TECHNOLOGY TRANSFER AND PATENT POLICY: DOE AND OTHER PERSPECTIVES

HEARING

BEFORE THE

SUBCOMMITTEE ON
ENERGY RESEARCH AND PRODUCTION

AND THE

SUBCOMMITTEE ON
SCIENCE, RESEARCH AND TECHNOLOGY

OF THE

COMMITTEE ON SCIENCE AND TECHNOLOGY U.S. HOUSE OF REPRESENTATIVES

NINETY-NINTH CONGRESS

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*Ranking Republican Member.
**Serving on Committee on the Budget for 99th Congress.

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WITNESSES

TECHNOLOGY TRANSFER AND PATENT POLICY: DOE AND OTHER PERSPECTIVES

MONDAY, JULY 15, 1985

HOUSE OF REPRESENTATIVES, COMMITTEE ON SCIENCE AND TECHNOLOGY, SUBCOMMITTEE ON ENERGY RESEARCH AND PRODUCTION, AND THE SUBCOMMITTEE ON SCIENCE, RESEARCH AND TECHNOLOGY,

Oak Ridge, TN.

The subcommittees met, pursuant to notice, at 9 a.m., American Museum of Science and Energy, 300 S. Tulane Avenue, Oak Ridge, TN, Hon. Marilyn Lloyd and Hon. Doug Walgren, presiding.

Present: Representatives Lloyd, Walgren, and Morrison.

Staff present: Dr. John V. Dugan, Jr., staff director; Nelson Milder, technical consultant; James Turner, counsel; and Tim Peckinpaugh, Republican technical consultant.

Ms. LLOYD. The subcommittee hearing will come to order.

Good morning, ladies and gentlemen. It is certainly nice to have all of you here and we are certainly very happy that our witnesses have agreed to participate in the hearings today.

There has been increasing attention over the past several years to exploring mechanisms for maximizing the return on the Federal Government's investment in R&D. Today's hearing is a first step for the ERP Subcommittee in examining the various options available to the Department of Energy to enhance its ability to transfer federally funded technology. Both Congressman Walgren and I have been long-time advocates of strong technology transfer programs within the Federal Government beginning with NASA, and this is certainly shared with Congressman Morrison as well. NASA was the agency pioneer for technology transfer under our committee's jurisdiction. My distinguished colleague, Mr. Walgren, approaches this topic from a more general perspective across the Federal agencies, and he has been involved with the other subcommittee chairmen in recent patent policy legislation.

The billions of dollars which this country spends in its various research programs to develop technology for applications to national missions is certainly applicable to other areas of our economy as well. In addition to the organic acts creating the agencies, the Congress has provided strong legislative incentives, such as the Stevenson-Wydler Act, to direct the various mission agencies within the Federal Government, such as the Department of Energy, NASA, and the National Science Foundation, to carry out vigorous technology transfer programs. Our ultimate aim is to closely examine the technological innovations resulting from research and develop-

ment programs within each of the agencies and determine their applicability to solving problems in areas of our national need. My particular interests are Department of Energy and Oak Ridge, but I would hope that they can also capture lessons learned by other agencies. Such innovative technology may be applied in areas not directly related to the original intent of the Federal funding for these technological innovations. The effort to transfer technological know-how from the developer to another party, which is commonly referred to as technology transfer, has been extremely successful throughout the Federal Government and yet there remains a much greater potential for applicability of these fruits throughout the economy. I would also remind everyone that there are many mechanisms for technology transfer, ranging from cost-shared Federal and industry research and development to the more directly identifiable process where the developer seeks out potential customers who may not be sure that such technology meets their needs.

It is particularly appropriate that we have this first hearing at Oak Ridge since it is the unique center for technology transfer with active programs at ORNL, ORAU, and with the OSTI functions, a major technology transfer tool is also housed here. There has been considerable interest by the State and other parties in enhancing the high technology thrust in this region, and it is a healthy climate to encourage such spinoffs.

In addition to subsidizing programs directly related to transferring technology, the Congress has had a prime legislative objective directed toward modifying Federal patent policies in such a way as to assist the agencies and the Federal laboratories in carrying out these transfer, technology transfer activities. In some cases, these efforts have been successful, but perhaps in other areas, Federal patent policy has actually served to deter or to inhibit the effective use of federally funded technologies in the development of commercial products in other segments of our national economy.

It is our intent today to hear the testimony of witnesses who have strong vested interests in federally sponsored technology transfer programs and the patent policies and other elements which comprise the set of Federal tools to carry out these programs. Our witnesses cover a broad spectrum of economic activity, ranging from the technology areas funded by the Federal sponsors of these programs, through the national laboratories who must implement and carry out the technology transfer tasks, to the industry that stands to gain heavily from successful and well managed technology transfer activities within the Federal Government. Moreover, there are many universities who also benefit from and are involved in such Federal programs. It is my hope, based upon the information obtained from today's inquiry, our subcommittees can gain a better insight as to how to proceed to assure that the Federal Government, the national laboratories, the industries and our universities can all work jointly to implement strong programs. These programs should not only provide an important ingredient of technological innovation to many segments of our economy, but their implementation will also allow us to make maximum use of the technical talents residing in those individuals and employees of industry and the Federal Government who have made these technological innovations possible.

Before we hear our first witness, I would like to ask my good friend, Mr. Walgren, to give his opening statement. Good morning, Doug. We certainly welcome you to Oak Ridge and the Third District of Tennessee.

[The prepared opening statement of Representative Lloyd follows:]

HON. MARILYN LLOYD'S OPENING REMARKS—HEARING ON "TECHNOLOGY TRANSFER AND PATENT POLICY: DOE AND OTHER PERSPECTIVES"—JULY 15, 1985

Good Morning. There has been increasing attention over the past several years to exploring mechanisms for maximizing the return on the Federal Government's investment in R&D. Today's hearing is a first step for the ERP Subcommittee in examining the various options available to the DOE to enhance its ability to transfer federally-funded technology. Both I and our Co-Chairman have been long-time advocates of strong technology transfer programs within the Federal Government beginning with NASA, which was the agency "pioneer" for technology transfer under our Committee's jurisdiction. My distinguished colleague, Mr. Walgren, approaches this topic from a more general perspective across the Federal agencies, and he has been involved with the other subcommittee chairmen in recent patent policy legislation.

The billions of dollars which this country spends in its various research programs to develop technologies for applications to national missions is certainly applicable to other areas of our economy as well. In addition to the organic acts creating the agencies, the Congress has provided strong legislative incentives, such as the Stevenson-Wydler Act, to direct the various mission agencies within the Federal Government, such as the Department of Energy, NASA and the National Science Foundation, to carry out vigorous technology transfer programs. Our ultimate aim is to closely examine the technological innovations resulting from the research and development programs within each of these agencies and determine their applicability to solving problems in areas of our national need. My particular interests are DOE and Oak Ridge, but I would hope that they can also capture "lessons learned" by other agencies. Such innovative technology may be applied in areas not directly related to the original intent of the Federal funding for these technological innovations. The effort to transfer technological know-how from the developer to another party, which is commonly referred to as technology transfer, has been extremely successful throughout the Federal Government and yet there remains a much greater potential for applicability of these fruits throughout the economy. I would also remind everyone that there are many mechanisms for technology transfer, ranging from cost-shared Federal/industry R&D to the more directly identifiable process where the developer seeks out potential "customers" who may not be sure that such technology meets their needs.

It is particularly appropriate that we have this first hearing at Oak Ridge, since it is a unique center for technology transfer (T2) with active programs at ORNL and ORAU, while the OSTI function, a major T2 tool, is also housed here. There has also been considerable interest by the State and other parties in enhancing the high technology thrust in this region and that is a healthy climate to encourage such spin-offs.

In addition to subsidizing programs directly related to transferring technology, the Congress has had a prime legislative objective directed towards modifying Federal patent policies in such a way as to assist the agencies and the Federal laboratories in carrying out these technology transfer activities. In some cases, these efforts have been successful, but perhaps in other areas, Federal patent policy has actually served to deter or inhibit the effective use of federally-funded technologies in the development of commercial products in other segments of our national economy.

It is our intent today to hear the testimony of witnesses who have strong vested interests in federally-sponsored technology transfer programs and the patent policies and other elements which comprise the set of Federal "tools" to carry out these programs. Our witnesses cover a board spectrum of economic activity, ranging from the technology areas funded by the Federal sponsors of these programs, through the national laboratories who must implement and carry out the technology transfer tasks, to the industry that stands to gain heavily from successful and well-managed technology transfer activities within the Federal Government. Moreover, there are many universities who also benefit from and are involved in such Federal programs. It is my hope that, based upon the information obtained from today's inquiry, our Subcommittees can gain a better insight as to how to proceed to assure that the Federal Government, the national laboratories, the industry and our universities

can all work jointly to implement strong programs. These programs should not only provide an important ingredient of technological innovation to many segments of our economy, but their implementation will also allow us to make maximum use of the technical talents residing in those individuals and employees of industry and the Federal Government who have made these technological innovations possible.

Before we hear our first witness, let me ask my friend Mr. Walgren to give his opening statement. Good morning, Doug, and welcome to Oak Ridge and the Third District.

Also, the Ranking Republican on our Subcommittee, a good friend and very involved member, Mr. Sid Morrison is here. I welcome you to Oak Ridge and look forward to your statement.

Mr. WALGREN. Thank you very much, Marilyn. It is really interesting and a real privilege to join you in these hearings in Oak Ridge. I have come from Pittsburgh, PA, and have never been to Tennessee before, and it is always interesting to go to visit another Member's district.

In this case, since the warmth and the supportiveness of the community here for you and measuring that against my own, which we are always measuring, as people who will run for election sometime soon, I really wish I could change places with you and——

Ms. LLOYD. Well, if the gentleman will yield, I am not in the mood to change places, but I am sure you are equally welcomed in your home State.

Mr. WALGREN. I am the chairman of the Science, Research and Technology Subcommittee, as Mrs. Lloyd is the chairman of the sister subcommittee in our overall Science and Technology Committee in the Congress. I have served on that committee for the last 10 years, and only feel that now I am beginning to learn of the depth of the resources that are available to this country.

In looking back over those years, I especially appreciate the piece of Oak Ridge that Mrs. Lloyd has brought to Washington and the appreciation for the science pool that has been built in institutionally into the memory of the committee over the years by Mrs. Lloyd. It has also been a real eye-opener for me to work with her on some very difficult projects, particularly the process of passing a comprehensive nuclear waste bill.

When I went to the Congress, some of the interests in my community were lamenting the fact that we had no policy in that area at all. Indeed, most people felt that it was not likely that the National Government develop a policy for the disposal of the kinds of nuclear waste which we were generating. But through the focused pursuit of that issue by Mrs. Lloyd, that certainly has come to be a reality on the national level. And I learned a lot in that process from her.

We are now both involved in particularly trying to develop some clean coal demonstration uses, something that is very needed in this country, something that my district will appreciate very much, as I know will Tennessee. And it looks like we are being successful in that area, as well.

It is a great pleasure for me to come and join you particularly in your district because of that history that you and I have had together over those several years. It is also hard, I think, to think of a more appropriate location than Oak Ridge for our committees to look at this question of the transfer of technology into the private sector, or for the benefit of the private sector, that has developed

out of the massive Federal research effort that we have. The committees are very aware of the achievements of Oak Ridge National Laboratory over the years, and in fact in technology transfer Oak Ridge looms large, particularly within the Department of Energy. It is my understanding that Oak Ridge accounts for some 70 percent of the revenues that are attributable to technology that has been developed within the Federal research effort and transferred in one form or another to commercial use. Seventy percent of the Department of Energy's royalties and the like that come from that are attributable solely to the effort that has been developed at Oak Ridge. And when you think of the breadth of the National Laboratory effort, that is quite a testimony to something good that has happened in this facility.

This hearing will represent the third day of hearings that my particular subcommittee has had on the question of technology transfer this year. As a Science Policy Subcommittee, we have general jurisdiction over the policies of the Federal Government that attempt to encourage transfer and where the origin of the original Stevenson-Wydler Act and also the reform of the patent law that we had on the Federal level just last year. So we, as a committee, are very interested in trying to improve the incentives that lead to that kind of benefit to society.

We did last year extend contractor ownership of patents to nonprofit organizations but not to those run by forprofit organizations with respect to Government-operated, Government-owned contractor-operated laboratories. But the legislative history and our intent in that process was very clear, in which we specified that although we could not statutorily change the treatment of forprofit GOCO laboratory situations, we intended the Department of Energy to establish as uniform a patent policy for these kinds of laboratories as is permitted by the law. There is a very wide range of discretion in the Department of Energy to make the transfer incentives uniform across the board, regardless of whether it is a profit or a nonprofit entity that is operating such an entity.

We are looking very much forward to hearing from the Department of Energy to hear what progress they are making in following that mandate of the Congress, which is to incorporate the changes that we have made in the patent area and make them as applicable as possible to Government-owned and contractor-operated laboratories and particularly these.

So, in bringing the staff of the subcommittee and making a record here today, we really feel that we are embarked on important concerns. Knowing the almost, well, the very widespread impact on local economic development of advances in knowledge and the new technologies have a much broader impact on a regional economy than do just one particular entity or one particular work force, we feel that there is much progress to be made in this area. The Federal Government is making a massive investment and we want to make sure that that investment is driven toward the benefit of the public, region by region, as it possibly can. So, in bringing the staff and particularly in making the record we make today, we will take back to us to Washington an ability to examine and reflect on the comments that are made to the subcommittee in

this hearing process. And we are very hopeful that something good and constructive can come from that.

I appreciate the opportunity to be with you, Marylyn, and look forward to the testimony.

[The prepared opening statement of Representative Walgren follows:]

OPENING REMARKS OF CONGRESSMAN DOUG WALGREN: OAK RIDGE HEARING

It is a pleasure to join with my colleague, Congresswoman Lloyd in cosponsoring these hearings on technology transfer. Mrs. Lloyd over the past decade has been a tireless advocate for the Oak Ridge area in the Congress and she has made us well aware of the great things this area's unique group of scientists and engineers has to offer. Mrs. Lloyd is a highly regarded Member of Congress who has had more than her share of tough battles to fight. Through it all she has maintained the goodwill of Members of Congress from both parties. She has shown herself to be an effective legislator by her hard work in getting a comprehensive nuclear waste bill enacted, a feat many thought was impossible given the great divisions within the Congress and the multitude of committees involved in the process. More recently, it has been a pleasure to work with Mrs. Lloyd to achieve a balanced energy policy for our country through the clean coal initiatives we both strongly support.

It is also hard to think of a more appropriate location than Oak Ridge, Tennessee to continue our exploration of better ways to get technology out of the federal laboratories and into the marketplace. We are well aware of the tremendous achievements of the Oak Ridge National Laboratory over the years and of the superior manufacturing techniques employed at the Y-12 facility here in Oak Ridge. As one of the few world-class research operations that is also engaged in state of the art manufacturing, I am sure that Oak Ridge has a lot to teach the rest of us. Today, we will talk a about what legislative and procedural changes are needed to make this happen.

For my subcommittee, this is the third day of hearings this year on technology transfer. We have received testimony from a wide variety of witnesses on proposed legislation to extend authority to all government laboratories to enter cooperative agreements, to institutionalize the federal laboratory consortium, and to improve the system of rewarding inventors who work directly or indirectly for the federal government. We may mark up legislation in this area in the Fall.

My subcommittee also considered last year's reform of federal patent policy, which extended contractor ownership of patents to GOCOs operated by non-profit organizations, but *not* to those run by for-profit organizations. Our legislative history is clear that, while we could not get agreement on the specific statutory change which formally would have changed the patent policy of Martin Marietta Energy Systems, we intended DOE to establish as uniform a patent policy for GOCOs as is permitted by law. Therefore, as part of this hearing we hope to learn what progress is being made in the impremention of this policy in Oak Ridge and to determine what further legislative changes, if any might be necessary.

Therefore, I look forward to today's testimony on technology transfer and patent policy, and to sharing in the wealth of information on these topics that today's witnesses have accumulated.

Ms. LLOYD. Thank you very much.

I might add that I think it is worthy to note that Members of Congress do make a great deal of personal sacrifice to attend hearings such as this across the United States. So, for that reason, I am even more grateful for Congressman Walgren being here. He has twin babies that need a lot of support, as well, and also Congressman Morrison flew in on the redeye—I am certain many of you are familiar with that—from Washington State.

We do welcome our ranking Republican on our subcommittee. He is certainly a good friend of mine and I have worked very closely with him as well. Mr. Sid Morrison, we certainly welcome you and look forward to your statement.

Mr. MORRISON. Thank you very much.

If it is all right, Madam Chairman, since I think I feel like I am a part of the Oak Ridge family this morning, to put my formal statement in the record and let me just make a couple of comments.

Ms. LLOYD. Without objection.

[The prepared statement of Representative Morrison follows:]

OPENING STATEMENT OF THE HONORABLE SID MORRISON, DOE TECHNOLOGY TRANSFER AND PATENT POLICY: JOINT FIELD HEARING IN OAK RIDGE—JULY 15, 1985

Good Morning. Today, our two Subcommittees will continue our review of one of the most important legislative issues facing our Committee—the transfer of technology from our national laboratories to the private sector. I welcome all of the witnesses who have joined us this morning in Oak Ridge, and I also extend a special thanks to my Chairman, the Honorable Marilyn Lloyd, for acting as our warm host for this joint field hearing.

For too long we have watched our substantial Federal investment in research not be translated into tangible innovative developments in private industry. I have always marveled at the ingenuity, sophistication, and creativity of our national labs. These elite laboratories—particularly the Department of Energy labs—are the jewels of our Federal investment in science and technology. We must harness the outstanding talents and resources of these institutions for the good of the entire nation.

To achieve this objective, we must facilitate the transfer of technology from the DOE labs to private enterprise. We must, however, approach this problem realistically, without compromising the primary Federal R&D missions of the national labs. "Tech. Transfer" has become a sexy buzz phase which everyone seems to support. The time has come to translate this very popular concept into concrete action.

A major component of technology transfer has become patent policy. The National laboratories must have sufficient control of the patents for technology developments conceived in their labs. The Congress and the Administration have made substantial progress on this front. But besides providing for a waiver of government ownership of patents, we also must give the labs the resources they need to pursue the development and approval of patents. Other important topics include direct private sector interaction, royalties, and other incentives aimed at encouraging the transfer of innovations from the laboratory to industry.

I look forward to exploring all of these options today as we continue to lay the foundation for legislative action. Thank-you Madam Chairman and Chairman Walgren.

Mr. MORRISON. First of all, an appreciation to you for the hospitality that has been shown in meeting an early-morning flight not too far from here.

Just to comment in this subject area that, as a relative newcomer to this committee, I have always marveled at the ingenuity, the sophistication and the creativity of our national labs, and I am sure Oak Ridge is very much in the category of providing the innovation that America now calls for as more and more of our citizens talk about high tech and all of these things that have become popular buzz words.

I appreciate, too, as Congressman Walgren has indicated, the opportunity to visit Oak Ridge, the beauty of the area, the diversity of the programs that I understand to be here. And I have to, just on a personal note, mention that I was pleased to see a Reactor Room just down the street a little ways. It makes me feel almost at home, since I represent the Hanford area, and people may occasionally give us a bad time. While I wasn't here in time to go into the Reactor Room, I understand from my staff that a chain reaction is possible.

I have had the privilege of sitting in with Congressman Walgren on at least one of his previous subcommittee hearings on the sub-

ject of technology transfer. From that and from talking with a lot of people in the area I represent, I understand some of the difficulties that we have. I am eager today to learn more about the complications when you are dealing with a forprofit government contractor as opposed to the nonprofit, which is more familiar in my particular area.

I understand that substantial progress has been made in this whole area in previous sessions of Congress, and, very frankly, I look forward to being part of the committee. Speaking for the members of my side of the politican aisle, we want to join you in whatever can be done in speeding the way for technology transfer done as it should be done, in fairness to America's taxpayers. And so I look forward to the session that you have set up today.

Thank you very much.

Ms. LLOYD. Thank you very much. And at this point, I would like to ask unanimous consent of the subcommittee to permit today's hearings to be recorded and covered by the media as well as other persons.

Without objection, so ordered.

We are ready now to hear from our witnesses. And I would like to state for the record that their complete written statements will be made part of the official hearings. And we have asked our witnesses to summarize their remarks in their oral presentations today if they so desire.

Our first witnesses this morning are from the Department of Energy's headquarters in Washington. Ms. Antoinette Grayson Joseph is the Director, Office of Field Operations Management, and Mr. Richard Constant is Assistant General Counsel for Patents. We very much appreciate both of you making this trip to Oak Ridge today. We look forward to your testimony. Ms. Joseph, you may proceed at this time.

STATEMENT OF ANTOINETTE GRAYSON JOSEPH, DIRECTOR OF FIELD OPERATIONS MANAGEMENT, OFFICE OF ENERGY RESEARCH, DEPARTMENT OF ENERGY

Ms. JOSEPH. Thank you.

Madam Chair, Mr. Chairman, and Congressman Morrison, I am pleased to appear before you today to discuss the Department of Energy's technology transfer policies and to present my view of how these policies have affected DOE laboratory technology transfer programs.

The laboratories and technology centers of the Department of Energy are a major part of the U.S. technology base. Over the years, the technology generated in mission areas of the Department of Energy has been reapplied by industry for use in commercial products and processes. Nuclear power, nuclear medicine, radiation processing, ion implantation, materials science advances, fluidized bed combustion, and supercomputers are but a few of the extensive technology transfers that have come about as a result of research and development sponsored by the Department of Energy. Oak Ridge National Laboratory is a leader in this area.

We have encouraged the transfer of research and development from these institutions to the private sector. Our Government lab-

oratories are encouraged to support the broader effort to improve technology transfer to U.S. industry by identifying appropriate laboratory technology; identifying and informing interested firms or investors; and supporting, by making laboratory facilities and staff available to industry, those developmental efforts necessary to commercialize spinoff technology.

