mentioned in your personal views that there are differences between laboratories—I think you mentioned their tribal behaviour is different also, which I found interesting—could you contrast for us your new organizational efforts at Argonne, which I find to be exemplary, and the procedures that you saw with the groups such as Battelle Laboratories. And they, too, are making some changes, by the way. But I know that you could be an observer of looking at two different arrangements, to benefit our thinking on this subject.

Dr. DRUCKER. Well, first of all, I think there has—Battelle is, as you know, a contract research organization, and as a contract research organization has tended to do more in the way of mission-oriented applied work. They have tended to award people, not necessarily—well, they don't have that much basic work relative to Argonne—but not necessarily based solely on publication but on invention on successful instances of technology transfer.

Argonne has been, historically, pretty much, save for its Reactor Development Program, which I think has been a very successful example of technology transfer, a basic research lab in physics, biology, chemistry. As such, its reward system, both formal and informal—and I should state for all that the informal system in culture, scientific cultures is as important as a formal. If your colleagues say, hey, that's great, you just got 20 publications, or, who cares, you got one patent, OK, that makes a big difference.

But Argonne has been pretty much, overall, a more basic oriented organization. It turns out it has an interest, its staff have an interest in the development of intellectual properties. We have in force to develop systems—I shouldn't say force, but we have had to develop systems that would allow them to express that. I think Battelle has such systems in place. That is one major difference.

Argonne is a little bit freer or more capable of awarding its people in terms of funds, in terms of other sorts of awards than is Battelle, which, as you know, has a policy of not issuing, or has had a policy—this may change—of not issuing bonuses to staff or awards to staff.

Battelle has a longer history of working directly with industry, of being able to sit down with them and talk about their problems. Argonne does not have such a history, but, it turns out, we are learning rather quickly how to do that. The vehicles that will mean success for Battelle and/or for Argonne will be different. Having worked for both, I think they will both be successful, as near as we can measure, but they will be very different. And the sorts of things that will come from them and the times it takes to get there will be different.

Mr. MORRISON. You are making an excellent point, which was one of your own personal views, these different institutions have to be treated differently because of their inherent structures and what has motivated them through the years.

I appreciate this. It has been most helpful to me. Thank you very much.

Ms. LLOYD. Mr. Walgren.

Mr. WALGREN. Thank you, Madam Chairman.

This development of this AR-CH Corp., there are no impediments to that at this point in law that are holding you back, in your judgment?

Dr. DRUCKER. I cannot answer that question categorically because we are still relatively early in development, the process of looking for a director of the facility; it says it in the written testimony, I believe. We have not resolved all the things between the University of Chicago, Argonne, and DOE that might need resolving. However, at the moment, it doesn't seem, from what I know, that we've got any major problems. That doesn't mean that some won't crop up. This is a new venture for all involved, and, like all new ventures, I would expect to see some tough sledding here and there. But, at the moment, I can't see any major problems.

Mr. WALGREN. The University of Chicago's contribution is reimbursable in some way from federal research sources?

Dr. DRUCKER. No. The University of Chicago's contribution to AR-CH Corp. will be reimbursed through whatever profit AR-CH Corp. should make, AR-CH Corp. and its spinoff should manage to make.

Mr. WALGREN. I see. So they are supporting this for a certain period of years and they are somewhat at risk in doing that?

Dr. DRUCKER. That is correct.

Mr. WALGREN. Do you see more benchwork interaction at your laboratory in view of the ideas, as I understand it, that we first started talking about, administrative transfer, and now we are all saying that it doesn't happen administratively, it happens because people spend more time together? Do you see more industry employees working in your laboratory? Do we need things like the steel initiative to focus that kind of thing to happen? Do you think you get more effective technology transfer if you had the laboratories with a more mission-oriented focus to their research?

Dr. DRUCKER. Let me answer that question in parts.

First of all, there has been much more in the way of industrial participation in the laboratory. We have had postdocs that have been funded by industry. We've had industry staff use major Argonne facilities for periods of months. We have had industry staff, not postdocs, full-time scientists come in and work in our laborato-

ries, primarily based on this one-on-one sort of contact I have been referring to.

Mr. WALGREN. What is causing that to happen? When did that develop?

Dr. DRUCKER. I think, in part, it developed because of Stevenson-Wydler, because of the laboratory's management and the University of Chicago's interest in furthering technology transfer. I think we had a situation where it got around that this is a good thing to do, that you would not—you would, indeed, benefit, you would be rewarded, awarded in some sense for participation, for work with industry, for having industrial people in your lab.

Let me get to the second part of your question. There are two different kinds of issues, or problems, that we feel exist in industry. There are those which crosscut, they go across an entire industry. That is the reason for something like the steel initiative. What you want to do is, you want to develop a technology that can go to a company, and they can make modifications as fits their needs.

There is a second set in which you have companies, both small and large, that want to learn how to do a new trick, with the hope that, perhaps, that new trick will allow them to do something very specific for their company. And we are involved in that with these people working in our laboratory, we are involved in that with our work with these companies. Both are important. It is hard to say which one is more important.

As I say, it is very hard to predict winners and losers in the technology transfer business.

Mr. Morrison probably knows that Xerox, which is Batelle's, occurred after the inventor of Xerox knocked on a number of doors and was told that he was criminally insane; really, metalography was never going to go anywhere. So, it is very, very hard to say which one is going to pay off.

Mr. WALGREN. The thing with the steel initiative, it is a little hard to know what came first, an industry in tremendous decline which was creating interest among public officials that ranged from Members of Congress to the President's Science Adviser, or did the laboratory, the management laboratory say, "Here is something that could be put together that might have a real constructive impact on our economy."

How do you—should we be asking the laboratory people to be looking for things like the steel initiative that can focus their efforts in a very immediately—although that's a down-the-road concept, but at least it's different than each of those investigators going in there and deciding what they wanted to do today?

Should we be focussing through mechanisms like that?

Dr. DRUCKER. I think the—that is one good mechanism—and the reason why I say that is the steel initiative, which did come about essentially through an industry in need and an administration recognizing that need and recommending to two laboratories, Argonne and Oak Ridge, that they try and do something about this. Once that initiative was about half developed, Argonne said, maybe there are some other things we should be doing. And that is what started the off-road initiative. And again, it has been very, very well accepted.

At this point, one should note, however, we haven't had success in either. I mean, it is going to take a while. We are really just getting off the ground.

If one thinks that starting these initiatives, getting this industry laboratory involvement is worthwhile—and I think it is—then probably these big initiatives are a good idea, however they occur. Now, we have set up an office which is supposed to provide help, and I think it will, because it uses people who are involved in both these initiatives to people who have ideas for new initiatives, both from industry and from the laboratory. So, I guess that says right there we think it is a good route.

Mr. WALGREN. Thank you, Madam Chair.

Ms. LLOYD. Thank you very much, Dr. Drucker, for your testimony. Thank you for being with us today. Have a good trip back to Chicago.

We are going to proceed with our next witnesses. Mr. Henry Clarks is Director of the Technology Utilization Program at NASA. NASA has been very successful at transferring technology developed at that Federal agency to the private sector. And the committee has reviewed these activities since 1958. We certainly welcome you. We also welcome Mr. Clifford Lanham of the Harry Diamond Lab. He is here today representing the Federal Laboratory Consortium and will provide us with an overall Federal perspective.

Please proceed with your statement, Mr. Clarks, and, Mr. Lanham, we do have your entire testimony. So, you may proceed as you wish. All of your prepared comments will be included in the proceedings of the hearing today.

STATEMENT OF HENRY J. CLARKS III, ACTING DIRECTOR, TECHNOLOGY UTILIZATION, NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Mr. CLARKS. Thank you, Madam Chairman, members of the committee.

Since 1962, NASA has actively and aggressively carried out its congressional mandate contained in the Space Act of 1958 to broadly disseminate and transfer aerospace technology—is it on?

Ms. LLOYD. I think you have to move it closer to you.

Mr. CLARKS. Since 1962, NASA has actively and aggressively carried out its congressional mandate contained in the Space Act of 1958 to broadly disseminate and transfer aerospace technology to U.S. industry and other users through its Technology Utilization Program. This program, which has evolved nationwide to provide support to industry, consists of publications, announcements of potential technologies, computerized access to scientific and engineering reports, selective access to laboratory and scientific and technical personnel, and application projects now comprise the system within which NASA operates its technology transfer activities.

The NASA TU Program, Technology Transfer Program, is designed to promote and encourage the effective use and commercial applications of aerospace-derived technology advances throughout the economy. It operates under the leadership of a small staff at NASA Headquarters and consists of the following components. I will briefly go through these without a clear explanation on each.

We have a Technology Utilization Office at each NASA center and laboratory;

We have the preparation of NASA Tech Briefs which will provide a description of those new inventions;

We have a nationwide system of what we term as being Industrial Application Centers;

We have application teams that help to assist the private sector and the public sector in terms of applications;

And we have a program, through the promotion of seminars and conferences for the U.S. industry.

In our view, it is the latter requirement, to maintain effective outreach to industry and other users of technologies, that represents the most difficult and yet one of the most important tasks for all Government laboratories and agencies. At NASA, we believe that our nationwide network of university-based Industrial Application Centers established for this purpose is an effective means to continually promote and stimulate industrial and corporate interests in available advanced technologies, emanating not only from NASA centers but from other Government laboratories as well.

Over the past few years, most of the States have undertaken new or expanded activities to apply science and technologies to their businesses and industrial development objectives.

The NASA IAC's, Industrial Application Centers, at the Universities of Pittsburgh, Southern California and Florida, in particular, have had considerable success in building these technology transfer interfaces with universities and institutions in their service areas.

Coordination and referral to technology and engineering experts in NASA laboratories is a significant element of the NASA transfer process.

An ever-expanding industrial outreach infrastructure exists at NASA which, we believe, could serve as one model for other Government laboratories, thereby providing U.S. industry broader and more direct access to all Government technologies and laboratories on a problem-need basis.

A final element, that has been a part of the NASA Technology Transfer Program, has been that NASA conducts an Active Patent Licensing Program under its implementation of direct licensing authority which is carried out in close coordination with the Technology Utilization Program. NASA views its patent program as an integral part of NASA's overall technology transfer objectives, and efforts to stimulate the creation, identification, reporting of new technology created in support of its programs, and to foster the utilization of this new technology in commercial applications. NASA's patent policy and procedures germane to its various types of activities are as follows:

NASA-funded contracts and grants—the NASA patent policies for NASA-funded activities under contracts or grants, as well as the procedures for implementing those policies, are based on section 305 of the National Aeronautics and Space Act of 1958, as amended, the Presidential Memorandum on Government Patent Policy of February 18, 1983, and Public Law 96-517, as implemented by OMB Circular A-124.

Essentially, section 305 of the Space Act provides that any invention conceived or first actually reduced to practice in the perform-

ance of any work under any NASA contract becomes exclusive property of the Federal Government unless the Administrator determines that the interests of the United States will be best served by waiving all or part of the Government's rights. In making such waiver determination, NASA has adopted the Presidential Memorandum of February 18, 1983, as a guide. This memorandum, in turn, is based on the policy of fostering private commercialization through the investment of risk capital.

As to the implementing contract provisions, all contracts that are subject to section 305 of the Space Act contain the "new technology" clause. This clause requires such contracts to contain effective provisions to assure that a contractor shall furnish promptly a written report containing full and complete technical information concerning any invention, discovery, improvement or innovation which may be made in the performance of the work under the contract.

It is specifically structured to recognize, however, the contractor's rights to obtain a waiver and thereby have first option to elect title to any patentable invention which the contractor intends to commercialize.

As to contracts and grants that are subject to Public Law 96-517, NASA uses the same clause as other agencies. This clause may be distinguished from NASA's new technology clause in that it is limited to patentable inventions only.

Inventions by NASA employees—NASA, as well as other agencies, determines rights to inventions made by its employees under the policies and procedures of Executive Order 10096. If there are certain contributions by the Government in making the invention, or if the Government is not interested in the invention, the employee may retain title, but the Government acquires a license to practice the invention. If there is no contribution by the Government, the employee retains all rights to the invention.

Licensing of NASA-owned patents—NASA has an active program for licensing those inventions covered by patents and patent applications for which NASA has acquired title, either from its employees or from its contractors. This licensing was previously done under the authority of section 305 of the Space Act, but was repealed by Government-wide authority provided in Public Law 96-517 to enable agencies to license inventions which they own on an exclusive, partially exclusive or nonexclusive basis. Currently, NASA issues on the order of 40 licenses annually, of which approximately 40 percent are exclusive.

Under section 203 of the Space Act, with respect to cooperative arrangements, NASA can get involved with cooperative arrangements with the private sector to facilitate the transfer of technology residing in NASA's laboratories. When engaged in such Space Act activities, it is normal NASA policy not to acquire rights to inventions or patents which may be used in or result from activities for which NASA has been reimbursed by the private sector. If the arrangement with a private-sector participant includes activities that are shared, of mutual interest, rights to inventions and patents are negotiated in a manner consistent with those mutual interests and the nature of those particular activities. As a general rule, the private sector participant may retain title to any inven-

tions and patents arising out of its contributions, subject to contingent rights consistent with mutual interests of NASA and the participants.

However, when needed as an incentive to further the commercialization of objectives, NASA will agree to afford the private sector participant first option to acquire license rights, including exclusive commercial rights, if appropriate, to any such inventions and patents.

In conclusion, NASA's long experience in technology utilization and the management of its intellectual property has afforded NASA opportunities to build a body of guidelines that maximize commercial use of its technology by balancing its dissemination mandate with the need for patent protection and exclusivity in appropriate circumstances. Additionally, NASA believes it has ample authority, primarily stemming from the Space Act, and flexible yet realistic in-place policies and procedures, to continue to carry out its patent program in a manner that supports NASA's overall efforts to stimulate the creation, identification and reporting of new technologies developed in support of its programs, and to foster the utilization of this new technology in commercial applications. No changes are needed, and in particular, it would be a matter of concern to NASA if any proposed changes operated to constrain or suppress NASA's present ability to assure prompt and effective reporting of new technology.

Madam Chairman, it has been a pleasure to come before you to discuss this important issue. Under the farsighted authority of the Space Act, we believe that NASA has achieved a high degree of success in fostering and implementing the transfer of its technology to industry, academia, and the public nationwide. NASA's experience and direct support in cooperation with other Federal agencies, universities, and the private sector have materially enhanced the achievement of technology transfer and utilization objectives throughout the Nation.

[The prepared statement of Mr. Clarks follows:]

Statement of

Mr. Henry J. Clarks
Acting Director

Technology Utilization Division

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

before the
Subcommittees on Energy Research and Production
and Science Research and Technology
U.S. House of Representatives

Mr. Chairman and Members of the Subcommittee:

Since 1962, NASA has actively and aggressively carried out its Congressional mandate contained in the Space Act of 1958 to broadly disseminate and transfer aerospace technology to U.S. industry and other user constituencies through its Technology Utilization Program. This program, which has evolved experientially over the years, now consists of and operates as a nationwide system whereby industry can gain effective access to a wide range of technologies made available through that system. Publications and announcements of potentially useful technologies, computerized access to scientific and engineering reports, computer software availability, selective access to laboratory scientific and technical personnel, and applications projects now comprise the system within which NASA operates its technology transfer activities.

NASA's Technology Utilization (TU) Program is a program of nationwide scope which we believe has been successful, and one which we believe should be continued. It has a solid yet flexible statutory basis in the Space Act which allows us to fine-tune and adjust implementing procedures to meet changing needs.

The NASA TU program is designed to promote and encourage the effective use and commercial application of aerospace derived technological advances throughout the U.S. economy. It operates under the leadership of a small staff at NASA Headquarters as an Agencywide "Office of Research and Technology Applications (ORTA)" and includes:

- a Technology Utilization Office at each NASA laboratory (or field center);

- the preparation of new technology reports (NTR) on each invention, discovery, innovation, or improvement resulting from NASA-supported R&D conducted by NASA laboratories or contractors;

- the evaluation of each NTR for commercial significance by a team of technical experts;

- the preparation and issuance of NASA Tech Briefs, a quarterly journal highlighting those inventions and innovations having the greatest commercial potential;

- the availability of more detailed technical information in support of the announcements in NASA Tech Briefs;

- the support of a nationwide network of Industrial Applications Centers (IAC's) which provide for governmental, commercial and industrial access to NASA's technology;

- support of a Computer Software Management and Information Center (COSMIC) which makes government-developed computer programs available to industry, government and academic institutions;

- an Applications Team which cooperates with public and private sector institutions in applying aerospace technology to meet public sector needs;

- the support of technology applications projects in cooperation with the public and private sectors, to accelerate the availability of aerospace technology for non-aerospace uses having high public priorities; and

- promotion of conferences and seminars for U.S. industry on current and proposed NASA research and development, and on its significant results.

The opportunities for technology transfer in both the private and public sectors are many and varied; thus requiring a high degree of system flexibility. Moreover, technology transfer processes must maintain a high degree of technical competence and credibility in order to effect meaningful and tangible end uses of the technology. Additionally, it is important that effective outreach efforts be maintained so that industrial firms, both large and small, as well as other potential users be continually

apprised of the opportunities which are available to access and utilize externally-generated technologies applicable to their needs.

In our view, it is this latter requirement -- to maintain effective outreach to industry and other users of technology -- that represents the most difficult and yet one of the most important tasks for all government laboratories and agencies. At NASA, we believe that our nationwide network of university-based Industrial Applications Centers (IAC's) established for this purpose is an effective means to continually promote and stimulate industrial and corporate interest in available advanced technologies -- emanating not only from NASA centers but from other government laboratories as well. The NASA-sponsored IACs have been working for years, cultivating strong ties with business and industry -- identifying and accessing industrial client problems and technological interests and then brokering available information and human resources to fulfill those needs. The NASA Industrial Applications Centers are, moreover, presently expanding their outreach initiatives by developing linkages and working relationships with State-sponsored institutions and universities across the U.S. to provide even greater industrial coverage than has been possible.

Over the past few years, most of the states have undertaken new or expanded activities to apply science and technology to their business and industrial development objectives. These activities have offered new opportunities for NASA to engage in cooperative Federal-state action to stimulate economic growth through technology transfer. A number of states have expressed interest in participating in a nationwide network based on the expansion of the NASA Industrial Applications Center (IAC) network, and are already investing their own funds in this effort. NASA is coordinating with these states and others to develop the appropriate network interfaces to accommodate increased access to NASA and other Federal technologies.

The NASA IAC's at the Universities of Pittsburgh, Southern California and Florida, in particular, have had considerable success in building these technology transfer interfaces with universities and institutions in their service areas. Key to these relationships is the Remote Interactive Search System (RISS) which provides real-time information search capabilities through remote telecommunications links, thus permitting industry in the participating states easy access to technical information and technology transfer services without the costly requirement of setting up duplicative search and transfer capabilities. Coordination and referral to scientific and engineering experts in NASA laboratories is also a significant element of the NASA IAC transfer service.

In the West, an experimental effort is already underway to extend this service provided by the USC-IAC to other Federal laboratories in the FLC Far West Region. Other less formal interfaces between NASA IAC's and other Federal labs are also beginning to evolve.

Thus, an ever-expanding industrial outreach infrastructure exists which, we believe, could serve as one model for other government laboratories, thereby providing U.S. industry broader and more direct access to all government technologies and laboratories on a problem-need basis. Such efforts would markedly increase and accelerate the transfer and use of government-generated technology, thus enhancing commercialization of these technologies, improving industrial productivity and creating a stronger industrial competitive base nationwide.

In addition, NASA conducts an active patent licensing program under its implementation of direct licensing authority which is carried out in close coordination with the Technology Utilization Program. NASA has historically viewed its patent program as an integral part of NASA's overall technology transfer objectives and efforts to stimulate the creation, identification and reporting of new technology created in support of its programs, and to foster the utilization of this new technology in commercial applications. This is reflected in procedures designed to precipitate the prompt and effective reporting of new technology (whether patentable or not) created under NASA sponsorship, to afford contractors first option to obtain patent rights to inventions made under contract to the maximum extent consistent with NASA's program objectives and mission needs, in order to provide incentives for commercial use, to obtain patents on inventions to which NASA has acquired title and which have commercial potential, and to actively license such inventions for commercial application. NASA's patent policy and procedures germane to its various types of activities are as follows:

NASA Funded Contracts and Grants

The NASA patent policies for NASA-funded activities under contract or grant, as well as the procedures for implementing those policies, are based on Section 305 of the National Aeronautics and Space Act of 1958 as amended (42 U.S.C. 2457), and to the extent consistent with that Section, the Presidential Memorandum on Government Patent Policy of February 18, 1983. An exception is made for funding agreements with certain small business firms and nonprofit organizations, where NASA follows Public Law 96-517, as implemented by OMB Circular A-124, in the same manner as all other agencies.

Essentially, Section 305 of the Space Act provides that any invention conceived or first actually reduced to practice in the

performance of any work under any NASA contract becomes the exclusive property of the Government unless the Administrator (of NASA) determines that the interests of the United States will be served by waiving all or any part of the Government's rights. In making such waiver determinations, NASA has adopted the Presidential Memorandum of February 18, 1983, as a guide. This Memorandum, in turn, is based on the policy of fostering private commercialization through the investment of risk capital. Thus waivers, which may be requested either prior to contract for all inventions that may be made under the contract, or for individual identified inventions reported under contract, are liberally granted. (Current data indicates that more than 90 percent of the waivers requested are granted.) A similar result is achieved, although by a different procedure, by election of title by a small business firm or nonprofit organization under Public Law 96-517. Any waiver of title by NASA, or any election of title by a contractor, is subject to a worldwide irrevocable royalty-free license for Governmental purposes and certain so-called "march-in" rights (as set forth in Public Law 96-517) in order to protect the Government and public interests.

As to implementing contract provisions, all contracts that are subject to Section 305 of the Space Act contain the "New Technology" clause as described in NASA Subpart 18-27.3 of the FAR Supplement Directive (NFSD) 84-1. This clause is based on Section 305(b) of the Space Act, which requires such contracts to contain "effective provisions" to assure that a contractor will "furnish promptly--a written report containing full and complete technical information concerning any invention, discovery, improvement or innovation which may be made" in the performance of work under the contract. This requirement is unique in that it covers unpatentable as well as patentable items of new technology both of which stimulate many of NASA's technology utilization and technology transfer activities, and also specifically recognizes the need for prompt and effective reporting of such new technology. Also, it is specifically structured to recognize the contractor's right to obtain a waiver (as previously discussed) and thereby have first option to elect title to any patentable inventions which the contractor intends to commercialize.

As to contracts and grants that are subject to Public Law 96-517 (rather than Section 305 of the Space Act) NASA uses the same clause as all other agencies as set forth in Subpart 27.3 of the Federal Acquisition Regulation. This clause may be distinguished from NASA's New Technology clause in that it is limited to patentable inventions, only, and does not place as much emphasis on the prompt and effective reporting of such inventions. While the data are incomplete, present indications are that there is a decline in the reporting of new technology that provides a stimulus for many of NASA's technology utilization and technology transfer activities.

Inventions by NASA Employees

NASA, as well as other agencies, determines rights to inventions made by its employees under the policies and procedures of Executive Order 10096. Basically, the Executive Order provides that an agency has the right to acquire title (ownership) to inventions made by an employee which bear a direct relationship to the duties of the employee, or are made in consequence of his/her employment. If such relationship does not exist but there are certain contributions by the Government in making the invention, or if the Government is not interested in the invention, the employee may retain title but the Government acquires a license to practice the invention. If such relationship does not exist and there is no contribution by the Government, the employee retains all rights to the invention. NASA evaluates those employee inventions for which it acquires title and may obtain patent protection and makes them available for licensing.

Licensing of NASA-owned Patents

NASA has an active program for licensing those inventions covered by patents and patent applications for which NASA has acquired title, either from its employees or from its contractors. Both exclusive and nonexclusive licenses, as appropriate, are available. This licensing was previously done under the authority of section 305(g) of the Space Act and implementing regulations which NASA initially issued in 1962, and which, for the first time, provided for exclusive (in addition to nonexclusive) licensing by an agency in an effort to foster early commercial utilization of its inventions.

Section 305(g) (and its implementing regulations) was replaced July 1, 1981, and repealed by Government-wide authority provided in Public Law 96-517 to enable agencies to license inventions which they own on an exclusive, partially exclusive or nonexclusive basis. The uniform regulations issued for this purpose. These regulations are consistent with NASA's established policies and provide even greater flexibility towards the objective of fostering utilization of inventions arising out of federally supported research and development. Currently NASA issues on the order of 40 licenses annually, of which approximately 40 percent are exclusive.