You will hear from Bill Carpenter in some detail about the recent success of Martin Marietta in these areas, including the new technology exchange research program initiatives funded by the Office of Energy Research. So I will not go into those at this point.

The Department of Energy R&D Laboratory Technology Transfer Program is managed by the Office of Energy Research and was implemented in response to the Stevenson-Wydler Technology Innovation Act. The program establishes the institutional policy and the framework for technology transfer to the domestic, public, and private sectors. Each laboratory has full flexibility to implement the activities in the most suitable fashion for its own mission and organizational circumstances.

The overall purpose of the technology transfer program, as you stated, is to facilitate improved utilization by State and local governments and the private sector of federally funded technology developments in order to strengthen the U.S. industrial base and our competitive position in the international marketplace.

The DOE policy is established by a Departmental Order which reflects the intent of the legislation that technology transfer be integrated into the operation of each R&D laboratory. The Secretary of Energy has said that a fundamental role of the laboratories is to provide the technology they develop to the public and private sectors and to facilitate cooperation between the national laboratories and industry. In order to improve on our technology transfer efforts, the Department continues to address potential improvements and policies relating to work for others, patent licensing, and incentives to technology transfer. The laboratories are encouraged to propose new initiatives to facilitate spinoff of technology developed at the laboratory to domestic industry and to improve the technology transfer process itself. Bill Carpenter will also report on some successful ORNL programs in this area, funded by the Office of Energy Research.

Each laboratory is required to establish an Office of Research and Technology Applications. Under John Foderstone, the ORTA at ORNL has enhanced the person-to-person interactions between laboratory researchers and potential public and private users of the technology which we believe are the key to the program's approach.

Consistent with the intent of Public Law 96-480, the Department publishes the Research and Development Laboratory Technology Transfer Program Annual Report. This publication, essentially a compilation of laboratory technology transfer reports to DOE, summarizes the highlights of technology transfer activity at the major Department laboratories. Recent examples of technical benefits of the energy programs range from the commercial development of thin-film photovoltaic cells to better technology for treating industrial and municipal waste.

The report lists technology applications, assessments, and technical information Energygrams by laboratory, and provides a listing of laboratory program contact personnel. I would like to provide our most recent copy for the record, along with a copy of the User's Guide to DOE facilities. These user facilities are an important mechanism for cooperative R&D and associated technology transfer at Oak Ridge National Laboratory and at our other major laboratories across the Nation.

Ms. LLOYD. Without objection, it will be included.

[The information follows:]

DOE/ER-0192/1

U.S. Department of Energy
Office of Energy Research
Director of Laboratory Management

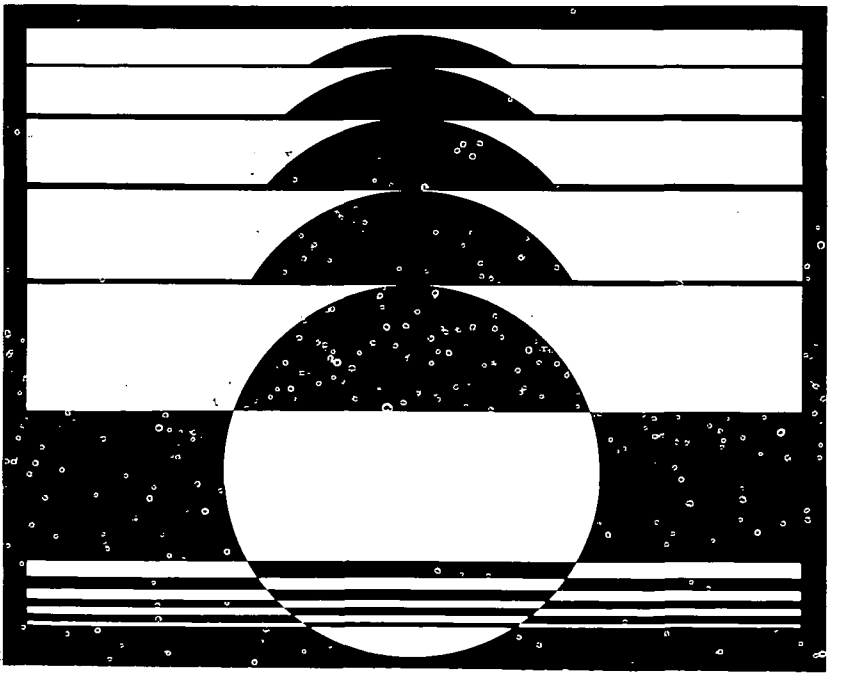
August 1985

Technology Transfer '84

Fiscal Year Annual Report

U.S. Department of Energy
Research & Development Laboratory
Technology Transfer Program

Complete Report on file in Subcommittee Offices



INSERT to TRANSCRIPT OF JULY 15 HEARING ON TECHNOLOGY TRANSFER AND PATENT POLICY
SPEAKER: MS. JOSEPH

Department of Energy (DOE) Multiprogram
National Laboratories
Technology Transfer Indicators

The estimated data below is for the nine DOE multiprogram national laboratories and should be considered preliminary.

The laboratories included in the survey are: Argonne National Laboratory, Brookhaven National Laboratory, Idaho National Engineering Laboratory, Los Alamos National Laboratory, Lawrence Livermore National Laboratory, Oak Ridge National Laboratory, Pacific Northwest Laboratory, and Sandia National Laboratories.

	FY 1982	FY 1985
Joint Projects Number	50	125
User Facilities Companies Represented*	70	100
Technology Transfer Workshops Number	55	105
Industrial Consulting by Laboratory Staff Number	540	810
Companies Started by Laboratory Personnel and/or Based on Spin-off of Laboratory Technology Number	11	23

*A copy of trends on visitors from 1981 to 1985 at user facilities from Brookhaven National Laboratory is also enclosed as a specific example for your information.

VII. EXTERNAL INTERACTIONS

LABORATORY COLLABORATIVE RESEARCH CENTERS

User Facilities

	1981	1982	1983	1984	1985
Alternating Gradient Synchrotron					
Number of Users	157	245	309	324	335
BNL	50	72	77	47	76
Visitors	107	173	232	277	259
% Use					
BNL	31	29	25	15	23
Visitors	69	71	75	85	77
Total Operating Costs ($M)	25.5	24.2	30.4	34.1	36.1
Tandem Van de Graaff					
Number of Users	116	133	109	115	55
BNL	22	22	20	18	11
Visitors	94	111	89	97	44
% Use					
BNL	56	55	49	43	25
Visitors	44	45	51	57	75
Total Operating Costs ($M)	1.7	1.8	1.5	1.5	1.5
High Flux Beam Reactor					
Number of Users	211	203	202	240	235
BNL	44	42	35	34	35
Visitors	167	161	167	206	200
% Use					
BNL	42	43	48	45	42
Visitors	58	57	52	55	58
Total Operating Costs ($M)	4.1	4.7	5.8	6.5	8.0
National Synchrotron Light Source					
Number of Users	—	57	90	137	300
BNL	—	16	21	35	50
Visitors	—	41	69	102	250
% Use					
BNL	—	28	23	26	25
Visitors	—	72	77	74	75
Total Operating Costs ($M)	—	7.4	9.7	11.9	14.45

	1981	1982	1983	1984	1985
Scanning Transmission Electron Microscope					
Number of Users	24	24	26	42	46
BNL	5	4	6	8	8
Visitors	19	20	20	34	34
% Use					
BNL	35	43	38	40	40
Visitors	65	57	62	60	60
Total Operating Costs ($M)	0.4	0.4	0.4	0.4	0.5

Ms. JOSEPH. Thank you.

Technology transfer is difficult at best, as many people with experience both from the industrial and laboratory sectors have noted. Roland Schmitt, who is senior vice president of corporate R&D at General Electric, has made the point that technology transfer is really a misnomer; it is really technology teamwork between R&D organizations and it needs to start early on and continue long after the first innovation. From the first year's experience with Martin Marietta, I think they understand this concept totally.

Given recent policy incentives from headquarters, there is growing movement in our laboratories toward increased interaction with industry and universities in the transfer of our technology to the domestic economy. The Department will continue to support innovative technology transfer programs and to encourage our laboratories to stimulate the invention, patenting, and transferring of unclassified new technology. Therefore, I believe this positive trend will continue.

I would be pleased to try to answer any questions you may have.

[The prepared statement of Ms. Joseph follows:]

PREPARED STATEMENT OF ANTOINETTE GRAYSON JOSEPH

Introduction

Mr. Chairman and members of the Subcommittee, I am pleased to appear before you today to discuss the Department of Energy's (DOE) technology transfer policies and to present my view of how these policies have affected DOE laboratory technology transfer programs.

Department of Energy Efforts

The laboratories and technology centers of the Department of Energy are a major part of the U.S. technology base. Over the years, the technology generated in mission areas of the Department of Energy has been reapplied by industry for use in commercial products and processes. Nuclear power, nuclear medicine, radiation processing, ion implantation, materials advances, fluidized bed coal combustion, and supercomputers are but a few of the extensive technology transfers that have come about as a result of research and development sponsored by the Department.

We have encouraged the transfer of research and development from these institutions to the private sector. The researchers in our laboratories have a natural motivation to see their discoveries utilized for the national good. The key to our technology transfer policy and program is person-to-person interactions between our laboratory researchers and industry counterparts. Success also lies in American industry's motivation to obtain Government-developed technology from the laboratories. The Department has established technology transfer as a

vitally important secondary role of the laboratories which should be implemented so as to reinforce the primary laboratory research and development missions.

Our Government laboratories are encouraged to support the broader effort to improve technology transfer to U.S. industry by:

- o identifying appropriate laboratory technology;
- o identifying and informing interested firms or investors; and
- o supporting, by making laboratory facilities and staff available to industry, developmental efforts to commercialize spin-off technology.

The DOE R&D Laboratory Technology Transfer Program, managed by the Office of Energy Research, was implemented in response to the Stevenson-Wydler Technology Innovation Act (P.L. 96-480). The program establishes the institutional policy and framework for technology transfer to the domestic public and private sectors. Each laboratory has full flexibility to implement the activities in the most suitable fashion for its own mission and organizational circumstances.

The overall purpose of the technology transfer program is to facilitate improved utilization by State and local governments and the private sector of federally-funded technology developments in order to strengthen the United States industrial base and competitive position in the international marketplace.

The DOE policy is established by a Departmental Order which reflects the intent of the legislation that technology transfer be integrated into the operations of each R&D laboratory. The Order, DOE 5800.1 (Research and Development Laboratory Technology Transfer Program), states: "It is DOE policy that technology transfer activities as required by Public Law 96-480 are legitimate functions of the R&D laboratories and will be conducted, as appropriate, at those laboratories specified in this Order." The Order details the objectives of the program, the responsibilities and authorities of relevant Departmental elements, and requires a technology transfer report each year from participating laboratories to communicate achievements and identify issues.

The Secretary of Energy has said that a fundamental role of the laboratories is to provide the technology they developed to the public and private sectors and facilitate cooperation between the national laboratories and industry. Providing technology transfer does not imply a change in the primary program mission nature of the laboratories but complements their technology development programs and facilitates use of the product of these programs by their spin-off to our national industrial base.

In order to advance the DOE technology transfer program, the Department and the laboratories must seek means of improving the transfer of technology from Government-sponsored R&D programs.

Therefore, the Department continues to address improvements in policies relating to work for others, patent licensing, and incentives to technology transfer. The laboratories are encouraged to propose new initiatives to facilitate spin-off of technology developed at the laboratory to domestic industry and to improve the technology transfer process itself.

Offices of Research and Technology Applications

Each laboratory is required to establish an Office of Research and Technology Applications (ORTA). In laboratories with budgets over $20 million/year, the ORTA is staffed by a full-time professional. Small laboratories may add the ORTA function to an existing position. In any event, the person-to-person interactions between laboratory researchers and potential public and private users of the technology are the key to the program's approach. In general, the ORTA:

- o Provides a central coordination point in the laboratory for technology transfer;
- o Provides support to technology transfer activities of the laboratory's scientific departments;
- o Identifies opportunities to improve the technology transfer process and to encourage spin-off of technology developed at the laboratory;
- o Facilitates one-on-one interaction between laboratory scientific personnel and technology recipients;

- o Disseminates information on laboratory technology having potential application in private industry or State and local governments;
- o Ensures that Application Assessment Records are prepared for research projects with potential for application in State or local governments, or private industry;
- o Cooperates with Government information clearinghouses that link the laboratory, the Federal Government, and potential users in State and local governments and private industry;
- o Provides technical assistance in response to requests from State and local government officials; and
- o Prepares Laboratory Technology Transfer Annual Report.

Application Assessment Records

The Application Assessment Records provide a standardized format for reporting information about laboratory R&D with potential for application in other sectors and meet the legislation requirement that laboratories report on technologies which they identify as having potential for application in private industry or State and local governments. The ORTA sends completed Application Assessments to the DOE Office of Scientific and Technical Information. That office incorporates the information in DOE data bases, publishes it in the DOE Energygram series, and transmits it to the National Technical Information Service for further dissemination.

DOE R&D Laboratory Technology Transfer Program Annual Report

Consistent with the intent of P.L. 96-480, the Department publishes the Research and Development Laboratory Technology Transfer Program Annual Report. This publication, essentially a compilation of laboratory technology transfer reports to DOE, summarizes the highlights of technology transfer activity at the major Department laboratories, lists technology application assessments and technical information Energygrams by laboratory, and provides a listing of laboratory program contact personnel.

Conclusion

Technology transfer is difficult at best, as many people with experience both from the industrial and laboratory sectors have noted. Roland Schmitt, Senior Vice President, Corporate Research and Development, General Electric Company, has made the point that "technology transfer" is a misnomer--it is really "technology teamwork" between R&D organizations and it needs to start early on and continue long after the first innovation. Abdus Salam, Director of the International Center for Theoretical Physics in Trieste, has emphasized the importance of "science transfer." These statements emphasize person-to-person interactions between laboratory scientists and their industry counterparts. Our policies emphasize the same person-to-person interactions.

Given recent policy incentives from Headquarters, there is growing movement in our laboratories toward increased interaction with industry and universities in the transfer of our technology to the domestic

economy. The Department will continue to support innovative technology transfer programs and encourage our laboratories to stimulate the invention, patenting, and transferring of unclassified new technology. Therefore, I believe this positive trend will continue.

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

Ms. LLOYD. Thank you very much, Ms. Joseph.

Mr. Constant, you may proceed with your statement, and your complete remarks will be made a part of the record, so you may summarize as you wish.

STATEMENT OF RICHARD E. CONSTANT, ASSISTANT GENERAL COUNSEL FOR PATENTS, DEPARTMENT OF ENERGY

Mr. CONSTANT. Thank you. Madam Chair, Mr. Chairman, Congressman Morrison, I will present my prepared statement first and then Ms. Joseph and I will be available to answer any questions.

In order to use the patent system to promote utilization of inventions arising from federally supported research or development, Public Law 96-517, enacted in 1980, provided that nonprofit organizations or small businesses may elect to retain title to subject inventions made under funding agreements with the Government. However, the law provided exemptions to this approach for funding agreements for the operation of Government-owned research or production facilities, referred to as GOCO's, or in exceptional circumstances when it is determined that restriction or elimination of the right to retain title will better promote the policy and objectives of the act.

Public Law 98-620, enacted in late 1984, amended Public Law 96-517 by modifying the exemption for GOCO facilities. It limits the exemption to DOE facilities primarily dedicated to naval nuclear propulsion or weapons related activities, and then further limits the exemption to inventions occurring under these specific programs at those facilities. The exemption for exceptional circumstances remains in the amended act.

Under the provisions of Public Law 98-620, to be implemented by regulations being written by the Department of Commerce, GOCO facility operators which are nonprofit organizations or small businesses will be permitted to retain ownership of inventions made by personnel of the facilities they manage and operate, unless the contract or invention in question falls within one of the exemptions provided in the statute.

The exemptions described above are enumerated in section 202(a) of the law and include cases in which a determination of exceptional circumstances has been made. The Department has made exceptional circumstances determinations for uranium enrichment, for civilian radioactive waste and spent fuel storage and disposal, and for all classified subject matter and unclassified but sensitive subject matter. In accordance with the provisions of the law, exceptions will also be made for work covered by international agreements.

The regulations being written by the Commerce Department are expected to cover DOE's use of the exemptions for GOCO facilities primarily dedicated to the weapons related and naval nuclear propulsion programs of DOE. According to the draft regulations made available to DOE, nonprofit and small business operators of such facilities would be permitted to retain ownership of inventions made at these facilities occurring outside the weapons and naval nuclear propulsion programs. Inventions occurring in these programs would be owned by the Government. However, the facility

operator could request waivers for these latter inventions on a case-by-case basis, consistent with current policy. Rights to inventions for for-profit contractors are still determined by the provisions of section 152 of the Atomic Energy Act of 1954 and by section 9 of the Federal Nonnuclear Research and Development Act of 1974. Under these provisions, title to inventions arising under contracts with for-profit contractors vests with the Government unless waived. The Department policy is to allow contractors to retain title to inventions to the maximum extent possible, consistent with the President's memorandum on patent policy, applicable statutory authority and mission requirements.

The Department intends to pursue a series of class waivers covering different contractual situations. These class waivers will permit the for-profit contractor to elect to retain rights to inventions arising under its contract in which the contractor has a commercial interest. The contractor, in order to qualify for the waiver, will have to exhibit a serious intention to develop the invention to the point of practical application either by the contractor or by its licensee. Exceptions to these waivers will fall into the areas of exceptional circumstances, weapons-related and naval nuclear propulsion technologies and work covered by international agreements.

As an example of the Department's activities in licensing and waivers over the last few years, I have put together, from a cursory review of our files, a few statistics that may be of interest. The Department has granted 47 nonexclusive patent licenses and 19 exclusive patent licenses in the last 4 years. The Department has also waived 220 identified inventions in the same period to its contractors for use in their commercialization efforts. Also, in the last 4 years, the Department has waived at the time of contracting all inventions arising under 110 contracts to encourage commercialization of contract efforts by the contractor. In other words, for the fiscal years 1981 to 1984 the Department retained title to a total of about 1,400 U.S. patent applications filed on its behalf and waived rights to its contractors to at least 600 U.S. patent applications filed on their behalf. That means that about one out of every three inventions arising under DOE contracts, in which the Government normally would have retained title to the inventions and which have resulted in filing of patent applications, have been waived to the contractor. These numbers do not take into account patent applications filed by small business and nonprofit contractors who retained rights under Public Law 96-517. Also, the patent rights to which DOE retained ownership are available to the public for licensing under the authority of 35 U.S.C. 207.

If I can answer any questions related to these matters, I would be pleased to do so.

[The prepared statement of Mr. Constant follows:]

PREPARED STATEMENT OF RICHARD E. CONSTANT

In order to use the patent system to promote utilization of inventions arising from federally supported research or development, Pub. L. 96-517, enacted in 1980, provides that nonprofit organizations or small businesses may elect to retain title to subject inventions made under funding agreements with the Government. However, the law provides exemptions to this approach for funding agreements for the operation of Government-owned research or production facilities (GOCO's) or in "exceptional circumstances" when it is determined that restriction or elimination of the right to retain title will better promote the policy and objectives of the Act.

Public Law 98-620, enacted in late 1984, amended Pub. L. 96-517 by modifying the exemption for "GOCO" facilities. It limits the exemption to DOE facilities primarily dedicated to naval nuclear propulsion or weapons related activities, and then further limits the exemption to inventions occurring under specific programs at those facilities. The exemption for "exceptional circumstances" remains in the amended Act.

Under the provisions of Public Law 98-620, to be implemented by regulations being written by the Department of Commerce, "GOCO" facility operators which are nonprofit organizations or small businesses will be permitted to retain ownership of inventions made by personnel of the facilities they manage and

operate, unless the contract or invention in question falls within one of the exemptions provided in the statute.

The exemptions described above are enumerated in section 202(a) of the law and include cases in which a determination of exceptional circumstances has been made. The Department has made "exceptional circumstances" determinations for uranium enrichment, for civilian radioactive waste and spent fuel storage and disposal, and for all classified subject matter and unclassified but sensitive subject matter. In accordance with provisions of the law, exceptions will also be made for work covered by international agreements.

The regulations being written by the Commerce Department are expected to cover DOE's use of the exemption for "GOCO" facilities primarily dedicated to the weapons related and naval nuclear propulsion programs of DOE. According to the draft regulations made available to DOE, nonprofit and small business operators of such facilities would be permitted to retain ownership of inventions made at these facilities occurring outside the weapons and naval nuclear propulsion programs. Inventions occurring in these programs would be owned by the Government. However, the facility operator could request waivers for these latter inventions on a case-by-case basis, consistent with current policy.

The Department intends to pursue a series of class waivers covering different contractual situations. These class waivers will permit the contractor to elect to retain rights to inventions arising under its contract in which the contractor has a commercial interest. The contractor, in order to qualify for the waiver, will have to exhibit a serious intention to develop the invention to the point of practical application either by the contractor or by its licensee. Exceptions to these waivers will fall into the areas of exceptional circumstances, weapons-related and naval nuclear propulsion technologies and work covered by international agreements.

As an example of the Department's activities in licensing and waivers over the last few years, I have put together, from a cursory review of our files, a few statistics that may be of interest. The Department has granted 47 nonexclusive patent licenses and 19 exclusive patent licenses in the last 4 years. The Department has also waived 220 identified inventions in the same period to its contractors for use in their commercialization efforts. Also, in the last 4 years, the Department has waived at the time of contracting all inventions arising under 110 contracts to encourage commercialization of contract efforts by the contractor. In other words, for fiscal years 1981-1984 the Department retained title to a total of 1,399 U.S. patent applications filed on its behalf and waived rights to its contractors to at least 605 U.S. patent applications filed on

their behalf. These numbers do not take into account patent applications filed by small business and nonprofit contractors who retained rights under 35 U.S.C. 202. The patent rights to which DOE retained ownership are available to the public for licensing under the authority of 35 U.S.C. 207.