Cooperative Arrangements

Under Section 203(c)(5) and (6) of the Space Act (42 U.S.C. 2473(c)(5)(6)), NASA has broad and direct authority to enter into so-called "cooperative arrangements" (which may be either on a reimbursable or shared activity basis) with the private sector to facilitate the transfer of technology residing in NASA's laboratories. Again, NASA's patent policies and procedures in

this regard (which are not subject to either Section 305 of the Space Act or Public Law 96-517) have been structured to maximize the potential for commercial use of NASA-supported technology. When engaged in such "Space Act" activities, it is normal NASA policy not to acquire rights to inventions or patents which may be used in or result from activities for which NASA has been reimbursed by a private-sector sponsor. If the arrangement with a private-sector participant includes shared activities (but no funding provided to the private-sector participant) of mutual interest, rights to inventions and patents are negotiated in a manner consistent with those mutual interests and the nature of activities. As a general rule, the private sector participant may retain title to any inventions and patents arising out of its contributions, subject to contingent rights consistent with the mutual interests of NASA and the participant. Basically, such contingent rights are structured to assure limited access to, or availability of, the technology for further commercial development under agreed terms and conditions in the event the participant cannot or does not pursue commercial use of the technology. Additional consideration may be given to assuring availbility of the technology sufficient to meet public needs in the area of health and safety where appropriate, as well as an understanding on the allocation of rights between the parties in the event of termination of agreement by either party under various circumstances. NASA may also receive a royalty-free license for certain stated Governmental purposes. All such contingent rights are a matter of negotiation, depending on the technology involved, the respective contributions of each party, and the commercialization objectives sought.

NASA on its side of the interface with the private-sector participant will acquire rights to inventions and patents arising out of its activities under policies applicable to the circumstances in which such rights arise. However, when needed as an incentive to further the commercialization objectives of the activity, NASA will agree to afford the private sector participant first option to acquire license rights, including exclusive commercial rights, if appropriate, to any such inventions and patents.

In conclusion, NASA's long experience in technology utilization and the management of its intellectual property rights has afforded NASA opportunities to build a body of guidelines that maximize commercial use of its technology by balancing its dissemination mandate with the need for patent protection and exclusivity in appropriate circumstances. Additionally, NASA believes it has ample authority, primarily stemming from the Space Act, and flexible yet realistic in-place policies and procedures, to continue to carry out its patent program in a manner that supports NASA's overall efforts to stimulate the creation, identification and reporting of new technology developed in support of its programs, and to foster

the utilization of this new technology in commercial applications. No changes are needed, and in particular, it would be a matter of concern to NASA if any proposed changes operated to constrain or suppress NASA's present ability to assure prompt and effective reporting of new technology. Experience has shown that such prompt and effective reporting of new technology can, by applying proper procedures and reasoned judgment, be achieved without prejudicing the contractor's right to have first option to elect title to inventions which the contractor intends to commercialize.

Mr. Chairman, it has been a pleasure to come before you to discuss this important issue. Under the farsighted authorities of the Space Act, we believe that NASA has achieved a high degree of success in fostering and implementing the transfer of its technology to industry, academia and the public nationwide. NASA experience and direct support in cooperation with other Federal agencies and the private sector have materially enhanced the achievement of technology transfer and utilization objectives throughout this Nation.

Mr. CLARKS. Before I close, I have noticed that there were some concerns concerning the potential of measuring certain activities within the program.

Ms. LLOYD. I was going to ask you about that, so I am glad that you are bringing that up.

Mr. CLARKS. The new technology reports, as I mentioned, in terms of inventions, innovations, and so forth, over the last 10 years we have had 48,000, from 1964 to 1984. Thirty-seven thousand have emanated from the contractors, 10,000 from in-house. With respect to those new innovations, we have a system wherein anybody that may want to attempt to commercialize or have an interest in the new technology can come in and request a technical support package. Also there are inquiries that come in from contractors' facilities, from commercial people, into the agency.

What we have measured over this same period, we have 1.8 million inquiries, 1.3 million being for additional or technical support packages with regard to the type of technology and the nature of that technology and how the technology can be applied.

We have had 500,000 inquiries that have come from the private sector into the laboratories to the scientists and engineers, who have developed the technology and to assist the private or commercial entity in solving any particular problems that he may have in the use of that technology.

Now, in terms of patentable and nonpatentable items, we did a survey over the last 3 years and we have found out of our reporting approximately 1,200 out of 1,800 were nonpatentable and 600 were patentable. This is between 1981 and 1984.

In terms of benefits, there was a study that was done back in 1977. It was reviewed back again in 1983. And the benefits from the NASA new technology reporting and the use of that technology and those inventions in the commercial sector has been estimated to weigh on the order of approximately $102 million annually, as of 1983. And this was done by the Denver Research Institute for us.

Ms. LLOYD. State that again, Mr. Clarks.

Mr. CLARKS. In terms of benefits from the use of technologies that have been developed by NASA and its NASA facilities, approximately $102 million is measured in terms of economic benefits from the use of those technologies as of 1983. This is on an annual basis.

This was done basically taking the projection from 1977 when we took a real close, indepth look, and then in 1983 we took another look, and somewhat escalated and made a determination from 1977 through 1983, we estimated on the order of $102 million.

Ms. LLOYD. Thank you very much. You know, if all of our Federal agencies had that good a track record, I think we could come near to eliminating our deficit.

Thank you a lot. Mr. Lanham.

STATEMENT OF CLIFFORD E. LANHAM, TECHNICAL SPECIALTIES COORDINATOR, FEDERAL LABORATORY CONSORTIUM FOR TECHNOLOGY TRANSFER

Mr. LANHAM. Thank you Ms. Lloyd and Mr. Morrison.

I am the Chief of Research and Technology Applications at the Army's Harry Diamond Laboratories and the Technical Specialties——

Ms. LLOYD. Excuse me, Mr. Lanham. Would you move the microphone closer to you?

Mr. LANHAM. I'm sorry. Is that all right now?

Chief of the Research and Technology Applications for Army's Harry Diamond Laboratories and the Technical Specialties Coordinator for the Federal Lab Consortium. I am pleased to come before you today representing the Federal Lab Consortium with which I have been associated since its inception in 1975, to discuss the current role of the Consortium in Federal technology transfer and suggest means by which improvements could be realized.

I must note that my statement represents my own views from my experience with technology transfer and the Federal Consortiums and those shared with me by diverse consortium participants. This statement does not reflect an official position of the Army or the Harry Diamond Laboratories, although the fact that they have a positive position on domestic technology transfer, I think, is adequately attested by their past actions.

I want to emphasize the comments that Dr. Drucker had made about the diversity of Federal technology, that there are more than new products that may be dealt with by exclusive licenses involved in the Federal technology reservoir and that we are talking about as well numerous processes. He talked about advice to businesses and industry, that we are also talking about methodology that may be applied to a whole range of the industrial sector as well as the public sector.

The collective experience of the Federal Lab Consortium has shown that, although a diversity of technology exists in the lab and a diversity of transfer methods are needed, all these kinds of technology may be transferred effectively without a large bureaucracy or high cost.

One must have a decentralized system which deals with the full spectrum of technology to realize the majority of economic benefits potentially available.

It is one of the major roles of the Federal Lab Consortium as stated in the bylaws to accumulate these experiences in effective and efficient technology transfer and share them with concerned policy makers. The real-world experiences have indicated that improvements are needed beyond Public Law 96–480, although that legislation was a good step in the evolution of policy appropriate to such a complex system.

Now there appears to be a growing consensus that we are ready for the next step of evolution in policy in this arena.

The basis of a strong lab program in the experience of the Federal Lab Consortium has focused on person-to-person interaction and on creating a technology from those users. We don't want to have a system or we don't want to rely on a system which lets us decide from a very limited point of view what kind of technology should be out there.

The major factors that are evident from the earliest days through the latest Laboratory/Industry/Interaction Committee survey is that technology transfer is accomplished by a person-to-

person interaction, and that a broader scope of technologies and situations may be addressed by encouraging clients to express needs to resource people who are sensitive to that client's environment and who are committed to help. As the excellent organization studied by Peters indicates, the laboratories perform better to the extent that the entire staff feels that the activity is important, that top management is committed to the accomplishment, and that there are dedicated people with special knowledge of the mechanisms of transfer and potential barriers to make the initial links to the clients. These factors establish that the laboratory that deals with the people who come in, whether they are industrial or public sector, cares about those customers and provides the means to develop a long-term relationship. This produces leads that evolve into a continuing exchange and addresses all types of technology. Further, if you really have commitment in the lab, the lab people who are dedicated to the technology transfer effort seek innovative ways and cost-effective ways to reach out to more clients and help them in a greater variety of ways.

The Technical Volunteer Service concept, for example, is an example of how personal commitment by those dedicated to transfer in a laboratory developed an innovative approach, and how such commitment by the entire laboratory staff has made it work. It is also an example of how new methods of transfer are disseminated through the FLC network. A growing number of laboratories have now implemented this through the FLC's efforts to make it more easily understood.

The new Department of Defense regulation on technology transfer specifically supports the development of Technical Volunteer Services.

A remaining factor which needs to be addressed at individual labs which stands out at individual labs is the transfer of new products and processes to innovative companies. There they need an ability to negotiate as a part of the lab level interaction, the provision of an exclusive position through patent licensing. This is needed to protect the company's investment in commercializing the product as well as in forming a usual and well understood basis for the venture.

These factors noted above are the major ones that comprise the basis for an optimum technology transfer program in laboratories.

Now, aside from the role of the FLC in collecting and sharing experiences of the individual laboratories, it has a role that has been demonstrated in facilitating the actual transfer of technology. Here those roles are to provide nationwide outreach and establish institutional relations on behalf of all laboratories to promote technology pull, to establish contacts useful to clients in all parts of the country and to refer them efficiently to a source of specific help, and to supply training and advice to individuals and organizations both inside the labs and outside who are seeking to understand the methods and mechanisms of technology transfer.

The nature of Federal lab resources and how they can be used to solve immediate problems will remain unknown to those at geographically distant locations from the labs or those who cannot invest the time to fathom the complexities of Federal organizations. The Consortium makes each laboratory a one-stop shopping

center. It makes available through those laboratories even technologies that may not be within their mission. Further, the FLC provides sort of a customer service number for those who are not really near a branch office or laboratory. It gives the potential client in any part of the country access to the broad scope of Federal technology, but still allows person-to-person interaction which is needed to help define the problem or determine realistic options.

New applications that should be noted in any environment whether it is a company or whether it is local government, represent innovations; and the people in those organizations that make these, need help, need to have support from people they perceive as reliable and supportive.

Representatives of laboratories active in the Federal Lab Consortium across the country represent a first point of contact potentially for almost 300 Federal laboratories. Referrals are usually made quickly with help as needed of tech specialists or the older hands to sources of technology in the labs which may be previously unknown to the client.

We are currently working on a technology transfer effort at Harry Diamond Laboratories which was referred to me from Sandia Laboratories to help life support systems for patients who have to undergo nuclear magnetic resmance diagnostics. That came up and was referred to me within the last month through the FLC network.

It should be noted in talking about this network that for those in this region, that Mr. Donald Jared of the Oak Ridge National Laboratory serves as the FLC southeast regional coordinator, and Ms. Tina McKinley of Oak Ridge Associated University serves as the technical specialist for training methods. These are particularly knowledgable users of the network, as well as contributors to it, and should be considered valuable contacts for those seeking Federal technology.

We have looked at the role of the FLC in providing an understanding of technology transfer to both practitioners and policymakers and its role in facilitating the process nationwide. Now we may draw upon insights to provide a development—to develop suggestions for improvement. The experience of those active in technology transfer and the FLC, who are largely volunteers who continue to share the pleasure and frustration of trying to make this work, indicate that the following measures might gain more positive results from the investment in R&D.

Make technology transfer an element in the performance evaluation of every Federal manager of R&D, as well as the directors of laboratories. As we said, if they believe it's important, they will participate.

Provide visible congressional interest—and I think we have a good start—interest in technology transfer by requiring plans and reports of results from the laboratory level.

Require that at least one professional be assigned full time to technology transfer in each laboratory with a $20 million or greater in-house budget and work with smaller agencies so that they dedicate personnel and staff on a regional or national basis. A full-time person understands the complexities of the transfer process,

and at least one such person is needed to accomplish transfer in the laboratories.

Allow for expeditious negotiation of exclusive licenses to patents originated in the Federal laboratory as part of the laboratory transfer process. You can get help from the legal counsel at an agency where those laboratories are smaller and don't have their own counsel, but it should be part of that negotiation.

Provide a legislative charter for the Federal Lab Consortium specifying its role as a facilitator and coordinator, not as a performer, of technology transfer on behalf of the whole government, so that you limit the bureaucracy and don't create any more bureaucracy but a legislative mandate to allow the cooperation of all the labs and the formation of the joint projects across all laboratory—all agencies, across the laboratories of all agencies.

I hope that these observations and suggestions from those of us in the FLC can make some positive contribution to your important efforts to improve the American economy.

Thank you.

[The prepared statement of Mr. Lanham follows:]

Prepared Statement of Clifford E. Lanham

Chairmen and Members of the Subcommittees:

I am Clifford Lanham, Chief of Research and Technology Applications for the Army's Harry Diamond Laboratories and the Technical Specialties Coordinator for the Federal Laboratory Consortium. I am pleased to come before you today representing the Federal Laboratory Consortium with which I have been associated since its inception in 1975, to discuss the current role of the Consortium in Federal technology transfer and to suggest means by which improvements could be realized.

I must note that my statement presents my own views, based on my eleven years of involvement in technology transfer and the Federal Laboratory Consortium, and views shared with me by diverse Consortium participants. This statement does not reflect any official position of the Army or the Harry Diamond Laboratories. That their position on domestic technology transfer is positive, however, is adequately demonstrated by past actions including the Army's promulgation of a regulation very supportive of technology transfer and the FLC, and Harry Diamond Laboratories continuing support of an aggressive program.

Technology and Transfer - Complex Concepts

Many previous discussions of these issues have tried to provide a total measure of the vast technological resources of the Federal laboratories and an understanding of the extent to which those resources are underutilized. These ideas were presented as the basis for a national effort to optimize the use of this national wealth of technology. Those discussions have succeeded in making us realize the magnitude of the opportunity we have to make Federal technology available for improving local, regional, and national economic conditions in a competitive world. I am sure that it is this realization that

brings us here today.

In order to understand what institutional changes are needed to optimize our use of these resources, however, we must step back from a single concept of "federally developed technology" to be "transferred" and see the many kinds of technical resources potentially available from Federal laboratories. Each must be identified and applied (i.e. transferred) in different ways to different client groups with different economic constraints. Indeed, this analysis leads us to believe that many small transfers of improvements in process and productivity over a period of time may produce a more significant economic result than the major examples of transfer often noted. Such analysis may also provide us with insight into the complex factors which influence the transfer process and help us to understand the nature of the committment needed by R&D organizations to pursue a successful transfer program.

Some of the kinds of technology (with examples) available from Federal laboratories are:

1)	Potential New Products	
	a) New Devices	Night Vision Scopes, Pulsed Jet Hand Washer for Hospitals
	b) New Materials	Nitinol - the memory metal
2)	Processes	Laser Surface Hardening of Steel
3)	Methodologies	Police Training, Fleet Preventive Maintenance, Various Operations Research Methods
4)	Specialized Knowledge and Expertise	Problem Analysis, Making Public Sector Organizations "Smart Buyers"

It is the first one of these, potential new products, which springs most readily to mind when one says the word "technology" and it is these potential new products which one expects to be identified in the assessments prescribed in the Stevenson-Wydler Act. Yet, for all their potential value - and a rare few may have a very high value - they may only be the tip of the iceberg in regard to economic impact. The collective experience of the FLC shows that, although a diversity of transfer methods is needed, all of the kinds of technology may be transferred effectively without a large bureaucracy or high cost. One must have a decentralized system which deals with the full spectrum of technology, however, to realize the majority of the economic benefits potentially available.

If transfer mainly depends on a paper assessment process in each laboratory and the publication of the results seeking to push technology from the labs, one is limited to those applications envisioned or implied by the originator of the description of the technology and transfer is likely only to those who search these publications. If beyond this, the entrepraneurs or small companies that are most likely to seek new products for new markets cannot easily acquire exclusive rights to laboratory inventions to protect their investment, we realize that there are many barriers to effective transfer which remain to be addressed.

It is one of the major roles of the Federal Laboratory Consortium, and a stated purpose in the By-laws (appended to this statement), to accumulate experiences in effective and efficient technology transfer and share them with concerned policy makers. These real-world experiences have indicated policy improvements needed beyond PL 96-480, although that legislation was a good step in the evolution of policy appropriate to such a complex system.

The Stevenson-Wydler Act made technology transfer officially part of the mission of every lab, mandated an organizational element (the ORTA) to be concerned with this function and strongly recommended that a full time professional and a specified minimum funding be committed to the management of an active program. Further, it pressed all the agencies and laboratories to think about means of evaluating the diverse potential applications of the technology they develop and to consider how, with limited manpower, they might provide technical assistance to potential client organizations, especially to those like the smaller municipal governments with limited capacity to deal with technological subjects. Finally, it prompted more agencies and laboratories to participate in the FLC network. These were all steps in the right direction which added innovative approaches and the views of new actors to the collective experience of FLC.

Now there appears to be a growing consensus that we are ready for the next step in the evolution of policy in this arena. Through its continuing evaluation of the accrued experience of most of those involved in technology transfer, the FLC can now fulfill its role by offering reliable insight into the factors which contribute to successful technology transfer gathered from across all agencies, all geographical regions and a majority of industrial sectors.

The Basis of a Strong Lab Program

The major factors which have been evident in FLC experience from the early days through the latest Laboratory/Industry Interaction Committee survey is that technology transfer is accomplished by a person-to-person interaction, and that a broader scope of technologies and situations may be addressed by encouraging clients to express needs to resource people who are sensitive to

the potential user's environment and who are committed to help. As in the excellent organizations studied by Peters, the laboratories perform better to the extent that the entire lab staff feels the activity is important, that top management is committed to accomplishment, and that there are dedicated people with a special knowledge of the mechanisms of transfer and potential barriers to make initial links to the clients. These factors establish that the laboratory "cares about the customer" and provide the means to develop long term relationships which, although they may be largely informal, lead to a continuing exchange of all types of technology and efficient program growth through word-of-mouth advertising.

Further, the people committed and involved in an effective program seek innovative and cost-effective ways to reach out to help more clients in more ways. As they see and understand the needs, the Federal scientists and engineers want their knowledge and ideas used to help their communities and their country.

The Technical Volunteer Service concept is an example of how personal commitment by those dedicated to transfer in a laboratory developed an innovative approach, and how such commitment by the entire laboratory staff made it work. It is also an example of how a new method of transfer is disseminated through the FLC network so that a growing number of laboratories may implement it more easily. The new Department of Defense regulation on technology transfer specifically supports the development of Technical Volunteer Service activities.

Using technical volunteers to provide technical assistance with leads and help supplied by the ORTA office allows an intense level of service needed by local governments, school districts and other small community organizations

while minimizing any adverse effect on main mission efforts. In fact, it provides increased job satisfaction and personal development experience for the lab staff. Further, community contacts and visibility provided by this technical assistance (see appended news article) give still more credible outreach for the overall program.

The remaining factor which stands out as needed at individual labs in the transfer of new products and processes to innovative companies is the ability to negotiate, as part of the laboratory level interaction, the provision of an exclusive position through patent licenseing. This is needed to protect the company's investment in commercializing the product as well as forming a usual and well understood basis for the venture.

The factors noted above appear to be the major ones which comprise the basis of an optimum laboratory technology transfer program. Different laboratories with different cultures would evolve diverse but effective programs at different speeds even if all constraints were to be removed, and effective programs may develop in spite of existing constraints. Organizations, such as the Oak Ridge National Laboratory and the Oak Ridge Associated Universities in this region, have developed excellent programs which continue to produce innovative approaches. The growth of these leading programs serve as models for others nationwide through the FLC.

The Role of the Consortium in Effective Transfer

Now, aside from the role of the FLC in collecting and sharing the experiences of individual laboratories, we can look at the demonstrated roles of the FLC in facilitating the actual transfer of technology. Here, the roles of the FLC are 1) to provide nationwide outreach and establish institutional relations on behalf of all laboratories to promote "technology pull",

2) to establish a contact useful for clients in all parts of the country and refer them efficiently to a source of specific help, and 3) to supply training and advice to individuals and organizations seeking to understand the methods and mechanisms of technology transfer.

The individual laboratories, even those with large and varied missions, each have only a small portion of the technological resources of the Federal Government. The nature of these resources and how they can be used to solve an immediate problem will remain unknown to those who are geographically distant from them and who cannot invest the time to fathom the complexities of Federal organizations. The Federal Laboratory Consortium makes each member laboratory a one-stop shopping center for its clients even if the technology sought is outside the mission of the laboratory. Further, the FLC provides a "customer service" number for those who are not really near a" branch office" (i.e. laboratory). This gives any potential client in any part of the country access to the broad scope of Federal technology, but still allows the person-to-person interaction needed to help define the nature of the problem and determine realistic options. New applications represent innovations in the organizations where they are made and those adopting the innovations need people perceived as reliable and supportive to help them.

Representatives of laboratories active in the FLC across the country and particularly those volunteers in key network functions, such as the Regional Coordinators, are a first point of contact to all of the almost 300 laboratories in the Consortium network. Referrals are usually made quickly with help as needed from Technical Specialists and the "older hands" to sources of technology in the labs many of which were previously unknown to the client. As the traffic in the network increases, the FLC must seek to

increase the efficiency of its referrals and there are strong indications that electronic mail, which should be available to all member laboratories, will allow a significant productivity improvement in the network.

It should be noted for those in this region that Mr. Donald Jared of ORNL, who serves as the FLC Southeast Regional Coordinator, and Ms. Tina McKinley of ORAU, who serves as a Technical Specialist in training methods, are particularly knowledgable users of the network, as well as contributors, and should be considered valuable contacts for those seeking Federal technology.

Suggestions for Improving Federal Technology Transfer

We have looked at the role of the FLC in providing an understanding of technology transfer to both practitioners and policy makers and at its role in facilitating the process nationwide. Now we may draw upon the insights provided to develop suggestions for improvement. The experience of those active in technology transfer and the FLC - largely volunteers who continue to share the pleasure and frustration of trying to make it work - indicates the following as measures to gain more positive results from the investment in Federal R&D:

1) Make technology transfer an element in the performance evaluation of every Federal manager of R&D, as well as the Directors of laboratories.

2) Provide visible Congressional interest in technology transfer by requiring plans and reports of results for each laboratory and research center.

3) Require at least one professional be assigned full-time to technology transfer in each laboratory with a $20 million or greater in-house R&D expenditure (agencies with much smaller research facilities should dedicate staff on a regional or national basis).

4) Allow for the expeditious negotiation of exclusive licenses to patents originating in Federal laboratories as part of the laboratory transfer process.

5) Provide a legislative charter for the Federal Laboratory Consortium specifiying its role in the facilitation and coordination of technology transfer by the Federal laboratories and research centers.

I hope that these observations and suggestions from those of us in FLC can make some positive contribution to your important efforts to improve the American economy.

THE BELTSVILLE NEWS
CITIZENS' ASSOCIATION
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Harry Diamond Laboratories - A Good Neighbor



Harry Diamond Laboratories engineer Jim Blackburn of Adelphi shows Sister Georgene one of the faulty clocks at St. Joseph's Elementary School in Beltsville. Blackburn's advice to replace the electric clocks with battery-operated quartz clocks saved the school principal over $2,000, she said. (U.S. Army photo by Joe Corallo)

Do you know what Harry Diamond Laboratories has done for you lately? You, its neighbors in nearby Maryland communities?

Quite frankly, it's a lot more than individuals or members of community groups might reasonably expect from a federal research laboratory. Recently they have assisted—The city of New Carrollton, —The town of Landover Hills, —A local entrepreneur, and —The Rockville Police Department.

—Finally, the 25-year-old bell clocks used to ring in classes at St. Joseph's Elementary School in Beltsville went haywire. A faulty automatic reset mechanism caused the clocks to chime at all the wrong times. Parishioners were told they could repair the clocks for $3,000, or replace them with battery-operated quartz clocks for $900. They were unsure which way to go. HDL engineer Jim Blackburn of Adelphi talked with Sister Georgene, automatic mechanism at his home. He advised the parishioners to replace the clocks. "We felt good about having a person with his knowledge advise us," said Sister Georgene. "We could go forward in confidence. And we saved more than $2,000 of our very limited budget."