If I can answer any questions related to these matters, I would be pleased to do so.

Ms. LLOYD. Thank you very much, Mr. Constant.

You both gave very enlightening testimony.

Ms. Joseph, you stated in your conclusion that technology transfer is difficult, at best. What has been the total dollar investment by the Department to meet the requirements of the Stevenson-Wydler Act in our technology-transfer-related activities at the laboratory? Do you have a figure that you could use?

Ms. JOSEPH. What we have done is ensured that the requirement in the Stevenson-Wydler Act, one-half of 1 percent on technology transfer, is indeed clearly expended on those kinds of activities, which, to be honest, a total dollar level that looks very accurate would be hard to come by. The way the Department of Energy operates in technology transfer in the program responsibility at, say, the Fusion Program Level, or the Fission Program Level, and there are dollars that are spent as a natural program development expenditure that would have to be taken out of the program dollars to calculate—quote—technology-transfer true expense. We haven't tried to do that because those things that are clearly technology transfer do go far beyond the one-half of 1 percent expenditure requirement.

Ms. LLOYD. I didn't really feel like you could give me a dollar estimate, but I was looking for some general figure.

What efforts have been made to really determine the economic benefits from the technology transfer from the national laboratories?

Ms. JOSEPH. One of the efforts that is underway is to put a panel together, some people from the National Academy of Sciences, to look at this question based on the questions we get at congressional hearings on the appropriations, because of the difficulty of explaining how basic research, for example, is something that can be translated into a product that the private sector ultimately benefits from. The examples that we have from the early days of the Atomic Energy Commission are obvious. Nuclear power came from the early basic research. In the early days of the Atomic Energy Commission, the whole nuclear medicine application field, which someone estimates is over $8 billion now as a commercial enterprise, came out of that nuclear research. Those kinds of things are being looked at in this study to determine whether or not you can put that kind of conclusion on tech transfer from these research efforts. The problem, of course, is that there is a lot of other interaction before it actually becomes a product. And the difference between the applied part of it and the actual part of the process that the private sector does is the part that is hard to calculate. What we'll be showing is the impact of basic research on the final product in the marketplace.

Ms. LLOYD. You build on your base as you progress in development of the technology——

Ms. JOSEPH. It's really——

Ms. LLOYD [continuing]. Certainly can't really quantify it to that degree.

The other DOE agencies, for example, the Office of Nuclear Energy Programs, support the technology-transfer programs. How well do you work with the other offices in coordinating activities?

Ms. JOSEPH. In coordinating activities with the other offices, very well. I think the special aspect of the Department of Energy is the integration of these programs that can take place in the laboratory. You have a laboratory like Oak Ridge National Laboratory that serves all the program activities of the Department of Energy, and has a central activity related to technology transfer that promotes transfer of the result from all of those programs to the marketplace. And so we work with the program planners at headquarters and we work with implementors at the laboratories.

Ms. LLOYD. Well, you really led me into the final question I want to ask you: What progress is being made to really coordinate and implement the programs here at the Oak Ridge National Laboratory in technology transfer? Are we moving in that direction since so much is done here in Oak Ridge?

Ms. JOSEPH. I think that the progress in tech transfer has been accelerated with the change of contractor to Martin Marietta. I think Martin Marietta as exemplified in the contract itself has a very strong commitment to tech transfer, and it is part of the determination of the management fee that will go to Martin Marietta in terms of their success in the technology transfer. So you have a double incentive at Oak Ridge that doesn't exist at all of the other laboratories. And I think that it is already reflected in the results ranging from the number of IR 100 awards that Oak Ridge National Laboratory has won, to the numbers of patents that they have identified that they are interested in commercially.

Ms. LLOYD. Ms. Joseph, do you think some of the bills that have been introduced this year, if they should happen to become law—there are some variations but basically they have one major thrust—do you think this would help to implement technology transfer and profit GOCO's, such as Oak Ridge?

Ms. JOSEPH. My personal opinion is that additional legislation is not required. I think that statutory opportunities are there and it is now a matter of implementing those in a fulsome way and speeding up some of the processes that exist.

Ms. LLOYD. In other words, you think that right now we need to be busy complying with the laws that we have instead of trying to formulate new laws?

Ms. JOSEPH. And as a bureaucrat, I appreciate some of the flexibility we can give the laboratories to tailor implementation to their own circumstances as compared to additional laws that might be very good at spelling out broadly what should be done, but it gets into too much detail at the implementation part that actually——

Ms. LLOYD. It really stifles innovation, in Congress.

Ms. JOSEPH. Exactly.

Ms. LLOYD. Thank you very much.

Mr. Constant, in looking over your statement, on page 2, you are talking about the exemptions enumerated in section 202(a) of the law. It includes cases in which a determination of exceptional circumstances has been made. Would you interpret this to mean that we could consider it exceptional circumstances to really study and make an evaluation of the transfer of technology such as the spinoffs in our AGC Program here?

Mr. CONSTANT. The exceptional circumstances described is for uranium enrichment and would be broad enough to cover the gas

centrifuge. We do—which would except them from retaining rights under any class waiver that we would propose. However, any inventions that come under any exceptional circumstance are available to contractors through our normal waiver process for them to retain rights. And under our proposed class waiver, they will be enabled to request rights for fields of use that are outside of uranium enrichment under the class waiver.

Ms. LLOYD. For instance, through the spinoff of such technologies as biomedical research or SDI Programs?

Mr. CONSTANT. Yes. They would be able to qualify under the class waiver to receive rights for those types of activities that are outside of uranium enrichment itself.

Ms. LLOYD. Very good.

It has been about a year and a half now since the Department of Energy began to negotiate class waivers with Martin Marietta energy systems. I was wondering if you could give us the status of these negotiations, Mr. Constant?

Mr. CONSTANT. Probably. It is unfortunate that it has taken us this long. It is a matter—a lot of it can be laid probably to the circumstances and timing. The advance, Martin Marietta originally asked for an advance waiver under our authorities of section 9 of the Federal Non-Nuclear Research and Development Act and under section 152 of the Atomic Energy Act. We are progressing well along on that. When the Public Law 98-620 was passed in the fall, when that law was passed, the Department, in order to maintain uniformity in its patent policy, initiated an internal review of its patent policy to assure that such uniformity continued under the new situation. That work was completed in February and, since then, we have been awaiting the Commerce regulations on how they want us to implement the existing legislation so that we can incorporate that into our policy and provide uniformity in how we approach Martin Marietta in our class waivers.

Ms. LLOYD. The Department of Commerce has not issued their regulations at this time, but if they should issue their regulations within 1 month and if Martin Marietta negotiates in good faith, how long do you think it would take before the Oak Ridge class waivers could take effect?

Mr. CONSTANT. The class waivers themselves are under review within the Department now. We're not waiting for the regulations to come out to continue our review. I would expect that within several months at the most, after the issuance of the Commerce regs, we should be able to go forward with the request waivers, ensuring that uniformity continues.

Ms. LLOYD. What do you think is the toughest outstanding issue right now?

Mr. CONSTANT. The toughest, there are a series of toughest. The toughest issue, I suppose, in many respects would be agency and possibly with the program people. And Mrs. Joseph could probably respond to that. Maybe in the area of the unknowns as to the possible liabilities that the Government may be subjected to by its contractors entering into licensing agreements. Since, under our GOCO system, the Government absorbs all the costs that the contractor may incur, including most liability costs, it is possible that we may be subjected to those liability costs under these licensing

activities, and the Agency has to deal with that issue and how to approach that.

Ms. LLOYD. That is certainly a major current consideration.

One final question for you, Mr. Constant. Congressman Fuqua, in his Congressional Record explanation of the GOCO provisions in last year's patent bill stated as follows, I would like to read it: While those laboratories such as Oak Ridge National Laboratory, which are run for the Government by large companies are not formally covered by this section, it is hoped that the Department of Energy, using Federal Non-Nuclear Act authority will develop a standard patent policy consistent with this title for all its GOCO facilities.

I just wanted to ask you what problems, if any, do you see in extending this provision to Martin Marietta Energy Systems.

Mr. CONSTANT. The problems are more into the area of the implementation than to the—we have the same problems with Martin Marietta as we have with our nonprofit GOCO's in the areas of conflicts of interest and in assuring that there are not conflicts of interest arising from such activities, maintaining some control over the costs that might be—the Government may incur not only liability costs, but also consideration of patenting and licensing costs, and also assuring that the commercial activities do not impact on the ability of the Agency to continue carrying out its mission responsibilities and ensuring the free flow of information from one lab to another.

Most of our GOCO's in performing their work cooperate with other GOCO's in performing the same mission type of activities.

Ms. LLOYD. But isn't that true that Oak Ridge has the same—I mean, that works both ways. Oak Ridge works with other laboratories——

Mr. CONSTANT. Yes.

Ms. LLOYD [continuing]. That are nonprofit.

Thank you very much.

Would you like to comment further on that, Ms. Joseph?

Ms. JOSEPH. No, I agree. From a program standpoint those are the issues, and the conflict of interest one is one that is either industrial or the not for profits, that the Department has to take into consideration, how it ensures that with laboratories that are a very important part of our program planning, as well as the implementation, how to ensure that conflict of interest as it relates to the patents doesn't impinge on the kind of advice that we get and take.

Ms. LLOYD. Thank you.

Mr. Morrison?

Mr. MORRISON. Mr. Constant, you mentioned the regulations the Department of Commerce is working on. Do you have any idea on the timing on when those can be finalized?

Mr. CONSTANT. No, I don't.

Originally, they were hoping to get them out out in the early part of July. The last I spoke to them, which is about a week ago, they couldn't give me any estimate of the date.

Mr. MORRISON. So, they are making progress?

Mr. CONSTANT. Yes, they are. They are reviewing the comments that our Agency, as well as other agencies and the public have pro-

vided and looking at what revisions they should make in the original proposed draft.

Mr. MORRISON. Rather than a number of detailed questions for either or both of you, I guess as I begin to understand some of the difficulties associated with technology transfer, I get the impression that even once all systems, when all systems are go, there is no question as far as proceeding with a good idea and developing it for applications somewhere, that the time, the expense and the difficulty of getting the patent plus the even greater difficulty then of making the huge step up into actual "here it is, world, bring your money"—what seems to be the best technique, in your eyes, to squeeze this technology on up into the sector where someone else will provide the financing, at a very low rate, as I understand, of good ideas that actually are latched onto by someone to the point of developing them and making them available?

Mr. CONSTANT. In terms of patenting, the percentages are quite low. In terms of inventions that are patented that actually reach the commercial market and the real income that is received from it is quite low, as I understand it from most studies that are made on the subject.

Mr. MORRISON. Is this because the ideas are not that good or just that they have not been presented properly?

Mr. CONSTANT. It is not that. It may be that there is already something on the market that does it just as well or is not as expensive, or maybe it is not quite as good, but the new one may cost too much money to get it on the market. It is a very complex subject to get from invention to commercialization. I know, reading some testimony recently made by—I think it was Battelle Northwest Laboratories, they indicated that it takes some 7 years to get from the point of invention to the point where they are receiving income, on an average, on most of their inventions. Of the ideas which they are studying—I believe the numbers, they said something like, out of 20,000 ideas, they obtained maybe 20 that they thought were, that actually were really used.

Mr. MORRISON. They had the advantage of the first one with Xerox——

Mr. CONSTANT. That's right.

Mr. MORRISON [continuing]. Which was nice.

Ms. JOSEPH. One of the things there seems to be a consensus on, in other words there is no single formula. The person-to-person interactions, particularly with the laboratory people with the private sector counterparts are the most important ingredient in the process itself, and that what you need then is a real entrepreneur, sometimes in the laboratory, sometimes from the outside; and the spinoff companies that come from the laboratory—and Oak Ridge is a good example of those kinds of transfer—have the greatest success of the working. People then transfer with their ideas and continue to promote it. But there is no baton passing, as in a relay race. It's not nice and clean. I have this idea and all someone has to do is grab the baton and take it on to commercialization.

Mr. MORRISON. I guess what I worry about is that, as in so many elements of Government, I see interference in this baton passing, if you will. Admittedly, there is no clean break. It would be ideal if we had someone probably like you making the decisions. But we

worry about that. I think that is why Congress has a tendency to even meddle in some areas, just to make sure that there are some clean lines, if possible. And I would trust, as a result of these hearings, we don't do anything wrong.

Ms. LLOYD. Well, that's certainly our mission.

Ms. JOSEPH. I think the hearings have really facilitated attention within the Department to this activity. And even though I can truthfully say this has always been the DOE's responsibility, the spotlight shining on this area, people's report cards getting graded specifically on how well they are doing has really acted in terms of increasing the results in this area. I do not say that for all the areas where Congress has inspired us to do more on something we think we are already doing. But in the area of technology transfer, I think institutionalizing the process and bringing it up to high-level attention under Stevenson-Wydler has significantly aided the bureaucracy in being able to continue to push in this direction.

Mr. MORRISON. We probably will want to do some pulling, too. Thank you.

Ms. LLOYD. I think it is worthy of thought. Thank you very much.

Mr. Walgren?

Mr. WALGREN. Thank you, Mrs. Lloyd.

Even though, Ms. Joseph, we say you feel that there is significant increase in delivery in this area, we really have no measure of that, do we?

Ms. JOSEPH. We do, but it is mostly anecdotal data. We do not have a final line that says: there are these many products, there are these many dollars invested, and here is the benefit based on the cost invested. The anecdotal data based on reports from the laboratories and implementing technology transfers, the kind of forums where the laboratories now participate, which judge technology innovation ideas, like the IR 100 Magazine Awards, the very fact that the numbers of awards that the laboratories have been winning over the past few years in an area where you are looking at all R&D across the country, including the industrial laboratories, that the national laboratories' percentage, their total number of awards in this category is going up consistently, whereas I think this year—last year it was 17 awards to the laboratories, this year we're up to 20 awards. And probably the single——

Mr. WALGREN. Out of how many?

Ms. JOSEPH. Out of a 100. IR 100 is—the 100 awards for the 100 best technical ideas that they believe, based on peer evaluation, will make it into the marketplace. Oak Ridge, I think, is the leading laboratory in our system in this area, but has only been actually winning those awards in the past 4 or 5 years.

Mr. WALGREN. How many did Oak Ridge win?

Ms. JOSEPH. Four or five last year, which was one of the highest percentages of any single winner in the process.

Mr. WALGREN. Of course, there are variables in that. And I guess my wish is that we have more than anecdotal evidence or we're taking some kind of steps to see what does work, because what I hear in this area is that the first effort was to have an office for technology transfer in the individual laboratories. Then as we grapple with the real world, which is never what we want it to be, we

want to do more. And now everybody is saying, well, you have to have this interaction, this team work between the private sector and those actually working in the Government laboratories. And that may be, but I would think that that would be something that we could measure.

Are there steps within the Department of Energy to make an accurate quantitative measure of the increase in hours spent together, if that's——

Ms. JOSEPH. The number of meetings that are held to promote technology transfer, are recorded in the book as well, and we can trace those over time, and they are increasing significantly.

Mr. WALGREN. All right. But I gather they are talking about something other than meetings and symposia, but actual working together in a laboratory so that they spend their informal time together and the like. Is there any measure that you could devise that might tell us whether the laboratories are doing more or less of that sort of contacting?

Ms. JOSEPH. The policy is to promote that the Department of Energy promotes more joint projects between industry and laboratory.

Mr. WALGREN. How are you going to tell whether the policy is implemented and the degree to which the policy is picked up?

Ms. JOSEPH. This is one of, I think, the hardest areas that we have been pushing as well, because it is very difficult to tell a program person that, in addition to your understanding how best to implement your program, I want to ensure that you have this aspect involved. The program may say, the way I take care of that aspect, that objective, is through an industrial advisory committee that meets once a month to review the program plans, the R&D objectives, or criteria, et cetera. Therefore, in our area, what we are doing is trying to ensure that the objective is kept up front, but not to dictate that there has to be a certain percentage of joint industry laboratory research projects or that there has to be a certain number of symposia in a given area or a number of industrial people on all advisory committees. But we do look at those numbers. There is an increase. We do that internally for the Secretary, and through what we would call seed money type funding, we have promoted that.

One of the programs that I run is the University Research Support Program and, under that, I run the Laboratory Cooperative Program. In that category, we also have a recently funded initiative which Senator Domenici has promoted, which is an industrial fellowship program, and that a high-level industry person, maybe two or three for each laboratory, when we get the funding up to reasonable levels, will specifically spend, say, a year to two years, or maybe shorter periods, back and forth during that time, at a laboratory working on a joint project with a technology transfer component to that project.

Mr. WALGREN. What is the history of that funding in that particular program?

Ms. JOSEPH. We have $600,000 for this current year, and we are about to announce over a dozen appointments to the laboratories.

Mr. WALGREN. So, you can get 12 appointments this year. How many did you have last year?

Ms. JOSEPH. It was the first year.

Mr. WALGREN. So this is the first year of the seed money program?

Ms. JOSEPH. This is the first year of the separate seed money program. Last year, I am not sure how many joint appointments there were, but they would be in the hundreds across the board.

Mr. WALGREN. Can you find that out and submit it?

Ms. JOSEPH. We can, with some difficulty.

Mr. WALGREN. Because the problem that we have, who only see this briefly several days a year, is that it is very hard to see the additional effort that is being made. The answer that comes back is, well, we are implementing the Stevenson-Wydler Act by doing just what we always did, which is to not have an identified person but publish the same kinds of things that we were publishing before. That is one of the ways that is cited in the act to promote technology transfer. So, the laboratories came back and said, "We are doing it just like we did before." And it is very hard to see a new effort being made. And given the difficulties of turf and the like in a bureaucracy, it is very easy to see that somebody will continue to do what they have always done in that area and that we won't get anything new, we won't get any new push out of it.

To say, as we have now, after 5 years of experience with the Congress wanting to see something new happen under Stevenson-Wydler, that essentially we cannot account for any effort because it was always subsumed under what the expenditures were anyway, I think, is something that we ought to recognize is not an adequate measure of our effort under this act; and we ought to be looking for ways to document what is happening.

Ms. JOSEPH. I do not want to give you the wrong impression. There are areas that are easy to document, which we have documented, and which do show substantial progress. And in the areas where we are continuing to do what we have done, in those areas that are significant accomplishments and unique to the Department of Energy, we have continued the user facility activity of the Department, is a significant technology transfer contribution. And——

Mr. WALGREN. Can you measure that in terms of man-hours and value of access? And then can you go back and do a history of that so that we can see whether there is additional effort being given in this area, or are we just doing what you did not need to be told to do?

Ms. JOSEPH. We can show that there is additional effort and there are new facilities like the National Light Source at Brookhaven National Laboratory, where participation by industry is 40 percent of the participation.

[The information follows:]

INSERT FOR THE RECORD

List of DOE-owned patents that have been exclusively licensed since inception of the Department of Energy.

Invention	Licensee
U.S. Patent No. 3,624,772 "Reading and Writing Machine Using Raised Patterns"	Research for Braille Communication Chicago, IL.
U.S. Patent No. 3,687,804 "Compact and Safe Nuclear Reactor"	Energy Conversion Systems Inc. Toronto, Ontario, Canada
U.S. Patent No. 4,094,492 "Variable Orifice Using an Iris Shutter"	B & B Enterprises Livermore, CA.
U.S. Patent No. 3,803,481 "Leak Detector"	Comstock, Inc. Oak Ridge, TN.
U.S. Patent No. 4,253,190 "Communications Systems Using a Mirror Kept in Outer Space by Electromagnetic Radiation Pressure"	Electronics Missiles and Communications, Inc. White Haven, PA.
U.S. Patent No. 4,152,248 "Hydrogenation of Coal Liquid Utilizing a Metal Carbonyl Catalyst"	Pentanyl Technologies, Inc. Boulder, CO.
U.S. Patent No. 4,169,280 "Method for Making Glass Nonfogging"	Anthony's Manufacturing Company, Inc. San Fernando, CA.
U.S. Patent No. 3,987,302 "Resonance Ionization for Analytical Spectroscopy"	Atom Sciences, Inc. Oak Ridge, TN.
U.S. Patent No. 4,274,394 "Electromechanical Solar Tracking Apparatus"	Stromberg Enterprises Albuquerque, NM.
U.S. Patent No. 3,786,838 "Method of Extracting Heat from Dry Geothermal Reservoirs"	Pan American Energy Corp. Los Alamos, NM. 87544
U.S. Patent No. 3,378,685 "Infrared Nondestructure Testing Technique" U.S. Patent No. 3,672,204 "Transient Thermal Method and Means for Nondestructively Testing a Sample"	United Western Technologies Corp. Richland, WA.

U.S. Patent No. 4,442,018 "Stabilized Aqueous Foam Systems and Concentrate"	Coulston International Corp. Albany, NY.
U.S. Patent No. 4,409,643 "Long Lifetime, low intensity, light source"	Alan M. Frank Livermore, CA.
U.S. Patent No. 3,533,273 "Thermal surface impedance method and means for nondestructive testing"	United Western Technologies Corp. Richland, WA.
U.S. Patent No. 4,265,982 "Coasted Woven Materials and Method of Preparation"	Progressive Technological Coatings, Inc. Pearland, TX.
U.S. Patent No. 3,957,031 "Light Collectors in Cylindrical Geometry"	University of Chicago Chicago, IL.
U.S. Patent No. 4,230,095 "Ideal Light Concentrators with Reflector Gaps"	University of Chicago Chicago, IL.
U.S. Patent No. 4,114,592 "Cylindrical Radiant Energy Direction Device"	University of Chicago Chicago, IL.
U.S. Patent No. 4,237,332 "Nonimaging Radiation Energy Direction Device"	University of Chicago Chicago, IL.
U.S. Patent No. 4,252,777 "Recovery of Aluminium and Other Metal Values from Fly Ash"	P.I.D. Associates Hendersonville, NC.