These and many other demonstrations of community concern have been performed by HDL employees since the summer of 1983, when the Technical Volunteer Service was established as part of HDL's Office of Research and Technology Applications.

The Stevenson-Wydler Technology Innovation Act of 1980, Public Law 96-480, requires federal laboratories that operate on an annual budget of more than $20 million to create an Office of Research and Technological Applications. The purpose of these offices is to transfer technology breakthroughs developed by government scientists into the private sector to improve the American economy and to help local governments provide better services at less cost. This gives taxpayers a double payoff for money spent on federal research. The Volunteer Service operates within this office and addresses the objective of helping local communities combat increasing technical problems in the face of dwindling tax revenues.

Harry Diamond is one of the 10 federal agencies nationwide actively pursuing the Technical Volunteer Service. The TVS combines the legal mandate for laboratories to provide technical assistance with the desire of federal employees to help their local communities.

Some 40 HDL employees have volunteered their own time to help local communities and, in some cases, individuals with technical problems.

Why do they do it?

"Everyone likes to do his or her own thing and help others in the process," explained Jim Blackburn.

Chris Fazi agrees. "You enjoy your technical field so much that you're willing to share it, especially with young people. It's very rewarding to find others with the same technical interest."

Community groups or individuals can tap the talent bank in the HDL Technical Volunteer Service by calling TVS coordinator Leo Struglia of Greenbelt at 202-394-1551 between the hours of 8 a.m. and 4 p.m.

BYLAWS
OF THE FEDERAL LABORATORY CONSORTIUM
FOR TECHNOLOGY TRANSFER

ARTICLE I. Name and Purpose

Section 1. The name of this organization is the Federal Laboratory Consortium for Technology Transfer, hereinafter referred to as the Consortium. The Consortium is an informal association of U.S. government laboratories and research and development (R&D) centers.

Section 2. The Consortium serves as a forum for the discussion of the principles and practices of technology transfer and provides a communication network for the purposes of:

a) Facilitating the exchange of technical information, the diverse application of R&D results, and transfer of technology from the government laboratories toward the solution of existing problems and the avoidance of future problems in both the private and public sectors.

b) Encouraging the collection, compilation, and dissemination of information on existing technology transfer techniques and methodologies and experiences in their application.

c) Encouraging the development and implementation of technology transfer techniques and methodologies.

d) Providing a baseline of experience for assisting decision makers in the development of national policy for technology transfer.

ARTICLE II. Membership

Section 1. The Consortium shall be comprised of government agency laboratories and R&D centers. These laboratories and R&D centers are member organizations, hereinafter referred to as Consortium Members. For the purposes of the agreements emboided in these Bylaws, a government laboratory or R&D center is defined as any organization supported primarily by public funds with its work devoted to technology related activities and located anywhere in the world.

Section 2. Each Consortium Member shall appoint a specific person as a point of contact and to represent that laboratory or center in the Consortium. These persons, hereafter, will be referred to as the Representatives. Groups of laboratories or centers in the same agency may have the same person serve as Representative for the group.

Section 3. A laboratory, center, or group of laboratories or centers, may become a member upon their written request designating an individual representative. The request will be followed by an acknowledgement and acceptance by Consortium officials. It is highly desirable to have demonstrated top level management support at the time of the request.

Section 4. Laboratory or Center representatives are bound by the provisions of these Bylaws except where those provisions are counter to specific policies of his/her parent agency. In those cases, agency policy takes precedence.

ARTICLE III. Organization

Section 1. Constituent regional subdivisions or regional Consortia comprised of Members from the geographical region may be formed within the National Consortium. Every two years each recognized regional Consortium shall elect a coordinator and a vice-coordinator to represent the member laboratories and centers of that respective region. The region boundaries will be defined as those of the Federal Regional Council. One or more regions may be represented by a single coordinator.

ARTICLE IV. Officials and Governing Body

Section 1. Officials

a) The Consortium shall have an elected Chairperson. The Chairperson shall preside at all meetings of the Consortium and the Executive Committee, defined in Section 2, Article IV, at which he/she is present. The Chairperson shall also serve as chief executive of the Consortium and, as such, shall be responsible for directing consortium activities and carrying out the policies and directives of the Executive Committee and the Consortium membership.

b) The Consortium shall also elect a Vice-Chairperson who shall preside at all the meetings of the Consortium and the Executive Committee in the absence of the Chairperson. He/She shall assist the Chairperson in carrying out those functions of the chief executive as agreed by the Chairperson and Executive Committee.

c) In the event the office of the Chairperson becomes vacant for any reason, the Vice-Chairperson shall fulfill all responsibilities of the Chairperson's office (Chairperson and Vice-Chairperson). The Executive Committee will appoint an acting Vice-Chairperson to serve until such time as the full Consortium has met for the purpose of electing a new Chairperson.

d) Officers may only be removed during their normal term of office by a two-thirds vote of all the Consortium representatives.

e) The Consortium shall have an Executive Secretary, appointed by and serving at the discretion of the Executive Committee. The Executive Secretary shall be responsible for the day-to-day administration of the Consortium. He/She shall report directly to the Chairperson and shall assist the Chairperson in the performance of his/her duties. Further, the Executive Secretary shall serve as Secretary of both the Consortium and the Executive Committee. As such, he/she shall keep minutes of all meetings, maintain other needed records and prepare reports of Consortium activities as required by the Executive Committee.

f) An Executive Secretariat hereinafter called the Secretariat, may be established by the Executive Committee with support funds supplied by a sponsoring agency or agencies. This Secretariat shall operate under the direction of the Executive Secretary to assist him/her in carrying out the duties specified in Section 1(e) above.

g) A representative of the agency which is the principle sponsor of the Consortium Secretariat shall be a member of the Executive Committee though be/she may not be a Representative of the Consortium as defined in Article II above.

Section 2. Governing Body

a) The governing body of the Consortium shall be the Executive Committee which shall consist of the Consortium Chairperson, Vice-Chairperson, a representative from the principle sponsoring agency, the coordinators of the six (6) Regional Consortia, the Technical Specialty Coordinator and seven (7) at-large representatives to a total of seventeen (17) members. The past Program Managers of the sponsoring agency, the past Chairpersons and the past Regional Coordinators will serve on the Executive Committee as non-voting members.

b) Executive Committee members shall serve until their successors are elected or appointed. The Executive Committee shall make appointments to fill vacancies on the Committee subject to the approval of the majority of the Consortium Representatives at the following regular meeting. Notification of the required approval will be included with the meeting announcement.

A quorum of the Executive Committee shall consist of nine (9) voting Representatives which may include the Consortium Chairperson and the representative from the sponsoring agency.

d) The Executive Committee shall, in general, make policy for the Consortium on the basis of issues brought before the Committee. These policy decisions may, however, be referred to a vote of the full body of the Consortium Representatives at the next meeting by a majority vote of the Executive Committee on a motion made and seconded by any Executive Committee members.

ARTICLE V. Nomination and Election

Section 1. The Consortium Chairperson, Vice-Chairperson, the Technical Specialty Coordinator and seven (7) at-large members of the Executive Committee shall be elected for a term of two (2) years. Elections will be held at the annual fall organizational meeting. The Chairperson and Vice-Chairperson shall be elected in even numbered years. The Technical Specialty Coordinator and seven (7) at-large members of the Executive Committee shall be elected in odd numbered years. The term of each official will begin at the first of the year following the fall organizational meeting at which he/she is elected.

Section 2. Nominations shall be made at least sixty days before the fall organizational meeting by a nominating committee of three (3) Consortium Representatives appointed by the incumbent Chairperson. Nominations may also be made from the floor by a Consortium Representative.

Section 3. Election of the Chairperson, Vice-Chairperson, the Technical Specialty Coordinator and the at-large Executive Committee members shall be by a simple majority of the Consortium Representatives present and voting. In case of a tie, the incumbent Chairperson shall cast the deciding ballot.

ARTICLE VI. Advisory Committee

Section 1. The Advisory Committee shall consist of sixteen user representatives. The composition of this membership shall include but not be limited to: state and local government; academic; and industrial representatives. The Advisory Committee shall advise the Executive Committee and provide the Executive Committee with user community views and suggestions related to the operation of the Consortium.

Section 2. Committee members shall be appointed by the Executive Committee. Qualification for candidate members of the Advisory Committee shall be established by the Executive Committee and may be, from time-to-time, revised by the Executive Committee to respond to changing requirements.

Section 3. Terms and selection process of the Committee officials shall be established by the committee membership with the concurrence of the Executive Committee.

Section 4. The Advisory Committee will meet at least two times during the calendar year. These meetings may be held in conjunction with the semi-annual Consortium meetings.

ARTICLE VII. Meetings

Section 1. The Consortium shall hold at least two national meetings during the calendar year. At least one of these shall provide for the conduct of the organizational business of the Consortium.

Section 2. The organizational meeting shall be held between 31 August and 30 December of each year.

Section 3. The Consortium Representatives shall be given at least four weeks notice in writing of the time, place and the scheduled business to be considered at the semi-annual meetings.

Section 4. Special meetings may be called by petition of one-half of the membership, to conduct Consortium business, provided the notice meets the requirements established in Section 3 above.

Section 5. The quorum for the national meetings shall consist of the simple majority of Representatives in attendance exclusive of Executive Committee members.

ARTICLE VIII. Amendments

Section 1. Amendments to the Bylaws may be made in the following manner:

a) Amendments may be proposed by the Executive Committee. Such proposed amendments must be submitted to the Representatives with the announcement in accordance with Article VII, Section 3, of these Bylaws. Such proposed amendments may be adopted by a simple majority vote of the Representatives present at the regular annual business meeting.

b) Amendments may be proposed by a simple majority vote of the Representatives present at any regular or special meeting. Such proposed amendments may then be adopted by a simple majority vote of Representatives present at the succeeding regular meeting, providing that the announcement requirements of Article VII, Section 3 are met.

Adopted: 16 May, 1978
Last Revised: 9 May 1985

Ms. LLOYD. Thank you very much, Mr. Lanham, for your testimony. At this time I am going to turn the Chair over to my colleague, Mr. Walgren. We will rotate the Chair for the next hour because, since we are running behind schedule, we are not anticipating a lunch break. The hearings are good and we do want to finish and give all of our witnesses ample time.

Thank you. Mr. Walgren.

Mr. WALGREN. Thank you, Madam Chairman.

Let me recognize Mr. Morrison.

Mr. MORRISON. Thank you, Mr. Chairman.

Mr. Clarks, I am impressed with the farsighted Space Act. They obviously, I think, put NASA out in front, by creating an infrastructure which led to a very real outreach program. I think you are to be commended for following through on that.

I get the impression they not only set up the network and spent some money up front, but they established their own chamber of commerce. You have done a good job in advancing and being able to put actual numbers to the technology transfer that has taken place.

Do you have any plans within that framework for strengthening any particular part of the program that, now, in retrospect you see you would modify from the experience you have had after 20 years?

Mr. CLARKS. Yes, sir. I must say, I have recently taken over as director of technology utilization. I am now about 3 months on the job. But two things I did recognize in coming in.

I didn't get a chance to attend the hearings on Stevenson-Wydler and on a number of issues regarding patents. What became pretty obvious to me, however, in taking a look at the question of revitalization and productivity in this country, is the fact that there is probably an enormous amount of money going into research and development. A lot of innovations that come are from that. But, nonetheless, those innovations, you know, sit somewhere on somebody's shelf.

We have viewed the FLC, if in fact it gets a mandate or gets—or whatever the case might be—as a viable instrument to carry on and disseminate a lot of the technologies that are developed in other laboratories, although we currently have a system in NASA. But we looked at that involvement as being one wherein NASA probably could get more involved in. We participated with FLC activities. We have our own order system. We have our offices in each laboratory. But what we probably see is a situation wherein the interface between the NASA Technology Utilization Program and that which would in fact be carried out by the FLC could be strengthened. So, one of the major objectives is to get more involved with the activities of the FLC and see whether we can bring this as a national initiative in terms of technology transfer as one being parochial in the sense that NASA has a program as opposed to DOE, and so forth. I think there are more linkages that need to be established there.

The other thing being, which I think should require some emphasis, is really working with the State and local governments. Now, we try to do a pretty good job with our industrial applications centers because most of those are connected to universities. The uni-

versities then are connected to the small SBDC's, and so forth, that get upon the local scale of helping small businesses and so forth. However, we think that if in fact we can make our industrial applications centers more accessible to a small business guy, to those small businesses, say, in remote areas, if in fact we can create a direct linkage either through, say, the FLC or directly into the industrial applications center.

So, those are basically two major initiatives, as I see, that we are going to approach to see whether or not we can contribute more to that whole technology process.

Mr. MORRISON. The feeling on greater coordination with State and local governments would be that they have their own mechanisms set up for transfer, that is commerce and economic development committees, commissions, that sort of thing?

Mr. CLARKS. Yes. You know, NASA, for example, has taken a look at the fact that a lot of the State and local governments have, in effect, been given the onus for their own local economic development. You see a transition more from the Federal to the State level. We think that through one system, for example, the remote interactive system that we have, wherein if a small business or through SBC, if in fact there is a problem with a small company, a concrete guy says, look, I have a problem, my mixture is not solidifying, he can be able to tie in through his system directly into our industrial applications center, who, in fact then could tie in directly to, say, our science laboratory of some sort, and have a linkage wherein we can put the small guy someplace, in some State and local level, directly in touch with our center, through our industrial applications center. So that means that they are going to have to, you know, develop and facilitate that technology transfer through having adequate equipment.

But the idea is to strengthen local programs, and we are going to try to work with them to see how that can be done.

Mr. MORRISON. Thank you.

Mr. Walgren, I would like to mention to you so the record will show that my service on the Agriculture Committee has some interesting parallels with what we've just heard, and that is agriculture a 100 years ago established an Extension Service so that the things that came out from the ivory towers of academia somehow got out onto America's farms.

And I sense that in a very high technology way we are sort of struggling now with the variety of institutions we have created to bring these same programs to the front. And I am pleased with particularly the report from NASA, since they seem to have this built in initially as an obligation.

My time is up. I just want to mention to Mr. Lanham that I think your list of suggestions should be taken by the committee's jurisdiction and included to the extent possible. For improvements, you have, like NASA, your own network. Yours has been done voluntarily as opposed to through the farsighted approach of someone. And I trust since you represent all of the laboratories, that you would concur with Dr. Drucker's point that each one is different, in fact needs a different approach, and, therefore, flexibility must be a part of the program.

Mr. LANHAM. Yes. This is the key, because the different cultures of the laboratories, and I think Dr. Drucker made the point very well, because of the differences in emphasis from research which needs extensive adaptation, or to engineering development, which may be directed largely toward the mission of the Agency, and then the different type of adaptation requires that different types of transfer methods be employed.

So, flexibility is one of the keys, I think, to getting this done. You mainly want to make the people in the laboratories responsible and empower and encourage their participation in the network and give them the productivity tools that they need to reach out and to exchange information because the exchange of information is critical.

Mr. MORRISON. Thank you.

Thank you, Mr. Chairman.

Mr. WALGREN. Thank you, Mr. Morrison.

You emphasized, Mr. Lanham, that it is harder and harder to make any real assessments of the value of this effort when you talk about the real value lying not in the individual things that you can isolate, but rather—I forget how your testimony put it—but on these ranges of different kinds of contacts. How did you put it?

Mr. LANHAM. I would like to separate the assessment of the technology, that is to say, people in the laboratory with a limited knowledge of potential applications, maybe as all of us having a rather foggy crystal ball as to what the things might be used for—on that issue I am saying separate that assessment process and the assessment of the effectiveness of the program.

I think that the assessments have a place, that you need to look for what you can use the technology for, because if you have something fairly obvious, then you should go tell those people who might use it, but you mainly want to put more effort than is currently done, I think, into encouraging people to come in and ask questions and pose problems and discuss with you what kinds of needs they have in the real world that you may not have guessed they had, in order to get more technology out more effectively.

Now, that is one term of assessment. Now, you are also talking about assessing the effectiveness of a program, which is different. And I think, although you are going to have a lot of loose edges, as you will with any kind of research and development effort, any type of creative or innovative effort is very hard to assess.

And we might suggest something like peer review as a means which has been used for assessing the effectiveness of R&D itself, that that might be appropriate to assessing the effectiveness of programs and technology transfer.

But I want to make the separation between assessment of the technology and assessment of the effectiveness of the program.

Mr. WALGREN. But you're saying that it—or you indicate that it is going to be even harder to assess the value of the—maybe I'm not making a distinction—the value of the technology? As you say, we should step away from the idea that there is a federally developed technology to be transferred and see the many kinds of technical resources available, and that this approach would lead us to understand, that many small transfers of improvements in process

over a period of time, may be more significant with respect to economic result than the major examples of technology transfer.

I guess what I am saying is that I hear you saying that it is going to be harder and harder to really recognize the value in this area. And yet we are going to be asked to rely on it more and more and put more of our focused effort into it. And one of the frustrations of Government is that nobody wants to be measured. People want to have a license to do something but they don't want to have an obligation to produce.

And I hear you saying, "We are not going to be able to show you too much of what we have got, but know that it is throughout the matrix and the web of everything, and don't worry about it."

Mr. LANHAM. No, I disagree a little bit with that interpretation. I'm simply saying that you cannot, up front, assess the technology from inside a laboratory and come up with the major value that that might be on—you can in some cases, but, on a reliable basis, that that is not—in other words, that the technology assessment process up front, assess the technology, find out what you've got, push it out there to those people that you identify that might use it, that it may turn out that that is not the most—that you have not transferred the majority of the technology.

That has nothing to do with your ability to evaluate the program.

Mr. WALGREN. I see, and you feel that you can do that, and you——

Mr. LANHAM. I think you can evaluate the program——

Mr. WALGREN [continuing]. Can retrospectively look and appreciate what we have done?

Mr. LANHAM. I think you can evaluate the effectiveness of the program by measuring after the fact of what you have accomplished.

You have to look at it after the fact. You have to somewhat make investments and steer the ship, so to speak, without knowing at all times, but you will get feedback. What that is intended to encourage, though, is making an investment in an outreach to encourage people to understand the effect of the potential value of Federal technology to them and to come in and get it, because if they look for it, they know what they are looking for.

Mr. WALGREN. Am I right in feeling that we are asked to rely on relatively anecdotal retrospective assessments at this point in this area?

Mr. LANHAM. Across the broad—with few exceptions, NASA being one of those exceptions and DOE rapidly following on, I think, we are to this point, because this is one of the difficulties with not having a focus, if you will, for the FLC. There is—its volunteer organizations, its contributions on a case-by-case basis. We are experimenting, for instance, with the use of electronic mail and have found it very helpful; but we do not have a means right now to get it used by the entire consortium network. And we don't have a very unified means of rolling up the experience in terms of quantitative data from the labs.

Mr. WALGREN. When you suggest specifying a role for the Federal Laboratory Consortium, could you outline that very succinctly,

as to what you would like to see that role and how it should be specified?

I gather you want a legislative charter setting——

Mr. LANHAM. Yes.

Mr. WALGREN [continuing]. Giving responsibility to the FLC for certain things?

Mr. LANHAM. For certain things. And that is—there is a concern that we would be creating a bureaucracy, yet another bureaucracy. I think that our experience has shown that that is not necessary, that we want to coordinate and facilitate the interactions of this distributed network which are created by the laboratories as an adequate approach.

I simply implied by that that we do not want to have this organization created and be told that it is responsible for transferring the technology of the laboratories, because that is going to centralize the effort.

Mr. WALGREN. But it would seem that, if you are saying that you would like to be the coordinator, that you really should be able to offer a disciplined measure of what the contribution of that organizational role is.

Coordination is one of those words that nobody knows what happens or doesn't happen, at least not directly. And, I guess what I am looking for is, I would really wish that the Federal Laboratory Consortium, in asking for that role, could come up and really emphasize how we tell whether we are succeeding or not succeeding and what led to the success.

Perhaps you could respond to that informally later on and we could go from there. I would like to underscore your point about the full-time nature of the necessity and the idea that maybe you make a regional, a full-time person. But my instincts are that if you have somebody doing something part time, you can bet that there will never be any way to measure what they do in that part of their time, because, if it is difficult, they will go and do something else. And they will use up their time on some other project that is perhaps more amenable to measurement.

Mr. LANHAM. That is a very good point, which I did not include in that assessment of full time. I know from my personal full-time involvement that it is very important that you understand the complexity of the system. A lot of times, people now working part time or working without a very strong mandate from the labs have not accrued data simply because they don't want to take the time to write down what they already did when three people are going to have to be put off who are knocking on their door, asking questions. And they feel that it is more important that they respond.

Mr. WALGREN. On behalf of the committee we want to thank you for your participation in this and look forward to talking with you as a resource with your various perspectives. We appreciate your testimony today.

Let me call the next witness. The next witness is Mr. C.H. Davis, the manager of chemical operations for the National Fertilizer Development Center, Tennessee Valley Authority. Welcome to the committee, Mr. Davis, and know that your written submission will be made part of the record, without more—please feel free to outline or emphasize those points that you feel really deserve to be un-

derscored. We do appreciate your coming and participating in this process.

STATEMENT OF C.H. DAVIS, ASSISTANT MANAGER OF AGRICULTURAL AND CHEMICAL DEVELOPMENT, NATIONAL FERTILIZER DEVELOPMENT CENTER, TENNESSEE VALLEY AUTHORITY

Mr. DAVIS. Thank you, Mr. Chairman, Madam Chairman, Congressman Morrison, ladies and gentlemen.

I am from TVA's Office of Agricultural and Chemical Development. This is located in Muscle Shoals, AL. We are also known as the National Fertilizer Development Center because most of our work involves fertilizer development. We are deeply engaged in advancing and transferring the technology of fertilizer development.

We want to express our appreciation for this opportunity to briefly describe our technology transfer activities. We are very enthused about our work and we are very proud of the technology transfer accomplishments that our operation has.

Our fertilizer program is a national program. It combines agricultural and industrial research and involves a partnership of Federal, State, and private sector organizations. The American farmer and the consumer are ultimate beneficiaries of our research, but members of the fertilizer industry also benefit as they use these developments to supply improved fertilizers to their customers. We estimate that about three-fourths of the fertilizers made in the United States are made with the aid of technology developed by TVA.

I have attached a map here that shows where plants are located that are using our developments. It looks like you've shot the map of the United States with a shotgun.

Our technology has helped to keep our food in plentiful supply and reasonable in cost. The United States spends less as a percent of disposable income on food than any other country in the world. The wise use of fertilizers is helping each farmer to provide food and fiber for 76 people today, as compared with only 26 in 1960.

Fertilizer costs have increased at a much lower rate than costs of other major agricultural inputs. We think our fertilizer research is a major factor in maintaining the continuous stability and competitiveness of our fertilizer industry. We estimate that the benefit to cost ratio of our program is more than $20 in benefits for each dollar of program cost.

Our mission is very specific. It is to develop new and improved fertilizer products and processes to lower their cost and improve the effectiveness.

We accomplish this mission through a combination of basic and exploratory research, applied research, development, and prototype plant operations. New products are evaluated in laboratories, greenhouses, and subsequently in actual field tests. Ultimately, we transfer this technology to the end user, typically U.S. industry firms. We use a multidisciplinary team approach that involves chemists, chemical engineers, soil scientists, and economists.

New knowledge about fertilizer materials and how they react in the soil is used to create the new and improved fertilizers. Small amounts of experimental products made in our research laborato-

ries are first evaluated in greenhouses. If these tests are successful, processes for making the fertilizers are developed, tested, and refined in our pilot plants that produce quantities ranging from a few pounds to up to about 2 tons of products per hour.

Products from these small-scale production plants are used in field evaluations at Muscle Shoals, at cooperating university experiment stations, and on farms throughout the United States. Information from these evaluations is fed back to the NFDC. This results in possible further research for product improvements and usually involves a comparison of the new products with the standard fertilizer materials. It may also involve studies of such related factors as chemical reactions in the soils, losses of nutrients from the soil system, and toxicity to seed or young plants.

If a new product and associated processes perform well through the pilot plant and field testing stages and the advantages remain clear, commercial adoption may occur without further demonstration. However, problems often remain, or advantages need more demonstration. If so, we may build a prototype plant at NFDC to complete the development and more convincingly illustrate the benefits.

Information about the new process or product is communicated to agricultural leaders and to the fertilizer industry. Our staff works closely with firms interested in adopting the new developments. We encourage commercial production so farmers and consumers will benefit from this technology at the earliest time possible.