Information on actual commercial utilization of the licensed inventions is incomplete. Since many of the exclusive licenses (11 of 21) have been granted within the last eighteen months, it is probably too soon for significant commercialization results to have materialized as to those inventions, particularly since the underlying inventions are generally undeveloped inventions requiring substantial private development efforts. Indeed, 17 of the 21 licenses were granted in the last three years.

One licensee, Atom Sciences Inc. has advised that it has brought the Resonance Ionization Spectroscopy technology (for analysis of trace elements) to commercialization, having been financed entirely with private funds.

Other licensees have reported some progress in pursuing commercialization efforts, e.g. financing efforts, and building and testing of prototypes.

Mr. WALGREN. Let me ask you, then, to go back, and if you can, without doing a big research project that is probably not in anybody's interest, if you can give us some information about the history of the user access. And if you can add to that any documentation of the teamwork contact historically, because I think we need to know whether anything more is being done now than was being done before. If the answer is 12 additional people in the teamwork aspect, that is not enough, and we deserve to know that, the public deserves to know that, and we have to try to add more effort in that area.

So, if you could review that with some submission, give us a chance to get our teeth into it and follow up on it, I would appreciate it.

Mr. WALGREN. I wanted to just wonder with you, Mr. Constant, about these numbers in here. When we ask ourselves how well we are doing under this, we said 19 exclusive patent licenses in the last 4 years. Now, exclusive patents are really the patents that drive, as I understand it, inasmuch as if you give a nonexclusive patent, anybody can jump into the pool and operate without any direct exclusive benefit certainly. So, we are really talking about five patents, an average of five patents a year over 4 years for the whole Department of Energy. Shouldn't there be more in there than that?

Mr. CONSTANT. I do not think, Mr. Chairman, that you can overlook the nonexclusive licenses, either. Under the provisions of the licensing authority under Public Law 96-517, in order to even get a nonexclusive license, the licensee has to show a plan for commercialization of those inventions. So, even nonexclusive licenses do indicate a strong commercialization. It just happens that there are some inventions that exclusivity, for one reason or another, is not required.

So, even though, as you say, 19 is not a large number, I think you have to combine that with the 47 nonexclusive licenses and look at the total picture.

In addition, I do not have the figures with me, but those 19, are a significant increase from what the Department has done in the past. Prior to that time, I believe there were only a few exclusive licenses granted by the Department.

Mr. WALGREN. Well, that's certainly what we're trying to—that is the problem we are trying to get at, and I hope we're coming up rather quickly. If it's possible to—if anybody has this view without looking at it too long, I wonder whether those licenses, there are 19 exclusive patent licenses, can be tracked into economic activity. We know who holds them, and we know the history of their economic performance. It would be interesting to see whether it is easy to get at the increase in the economic work, whatever numbers of jobs or numbers of dollars in the bottom line of whoever holds those licenses to see if there is not some quick way to look at whether or not holding an exclusive patent license from the Department of Energy has been helpful at all in these years to that entity.

Perhaps you could give us a start on looking at that by giving us a list of who they are and any other description that you could. And maybe together with you, we could look for the rest of the answer to that question.

Mr. CONSTANT. I think, too, Mr. Chairman, in terms of exclusive licensing, the waiver numbers that I quote in there, the 600 patent applications that have been waived to contractors, in those cases they do, they have received the exclusive rights to those inventions, also.

Mr. WALGREN. The 600 come under where you waive at contracting, any interest in what comes out of it?

Mr. CONSTANT. Yes.

Mr. WALGREN. You waive at the time of contract?

Mr. CONSTANT. That number includes those inventions that were waived at time of the contracting and those that were identified when the invention arose.

Mr. WALGREN. So, approximately 550 waived at time of contract and a little over 69—47 nonexclusive and the 19 exclusive.

You mentioned 1,400 patent applications in which you retained title. How many of those were with respect to classified technology, classified areas?

Mr. CONSTANT. I do not have that information, but I could get that for you and insert it for the record.

Mr. WALGREN. I think that would be helpful to try to see what it is that the Department of Energy is retaining.

[The information follows:]

There are 95 patent applications that are classified.

Mr. WALGREN. You mentioned that you are considering field-of-use licensing for title to developments which may be directly applicable in a classified area or a sensitive area. You feel you can get that out into other fields by approving the use of patent rights for field of use?

Mr. CONSTANT. Yes.

Mr. WALGREN. Has that happened yet?

Mr. CONSTANT. No, the class waivers have not been implemented yet which will provide for that. It is not for the classified and the sensitive, but it is for the other exceptional circumstances, the uranium enrichment and the high-level waste, civilian high-level waste technologies.

Mr. WALGREN. In thinking about how fast these waivers for this class of laboratories are going to be implemented, it is my understanding that the Commerce Department is really about to do it. We know what their regulations look like. They have gone through the preliminary publication. They are about to issue their final regulations in that area. How long does it take the Department of Energy to pick those in a formal approval and sign off on a waiver for an operator like Martin Marietta at Oak Ridge?

Mr. CONSTANT. Under the class waiver, it will be done by a process located at the field level only, once the class waivers are implemented. We have no experience on those, but we are anticipating that it will be within several weeks to a month.

As an example of how rapidly we can move on such waivers, when Martin Marietta identified to us that there were a series of inventions in which they were in licensing negotiations and needed a waiver right away and which were being held up because we did not have the class waivers implemented yet, we were able to process those waivers from the time we were notified at headquarters

that they were critical, and had the waivers approved, I believe it was within 9 to 10 days after the request came in. So, we can move fast when we have to, and I believe that under these new waiver proposals, they will move much more rapidly than in the past.

Mr. WALGREN. So, you expect that to come out within, literally momentarily. So, if you are only talking about 30 days or so to implement it on the field level, by the end of September this relationship should be settled?

Mr. CONSTANT. I believe, yes, it should be.

Mr. WALGREN. Are there outstanding unresolved issues between the Government and the operator at Oak Ridge that could create problems in that they're asking for certain indemnities and that has not been agreed to yet?

Is that something which we can anticipate coming back here 6 months from now and finding that as a government we had so much difficulty with that that we decided not to do anything?

Mr. CONSTANT. I believe there are some difficulties, and there are some areas that have not been finalized. The efforts to date have been between the Operations Office and Martin Marietta. Those negotiations and the determinations that they make will come to headquarters for approval at some point. We are in anticipation of those issues coming to headquarters, already looking at them, so that we can respond to them rapidly when they do reach us formally. The whole key is getting the class waiver approved and then receiving their——

Mr. WALGREN. Do you have problems with what the field representatives of the Department of Energy have agreed to with respect to the operator in this instance?

Mr. CONSTANT. We have questions——

Mr. WALGREN. By that I mean the headquarters review function. Is that—have you identified elements which you would not agree to at this point?

Mr. CONSTANT. We haven't reviewed it formally to the point where we can say that we agree or disagree on specific points. There are areas that we will have concern and which we will have to look at very closely, and which our program people will also have to look at closely when it comes up to be sure we do not have a problem.

It is possible that we may ask them to go back and renegotiate some point to something different, I don't know, but I do not know that at this point.

Mr. WALGREN. What are the areas that are most difficult for you?

Mr. CONSTANT. It would be in the areas that I mentioned earlier. It would probably be in the area of potential liabilities from licensing activities, the allowable costs for licensing activities, the areas of conflict of interest to ensure that they have addressed them to our satisfaction.

Mr. WALGREN. Let me ask you, it's hard for that to have much life, in my mind, the area of conflict of interest. It is obvious that you can have a conflict of interest. How do you address that? What are some of the elements that go into addressing that? Or is it that we look at it and say it is acceptable or it is not acceptable conflict? How do you minimize it?

Mr. CONSTANT. Mr. Chairman, I guess what we described is the minimizing it. You can't eliminate it. There is no way that you can eliminate it. It is a fact of life. The commercialization effort raises them to a higher level than we would be faced under a normal contract activity.

The Agency, in my opinion, would be looking at them to see whether it felt comfortable that the opinions it would be receiving from its contractor, when it asked for the contractor to make recommendations in mission areas, that the contractor was aware of conflicts, problems and was doing the most it could do under those circumstances to minimize them to some acceptable level.

Mr. WALGREN. So it is more in choosing the direction of the work of the laboratory at that point. The management of the laboratory, you want to be sure, guides the laboratory in an area toward the maximum public interest as opposed to pursuit of a more narrow interest. And you want to see that issue considered in a management structure. Is that what you are saying?

Mr. CONSTANT. Correct, yes.

Mr. WALGREN. Thank you, Madam Chairman.

Ms. LLOYD. Thank you, Mr. Walgren.

And thank you, Ms. Joseph and Mr. Constant. You have proved to be very good witnesses and we appreciate your ability and appreciate your being here today.

Our next witness is Mr. William Carpenter. Mr. Carpenter is vice president of technology applications at Martin Marietta Energy Systems. Martin Marietta, as everyone here knows, operates the Oak Ridge National Laboratory. We are particularly interested in what Mr. Carpenter has to say, since I hear that you are known as the godfather of technology transfer for the lab. So, we are very interested in your remarks today.

We do have a copy of your complete statement. You may summarize or proceed as you wish.

STATEMENT OF WILLIAM W. CARPENTER, VICE PRESIDENT, TECHNOLOGY APPLICATIONS, MARTIN MARIETTA ENERGY SYSTEMS, INC., OAK RIDGE, TN

Mr. CARPENTER. Thank you very much, Madam Chair. Good morning, ladies and gentlemen.

I have prepared a written statement and it is available in the prescribed number of copies. So, I won't spend a great deal of time in summarizing that.

To listen to the preceding discussion has been helpful. And perhaps in addition to a brief summary of my submitted testimony, I can address our view, the view of Martin Marietta related to some of the issues that your committees have already surfaced.

First of all, let me say that, as a corporation we are indeed—I hope we are both a large firm and a profitmaking firm. That is our objective. And although it complicates the issue of the patent policy, I hope no apology is required for either circumstance. As a company, we certainly endorse the positions that your committee has taken in terms of both the need and the method for accelerating technology transfer and the benefit to us as a Nation, that we think you are on a very pertinent and vital issue. We are support-

ive really of the measures that we have seen come out in revised and improved legislation dating from 1980.

We, of course, in viewing the potential long range benefit of technology transfer, one must conclude, and we certainly agree, that technology is going to be—good technology is going to be a primary determinant in the future economic health of our Nation and our ability to compete internationally to a good extent.

The U.S. Government is the largest creator of technology in the free world. When we spend, from the U.S. Government approximately $50 billion a year, and that constitutes not only half of our total R&D expenditure investment as a Nation, but it consumes half of our very valuable skill pool of scientists and engineers. And we certainly agree with what we feel the sentiment of your committee activities have been, to recognize that we can no longer afford to partition off Government R&D and consider it separate from commercial derivative advantage.

We must get two for the price of one if we're going to compete well with the Japanese and West Germans, and we should indeed be able to, when our expenditures on R&D, as a nation, exceed the total expenditures of Japan, West Germany, France, and the United Kingdom put together. So we should fare better than we are in the technology competition on an economic front.

In order to do that, we should seek larger commercial advantage, derivative advantage of our Government R&D expenditures. We think the potential for that, although the track record in technology transfer has been encouraging since 1980, it is our view that we have not yet really tapped the potential of identifying commercial advantage from these Government R&D expenditures.

As has been noted, Martin Marietta is the operator and managing contractor for the Department of Energy facilities here in Oak Ridge. We have had that happy responsibility since April of 1984. When we were engaged in the competition to operate and manage those facilities in 1983, we sensed that the mood was that we should propose bold measures to accelerate technology transfer and that the environment was correct, it was receptive, and that this large shift in national policy was more possible in 1983 than it had ever been before. And so we were asked by the Department of Energy, who I think also sensed this changing mood; and, of course, as you know, it was 1983 when the so-called Packard Report came out and was critical of the total benefit to the Nation of our national laboratory endeavors. Certain other authoritative reports came out at that same time. The ERAB Report, Energy Research Advisory Board, themselves were critical of the benefit to the nation that was deriving from national laboratory expenditures. Several other reports contributed to the mood that people were ready to do business differently, we thought.

We proposed in our proposal to manage these facilities in 1983 four basic measures, a very broad thrust that we thought if we were able to implement them all, we could make a big difference in the way that the benefit of Oak Ridge National Laboratory and the other facilities here, their commercial benefit.

These four measures were, first of all, the establishment of a central office at an executive level to manage not only the technology transfer activities that derive, and opportunitites that derive from

Oak Ridge National Laboratory, but the Y-12 weapons plant and the enrichment enterprises. In other words, the extent to which technology transfer had received emphasis in Oak Ridge, prior to 1983 was pretty much concentrated in the laboratory. And we felt there was good, worthy technology yield from Y-12 and from the enrichment enterprises, and that we should establish a central office to coordinate all of those in a systematic way.

That was one measure we proposed. The second measure was the one that has received discussion earlier this morning. That is our application for an advanced patent waiver. That was the second measure.

I'll discuss our view of that and the aspects of the program that we proposed a little bit later. But it was a very central request and central to our ability to do well in technology transfer.

The third measure, we proposed to implement an array of inventor awards for our people. It's not our feeling that you can either turn on or turn off creativity. Creative people are going to create wherever they are. But a fair way of rewarding them does encourage them to record their ideas. And so we proposed that as an additional and third measure.

Finally, the fourth measure, it was our view that many ideas—and I think perhaps this gets to one of the questions that you asked a little bit earlier, Mr. Walgren. And that is, can you ever count or quantify the benefit of a successful technology transfer.

Well, if you use it to form a new business, which is one preferred mechanism, in our view, it is fairly easy to count the jobs that derive. If, on the other hand, we assign a license to a large company like IBM, or Martin Marietta, or 3M, it is a little difficult to quantify whether or not they—well, we can tell whether or not they paid their royalty fee, but we don't know how many jobs we've created, or it's difficult to calibrate the extent to which it is actually being exploited correctly.

But we think a preferred mechanism often, in radically new, different ideas and inventions, a preferred mechanism to export it is to use it as the basis for a new business. Large firms don't operate well on dramatically different ideas. You know, I say that representing a large firm, you know, we don't do well on small, new ideas. We change what we are doing to improve it. But to adopt a completely new policy is difficult for a small firm. And so, we prefer the formation of new businesses as a mechanism. And we have established at our corporate investment the Tennessee Innovation Center as a supportive and nurturing mechanism to not only assist in new business formations but to cause new business formations.

Of these four measures, establishment of an executive office, requesting a patent policy, or requesting a patent waiver, implementing inventor rewards, and instituting a support mechanism for new businesses, we have in place three of those four measures. The objective that has eluded us so far is to finalize, of course, and obtain the patent waiver. And we consider that a crucial aspect of our ability to really capitalize on technology transfer.

Now we do believe that the activity is up, that the pace of tech transfer has, indeed, accelerated. As an example, I would like to note that the number of publications that our scientists and engi-

neers have generated in 1984 is up over 1983 by about 10 percent. That reverses a trend, a 5-year trend in decline. The number of invention disclosures likewise are up for the first time in 6 years. So the technology is taking place. It is high quality technology. And given the additional liberties that we are asking for in the patent policy, we think that we can make dramatic improvement in commercializing some of these.

I would like to move to the constraint that we are operating under. Our apparent inability, so far, at least, to obtain on any general or blanket basis, the patent rights. And I would like to explain the program that we have proposed to the Department of Energy.

We proposed it both during negotiation in the first quarter of calendar year 1984, and unable to agree prior to signing the contract in April 1984, we proposed it formally in an advance blanket patent waiver petition in April 1984.

We are asking the Government to give us title to the patents, as a corporation, give us legal title to the patents. And, having done that, we will act to advance the objectives of the Government by being in a position to readily reassign those to commercial clients based on the criteria of who can we assign it to that gives us maximum commercial penetration. In many cases, we will be able to assign royalty arrangements to the licensing arrangements. What we would propose to do with the royalty incomes, we will put it in a separate set-aside account and spend that for three purposes.

No. 1, we will permit the inventor to directly share in that. That is a little unusual for industrial firms to volunteer to that, but it would be consistent with the way we handle our aerospace company right now. That would be the first claim on those revenues, a minor claim.

The second claim would be to pay for patent processing costs and to defend any attack on our patent positions.

And the third method, the third purpose of those revenues would be to rededicate those moneys within the institutions that we operate for the Department of Energy to other technologies to bring them to the point of being commercially attractive.

In other words, I think the fundamental point is that we would never, as a corporation, profit from any of these moneys. We have proposed provisions that would see us, in the instance of the patent waiver, behaving just as a nonprofit corporation. In fact, we think that we are asking for less privilege than is already being accorded to the university-managed GOCO's, because in those cases where our parent firm might wish to use the technology, we're volunteering to pay a royalty just like everybody else. In the negotiation of that royalty in that case we would defer to the Department of Energy, to maintain an arm's-length relationship and to minimize, if not avoid altogether, a conflict position.

So, we think that, even in the provisions of the program that we recommended a year and a half ago, that we are quite consistent, that the wisdom of that has been confirmed by legislation that was already passed last fall applying to the universities and the nonprofit firms. So it looks to us like we are right on target with the will of your committee and the will of Congress. And, of course, from our point of view, we think that we have adopted a very self-

less position from the standpoint of our corporation, and that our application ought to be picked up in a heartbeat.

I might say that the economic dividends of this program, should we get the patent request in place, will be significant in our view. We believe that a lot of new company formations, spinoffs, will take place. They will prefer to locate right here, and that will be an advantage to them. We think that other large firms, large and small, will wish to locate R&D activities in this area because of the advantages of the one-to-one interactions that can take place in such a preferred manner if you locate right where the technology platform exists, which we think is in Oak Ridge, TN.

So it is important to the region as well.

I believe that I will stop and would be happy to entertain any questions the committee might have.

[The prepared statement of Mr. Carpenter follows:]

U. S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE AND TECHNOLOGY

JOINT FIELD HEARINGS ON "TECHNOLOGY TRANSFER AND PATENT POLICY: DOE AND OTHER PERSPECTIVES" BY THE SUBCOMMITTEES ON ENERGY RESEARCH AND PRODUCTION AND SCIENCE, RESEARCH AND TECNOLOGY ON JULY 15, 1985.

STATEMENT OF WILLIAM W. CARPENTER, VICE PRESIDENT, TECHNOLOGY APPLICATIONS, MARTIN MARIETTA ENERGY SYSTEMS, INC., OAK RIDGE, TENNESSEE.

The Importance of Enhancing the Technology Transfer Process

We, at Martin Marietta Corporation, agree with those who observe that the growing reliance on higher levels of technology has become a fundamental, long-term trend in the U.S. economy. It has become increasingly clear to us and others that the future of the economy will be largely dependent on how well new technologies are put to use to create products, markets, jobs, and returns on investments. Because the federal government contributes over $50 billion - or roughly half of the total national investment in research and development - the future of the economy will depend, in part, on how well the inventions and new technologies that result from federal efforts are put to use by the private sector.

There is broad agreement that with about $18 billion going to the federal laboratories employing one sixth of the nation's research

scientists and engineers, improved means of increasing the flow of technology from these laboratories to the private sector must be found. A number of recent reports have underscored the need for federal laboratories to play an increased role in improving economic productivity through technological innovation. A 1983 report by the White House Science Council, the so-called Packard Report, stated:

> The National interest demands that the federal laboratories collaborate with universities and industry to ensure continued advances in scientific knowledge and its translation into useful technology. The federal laboratories must be more responsive to national needs.

Similar sentiment was espoused in a 1983 report by the National Governors' Association stating:

> The fact remains that these national laboratories are far from having begun to realize their full potential as catalysts for close industry-university research cooperation or as collaborators in joint university/industry research.

We support all the recent initiatives by the federal government to enhace the transfer of federal technology to the private sector. However, to agree upon the objective is much easier than succeeding with the process.

In the 1983 competition for the Oak Ridge facilities management contract, DOE asked the bidders to propose resourceful measures to accelerate the process of technology transfer. Martin Marietta proposed four primary measures:

1. Broaden the scope of existing technology transfer functions to include all operating facilities under the management contract and establish a central function, headed at the executive level, that would not just permit but would cause increased levels of technology transfer.

2. Put the title to all intellectual property of commercial value in the contractor's name under the terms of an advanced blanket waiver.

3. Develop and implement an array of financial rewards and recognition for the inventors.

4. Create supporting mechanisms to cause and encourage new business formation based on Oak Ridge-developed technologies.

Of the measures requested, all have been accomplished and are in place except the second. We still lack what we consider to be the most important tool - the ability to control the rights to patents issued on technologies invented at the Energy Systems facilities. In spite of this major constraint, we have proceeded to vigorously institute a program that, should we finally be granted the patent waiver we seek, will enhance the rate of successful transfers of technologies from the Energy Systems facilities to industry. Although the measures we have taken has already led to a significant increase in interest in our technologies expressed by industry, our inability to offer suitable licensing arrangements has discouraged these companies from pursuing the further commercial development of the technology. Before turning my attention to the constraint on technology transfer posed by our lack of control of our patent portfolio, I would like to describe for you some of the measures we have already taken.

Martin Marietta's Initiatives in Oak Ridge

We have created an executive office of Technology Applications (OTA) under my direction. The Office is staffed by a group of professionals with the spectrum of functions to centrally administer the total technology transfer process for all activities under the management contract. OTA has examined the existing functions at Energy Systems. We have developed and implemented new standard practice procedures to coordinate and improve each step of the process. New procedures include:

* Technology Transfer Assessment and Development Process for determining the transfer potential of inventions;

* Awards for Inventions that provides a schedule of cash awards to inventors for patent applications;

* Royalties from Licensing that provides a means for sharing royalty income with the inventors named on licensed patents; and

* Intellectual Property Rights covering employees' rights and responsibilities in reporting all inventions developed in the course of their employment at Energy Systems.

To further stimulate our inventive employees, we have instituted other measures in addition to providing cash awards for patent applications and sharing royalties with inventors. We have created the Inventors' Forum to encourage exchange of ideas and to facilitate intersite communications. The Forum is an employee-managed organization of all Energy Systems patent holders. The kickoff meeting of this organization was held April 30 at the annual patent luncheon. A new feature of this awards luncheon was also introduced - Inventors' Forum lapel pins to recognize Energy Systems patent holders.

Recognizing that most technology transfer occurs from one-on-one interactions between our researchers and industry's, we have taken steps to allow and encourage these types of exchanges. It is our belief that we can accelerate technology transfer by freeing our people to perform as consultants to outside firms. We recently implemented a revision of our consulting policy consistent with DOE's desire to further liberalize the employees' ability to engage in these interactions outside of the course of their normal work activities.

Initial Impact of Technology Transfer Program

Evidence abounds to show that acceleration in the process of technology transfer is already taking place in Oak Ridge.

* Inventions disclosures are up over 15% during our first nine months of performance - reversing a five-year declining trend.

* Publications are up 5% - also a trend reversal.

* Since the fall of 1984, nine workshops or conferences related to technology transfer have been presented - a 50% increase over FY 1984 - with a combined attendace of 2400.

* Energy Systems now has 60 Technical Bulletins in the preparation and publication stages; 1985 will be the biggest year ever in bulletin publication by a factor of 2.

* A high number of inquiries have been received from commercial firms, many of them inquiring of Oak Ridge for the first time.

* Even though Energy Systems has not yet received title to the intellectual property, we are in the process of prenegotiating licenses with several commercial firms.

OTA has been identifying technologies with commercial potential, documenting the present status, and then developing marketing strategies for them. As a result of our initiatives, we have begun to take action on nearly 50 different technologies with commercial value. We believe that about one-half of these have near-term commercial potential. These technologies include:

* Nickel-iron aluminides, a superalloy that gets stronger as temperatures get higher which has potential applications in heavy duty diesel and gas turbine engines, die material, specialty fastners, and tubing;

* Lead-iron phosphate glass, a highly durable, easy to process material that has several unique optical properties which make it attractive for precision lenses, optical fibers, glass-to-metal seals, and encapsulation of semiconductors used in hazardous environments;

* Silicon carbide whisker-reinforced alumina, a very tough, fracture resistant ceramic material useful for cutting tools, recuperator tubes in gas-fired furnaces, and armor plating for tanks;

* An economic ion-implantation treatment that virtually eliminates wear/corrosion as a clinical problem for artificial hip- and knee-joint prostheses made of a titanium alloy; and

* Clinical radioisotope generator for use in evaluating cardiovascular defects and blood flows in young patients.

A number of unpatented technologies have been transferred in recent months, including:

* Ion-implanted prosthesis to Spire Corporation and Johnson and Johnson;

* A non-force-reflecting manipulator system to Remotec;

* Tritium light source to Safety Light Corporation, NRD (Division of Mark IV Industries), and Self-Powered Lighting Corporation; and

* Diffuse reflectance cell to Harrick Scientific Laboratory.

Many of our technologies with commercial value, however, need considerable refinement before they are ready for the commercial marketplace. This is especially true since the commercially attractive concept is often only tangential to the main purpose for which the research was conducted, and DOE program managers cannot justify spending federal funds to test out the viability of commercial applications. We have recently initiated two programs in conjunction with the DOE to help promote the transfer of such promising, but not yet mature, technologies.

In 1984, DOE agreed to give $100,000 to ORNL on a matching basis to identify commercially promising developments and allow additional work to bring the technology to a stage where industry could make an assessment of its true commercial potential. From 22 candidates for funding, five technologies were selected to receive funds. The items in Table 1 were chosen for support. Based on the success of the first year effort, the program has been expanded this year to support the further development of six more technologies (see Table 2).

Another new initiative supported by DOE is the Industry Technology Exchange Research Program. The purpose of this program is to support visiting research appointments at ORNL for scientists and engineers currently working for industry. This program allows the

Table 1. Technologies with Commercial Potential Funded in 1984

Technology	Action
1. Nickel aluminide alloys	In licensing negotiations
2. Pulsed helium ionization detector	Invention disclosure filed; 1985 I-R 100 award winner
3. Continuous annular chromatograph	Inventions disclosure filed; instruments loaned for test
4. Electronic autofluorography	Invention disclosure filed;
5. Remote analytical instruments	Displayed at trade show

Table 2. Technology Maturation Initiatives Funded in 1985

Technology	Purpose
1. Pulsed Helium Ion Detector	Electronic design, testing, and information dissemination
2. Nickel Aluminide Alloys	Casting optimization, sample production and testing
3. Ceramic Composites	Sample production and testing, information dissemination
4. Biocatalyst Beads for Fermentation	Sample production and testing, information dissemination
5. Simplified Blood Processing System	Prototype development and testing
6. ANFLOW	Design development and optimization and costing
7. Evacuated Insulation Panels for Energy Efficient Appliances	Joint Development of commercial prototypes with manufacturer
8. Lightweight Oxide Fiber Composite	Fabrication of test hardware and performance testing

visiting researcher to work side-by-side our staff members to give them exposure to our developments along with hands-on experience with the technology. It is expected that this process will help deepen the understanding of the new technology and speed the adoption process when the researcher returns to his company. We have two such researchers presently on site: one from CPC International working in our Biology Division on anaerobic enzymes for food processing and one in Metals and Ceramics Division working on metal to ceramic joining.

Admittedly, the ultimate commercial potential for many of our technologies spans a wide range from a few million dollars in sales to possibly over one hundred million dollars; if our market studies of the nickel-iron aluminide alloys is correct. It should be noted, however, that some of the technologies developed at the Energy Systems facilities do have the potential of changing basic industries within the U. S. and strengthening our competitive position in the international marketplace. Just one example will illustrate my point.

Seeking to capitalize on the wealth of technical talent and expertise in material science at national laboratories, a consortium of U. S. steel companies, including Bethlehem, U.S. Steel, Armco, National, and LTV, are working with Oak Ridge and Argonne. The idea is to develop leapfrog or breakthrough technologies which could help the domestic steelmakers regain its competitive position in world steel markets. One thrust of the program will be to find new ways to convert iron ore into liquid metal, bypassing the expensive coking ovens and blast furnaces now used. Another focus will be on casting liquid metal into pieces close to the dimensions of the final product. One possibility is to use powerful magnetic fields to confine the molten metal so it can be cast

into thin sheets, eliminating the need for strip mills to flatten thick billets. ORNL's fusion program will contribute its magnet expertise to the problem of casting steel.

Technology Transfer and Local Economic Development

We are convinced as our technology transfer program matures, it will begin to have a significant positive impact on the economic development of this region. It does not appear to be an accident that technology complexes such as the Silicon Valley, Boston's Route 128, and Princeton's Forrestal Center have evolved around major universities. Direct access to a university and the university's right to transfer the results of its research on an exclusive basis are important to develop and commercialize technologies. Other forms of assistance such as consulting, continued involvement of researchers in the commercialization process, and various business services are also important.

As we continue to make technologies more accessible to commercial firms, we expect three things to begin to happen that will have a positive impact on the local economy. First, established firms will desire more direct interactions with Energy Systems staff and facilities in the form of collaborative R&D. This activity has already begun to expand. In the Metals and Ceramics Division, for example, in addition to the steel industry initiatives, there are major collaborative R&D agreements in place with Cabot Corporation, Cummins Diesel Engine Company, and Babcock and Wilcox. Other similar scale projects are being developed with Atlantic Richfield Company and 3M among others.

Second, an established firm may wish to locate an operation or an R&D activity in the Oak Ridge vicinity in order to better access the

technology developed here. In fact, this has already begun. Manufacturing Sciences Corporation chose the Oak Ridge location because the Energy Systems committed to cooperate with them and offer them technology access in their commercial endeavors to roll and form depleted uranium. Their plant, now under operation, will employ 25 people within the next few months. They have used some Energy Systems employees as consultants. Based on discussions we have had with other companies looking for expansion opportunities, we believe that other firms, perhaps on a much larger scale, will take similar action in the future.

The third local economic dividend from technology transfer is new business formation. We continue to believe that one of the most promising avenue of successful technology transfer is often the formation of a new business based on that single technology. Our conviction on this matter is such that the Martin Marietta Corporation has invested several million dollars in the establishment of the Tennessee Innovation Center. Martin Marietta Corporation formed a partnership with the Utah Innovation Center to help facilitate the transfer of technology from the research stages at the Oak Ridge facilities to successful commercial enterprises.

The purpose of the Center is to create a favorable climate for new business formation and to assist start-up companies in overcoming the inevitable obstacles. Since the task of the entrepreneur is to conceive, produce, market, and manage new products is difficult, complex, and risky, the Center will provide needed assistance to enhance the probability of success for the new venture. To that end, the Center will join with the entrepreneur to become a full business partner. With

its network of resources, the Center will assist the entrepreneur so he/she can better run the company. It will provide:

* input in developing the initial business plan,
* office and laboratory space,
* management and technical aid,
* legal and accounting assistance,
* help in arranging financing for operating expenses, and
* use its experience and skill to raise investment capital.

The Tennessee Innovation Center is modeled after the Utah Center - a private-for-profit corporation based in the University of Utah's Research Park. The Utah Innovation Center was originally formed in 1978 by the University of Utah through a National Science Foundation grant. In 1982, Dr. Wayne S. Brown, a faculty member of the University of Utah, College of Engineering, and former Dean of the Engineering School; and Don A. Stringham, a local attorney, converted the Innovation Center from a university-based experiment in technology transfer into a private corporation.

The Tennessee Innovation Center will be located in a modern, new 50,000 square foot facility. The facility will contain central laboratories, computer, telecommunication, and administrative support services. Martin Marietta Corporation has made a multi-million dollar commitment to provide for the operation of the Center and to establish a seed capital pool for new, start-up ventures. In addition, the Center is exploring the feasibility of establishing a R&D Limited Partnership pool to fund the further commercial development of technologies invented at the Oak Ridge facilities.

The Innovation Center has already associated with or established six new, small, high-technology businesses. The Innovation Center is in the final negotiation stages with another four new businesses. Of these

ten initiatives, eight are based squarely on Energy Systems/DOE-developed technologies.

Constraints Imposed on Energy Systems Technology Transfer Program

We believe that considerable progress in improving the technology transfer process has been made in the past year. We think that our record speaks clearly on that point. We have developed and implemented a comprehensive system to identify technologies with significant commercial potential and reward their inventors. We have begun marketing efforts to bring these technologies to the attention of prospective industrial clients that has led to a significant increase in the interactions between our research staff and their counterparts in industry. A number of new companies have been started in Oak Ridge to capitalize on technologies developed at the local facilities. We have also transferred a number of technologies to other, existing commercial companies.

All of the technologies transferred, however, were unpatentable. These technologies were transferred to companies hoping to exploit a small niche that was, and would continue to be, overlooked by the major forces in the market. These market niches are attractive to small companies, but do not present enough opportunity for larger concerns.

Unfortunately, because we can not provide a company access to the patent rights to our inventions, we have had only limited success in developing agreements with industrial clients to exploit some of our most commercially exciting new developments. The importance of patent protection to protect a company's investment was clearly demonstrated recently at Los Alamos National Laboratory. Researchers at Los Alamos have invented and patented a laser-based technique capable of detecting

bacteria and viruses quickly and inexpensively. They estimated that it would take millions of dollars, however, for a commercial product to realize this potential. After the lab obtained the rights to the invention from DOE and the authority to perform proprietary research for private sector organizations, Los Alamos was able to negotiate a license agreement with a new, small business firm, Mesa Diagnostics, to develop and produce the device. Mesa Diagnostics has raised over $8 million through venture capital and research and development limited partnerships to fund this effort. $4.3 million of this amount will be used by Los Alamos to further develop the technique to serve both the DOE and medical diagnostic purposes. It is very important to note that these agreements could not, and would not, have been completed if Los Alamos did not have the ability, in this case, to provide an exclusive license of the patents to Mesa Diagnostics.

Obviously, patents are only one factor in a decision to invest in the creation of a new product. The ownership of inventions and the patents that cover them are, however, an important factor in new product development. Most companies are reluctant to invest the large sums required to fine-tune inventions without the guarantee that a competitor would be precluded from copying the product by reverse engineering. When faced with a choice between investing in the exploitation of a government-held patent with significant commercial potential and a privately-held patent, even with less commercial potential, most companies will decide against the government patent opportunity because of the lack of protection.

Thus, we firmly believe that our inability to negotiate licensing arrangements for our technologies is the single, greatest obstacle to our

operating an optimally effective technology transfer program. Although many of the companies exposed to our inventions have expressed great interest in developing a commercially viable product based on our technology, none are willing to commit the significant resources necessary for such an undertaking without the proper patent protection.

Martin Marietta's Proposed Solution: An Advanced Blanket Patent Waiver

In order that we might be in a position to offer the necessary patent protection to commercial clients interested in further developing products based on our technologies, we originally proposed that we receive an advanced blanket waiver of patent rights from DOE as part of our management contract. Unable to agree upon this clause of the contract, we agreed to delay final resolution of this issue until after the contract was signed. We subsequently petitioned DOE to grant us this waiver. Our patent waiver proposal was subsequently endorsed in the DOE patent policy directive issued by then-Secretary Donald Hodel on 5 February 1985. As you can see from the chronology of events in Table 3, we have been unsuccessful in obtaining DOE approval for this petition to date.

Without the requested advanced waiver, Energy Systems would have available only the procedure for petitioning, on a case-by-case basis, for a waiver of patent rights on each invention after it is made. This is a cumbersome and time-consuming procedure and, historically, has not yielded a satifactory result.

Waiver petitions require the description of plans for exploitation. Given the large number of invention disclosures generated at the

Table 3. Patent Waiver Petition Chronology of Events

Action	Date
Energy Systems signs management contract without advanced blanket patent waiver	March 30, 1984
Jarmolow and LaGrone sign memorandum of understanding to negotiate and implement waiver by August 30, 1984	March 30, 1984
Advance blanket patent waiver petition sent to DOE	April 30, 1984
Petitions Ni_3Al individual patent waiver petitions set to DOE	June 8, 1984
Jim Eisel, Martin Marietta Patent Counsel, made trips to Oak Ridge to negotiate the advanced blanket patent waiver provisions	June 26 & 27, July 11, 12, & 13, Aug 21 & 22, 1984
Substitute Ni_3Al waiver petitions filed	Sept 25, 1984
Additional Ni_3Al petitions filed on new discoveries	Oct 18, 1984
P.L. 98-620 amendment to Patent Act 35 USC 200	Nov 9, 1984
Hodel Memo regarding DOE Patent Policy	Feb 5, 1985
Additional petition filed on long-range ordered alloys	March 22, 1985
Specimen patent license agreement set to DOE-ORO	March 29, 1985
Jarmolow letter to LaGrone regarding petition status	March 29, 1985
Department of Commerce regulations on P.L. 98-620 published for comment	April 11, 1985
Dingell letter to Herrington concerning waiver petition	April 22, 1985
DOE grants individual waivers on Ni_3Al cases subject to: (1) DOE comment on license agreement, (2) signing confirmatory license agreement, and (3) holding royalties pending DOE decision on manner of treatment	June 21, 1985

administered facilities (about 250 last year alone), it would be impractical to apply for individual waivers on the vast majority of inventions. Without the advanced waiver, we are able to seek waivers only for the few inventions that appeared to be sure winners, and/or for which a definite plan for development and exploitation exists. We have already gone through this laborious process on 31 cases. Table 4 lists these cases along with their current status. The necessity of seeking case-by-case waivers would result in a large number of inventions being put on the shelf because there were no immediate and sufficiently well defined plans for commercial exploitation.

The value of the intellectual property is often perishable with time. The ability to make timely decisions is important in order to respond quickly to industrial requests for licenses. Inventions developed at the Oak Ridge-Paducah facilities tend to be on the leading edge of technology and are, thus, highly susceptible to rapid change. Delays in assigning licenses can often result in missed opportunities to successfully transfer the technology either because alternative technolgies are developed, the market opportunity to capitalize on the project passes, or the company grows frustrated and loses interest in the technology.

Implementing the Patent Waiver Process

If the advance waiver is approved, Energy Systems, would then have the right to patent all inventions made under the operating contract except inventions in:

* certain programmatic areas of technology which are certified by DOE to be in the national interest for the Government to retain title (e.g., nuclear weapons and naval nuclear propulsion), and

* international agreements of the U.S. Government.

Table 4.

SUBJECT INVENTION PATENT WAIVER PETITIONS

CNID NO.	DATE SUBD.	STATUS	SUBJECT	ACTIVITY UCC Letter/Inventor(s) Letter			
4503-X/S-61,834	11/26/84	Disclosed	Extended Range Counting Pulse Counters	01/02/85			
4513-X/S-61,875	11/26/84	Inactivated	Improved Radioluminescent Light	01/02/85	12/03/84,	12/03/84 12/15/84	- Withdrawn 4/2/85
4207-Y/S-58,019	11/26/84	Application Filed	ZrO Carbon Free	02/12/85	12/04/84,	12/05/84 12/12/84	
4477-Y/S-61,184	11/26/84	Application Filed	Electrochemical Cell	01/02/85	12/03/84,	12/04/84	
4514-Y/S-61,848	11/26/84	Application Filed	Electrode Controller	01/02/85	12/04/84,	12/04/84	
4392-K/S-60,513	11/26/84	Disclosed	Remote Tong Tool Catch for Servomanipulator	01/02/85	12/04/84		
4340-K/S-59,925	11/26/84	Application Filed	Laser Cooling	01/02/85	12/04/84		
4345-K/S-59,963	11/26/84	Approved	Clarification Process	01/02/85	12/04/84 12/07/84		
4381-K/S-59,987	11/26/84	Approved	Expanding Mandrel	01/02/85	12/10/84		
4434-K/S-60,595	11/26/84	Application Filed	Viscosity of Centrifuge Damper Fluids	01/02/85	12/04/84		
4484-K/S-61,826	11/26/84	Disclosed	Alarm Circuit Optical Interface Security Device	01/02/85	12/04/84,	12/04/84 12/05/84	
4374-K/S-59,962	11/26/84	Inactivated	Constant Temperature Oven	01/02/85	01/11/85		- Withdrawn 4/2/85

Table 4 (cont).

SUBJECT INVENTION PATENT WAIVER PETITIONS

CNID NO.	DATE SUBD.	STATUS	SUBJECT	ACTIVITY UCC Letter/Inventor(s) Letter		
4338-X/S-59,268	09/25/84	Executed	NiAl	11/21/83	09/21/84, 09/27/84	- Granted 6/21/85
4412-X/S-61,109	09/25/84	Application Filed	NiAl	11/21/83	09/21/84, 09/21/84	- Granted 6/21/85
4531-X/S-61,893	10/18/84	Approved	High Temp NiAl	01/02/85	01/08/85	- Granted 6/21/85
4442-X/S-61,111	11/26/84	Application Filed	Pb Fe PO_4 Glass	01/02/85	12/03/84, 12/03/84	
4451-X/S-61,153	11/26/84	Application Filed	Ceramic Composites by Chemical Vapor Deposition		12/10/84	
4488-X/S-61,825	11/26/84	Executed	Ceramic Composites		12/14/84, 12/18/84	
4536-X/S-61,894	11/26/84	Application Filed	Method for Joining	02/12/85	12/04/84, 12/04/84 12/05/84	
4511-X/S-61,853	11/26/84	Disclosed	Plastic Semiconductor Barrier Diode	04/02/85	12/15/84, 12/16/84	
4385-X/S-60,520	11/26/84	Application Filed	Servomanipulator	01/02/85	12/04/84, 12/10/84 12/10/84	
4507-X/S-61,896	11/26/84	Disclosed	Tong Actuator Servomanipulator	01/02/85	12/04/84, 12/04/84	
4508-X/S-61,874	11/26/84	Disclosed	Master Controller for Servomanipulator	01/02/85	12/10/84, 12/10/84	
4501-X/S-61,844	11/26/84	Application Filed	Pulsed He Ionization Detector	01/02/85	12/04/84, 12/04/84	

Table 4 (cont).

SUBJECT INVENTION PATENT WAIVER PETITIONS

CNID NO.	DATE SUBD.	STATUS	SUBJECT	ACTIVITY UCC Letter/Inventor(s) Letter
4406-X/S-60,528	03/22/85	Application Filed	Silicon Carbide Wisker Reinforced Ceramic Composite	
4538-X/S-62,523	03/22/85	Disclosed	Filler Metals for Direct Brazing of Ceramics	
4544-X/S-62,552	03/22/85	Approved	Oxidation Resistant Filler Metals for Direct Brazing of Structural Ceramics	
4489-X/S-61,824	03/22/85	Application Filed	Improvement in Long-Range Ordered Alloys	
4490-X/S-61,831	03/22/85	Application Filed	Improved Metallic Glass	
2-X/S-61,854	11/26/84	Disclosed	Plastic Semiconductors	

It is Energy Systems' intention to pursue patents only in those cases where inventions are determined to have commercial value and not within the exceptions stated above. Historically, 10 to 20 percent of the patentable ideas coming out of the Oak Ridge activities are thought to have significant commercial value. In these cases only, Energy Systems would make patent applications and be responsible for patent maintenance costs as an effort under the management contract.

When Energy Systems determines that inventions do not hold commercial value, DOE would be so notified. In these cases, DOE would proceed with those patenting actions which they determine to be appropriate.