The acceptance and transfer of new technology is emphasized as much as the development. We accomplish this transfer through a combination of demonstrations, sessions with industry trade associations, personal visitations, publications, and the use of an effective patent and licensing procedure.

Demonstrations are conducted at our facilities in Muscle Shoals and also at cooperating industry plants. Every 2 years we have a 2-day technology demonstration or open house at Muscle Shoals that features operation of our new plants and related technical and economic discussions. Additionally, we periodically demonstrate the individual processes for interested parties. Through our industry demonstration program, a number of industry cooperators take our new materials and use them in specified programs involving test production and marketing of the new or improved products.

We conduct technology transfer sessions in cooperation with industry trade associations. These sessions are conducted at various locations and key on a specific area of technology such as fluid fertilizers or production of ammonia from coal.

We operate with an open door policy that results in a steady stream of technical visitors to see our operations and consult with our staff on the specific areas of their interest. Typically, we have about 1,500 technical visitors per year, and some of them stay for several days. Whenever an organization adopts our technology, our staff also visits the facilities of that firm, as necessary, to help solve problems and optimize the operation.

We have a continual outflow of technical papers, indepth reports, and publications in journals about our developments. Copies of these are readily available to the public from our library.

We use our patent and licensing procedures to ensure that our technology is readily available to all producers. This stimulates competition, resulting in low-cost supplies of fertilizers for farmers. Most important, it has ensured that inventions resulting from the work at NFDC will be used to benefit all the people of the country. We take patents on our new developments and issue nonexclusive, royalty-free licenses to anyone. We presently hold 259 patents. We have issued 672 licenses for use of our developments in 584 plants owned by 395 companies in 39 States.

Although NFDC's fertilizer developments are available to everyone, their impact probably has been greatest on the hundreds of small businesses that comprise much of the fertilizer industry. These businesses have neither the training nor the resources to conduct research. Yet, they are among the most innovative and most competitive in the industry. Small firms typically have been the first to adopt new TVA technology and we feel that they are vital in the rapid transfer of benefits of new developments to farmers.

I would like to submit for the record this circular, which is also attached, Z–135, which describes our technology transfer activities more completely, Mr. Chairman.

We would be pleased to answer any questions you may have.

[The prepared statement of Mr. Davis follows:]

PRESENTATION FOR CONGRESSIONAL HEARING

OAK RIDGE, TENNESSEE, JULY 15, 1985,

ON TECHNOLOGY TRANSFER

Good afternoon. I am C. H. Davis, Assistant Manager of TVA's Office of Agricultural and Chemical Development. I also am Director of the Division of Chemical Development, which is one of the three divisions that comprise our office. Since our work primarily involves fertilizer development, we are also known as the TVA National Fertilizer Development Center or NFDC. The NFDC is deeply engaged in advancing and transferring the technology of fertilizer development. Our offices are located at Muscle Shoals, Alabama. I want to express our appreciation for this opportunity to briefly describe how we obtain the transfer of our technology and the utilization of patents in this process.

Our fertilizer program is a national program. It combines agricultural and industrial research and involves a partnership of Federal, State, and private sector organizations. The American farmer and the consumer are ultimate beneficiaries of our research, but members of the fertilizer industry also will benefit as they use the developments to supply improved fertilizers to their customers. Three-fourths of the fertilizers made in the United States are made with the aid of technology developed by TVA. The dots on this map show the locations of plants using our technology. This technology has been one of the keys in Amarica's increasingly efficient and productive agriculture. It has helped keep food in plentiful

supply and reasonable in cost. U.S. food expenditures as a percent of disposable income are the lowest in the world. The wise use of improved fertilizers is helping each farmer to provide food and fiber for 76 people today, compared with 26 people in 1960. TVA fertilizer research is a major factor in maintaining the continued stability and competitiveness of the U.S. fertilizer industry.

Our mission is very specific. It is "to develop new or improved fertilizer products and processes to lower the cost and/or improve the effectiveness."

We accomplish this mission through a combination of basic and exploratory research, applied research, development, and prototype plant operations. New products are evaluated in laboratories, greenhouses, and subsequently in actual field tests. Ultimately, we transfer our technology to the end user, typically U.S. industry firms. We use a multidisciplinary team approach involving chemists, chemical engineers, soil scientists, and economists.

New knowledge about fertilizer materials and how they react in the soil is used to create the new or improved fertilizers. Small amounts of experimental products made in our research laboratories are first evaluated in greenhouses. If those tests are successful, processes for making the fertilizers are developed, tested, and refined in our pilot plants that produce quantities ranging from a few pounds to as much as a ton or two per hour.

Products from these small-scale production plants are used in field evaluations at Muscle Shoals, at cooperating university experiment stations, and on farms throughout the United States. Information from these evaluations is fed back to the NFDC. This results in possible further research for product improvements and usually involves a comparison of new products with standard fertilizer materials. It may also involve studies of such factors as chemical reactions in soils, losses of nutrients from the soil system, and potential toxicity to seed or young plants.

If a new product and associated processes perform well through the pilot plant and field testing stages and advantages remain clear, commercial adoption may occur without further demonstration. But problems often remain or advantages need more demonstration. If so, we may build a prototype plant at NFDC to complete the development and more convincingly illustrate the benefits.

Information about the new process or product is communicated to agricultural leaders and the fertilizer industry. Our staff work closely with firms interested in adopting the new developments. We encourage commercial production so farmers and consumers will benefit from the technology as soon as possible.

The acceptance and transfer of new technology is emphasized as much as development. We accomplish this transfer through a combination of

demonstrations, sessions with industry trade associations, personal visitations, publications, and use of an effective patent and licensing procedure.

Demonstrations are conducted at our facilities in Muscle Shoels and also at cooperating industry plants. Every two years we have a two-day technology demonstration or open house at Muscle Shoals that features operation of our new plants and related technical and economic discussions. Additionally, we periodically demonstrate individual processes for interested parties. Through our industry demonstration program, a number of industry cooperators take our new materials and use them in specified programs involving test production and marketing of the new or improved products.

We conduct technology transfer sessions in cooperation with industry trade associations. These sessions are conducted at various locations and key on a specific area of technology such as fluid fertilizers or production of ammonia from coal.

We operate with an open door policy that results in a steady stream of technical visitors to see our operations and consult with our staff on specific areas of their interest. Typically, we have about 1500 technical visitors e yeer. Whenever an organization adopts our technology, our staff also visits the facilities of that firm as necessary to help solve problems and optimize operation.

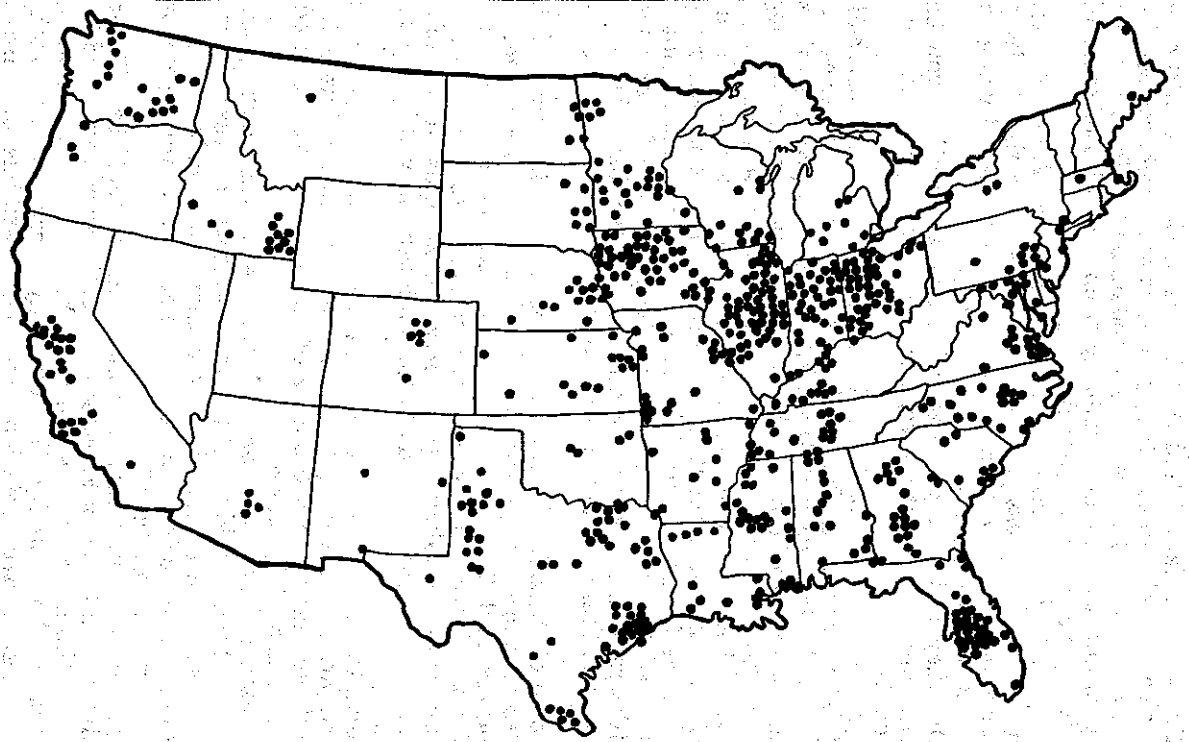
We have a continual outflow of technical papers, in-depth reports, and publications in journals about our developments. Copies of these items are readily available to the public from our library.

We use our patent and licensing procedures to ensure that our technology is readily available to all producers. This stimulates competition, resulting in low-cost supplies of fertilizers for farmers. Most important, it has ensured that inventions resulting from work at the NFDC will be used to benefit all people of the country. We take patents on our new developments and issue non-exclusive, royalty-free licenses to anyone. We presently hold 259 U.S. patents. We have issued 672 licenses for use of our developments in 584 plants owned by 395 companies in 39 states.

Although the NFDC's fertilizer developments are available to everyone, their impact probably has been greatest on the hundreds of small businesses that comprise much of the fertilizer industry. These businesses have neither the training nor the resources to conduct research. Yet, they are among the most innovative and most competitive in the industry. Small firms typically have been among the first to adopt new TVA technology and are vital in the rapid transfer of benefits of new developments to farmers.

I would like to submit for the record this paper which covers our technology transfer activity more completely (TVA Circular Z-135). We would be pleased to answer any questions you may have about this information.

PLANTS THAT HAVE BEEN LICENSED TO USE TVA-DEVELOPED PROCESSES OR EQUIPMENT



Mr. WALGREN. Thank you very much for that testimony.

We will take the report also under advisement.

Mr. Morrison, this is more your area than mine.

Mr. MORRISON. Thank you, Mr. Chairman. Yes; this one I am familiar with. In fact, I find that this is probably the ultimate technological transfer in that they give it away, which, considering that you are funded 40 percent, as I understand it from congressional sources and the balance made up from the sales of some of your products, that provides your funding.

I am a little surprised that the Tennessee Valley Authority is doing this, but I guess you got started first, took the challenge, and you are doing this instead of some university. Could you give me a little of the historical background on that?

Did they feel that you had a broader application, you had the energy and the opportunities, and that is why you were given this mandate?

Mr. DAVIS. Mr. Morrison, the mandate is in the original TVA Act. The facilities at Muscle Shoals, the construction was started prior to the formation of the TVA, a plant to produce nitrates for munitions in World War I. The construction was begun along with the facilities to produce power that involves a steam generating plant and initiation of construction of what is now Wilson Dam. And the war ended about the time the construction was completed. And these facilities were idle for a long time. But I think it was visualized that the facilities could be put to use for production of fertilizers and, of course, not only nitrate fertilizers but also phosphate fertilizers. In fact, it was more concerned about phosphate at that time.

Some of these facilities were amenable to adjustment to the furnaces to phosphate production. I think it was recognized by the Congress that TVA had capabilities that could be put to use to assist the Nation in its food production. Also, there were severe problems in the valley with poverty and soil erosion and, of course, certainly the lack of ability to maintain a viable agricultural system.

Mr. MORRISON. Yours is certainly a record of success. And I commend you for it. And probably, as your brochure points out, it is a significant factor in the ability of America not only to feed itself but so much of the world.

I wonder, in conjunction with the rest of the hearing, that you sense that you would benefit if you had greater access to, say, some of the brain power and the talent that is available in some of the national laboratories that could augment your work, your own capabilities that you have?