Energy Systems would then search for licensees who have a high probability for the fullest exploitation of the commercial potential of the patent. The objectives in the placement of these patents would be: (1) successful transfer and adoption, (2) maximum commercial penetration, and (3) royalty incomes in return for the rights assignments. In the process of evaluating the applicants, any interests of the inventor would be given first consideration. The government would, of course, retain rights for royalty-free use.

Disbursement of Royalty Revenues

None of the income generated from the licensing of patent rights would become Energy Systems income or profit. The money would flow to a separate Energy Systems account where it would be used exclusively to advance DOE's stated objectives regarding technology transfer. First, this fund will be used to pay inventors their share of the royalty income. Second, royalties would be used to cover expenses incidental to patenting and licensing inventions. Finally, the remainder

of the fund will be rededicated to fund selected technology maturation initiatives directed toward bringing new developments to a state where industry could make a better assessment of the true comercial potential similar to those already being undertaken.

Martin Marietta Corporation's Rights

In order to restrict the possibility that Energy Systems' parent corporation might receive an unfair competitive advantage through preferred access to the technologies developed at the Oak Ridge-Paducah facilities, the basic management contract between DOE and Martin Marietta Energy Systems, Inc. establishes an "arm's length" relationship between Energy Systems and Martin Marietta Corporation. The procedures for granting Martin Marietta Corporation access to technologies developed by Energy Systems are stipulated in Contract DE-AC05-84OR21400.

In general, these procedures state that in those cases where Martin Marietta Corporation is interested in obtaining a technology developed by Energy Systems, the Corporation, with only one exception, will not be treated differently from any other company seeking similar access. The exception is that whereas all other companies will state their interests and negotiate a license with Energy Systems, to avoid a conflict of interest situation, Martin Marietta Corporation must make its interest known to DOE in the form of a request for a license. DOE will conduct all negotiations with the Corporation regarding the terms and conditions of the licensing agreement.

In a very real sense, the Corporation is actually asking for less advantage to their firm than has been available to DOE contractors in the past. The previous contractor was granted the right to file for

individual patent waivers in order to take title to the invention. Martin Marietta Corporation, however, will be required to negotiate royalty-bearing licenses.

Consistency with the Intent of Most Recent Changes in Federal Patent Policy

In reviewing the trends in federal patent policies, especially over the last five years, we have come to firmly believe that the program I have outlined for you here is perfectly consistent with the intent of Congress. Indeed, we believe that we are actually asking for less liberties than our counterpart university contractors were granted with the passage of P.L. 98-620 last year. In granting our request for a patent waiver, the government would have lost nothing pertinent to the interests of the technology developer. Martin Marietta's sole gain is in their ability to perform well regarding our contract responsibilities for technology transfer. The real beneficiary is the government in that this procedure offers great potential for advancing the technology transfer process.

If this remaining constraint is removed from Energy Systems, we believe that our technology program will become a model for other federal laboratories to follow. Granting our waiver petition will be a signal that will not be overlooked by the commercial sector. Facilitating the access to our technologies has, and will continue, to prompt firms to look more closely at what we are creating. The frequency of interactions between our research staff and industrial concerns will definitely increase. Through these interactions, technologies with significant commercial potential are more likely to be brought to the attention of industry in an efficient and effective manner.

Such linkages government and industry are essential if the results of federally-sponsored R&D are to be applied in the commercial, as well as the government, sector of the economy. Only when our technological developments are exploited in the commercial sector can the nation be certain that we are receiving the maximum benefit of the national scientific and technical resource that the federal laboratories embody. The increased integration of such a vast technical resource into the nation's economy will assist the nation in achieving the goal of enhanced economic productivity through technological innovation.

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

I want to applaud Martin Marietta for their dynamic efforts to really work for technology transfer in this area. If you remember, before the RFP's were actually drawn up by the Department of Energy, I talked to then-Secretary Hodell and asked him, please, that this was a once-in-a-lifetime opportunity, to please incorporate in the RFP's interaction between the universities and other areas of learning so that we could move this into what we call a very high tech corridor, which I think is a term that is overplayed. But I think that we do have such enormous potential here with the Oak Ridge Laboratory.

In referring to your class waiver that you are working for, what do you see as any real problems or impediments at this time?

Mr. CARPENTER. Well, of course, Mr. Constant mentioned two things that are of concern to the Department. I might say that——

Ms. LLOYD. I thought you might like to add something——

Mr. CARPENTER. I'm afraid I can't add any problems, Mrs. Lloyd. Really, I really don't see any fundamental problems.

Ms. LLOYD. Do you see any regulations or legislation that are helping or hindering at this point, that you would like to comment on?

Mr. CARPENTER. I believe that if we can get the substantial provisions of the patent rights that we have asked for, that the positive impact will be very great. It will be great enough that we won't even have to worry about counting jobs. The effect is going to be obvious to us. I believe that we can give the Government, if they give us the patent rights, that we can give them liability shields which we, of course, are asking for ourselves. We don't profit so we don't think we ought to be put in a position of liability. That we can put ourself in a position where we are well shielded from liability, and put the Government also in a position where they are well shielded from liability. In fact, we believe that we can give them better protection than they are receiving right now and have received on the 19 exclusive patent assignments that we have heard they have already made. So, we don't see that as any problem in being able to give the Government good protection, and in being able to offer a position which is free of conflict. We think that the proposition we have offered the Government really accomplishes that.

So I see no great impediment in terms of issues that should prevent us from being able to sign up.

Ms. LLOYD. Do you intend to apply for any individual waivers?

Mr. CARPENTER. Yes, ma'am, we have. We have applied for 31 individual waivers since we assumed the contract in April of 1984. And we redoubled these efforts when we saw the difficulty arising in our being able to get a blanket waiver. It is still our hope that those 31 requests can be acted upon expeditiously as individual waivers even in the interim of a resolution of the larger general patent——

Ms. LLOYD. In what areas are these individual waivers?

Mr. CARPENTER. They span—I have listed them for the record, Madam Chairman.

Ms. LLOYD. They are included, OK, thank you. I didn't——

Mr. CARPENTER. But there are, let me say, some that have tremendous, in our view, tremendous commercial potential, including a couple that have the potential of affecting basic industries in the United States. I might mention that nickel-iron aluminides is, we think, a super, super alloy that is going to be regarded as with very great commercial significance. That's one. Lead-iron phosphate glass, which could fall in one of the exception areas, depending on how we eventually identify the exception areas to a blanket waiver—we think that has very high potential applications.

Silicon carbide whisker-reinforced alumina will contribute to regaining a technology parity in the advanced ceramics area, regaining parity with the Japanese, we believe.

Ms. LLOYD. This is very impressive, and it will, as I said earlier, be made a part of the record of these hearings.

I want to ask you if you see any problem with conflict of interest as you plan to invest further in Oak Ridge technology?

Mr. CARPENTER. There are issues that we must remain sensitive to avoid conflict. I believe we are aware of them, for example, stating the reverse side of this, we see no reason why, simply because we operate and manage the facilities, we should be deprived of the same technology access as any other firm has to what takes place in Oak Ridge. And there are technologies that could be significant to our other corporate endeavors. But if we want those, let us say that they are licensable and patentable, and our aerospace guys in Orlando want them. If we think that that is the way of achieving the largest commercial penetration of that, we would describe that circumstance to the Department of Energy, excuse ourselves from negotiating the licensing placement, encourage DOE to further it, and we would expect to see royalties applied wherever they are appropriate.

So that would be a DOE decision to assign a technology that was developed in Oak Ridge under a licensing agreement to an aerospace arm of Martin Marietta. And we would expect to pay royalties just like anyone else, which was never true with Carbide, may I say. Even though they were restricted to asking for individual waivers, they got them royalty-free. We are not asking for that.

Ms. LLOYD. We know that Martin Marietta has many arms.

Mr. CARPENTER. Yes.

Ms. LLOYD. Do you have any commercial clients, besides Martin Marietta, that you would hope to develop a technology for, if you should get a waiver?

Mr. CARPENTER. Absolutely. As a matter of fact, you know, that is our concentration and our emphasis. We have many large, substantial commercial firms which have expressed interest in the technologies that are emerging from Oak Ridge, and they are more interested this year than they were last because they think the technology should be more accessible to them. We have conducted, we prenegotiated some licensing provisions with some of these firms, anticipating that some day we are going to have the patent rights that we are striving for.

Ms. LLOYD. Do you plan to exploit any of these technologies in this area?

Mr. CARPENTER. Yes, ma'am.

Ms. LLOYD. Would you elaborate on that, please?

Mr. CARPENTER. Sure. I mentioned earlier the Tennessee Innovation Center. That is a corporate investment that we made here. The Tennessee Innovation Center—a construction contract has been let for the facility. It will be located in the Oak Ridge Technology Park which represents another corporate investment that Martin Marietta has made in Oak Ridge. That Center is formed for the purpose of new business formations. They either have announced the formation or are in final negotiation stages of announcing the formation of ten businesses. Eight of them are based squarely on Oak Ridge developed technologies. None of them are patentable. None of them require licenses. So, it is as available to anyone else as it would be us. But we are trying to spark new company formations right here in the area, and the majority of those will be based on Government R&D.

Ms. LLOYD. Do you feel this gives you an economic edge over, for instance, Boeing or Goodyear?

Mr. CARPENTER. It shouldn't. It is quite true that we are better informed about the technologies that are taking place. You know, I mean, we have front row seats. We operate the facilities.

Ms. LLOYD. These are some of the concerns that the Congress has to face.

Mr. CARPENTER. Sure. It is equally as available and to the Westinghouses of the world and to the Boeings of the world as it is to us. And, you know, we are anxious to inform them about the technologies that are emerging and they will get just as good a crack at it as anybody else.

Ms. LLOYD. We are proud of the TIC, but what plans do you have to really use the national lab, the enormous technology base we have here, in the formulation of these new innovations?

What are the plans for including the lab?

Mr. CARPENTER. Well, the process——

Ms. LLOYD. In the formulation of the new business——

Mr. CARPENTER. You mean, perhaps, the employees?

Ms. LLOYD. That's correct.

Mr. CARPENTER. OK. Well, we have talked about this a great deal, Mrs. Lloyd. We have determined that we are willing to be a very understanding employer when it comes to encouraging some of our principal investigators to themselves associate themselves with new business formations. And we are going to—they, of course, have the technology information. So, often it improves our probability of success if the inventors themselves can be associated with the new enterprise formation, and we are encouraging our employees to consider this. And we are entertaining some arrangements which include giving them leave of absence, agreeing to their working in such a moonlighting effort, adjusting their work week in some cases, and really, really trying to help them help the new companies succeed. It gives us penalties——

Ms. LLOYD. I would certainly encourage you do it to make the most of the lab, which I think is a national treasure.

Mr. CARPENTER. Yes.

Ms. LLOYD. Thank you very much.

Mr. Morrison.

Mr. MORRISON. I was only going to ask one question. I am a believer in the profit motive, and your statement on behalf of Martin

Marietta certainly is fantastic from the point of view of taxpayers getting a return on investment.

You partially answered the one inquiry I was going to make. That is the incentives down to the individual. I mean, these ideas essentially are going to come from your team.

Mr. CARPENTER. Yes.

Mr. MORRISON. But my experience has been that usually there is one spark plug in that team that has the idea. And I read through your statement and have a fairly good feel for this. I mean, you start with lapel pins, and they belong to a forum, and this sort of thing, which doesn't go quite far enough. But now you have indicated encouragement to associate themselves with someone who might apply the technology; and that would be, of course, there would be professional reimbursement for that sort of opportunity. Is there more that could be done? Should others be following the example of some of these individual employee incentives that you have provided? You sent your leaders in this arena?

Mr. CARPENTER. Well, it is nice to have a new circumstance to be able to create out of whole cloth in a contemporary opportunity in the last 2 years. You know, it is a little more difficult for an established firm to change what he's done. We had the advantage of being able to say, hey, if you give us the Oak Ridge contract, here are some ways we'd try to behave.

So in that sense, simply because we are new on the scene and have the opportunity of establishing a new and original arrangement, perhaps we have been able to move a little more briskly than other established firms.

I did mention also, Mr. Morrison, that we are adopting procedures which would place our employees directly in the revenue stream. This is nontrivial financial reward.

Mr. MORRISON. This is from your pool of royalties?

Mr. CARPENTER. Yes, sir, right. And right now, you know, as we see that circumstance, we would give them 10 percent of the first $500,000 gross, you know, don't subtract out administrative support costs and stuff like that. Five percent above that——

Mr. MORRISON. Just taxes and that sort of thing——

Mr. CARPENTER. Just taxes, right.

Five percent above that, to a cap of $100,000 per invention, per employee. So there is the opportunity for a significant financial reward and financial participation by our employees.

Mr. MORRISON. I certainly commend you for that. I personally feel that that is one of the significant keys.

I'm impressed, Mr. Chairman, with what Martin Marietta has done with this responsibility and trust that whatever we do legislatively out of your subcommittee will enhance their opportunities.

That is the extent of my questioning.

Mr. WALGREN. Thank you, Mr. Morrison.

Now it does seem like there is a lot of energy here and you bring a lot to it individually. And we all know that that is what drives our system. And there is something here that we certainly should be trying to encourage to happen elsewhere.

What is in it for Martin Marietta, though?

I am curious——

Mr. CARPENTER. That is a frequently asked question, Mr. Walgren. It is just unbelievable that a profitmaking company would propose a program that has no profit potential for them, isn't it? But, really, we do have advantage potential for that. And that is, as Ms. Joseph mentioned, our job is to perform well under our management contract with the Department of Energy. If we perform well, we are graded well and our profit increases. This is one of the aspects.

Mr. WALGREN. What is the range of that profit increase?

Mr. CARPENTER. It can range—it is renegotiated every year. Under the award fee contract that we are operating right now, it can swing from $5-plus million up to a maximum extreme of $20 million. So, the swing based on our performance is $12, $14 million, something like that, significant even to us.

Mr. MORRISON. Would the gentleman yield?

Mr. WALGREN. I would be happy to yield.

Mr. MORRISON. Could we relate that figure back as a percentage of your total operating contract?

Mr. CARPENTER. Minuscule, as we drive off of the Department of Energy acquisition regulations, where fee curves apply, you know, we are out there where we'll cycle about $2 billion through, between $1.8 and $2 billion a year, through these facilities. And our profit potential is something under 1 percent of that, of which about two-thirds of our profit potential, the way we have it structured right now, relates to how well they feel we have done.

Mr. WALGREN. If the gentleman would yield. The potential fee increase would be quite free and clear of any cost. Is that right?

Mr. CARPENTER. That is correct.

Mr. WALGREN. So the measure of the fee increase would be against your, or the company's profit after tax of net income, if that is right, net income from the contract as a whole. Is it minuscule when measured against the net income, or the actual kept value by Martin Marietta, at that point?

Mr. CARPENTER. Investments, sir?

Mr. WALGREN. Well, no. I guess, I'm sorry I can't make myself clear. As I understand it, you have the potential of increasing your gain under the contract by $14 million, let's say——

Mr. CARPENTER. Approximately.

Mr. WALGREN. To a total of 20 million in technology transfer success.

Mr. CARPENTER. No, no. Well, that is in total at management of the contract, sir. Not just one factor. A significant factor of that but not an overwhelming factor is technology transfer. There are many other things that——

Mr. WALGREN. I see. The total management contract is——

Mr. CARPENTER. Yes.

Mr. MORRISON. If they do a good job overall——

Mr. WALGREN. As much as $20 million but as little as $5 million. Is that correct?

Mr. CARPENTER. That is correct.

Mr. WALGREN. I see. And then how much of that is reachable through performance on the technology transfer aspect?

Mr. CARPENTER. OK. Well, I think I can give you a pretty closely approximate figure. Right now, we are being graded under our per-

formance on technology transfer as a sub-element of the ORNL award fee. ORNL is one of several activities that we manage: ORNL, the weapons plant and the enrichment. This year, on the first 6 months' award fee, 25 percent—no, no, it was 10 percent of the total ORNL award fee was based on technology transfer. So ORNL is about 25 percent of our total award fee. So, you've got about $400,000 of profit to us that will swing based on how well we do in technology transfer. Not a large item, but significant to us.

Mr. WALGREN. When you say that swings, is there an upside and a downside in that to your balance sheet?

Mr. CARPENTER. Oh, yes.

Mr. WALGREN. Say 400,000 in profit, can that be greater?

Mr. CARPENTER. $400,000 would represent the maximum. If we do poorly, we get none of that in technology transfer. If we do well, as I might observe that we were graded superior on technology transfer in the first 6 months' period, and, so, we got all of that increment.

Mr. WALGREN. That is a retrospective grade——

Mr. CARPENTER. Yes, sir, it is.

Mr. WALGREN [continuing]. Created by——

Mr. CARPENTER. By the local Oak Ridge operations component of DOE; yes, sir.

Mr. WALGREN. And then you can renegotiate that component in the next year?

Mr. CARPENTER. Yes, that's right.

Mr. WALGREN. If there is something else that should be taken into account.

Mr. CARPENTER. That is correct.

Mr. MORRISON. If the gentleman would yield, I might add that this is a standard procedure. As I understand it, the great game for contractors working with the Department of Energy is to receive a high rating because it spins off in dollars.

I guess the only point that comes out of the responses from Mr. Carpenter to me is maybe that 10 percent weight applied to technology transfer should be made higher for the purpose of getting other contractors across the country to do an increasingly superior job of providing for technology transfer.

I will offer that to the chairman just as an idea that may not have any merit.

Mr. WALGREN. We are sort of looking at 2½ percent, is that right, of the——

Mr. CARPENTER. That is correct. The way it was structured the first 6 months, about 2½ percent of the total award fee, which measures many important aspects of our performance, of course.

Mr. WALGREN. I see. And the investor has up to $100,000, an individual—not the investor, the inventor has up to $100,000. That is very comparable to your total fee.

Mr. CARPENTER. Well, that doesn't come out of our profit, remember, Mr. Walgren. In other words, that money that we pay the inventor will come out of the revenue, the royalty revenue pools. The beauty of that is that it does not happen—it is additional money, it really doesn't cost us profit, and it doesn't cost the Government new expenditures. It comes out of the—his payment would directly come out of the revenue pool.

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

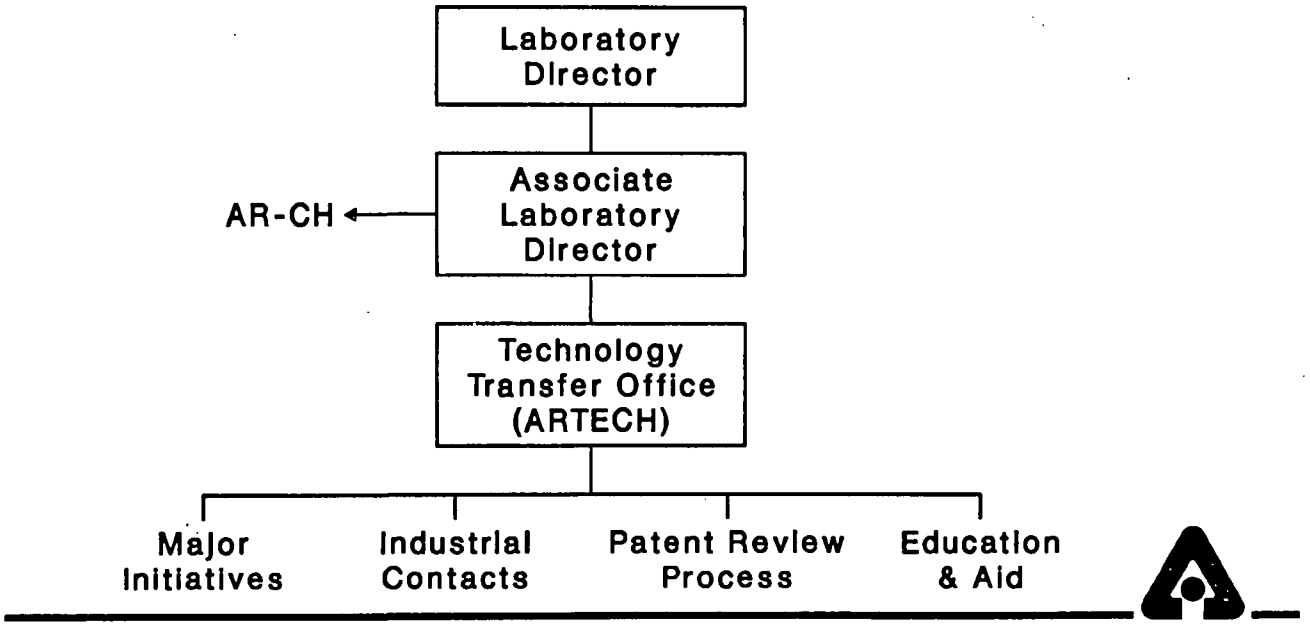


Figure 2

Organization for AR-CH Development Corporation

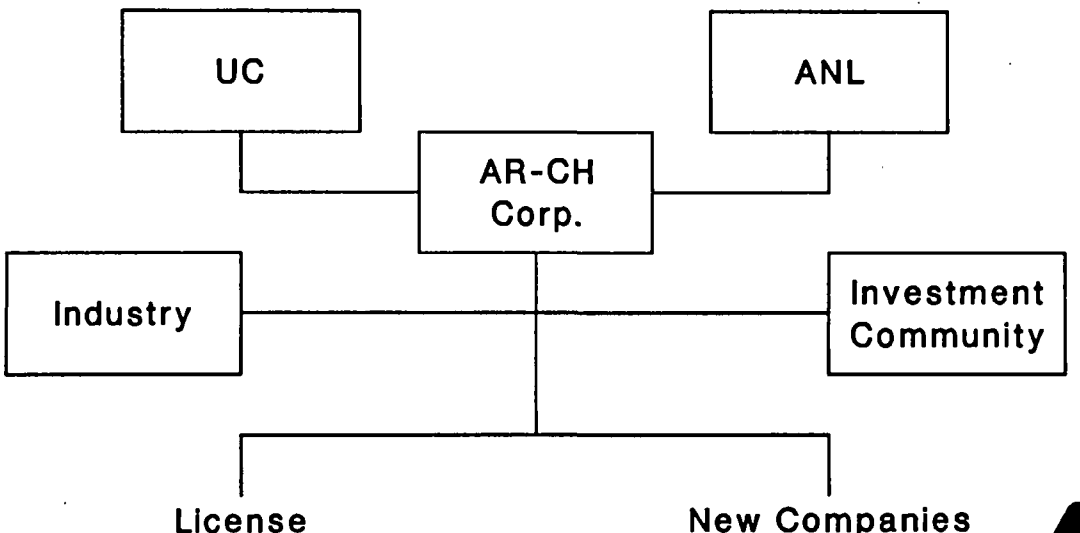


Table 1

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 entrepreneurs 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 licensing. 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 neture 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 laboretories 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 aignificant 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 valueble 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 profeasional 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

PUBLISHED BY THE BELTSVILLE-VANSVILLE DISTRICT 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 Coralle)

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 Les 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 he/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.

c) 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 America'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.

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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.

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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 a year. Whenever an organization adopts our technology, our staff also visits the facilities of that firm as necessary to help solve problems and optimize operation.

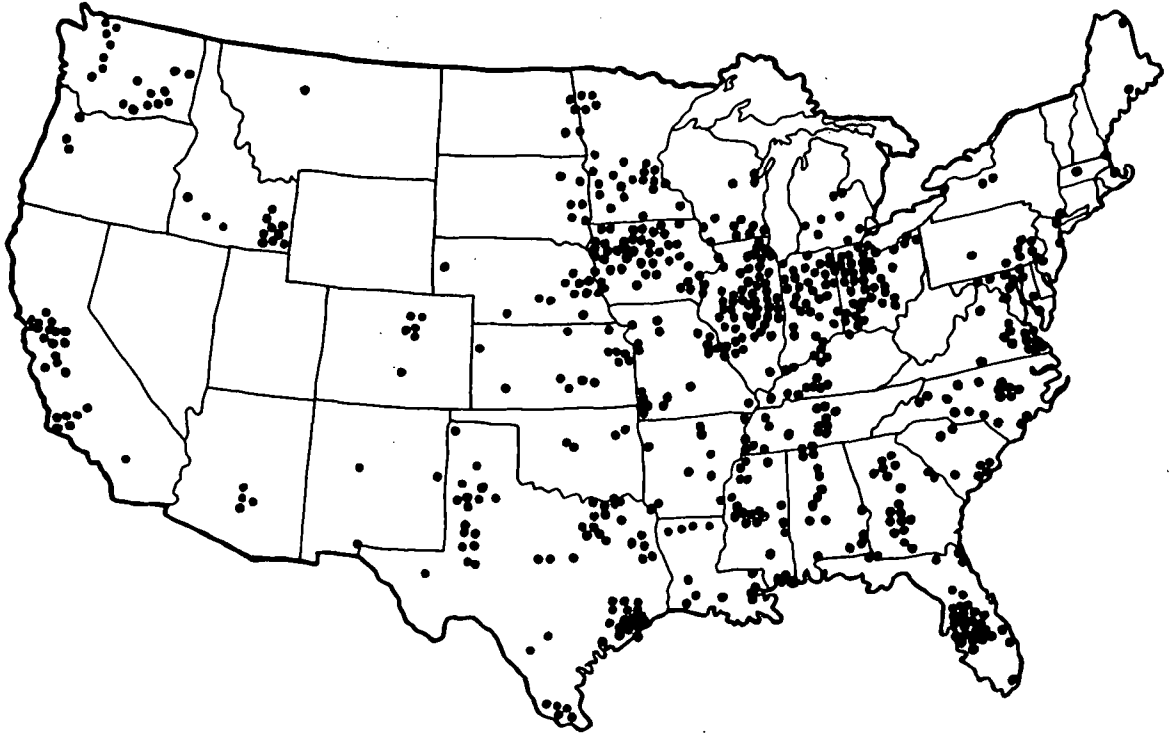
We have a continual outflow of technical papers, in-depth reports, and publications in journals about our developments. Copies of these items are readily available to the public from our library.

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:]

STATEMENT OF JOSEPH G. COYNE, MANAGER, OFFICE OF SCIENTIFIC AND TECHNICAL INFORMATION, DEPARTMENT OF ENERGY, BEFORE THE SUBCOMMITTEES ON SCIENCE RESEARCH AND TECHNOLOGY AND ENERGY RESEARCH AND PRODUCTION, COMMITTEE ON SCIENCE AND TECHNOLOGY'S FIELD HEARING ON TECHNOLOGY TRANSFER AND PATENT POLICY; DOE AND OTHER PERSPECTIVES.

INTRODUCTION

Mr. Chairman and members of the Subcommittee, I am pleased to appear before you today to discuss the technology transfer-related activities of the Department of Energy's Office of Scientific and Technical Information, and to describe how these efforts support DOE's mission, U.S. industry, universities, and other government agencies.

OSTI'S MISSION AND HISTORY

As Manager of the DOE's Office of Scientific and Technical Information, much of my job focuses on technology and information transfer in meeting the Department's responsibilities as mandated in the Energy Reorganization Act of 1974 that incorporated the DOE enabling legislation, which states:

> "(The Department) shall disseminate scientific, technical, and practical information acquired pursuant to this title through information programs and other appropriate means, and shall encourage the dissemination of scientific, technical, and practical information relating to energy so as to enlarge the fund of such information and to provide that free interchange of ideas and criticism which is essential to scientific and industrial progress and public understanding."

Before we get into the OSTI activity, I'd like to provide you with some information on my background, I have served and currently serve in a number of roles, both nationally and internationally, where the primary objective is the transfer and dissemination of scientific and technical information. I served for eight years as a member of NATO's Advisory Group for Aerospace Research and Development (AGARD) Technical Information Panel. Currently, I serve as the U.S. Liaison Officer to the International Atomic Energy Agency's International Nuclear Information System. I am the

U.S. representative on the International Energy Agency's (IEA) Information Technical Committee, which is designing technical information programs that support the U.S. cooperative efforts. I am also an officer of the International Council of Scientific and Technical Information, an affiliate organization of the International Council of Scientific Unions.

Technology transfer is defined in various ways. The fact that technology transfer can be viewed from several different perspectives Is shown by the different testimony of other DOE officials who have testified: Toni Josephs and Dick Constant.

Several approaches to gain access and use of DOE R&D results have been implemented both within and outside DOE, but all in varying degrees touch on or utilize OSTI's comprehensive information technology base. In carrying out its mission, OSTI assists in the monitoring of R&D contracts technical information deliverables and receipt of information therefrom; centralizes for Departmental use these R&D results; announces and disseminates this information internally within and among DOE's offices and contractors and externally to the public through NTIS and commercial availability of large data files; controls the dissemination of such information under current laws and regulations; and exchanges authorized information with foreign governments for purposes of enriching DOE's technology base.

HOW THIS LARGE TECHNOLOGY BASE IS COLLECTED AND MANAGED

Let me describe briefly how this comprehensive, mission and discipline oriented technology base is developed, maintained, and utilized. DOE is currently authorized to spend approximately five billion dollars on research and development efforts in FY-86. This research is carried out by about 70 large Government Owned, Contractor Operated (GOCO) facilities, similar to Martin-Marietta Energy Systems here in Oak Ridge, and by over 6,000 other contractors. These contractors employ about 45,000 researchers to carry out DOE-funded research.

DOE requires that all research and development results emanating from this research be deposited with the OSTI. This action results in receiving over 40,000 DOE scientific and technical reports and research information items reported in scientific and professional journals annually. OSTI receives, enters this information into sophisticated

state-of-the-art computer systems in the form of bibliographic data bases, and makes this information available to all parties needing the information. The information is made available in a wide variety of formats (i.e., computer data files, hard copy, microfiche, etc.), in summary or full text copy, depending on the user's need.

In addition to collecting all R&D information which DOE funds, OSTI also collects other scientific and technical information which is not funded by DOE but is related to DOE's interests in energy technology, both domestic and worldwide. This information is received, processed, merged, and made available in the same manner as DOE-funded R&D, to both DOE researchers and U.S. business and industry at large. Approximately 160,000 domestic and foreign research projects are added annually to the technological base. About 40,000 are domestic non-DOE funded projects and about 120,000 are R&D results received from foreign research.

Accordingly, this large technological data base continues to grow at the rate of approximately 200,000 research projects annually, or over 800 each workday. The cost of these projects ranges from $50,000 to $300,000 each.

It is estimated that, based on dollar-of-the-day investment, the cost of the R&D entered into the DOE Energy Data Base from 1952 to the present is over $300 billion. The continued effective use of R&D results within the DOE and Federal community to assure mission accomplishment is a paramount function of the Office of Scientific and Technical Information.

By providing a system covering the reporting of technical information generated by DOE researchers, announcement and dissemination is easy and largely decentralized. At least half of the information generated by the Department (particularly that originated within GOCOs) is published in the "open literature"; i.e., results are given at conferences or submitted to professional or technical society publications. Encouragement by the Department to disseminate information in this way allows efficient access to the information and permits professional recognition to scientists among their peers. This type of review is considered of paramount importance both to gain professional recognition of the researchers and to the nation's scientific health.

WHY THIS TECHNOLOGY BASE IS VITAL

Let me provide you with a few specific examples of how this important technological data base is utilized to benefit research, to provide programmatic direction, to eliminate unnecessary duplication and overlap, to increase research productivity, and to encourage the transfer of technology.

Within DOE R&D programs:

- this technological data base is searched prior to authorizing research to eliminate unnecessary duplication and overlap;

- all currently authorized research is stored in data files, and the required R&D deliveries are tracked to assure DOE obtains the R&D results called for in the contract;

- the information accumulated is utilized in exchange to obtain the results of important non-U.S. generated energy R&D technology;

- when large research programs are stopped or dismantled such as the Clinch River Breeder Reactor Project (CRBR), the results are captured and stored in the event the technology is needed at a later date;

- the centralized technological base permits DOE program offices to be selective in extracting unique data of special interest and creating special data files. One such project underway is Arms Control and Disarmament;

- costly, high priority national research efforts depend heavily on research performed in the past which is an integral part of this important technological base. Without it, the programs would cost substantially more and take much longer to complete.

As DOE's technical information arm and through the application of modern technologies, OSTI has unique access to DOE information and to the technical information of DOD, NASA, and other R&D programs as well. Thus, the information resources of major Federal research and development agencies may be rapidly brought together to address the technical demands of new national issues.

DOE'S COMPETENCE AND EXPERTISE

The system handles the volume and diversity of information needs of today, and has the flexibility to cost-effectively and efficiently handle the varied forms of information of tomorrow. Central to this concept is the development of a gateway computer that has the capability to provide DOE users access to data bases outside OSTI, yet tied to OSTI's central production system. Information can be downloaded, merged, displayed, manipulated, and printed in forms to satisfy large and small users.

OSTI'S SUPPORT OF STEVENSON-WYDLER

As a part of its role in managing information resulting from DOE's research and development efforts, OSTI performs several functions in support of the Department's technology transfer mission. In addition to making the Energy Data Base available commercially and to providing information in publications such as Patents Available for Licensing, OSTI has two important programs specifically designed to be in direct support of DOE's response to the Stevenson-Wydler Innovation Act for technology transfer. They are the Energygram Program and the Application Assessment Records program.

The Energygram Program was instituted by OSTI as a part of the broad effort to transfer information and technology generated from DOE-sponsored research to members of industry, education, and federal, state and local government. OSTI coordinates with DOE facilities and contractors to identify research of potential value to the private sector. OSTI then develops brief summaries describing the technology and its potential uses. These are then disseminated as single copies and periodic compilations to professional societies, trade associations and other organizations which will provide them to appropriate user industries. In addition, these summaries are available through the Department of Commerce's National Technical Information Service.

OSTI also serves as a central collection and distribution point for DOE-sponsored Application Assessment Records required by the Stevenson-Wydler Act. DOE laboratories prepare written reports that contain evaluations and

descriptions of research which is planned or under way, and which may have uses in the private sector. These reports are sent to OSTI where they are collected and entered into one of the DOE RECON data bases. They also are examined for inclusion in the Energygram Program, and then forwarded to the Department of Commerce, Center for the Utilization of Federal Technology (CUFT).

FOREIGN RESEARCH RESULTS ARE A VITAL PART OF THE TECHNOLOGY BASE

The position of the United States in the world information order has changed dramatically in the last decade; the U.S. has become much more sensitive to the need to assemble information from abroad. Sharing R&D results has even more meaning today as costs of performing research and competition for research funds in all nations increase. It should be understood that the emphasis here is on the sharing of information resulting from basic research rather than information resulting from applied research or research having direct commercial application.

The Department of Energy participates in several significant international collaborative efforts in energy R&D. To facilitate the exchange of information resulting from these collaborative efforts, DOE has developed a program to maximize the accessibility and usability of this information within the Department. Under a long-standing policy requiring reciprocity in the international exchange of scientific and technical information, we work in concert with the other DOE program offices, particularly the Office of International Affairs and Energy Emergencies and the DOE General Counsel. From these mutual efforts, DOE has developed a protocol establishing reciprocity as the basis for its international technology efforts.

This protocol provides for the exchange of energy-related research between the U.S. and the Federal Republic of Germany, the Nordic Consortium (consisting of Norway, Denmark, Finland and Sweden), France, The Netherlands, and the United Kingdom and Northern Ireland. By the way, ministers representing the 21 member countries of the International Energy Agency met last week on the concept of a centralized technical information program for that organization modeled after the Department of Energy's. It is my understanding that it was approved and will likely operate out of OSTI in Oak Ridge.

All information obtained through these international cooperative programs is brought into DOE's Energy Data Base

for immediate access and interrogation by U.S. researchers. The EDB now contains several million energy research items of which more than half are contributions from foreign sources. The ratio of foreign to domestic is increasing each year, with the current year ratio being 3 to 2 foreign over domestic.

As you can see from my testimony, we in DOE's Office of Scientific and Technical Information have been diligent in developing, maintaining, and encouraging utilization of our national technology base. DOE researchers have a natural motivation to see their discoveries and research utilized for the national good and to strengthen the domestic economy.

ATTACHMENT

STATUS OF EDB FILE

SUBJECT CATEGORIES	File Size 12/31/84
Coal and Coal Products	127,000
Natural Gas	43,000
Oil Shales and Tar Sands	17,000
Petroleum	89,000
Synthetic and Natural Fuels	24,000
Fission Fuels	46,000
Nuclear Power Plants	61,000
Nuclear Reactor Technology	60,000
Fusion Energy	51,000
Advanced Automotive Propulsion Systems	19,000
Conservation, Consumption, and Utilization	56,000
Geothermal Energy	20,000
Hydrogen	12,000
Hydro Energy	5,000
Solar Energy	79,000
Tidal Power	1,000
Wind Energy	7,000
Biomedical Sciences	142,000
Chemistry	93,000
Conversion	16,000
Electric Power Engineering	40,000
Engineering	91,000
Environmental Science	81,000
General and Miscellaneous	13,000
Geosciences	22,000
Instrumentation	41,000
Isotope & Radiation Source Tech.	6,000
Materials	120,000
Particle Accelerators	20,000
Physics Research	256,000
Policy	80,000
Storage	19,000
	1,757,000

Mr. MORRISON. Thank you, Mr. Coyne. We appreciate your efforts. I am impressed with the volume, particularly of that file, which represents a significant investment taxpayers have made.

Do you have any way of measuring the effectiveness of this available information? I know it is hard to put numbers.

I am just wondering, that basis there, how effectively is it used by people who will say, we need information on this subject, and then they obviously make some sort of a transfer into the private sector.

Mr. COYNE. We have conducted several analyses of those to get a measure point. One is, if the information were not available through the centralized DOE system, where would the researchers go? It turns out that they would go, very specifically, to 14 other data bases, someplace in the world. And they would still be lacking comprehensiveness of the information they're interested in to conduct the research to a very high degree.

The reason is that the U.S. Government, through the DOE, has access to information from other countries, for example, that the private sector does not have access to, and so on. So, we not only know the cost of that, of conducting those extra searches, as has been documented in these studies, but we know that the time lags, in another study that we have here, of what happens if the information is not available, even within 2-week timeframes, researchers, they tend to say, "If I don't get it now, I've got things to do," and they'll go redo it, they will go reconduct the research. They will do things like that. In other words, they are going to do the most efficient thing, in terms of their project.

Mr. MORRISON. Along those lines, obviously the use of this material has significant value. That is, if they had to redo the work, they would make great investment.

We notice that the 1986 budget request from the Department of Energy proposed that a user's fee system be instituted to cover the costs of your activities basically.

Mr. COYNE. Yes.

Mr. MORRISON. Do you have such a system? And how does it work?

Mr. COYNE. We have a system that works in three—basically what we are trying to establish, based on this requirement of the OMB, is to—the system that we have had for some time, that is, when we take on very special projects or programs that are beyond the mission that has been assigned to OTI, we have always asked for reimbursement for those projects. So that is kind of a set-aside.

We have a second category of costs that are incurred and they are largely associated with data base building with our participation in international activities, and that sort of thing. A decision has been made by the Department of Energy to apply an assessment to the DOE programs based on a proportionate share of the information that is relevant to their programs that we work with. And that program is, to the best of my knowledge, the assessments have gone out to the programs, beginning in 1987. Quite frankly, we don't know how we are going to deal with 1986 at this point.

Mr. MORRISON. Do you sense that the efforts of your office to make information available flies in the face of our need to empha-

size the sharing of technology within the individual Department of Energy laboratories?

Mr. COYNE. I have been in the business for a long time. I was with the National Technical Information Service when I was at the Department of Commerce. When I was there, I was completely of the other mind. I think what we need is a blend of the two systems, someone like NTIS to get out front with industry. I do think the agencies, mission-oriented agencies need ability and the capability to capture the information as we are doing, as you have heard from NASA, in a way that can move it into the private sector. And the choice of funding—well, I think you have seen other ways of doing it within the Department of Energy. This is a new way and I guess we will have to try.

Mr. MORRISON. Thank you, Mr. Coyne.

Madam Chairman, I am delighted to turn Mr. Coyne over to you, and congratulate you because I find Oak Ridge is not only the great source, the font of all knowledge for the United States, but now it is going to be internationally as well. So, you have done very well.

Ms. LLOYD. We are happy that you have been so enlightened. And we want to also apologize that you are the last one yet to go and eat lunch. You are appropriately excused now. Thank you so very much, Mr. Morrison.

I also appreciate, Joe, that you've certainly been a wonderful friend of mine to help me become better informed on not only what is going on here but also in the many areas where you have such great expertise. And I will continue to look to you for guidance in the future.

I would like to have some recommendations from you, if you have any, for improving the way that we disseminate information in reference to our technology innovations to the private sector as well as the state and local. I just wanted your very keen perspective.

Mr. COYNE. I think there are two things, two areas that we have to identify. One is related to technology. The technology area has to do with speed and accuracy of the transfer of information.

There are technologies available today that, I think, could speed up many, many-fold the movement of federally discovered R&D to the U.S. private sector. We are just barely on the tip of the iceberg in terms of being able to work with those technologies, technologies I am convinced are there. And they work in many different ways, but we can get into detail at any point in time. But just by way of one example, even within our own Department of Energy, out in Rocky Flats we have a very big organization, geographically speaking, and if you are on one side of that terrain and you need technical information rapidly, it is very difficult to get at it. Today's technology would permit, if we were using it properly, would permit that researcher who needed fast access, to do it right from his site rather than having to travel to the main site or back and forth or wait around. That's just a fact of life.

I think we need to do a better job of understanding the responsibilities that we have with regard to copyright or patent on software. That is an area where we have a responsibility for managing

the operation of the national energy software. I'm not sure we've done quite the job that we should be doing there.

We have many later-generation computers. We spend a lot of time and effort on labor-intensive software development that is not available off the shelf. And then what do we do to really move that and even help move it into the private sector where fifth-generation computers, I see recently, are just almost catching up in terms of use with Federal Government use. That is an area that I think we need to worry about.

I think we need to make—I would like to see that the policies of the Federal agencies that are large R&D players are as consistent as possible both in dealing with non-U.S. research, that is, on the exchange side—sometimes I feel we are a little bit whipsawed. I would also like to see the policies with respect to the management of information within the United States, to make sure that they are as consistent as possible. And I know we're all saying that they probably are, it's either classified or unclassified, but we have to bring it into play. Things like—the facts of life are the Export Control Act, ITAR, all of these things that do complicate life a little bit. So I think there is something that could be done there. I think a lot of that is a responsibility, very definitely, of the Federal agencies to work on, and indeed we, myself, and several others from NASA to DOD are looking at and addressing these issues. But those are serious, I think, problems.

Ms. LLOYD. It is fascinating to me, a rather regrettable experience also, to learn that the Japanese are moving ahead of us in the high-technology industry where we once had the competitive edge, that they are now moving in with that industry. You know, so long we said, well, you know, we're losing our smokestack industries, but we're going to move ahead with the high technology industries. But now we're saying, hey, wait a minute, we're seeing the high-technology industries in Japan that are being shipped into the United States at the present time. So maybe your comments on speed and getting our copyrights and our patents is certainly well taken.

Mr. COYNE. It's ironic. I think not only patents, copyrights, but the general transferral of information, if we look at what is actually transferrable in the terms of patent and copyright, of the total Federal R&D expenditure, it is an important amount; but there is this much bigger amount that we still must worry about in the productivity aspect of U.S. industry. And that's—we have got to make sure that we pay attention to that, the speed with which we handle that, the efficiency with which we handle that information, and move it not only to Federal R&D types, because they're the font of much of what we're about in this country, but also to U.S. researchers. I just can't overemphasize my feeling that that is where we really need to work. I think there are some very good things happening, from what I've heard, on the patent and copyright side. I know you are concerned with them, but I have this concern that we neglect this other part of the system.