Mr. DAVIS. I think there are ways that we could benefit certainly indirectly. In terms of knowledge of fertilizer research and development, I think we have in-house the best and we are singularly involved in that activity. But certainly there are high technology areas, like instrumentation, analyses, materials of construction, that relate to our work that I think we could benefit from.

Mr. MORRISON. OK. Thank you very much. Thank you, Mr. Chairman.

Mr. WALGREN. Thank you, Mr. Morrison.

Yours is generally an open, nonexclusive patent process?

Mr. DAVIS. Yes, Mr. Walgren, that is correct.

Mr. WALGREN. On the behalf of the committee, let me thank you very much for your testimony, and we appreciate your being a resource to the committee.

Mr. DAVIS. Thank you.

Mr. WALGREN. Let's at this point take a 5-minute break to give the reporter an opportunity to rest a little bit. But we don't want to break too long because we do want to move through the balance of the witnesses. We are going to sort of be cycling Mr. Morrison and Mrs. Lloyd and myself through the Chair here so that we can take care of some other things in the process. We appreciate your attention this morning and we will start again in about 5 minutes.

[Whereupon, at 12:36 p.m., the hearing was recessed, to reconvene 5 minutes later, at 12:41 p.m., the same day, Monday, July 15, 1985.]

AFTERNOON SESSION

Mr. MORRISON. The subcommittee hearings will come back to order. Is Mr. Coyne available? There he is, a seasoned veteran, and he didn't leave the room.

Joseph Coyne is the Manager of the Office of Scientific and Technical Information from the Department of Energy.

Mr. Coyne, we are delighted to have you with us, with the usual admonition which you have heard many times, and that is that your formal testimony will be made part of the record automatically. We are looking forward to any form in which you wish your presentation to take.

STATEMENT OF JOSEPH G. COYNE, MANAGER, OFFICE OF SCIENTIFIC AND TECHNICAL INFORMATION, DEPARTMENT OF ENERGY

Mr. COYNE. Thank you very much, Mr. Chairman.

I was going to follow the course of the testimony that I believe you have in front of you, but I will try and pare it down in the interest of time and to permit devotion to some questions and answers.

The one thing that I wanted to emphasize here is that the Department of Energy had in its enabling legislation of 1974 some language that was quite specific to the business of the dissemination of technical practical information, and to encourage dissemination of that information relating to energy so as to enlarge the fund of such information and to provide that that free interchange of ideas and criticisms which is essential to scientific and industrial progress and full understanding.

I just would like to say that that is a very essential element of the program that I am responsible for managing.

In addressing those issues of the oversight of the Department's technical information resulting from its R&D activity, the Department of Energy has decided to choose as its manager of this activity the Office of Scientific and Technical Information, located here in Oak Ridge. But I wanted to emphasize that we have DOE-wide responsibility for the program.

I have some background in the prepared statement that gives you some of the adventures I have been involved in in recent years with the Government, but I will leave those for the record.

Suffice it to say that there are several approaches to gain and use access to the Department of Energy's R&D results that have been implemented both within and outside the Department.

We have heard this morning about the efforts that Toni Joseph described and Mr. Constant. I would like to describe some of the things we are doing that I believe and we in the Department, I think, believe are very complementary but follow slightly different tracks.

One of the first things we have chosen to do in the Department of Energy is to establish a monitoring system to try and ensure that the R&D that is contracted for that has technical information deliverables actually arrives at a centralized point in the Department of Energy.

We have heard earlier testimony talking about accountability. We do have such a system. It is reasonably sophisticated. It links the Department of Energy Procurement System with a Technical Information Reporting System. And so we are reasonably confident that what the Department contracts for actually arrives in a data base here in Oak Ridge for subsequent use and reuse by Department of Energy funded researchers as well as U.S. business and industry.

The Department, as you know, currently has an R&D budget of around $5 billion. That is consumed by 70-some GOCO's. What is less known is that there are about 6,000 other contractors around that support 45,000 researchers in the DOE family.

This results in two kinds of technical data being created, several classes, that that is published in technical report literature and that that appears in the open literature, then setting aside the patents applications and so on. The way that we have our system established permits us to acquire not only information on that literature that appears openly, but that that appears in the technical report literature. We store it in a rather sophisticated computerized activity and then categorize it. At the last part of my statement you will see a listing—the last page, as a matter of fact, of some of the various categories that we push this information into so that it can be easier to use by researchers within the country.

The data base itself, because of our participation not only in Department of Energy research and development programs but our interest in making available to DOE-funded researchers energy-related work that goes on in other parts of the United States, and, more importantly, in other parts of the world, is all incorporated into the same data base so that we are adding some 800 projects a day, valued anywhere from $50,000 to $300,000, just to give you a framework of the value of the research that is going on.

Mr. MORRISON. Excuse me, file size, is that number of entries, pounds, pages? What is the unit?

Mr. COYNE. File size is a description of a research project, a discreet research project.

Mr. MORRISON. So, when we talk about 1,757,000 research projects——

Mr. COYNE [continuing]. Projects——

Mr. MORRISON [continuing]. Are in your data base?

Mr. COYNE. That we have a description of and either have a full text, whole information, or data base descriptions of that project, or we know where to go get it.

So, by providing this system that flows that permits our researchers to go to the open literature and describe the work that they are doing, that meets some of the basic needs of scientists and engineers, in having peer review of their work. It also serves, just as importantly, we believe, as another technology transfer mechanism for the United States to consider. It is a part of a whole tracking base of technology transfer technical information that has worked very well, reasonably well in keeping the U.S. technologically advanced over other nations, I believe.

The question of why do we work so hard to gather all of this information into this data base within the confines of Energy R&D—let me just try and provide you a few examples. We have asked that same question ourselves: Why are we doing this? Why are we operating a centralized system within the Department of Energy as opposed to a decentralized system in other agencies?

One of the reasons is that the other agencies, some of the other agencies that are conducting R&D aren't quite sure where the results of that work is, how to get your hands on it. And another reason is that within the confines of the energy mission that we have described within the DOE, we know pretty well what kinds of information needs these researchers have, we thought we did.

So we went out and conducted a study, we conducted several studies, as a matter of fact, one of which has now been emulated by the Department of Defense. But we wanted to find out if, indeed, the researchers that are being funded by DOE, these 40,000, 45,000 researchers are actually using this information resource that we have created.

We found out, to our satisfaction, that they are, but also to the satisfaction of a lot of other people, because we were looking for a measurable, is it worthwhile?

We found out that the data base—and we have several studies that can be made available, if you are interested, for the record, that describe precisely what those measurements are in terms of dollar values, in terms of the amount of time researchers spend using information and what value they get out of the information that they use coming out of this data system.

Mr. MORRISON. We will include those in the record without objection.

[The information is available in subcommittee files:]

Mr. COYNE. One of the second reasons that we wanted to follow this approach is to make sure that the researchers have an opportunity to know what was going on before they commissioned new R&D expenditures. And, indeed, by way of example, the Department of Energy's Fossil Energy Program, at the program level, insists that their program managers come into these data bases, look at them before they commission new research and development to make sure that the new work is not tailored along the same path unnecessarily that a previous track has taken or that, perhaps, advantage can be taken of work already—that has already been completed to reduce costs.

We talked a little bit about the value of tracking DOE's funded R&D deliverables to make sure we get what we paid for.

I wanted to also emphasize that we are receiving considerable value in the work that we are receiving in from non-U.S. research. And I will talk a little bit more about that in a moment.

We've had some experiences in this country that when large technology projects have been discontinued, the research was not properly documented, captured, stored, so that if and when the pendulum swung again or that same research could be used on other work, it was not available. At least one example of that is the new space reactor work that was done in the 1950's and 1960's in which, in a recent effort to get SP-100 up, we found that NASA, Department of Defense, and the Department of Energy all had significant amounts of information relevant to the work. None of them had it adequately documented for use, reuse in this project. And we really, quite frankly, had to scramble in order to help get this project going.

If we had spent an extra small bit of money at that time and said the work has already been done, let's get it organized, it would have been ready to go today.

We have done that on the breeder reactor project. We have done that. We are in the process of completing that with the DOE program offices, and we can rest assured that if that technology is useful in the future, it will be available for rapid retrieval and use.

In addition, there are other ways in which this data file is available for technology transfer. One of them includes an effort by the people that are working on the arms control business. It turns out there is really not a very good arms control data base, disarmament data base, around in the United States. There has been little continuity over the years in terms of what we have been saying and what technologies we are trying to deal with. We are building on the knowledge that we have in our energy data base to create such a file for the people that are involved in that particular program.

So, generally speaking, any high priority national research effort that begins again must depend on a good data base system and organization.

We think that the unique system that we have in DOE contributes greatly both to R&D transfer and to productivity in the R&D process.

With regard to the Stevenson-Wydler Act, more specifically than to our support of DOE researchers, we have done a number of things. We do produce regularly the DOE patents available for licensing in both products and services that are available nationwide. They receive good distribution, and so if there is an opportunity for transfer there by looking at those documents, it can occur.

We also have a program very similar to the NASA program called Energygrams, in which we develop brief summaries of technology that we think is appropriate for commercial transfer. We have, quite frankly, depended on the work that NASA has done in measuring the effectiveness of those technologies brief programs. My feeling has been that that is a study that we don't need to conduct if NASA has done it pretty well. We will trust the work that their contractor did. And we feel the application is very similar.

But at any rate in this program we have established and produced over 1,000 of these Energygrams to date and they do receive the same kind of attention that you would hope that they would. That is, they go to professional societies, trade associations, and industrial groups which we believe are helping transfer the knowledge that is contained in those Energygrams around the country. In addition, we use Department of Commerce as a marketing source.

We also serve as the central point for the technology—the application assessment records program. And, to date, we have completed and put into the national distribution system some 500 of these particular records. And the program is improving, I would say, almost every week.

I wanted to talk a little bit more, in brief, about the foreign research results that we feel are a vital part of our technology base for several reasons. There is an executive order that directs the Secretary of Energy to acquire from any source possible, information from other countries on their progress in certain fields such as nuclear. One of the ways that the Secretary of Energy does that is through our program with other countries, through our participation in the International Atomic Energy Agency, and so on.

One of the significant things that we have felt in the Department of Energy has been that reciprocity must be a basis for work that we do with other countries. Until a few years ago, that was not well explicated, that feeling; it is now. And as a result, we have recently entered into agreements—recently, I mean knowing the length of time that these kinds of things take—have a protocol with France, with The Netherlands, with four Nordic countries, with the United Kingdom, with the Republic of Germany, and so on, to bring in the results of their work to the Department of Energy into other United States researchers.

One thing that I think I neglected to point out, Mr. Chairman, was that through the commercial mechanisms that we use to transfer information outside of the Department of Energy to U.S. firms is a very significant involvement in the commercial sector. We use those people, and it results in almost immediate access to the information we produce both domestically and that we acquire from other sources, to tens of thousands of U.S. firms in this country. So, that is another what I believe to be very significant form of technology transfer within the United States serving those people.

And the information is well used. The energy data base, as you might expect, happens to be one of the best used in the United States.

Another significant event that is occurring right now has been—and it goes along with this business of reciprocity—a statement of this department, I believe, is that it is going to do more to try and minimize the costs of research and development, conducting research and development, by working with other countries. It has also been a recent recommendation of the Energy Research Advisory Board. It turns out that the information policy that we have in place, which calls for reciprocity of technical information in exchange programs, fits very nicely with that direction. The International Energy Agency has 21 members. Last week the ministers of those countries met and agreed to establish a large centralized in-

formation program that will help the researchers know what is going on in that program.

A nicer thing about that is that the system probably will be located here in Oak Ridge, operated by OSDI. A nicer thing, yet, is that I think, we think that on the best estimates we have, that there are some 1 billion dollars' worth of research going on in those countries that we do not now have quick access to and that our management and the establishment of this data base will give us at least a first shot at that information, and, maybe, that is all we can hope for in the world today.

In summary then, I think, as you can see from what I've said, on the line that we have been following on the information transfer side in the business that I'm in, we have been pretty diligent for some years now in trying to create information bases that will be valuable not only to the DOE researchers but to U.S. firms and to encourage reciprocity with our non-U.S. participants, again, which, I say is quite a change from several years ago. And it gives us the balance, I hope, that we needed in setting the pace for informations programs in the future. Thank you.

[The prepared statement of Mr. Coyne follows:]