Ms. LLOYD. In reference to our allies, our Cocom partners, our Export Administration, do you think that the bill is a little bit too lax, or—it is not really relevant to these hearings, but I would like to take advantage of this opportunity to ask you: Do you think we

were a little bit too lax, or we should have been a little bit more specific?

Mr. COYNE. I guess I would rather err on the side of being lax, at the moment. When we look at things from our standpoint of these 40,000 DOE research projects coming in each year, many of them are cross-cutting, not only done in defense programs or nuclear, but could be done in fossil. It may have cross-cutting technology in nuclear or defense programs. And then to look at things like the military critical technologies list and say, where does this fit, there are no easy answers to this question. I guess we've got a lot of worrying to do about that, we in the laboratories and those people, the program officer.

Ms. LLOYD. Thank you very much. We are fortunate to have you. Thank you for being with us today.

We next have a panel of witnesses. This is our industry panel. It includes Mr. Ray Sanders who is director of research and development from Boeing Engineering Co. Southeast, and Mr. Alan Fishman who is vice president of Electro-Nucleonics, and Dr. Harold Schmitt, who is with Atom Sciences.

Gentlemen, we welcome you to our hearings today. We look forward to your testimony. We do have your prepared statements and you may proceed as you wish. But your entire prepared statement will be made part of the record.

Mr. Sanders, you may proceed.

STATEMENT OF RAY SANDERS, DIRECTOR, RESEARCH AND DEVELOPMENT, BOEING ENGINEERING CO. SOUTHEAST, INC.

Mr. SANDERS. Thank you, Madam Chairman.

On behalf of the Boeing Engineering Co. Southeast, Inc., I would like to thank the entire committee for the opportunity to comment on DOE's policies and procedures on technology transfer and patent policy. I will confine my comments to our experience on the gas centrifuge project and to the transfer of centrifuge related technology to the private sector. We at BECSI have encountered no problem with the Government patent policy.

In our case, DOE's policy on technology transfer is so closely tied to the classification of the technology that they cannot be discussed separately. When DOE classifies a technology, they have, in effect, eliminated any opportunity for transfer of that technology to the private sector. The classification of the centrifuge technology is the reason we have encountered significant problems in commercializing the technology that has been derived from our centrifuge development work.

With that clarification, I will discuss our views on the potential for commercialization of centrifuge technology if DOE's policies relating to technology transfer and classification are modified.

The DOE decision to develop the AVLIS process for future uranium enrichment and to terminate all research and development on the AGC seals a large portion of the technology and experience acquired over the last 30 years of centrifuge development behind the doors of classification. Because of the classification issue, we in the private sector have problems in utilizing commercially the information that we have acquired from our involvement in the Gas Cen-

trifuge Program. Even if elements of the technology are unclassified when disassociated with the Centrifuge Program, we cannot tell potential customers, inside the Boeing Co. or outside the company, of our experience because the association with the Centrifuge Program results in the information being classified. We, therefore, are and have been handicapped in our efforts to obtain new business in centrifuge related areas because of our association with the classified elements of the Gas Centrifuge Program. And of course, there are processes, materials and equipment that have been developed for the Centrifuge Program that are classified because they are unique to the program and we cannot pursue their potential commercial or military application to the fullest extent.

We believe declassification of the centrifuge technology and transfer of the information to the private sector a few years ago would have minimized the present economic impact to BECSI, its employees and the region caused by the cancellation of the Government program. We, therefore, propose that the centrifuge technology, to the maximum extent possible, be declassified and that the private industry be allowed to market the technology for potential commercial and defense applications.

Because of classification restrictions, I cannot be specific, but the following are general areas of commercial applications for centrifuge technology:

Flywheel applications, advanced materials technology, commercial centrifuges for medical applications, gyroscopic control systems.

Although we have not addressed DOE's policies and procedures on technology transfer specifically, the classification of the centrifuge technology effectively precludes transfer of very valuable information to the private sector. The classification issue also penalizes the direct participants, companies and individuals, in the program by denying the participants the opportunity to overtly market products, skills and experience gained by participation in the Centrifuge Program. We, therefore, suggest that every classified Government program be routinely reviewed for classification requirements and that the technology be declassified to the maximum extent possible so that the technology can be transferred as early as possible.

Obviously the preceding statement implies that we believe the classification of the centrifuge technology has been unduly restrictive and that much of the information should have been declassified years ago.

We certainly don't advocate positions which would jeopardize our national security; we believe many of the more fundamental aspects of the program can be easily declassified without compromise to the security of the Nation. What this declassification would do is permit us to communicate with others in the private sector who are working with the same materials of construction and who have knowledge of special projects and special high-technology enterprises. This would permit us to study in much more depth the potential applications of the technology.

In effect, we are not asking for dollars, we are asking for permission. Just as the technology advances of the space age have been utilized to improve the quality of life for Americans, the technology

advances associated with the 30 plus years of research and development on the Centrifuge Program should be released so that future generations will gain some benefit from taxpayers' investments.

[The prepared statement of Mr. Sanders follows:]

STATEMENT

MR. RAY SANDERS

Director, Research & Development

BOEING ENGINEERING COMPANY SOUTHEAST, INC.

Oak Ridge, Tennessee

Joint Field Hearing

Subcommittee on Energy Research & Production

and

Subcommittee on Science Research & Technology

U.S. House of Representatives

July 15, 1985

Chairwoman Lloyd, Chairman Walgren, distinguished members and committee staff, my name is Ray Sanders. I am Director of Research and Development for the Boeing Engineering Company Southeast, Inc. (BECSI), a wholly-owned subsidiary of The Boeing Company. On behalf of BECSI, I thank you for the opportunity to comment on the U.S. Department of Energy's policies and procedures on technology transfer and patent policy. I will confine my comments to our experience on the gas centrifuge project and to the transfer of centrifuge related technology to the private sector. We at BECSI have encountered no problem with government patent policy.

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- o Gyroscopic control systems.

Although we have not addressed DOE's policies and procedures on technology transfer specifically, the classification of the centrifuge technology effectively

precludes transfer of very valuable information to the private sector. The classification issue also penalizes the direct participants, companies and individuals, in the program by denying the participants the opportunity to overtly market products, skills and experience gained by participation in the centrifuge program. We, therefore, suggest that every classified government program be routinely reviewed for classification requirements and that the technology be declassified to the maximum extent possible so that the technology can be transferred as early as possible. Obviously the preceding statement implies that we believe the classification of the centrifuge technology has been unduly restrictive and that much of the information should have been declassified years ago.

We certainly don't advocate positions which would jeopardize our national security; we believe many of the more fundamental aspects of the program can be easily declassified without compromise to the security of the nation. What this declassification would do is permit us to communicate with others in the private sector who are working with the same materials of construction and who have knowledge of special projects and special high-technology enterprises. This would permit us to study in much more depth the potential applications of this technology.

In effect, we are not asking for dollars, we are asking for permission. Just as the technology advances

of the Space Age have been utilized to improve the quality of life for Americans, the technology advances associated with the 30 plus years of research and development on the centrifuge program should be relased so that future generations will gain some benefit from taxpayer's investments.

Ms. LLOYD. Thank you very much, Mr. Sanders.
Mr. Fishman, would you proceed?

STATEMENT OF ALAN M. FISHMAN, VICE PRESIDENT, ELECTRO-NUCLEONICS, INC.

Mr. FISHMAN. Thank you, Madam Chairman. I am pleased to be given this opportunity to present our company's views on the subject of technology transfer. I am the individual responsible for directing our company's gas centrifuge efforts. My comments today will be specifically related to gas centrifugation.

ENI has been an R&D contractor to the Department of Energy and its predecessor agencies for the past 18 years in the field of gas centrifugation and has had a long and fruitful relationship with the national laboratories, especially here in Oak Ridge, TN. Our most recent responsibility in the Advanced Gas Centrifuge Program has been development of a highly energy-efficient, microprocessor-controlled drive system for the AGC machine.

Aside from our gas centrifuge involvement, the major business activity of electro-nucleonics is in the field of medical diagnostics. We supply a broad range of instrumentation systems and the chemical reagents needed to perform various types of blood tests. These systems are sold to hospitals, blood banks, and most recently, directly to physicians' offices. Included are tests for naturally occurring constituents of blood such as glucose, cholesterol, and uric acid; levels of therapeutic drugs administered to patients; and presence of infectious disease agents or antibodies to these agents such as hepatitis, herpes, and, most recently, AIDS.

It might not seem obvious how these two activities of gas centrifuge enrichment and biomedical equipment are tied together, but they are. Our diagnostics business, which now accounts for over $60 million a year in sales, evolved out of our association with the Government's national laboratories.

If you would permit me a few minutes to review our history in this regard, I think it will become clear why we believe a strong technology transfer program involving gas centrifugation is in the national interest and should now be instituted by the Department of Energy.

In the late 1960's, ENI had a privately funded gas centrifuge research program underway. The Government ultimately decided this was not appropriate for the private sector and ordered us to stop work. In its place, in July of 1967, we were awarded a small prime contract to support the Government's ongoing Gas Centrifuge Program. This is the contract which, 18 years later, is to terminate due to the AVLIS selection decision. Recognizing that the Gas Centrifuge Program was the company's only business venture at that time, the Atomic Energy Commission was kind enough to invite us to Oak Ridge to review certain technology present at the Oak Ridge National Laboratory that had evolved out of the Government's then current gas centrifuge efforts. Out of those discussions evolved an extremely successful technology transfer program involving two separate projects.

First, we collaborated with ORNL in completing development into commercialization of the model K ultracentrifuge. Hundreds of

these machines have been sold by ENI since we introduced it in 1968. It is used by pharmaceutical companies all over the world to separate and purify viruses and other biological substances. Some applications include influenza and hepatitis viruses used in the manufacture of ultra-pure vaccines and the AIDS virus used in the current AIDS antibody test recently introduced by ENI and two other companies.

A second project we embarked on with ORNL was commercialization of a centrifugal blood analyzer. Here centrifugal technology was used not to separate, but to thoroughly mix a blood sample with appropriate chemical reagents under precise conditions and the reaction monitored under computer control. The 1970 introduction of the centrifugal analyzer, called GEMSAEC, which is an acronym for the two agencies in Government that sponsored its development, the General Medical Sciences Department of NIH, and the Atomic Energy Commission, GEMSAEC, was the result of that effort. Now in its third generation at ENI, thousands of these centrifugal systems are routinely used in hospitals and independent clinical laboratories. Besides contributing to improving the quality of health care, these two projects which I have just discussed have returned millions of dollars to the Government in the form of royalties and taxes as well as providing employment to thousands of people.

ENI feels the time is now ripe for another round of technology transfer. Eighteen years ago, an abrupt Government action stimulated an effort by the Government and the private sector to initiate a successful technology transfer effort with benefits accruing to the field of biotechnology. Now that a decision has been made not to deploy centrifuge technology for uranium enrichment, attention can be focused on new spinoff applications. Close to $1 billion R&D dollars have been spent by the Government over the past 25 years in bringing centrifuge technology to the point where it is today. Without comment on its relative position vis-a-vis AVLIS, we believe the centrifuge program has embedded in it very impressive and commercially useful technology.

In conjunction with termination of gas centrifugation activities, we therefore suggest the following general program be implemented:

One, declassify as much of the centrifuge technology as possible consistent with national security considerations;

Two, establish an office within DOE to develop guidelines for and administer an aggressive technology transfer program; and

Three, provide technology transfer funding in fiscal 1986 to those companies who have appropriate capabilities and who submit acceptable proposals which are designed to demonstrate technical feasibility of products they have identified as having commercial applications.

It is our understanding that hundreds of millions of dollars may be required to be spent in fiscal 1986 just to terminate the gas centrifuge program. While necessary, these shutdown costs will provide no return to the taxpayer. A modestly funded technology transfer program at least provides the opportunity for payback to be realized from the huge investment the Government has made in this field. The talent is available. It resides in the core R&D groups

of the centrifuge contractors. We at ENI have already identified some promising products which may be developed from centrifuge technology and we are discussing them with DOE and the Martin Marietta people here in Oak Ridge. We would urge, however, that quick action be taken before the results of termination lead to the disassembly and scattering of the key R&D people needed to work on technology transfer projects and the effective dissipation of the technology itself.

We appreciate the opportunity provided us to discuss our views and would be happy to answer any questions you might have.

[The prepared statement of Mr. Fishman follows:]

Prepared Statement of Alan M. Fishman

Madam Chairwoman and Congressman Walgren, Distinguished Members of the SubCommittees, my name is Alan Fishman; I am a Vice President of Electro-Nucleonics, Inc. (ENI) and the individual responsible for directing the company's gas centrifuge efforts. I am pleased to be given this opportunity to present my company's views on the subject of Technology Transfer.

ENI has been an R&D contractor to the Department of Energy and its predecessor agencies for the past eighteen years in the field of gas centrifugation and has had a long and fruitful relationship with the national laboratories, especially here in Oak Ridge, Tennessee. Our most recent responsibility in the Advanced Gas Centrifuge Program has been development of a highly energy-efficient, microprocessor controlled drive system for the AGC machine.

Aside from our gas centrifuge involvement, the major business activity of Electro-Nucleonics is in the field of medical diagnostics. We supply a broad range of instrumentation systems and the chemical reagents needed to perform various types of blood tests to hospitals, blood banks and most recently, directly to physician's offices. Included are tests for naturally occurring constituents of blood such as glucose, cholesterol and uric acid; levels of therapeutic drugs administered to patients; and presence of infectious disease agents or antibodies to these agents such as hepatitis, herpes and now, AIDS.

It might not seem obvious how these two activities are tied together, but they are. Our diagnostics business, which now accounts for over $60 MM per year in sales, evolved out of our association with the government's national laboratories.

If you would permit me a few minutes to review our history in this regard, I think it will become clear why we believe a strong Technology Transfer program is in the national interest and should now be instituted by the Department of Energy.

In the late 1960s, ENI had a privately funded gas centrifuge research program underway. The government ultimately decided this was not appropriate for the private sector and ordered us to stop work. In its place, in July of 1967, we were awarded a small prime contract to support the government's ongoing gas centrifuge program. (That is the contract which, 18 years later, is to terminate due to the AVLIS selection decision). Recognizing that the gas centrifuge program was the company's only business venture in 1967, the Atomic Energy Commission also invited us to Oak Ridge to review certain technology at the Oak Ridge National Laboratory (ORNL) that had evolved out of the government's then current gas centrifuge program. Out of those discussions evolved an extremely successful technology transfer program involving 2 separate projects.

First, we collaborated with ORNL in completing development and commerialization of the Model K ultracentrifuge. Hundreds of these machines have been sold by ENI since we introduced it in 1968. It is used by pharmaceutical companies all over the world to separate and purify viruses and other biological substances. Some applications include influenza and hepatitis viruses used in the manufacture of vaccines and the AIDS virus used in the current AIDS antibody test recently introduced by ENI and two other companies. The attached news release issued by DOE last year extols development of the liquid centrifuge as a major spin-off of gas centrifuge technology.

A second project we embarked on with ORNL was commerialization of a centrifugal blood analyzer. Here centrifugal technology was used not to separate, but to thoroughly mix a blood sample with appropriate chemical reagents under precise conditions and the reaction monitored under computer control. The 1970 introduction of the centrifugal analyzer, called GEMSAEC, was the result of that effort. Now in its third generation at ENI, thousands of these centrifugal systems are routinely used in hospitals and independent clinical laboratories. Besides contributing to improving the quality of healthcare, these projects have returned millions of dollars to the government in the form of royalties and taxes as well as providing employment to thousands of people at ENI and the other manufacturers of centrifugal analyzers.

ENI feels the time is now ripe for another round of technology transfer involving gas centrifugation. Eighteen years ago, an abrupt government action stimulated an effort by the government and the private sector to initiate a successful technology transfer effort with benefits accruing to the field of biotechnology. Now that a decision has been made not to deploy centrifuge technology for uranium enrichment, attention can be focused on new spin-off applications. Close to one billion R&D dollars have been spent by the government over the past 25 years in bringing centrifuge technology to the point where it is today. Without comment on its relative position vis-a-vis AVLIS, we believe the centrifuge program has imbedded in it very impressive and commercially useful technology.

In conjunction with termination of gas centrifugation activities, we therefore suggest the following general program be implemented:

(1) Declassify as much of the centrifuge technology as possible consistent with national security considerations;

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(3) Provide technology transfer funding in FY 1986 to those companies who have appropriate capabilities and who submit acceptable proposals designed to demonstrate technical feasibility of products they have identified as having commercial applications.

It is our understanding that hundreds of millions of dollars may be required to be spent in FY 1986 just to terminate the gas centrifuge program. While necessary, these shut-down costs will provide no return to the taxpayer. A modestly funded technology transfer program at least provides some opportunity for payback to be realized from the huge investment the government has made in this field. The talent is available. It resides in the core R&D groups of the centrifuge contractors. We at ENI have already identified some promising products which may be developed from centrifuge technology and we are discussing them with DOE and the Martin Marietta people here in Oak Ridge. We would urge, however, that quick action be taken before the results of termination lead to the disassembly and scattering of the key R&D people needed to work on technology transfer projects and the effective dissipation of the technology itself.

We appreciate the opportunity provided us to discuss our views on this most important subject and would be happy to answer any questions you have.

U.S. DEPARTMENT OF ENERGY
OFFICE OF THE PRESS SECRETARY
WASHINGTON, DC 20585

DOE FEATURE:

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September 14, 1984

ENERGY DEPARTMENT TECHNOLOGY LEADS
TO DISEASE-FIGHTING VACCINES

Centrifugal force -- as old-fashioned as a cream separator and as modern as the nuclear age -- has helped scientists develop pure and potent new vaccines to fight diseases such as influenza, rabies and hepatitis.

Dr. Alvin W. Trivelpiece, director of the U.S. Department of Energy's Office of Energy Research, says more than 50 centrifugal systems for the high resolution separation of viruses and bacteria have been built, tested, and produced commercially -- thanks to research supported by the department and its predecessors.

In rapidly-whirling centrifuges, light-weight bacterial substances rise like cream to the top while heavier components settle at lower levels in a fluid medium. The research that led to development of the new vaccines was pioneered by Dr. Norman G. Anderson. Dr. Anderson began his research in the Molecular Anatomy Program at the Oak Ridge, Tennessee, National Laboratory and is continuing it at the Argonne National Laboratory near Chicago.

From Dr. Anderson's pioneering research, other scientists have gone on to develop new and better vaccines from highly purified fractions separated on the bases of both density and sedimentation rate. The development of these centrifuges drew heavily on research and development done at Oak Ridge related to the separation of fissionable material.

OVER

Several new vaccines have been developed with the assistance of the Oak Ridge centrifuges. These vaccines include new experimental preparations to combat influenza and several other viruses suspected of causing illnesses similar to the common cold.

Equally important is the ability of some centrifuges to separate genes, viruses, and other individual components from living cells, opening new areas of exploration in the study of human cells and cell particles.

Thus, the centrifuge became a critical tool as the emphasis shifted from research at the anatomical and microscopic levels to work at the molecular and sub-molecular levels.

High resolution techniques for separating viruses, cell particles and body fluids require the cooperation of many specialists. For such programs to be successful, problems must be broken down into pieces which are intelligible to a given specialist.

The development of the ultracentrifuge is a prime example of the products that can result from research at large, multidisciplinary laboratories such as the Energy Department's laboratory at Oak Ridge.

-DOE-

PF-84-011

Ms. LLOYD. Thank you very much.
Dr. Schmitt.

STATEMENT OF DR. HAROLD W. SCHMITT, PRESIDENT, ATOM SCIENCES, INC., OAK RIDGE, TN

Dr. SCHMITT. Thank you for the invitation to comment to you today on technology transfer and DOE's patent policy. As you may already know, Atom Sciences' formation and its potential for the future are, to a great extent, a result of those policies and initiatives.

It appears that Atom Sciences has in fact played a key role in the formative stages of recent technology transfer policies and procedures at the ORNL and in DOE-Oak Ridge, although this came about really quite by accident. Our desire to commercialize a particular ORNL-developed technology, via the formation of a new company for that purpose occurred at about the time ORNL's and DOE's desires to encourage technology transfer and to develop appropriate policies and procedures were crystallizing. Thus Atom Sciences provided a real live case study on which new policies, rules, and procedures could be tried.

The successful formation of Atom Sciences depended on working out appropriate arrangements and agreements with ORNL and DOE. Likewise, the successful formulation and adoption of internal policies and procedures, especially at ORNL, depended, at least in part, on demonstration that they would work acceptably in the case of Atom Sciences. In those days in 1980 and 1981, when this territory was relatively uncharted, considerable care and a good deal of mutual trust were required in order to accomplish the objectives of all concerned, without creating substantial difficulties or problems. I want to say here that it was a real pleasure to work through all of this with Herman Postma, Clyde Hopkins, and other senior managers at ORNL at the time, and with members of the local DOE patent office. They are to be genuinely commended for their trail-blazing accomplishments in technology transfer and for their continued efforts and activities in this field.

Now, in the following comments, I just want to briefly outline the Atom Sciences story and then comment on some aspects of the policies and procedures that I believe to be most relevant and most important in a generic sense.

The particular technology is called resonance ionization spectroscopy—we call it RIS technology—represents a true breakthrough in the analysis of elemental composition of materials. It is perhaps one of the most exciting and revolutionary measurement technologies developed in recent times, in that it enables identification and counting of single, individual atoms. Indeed, it enables the determination of the elemental composition of materials down to the few atom level.

Both practical and scientific applications of the RIS technology are important. They are found in many industries, for example, in the analysis of high-purity materials such as semiconductors, fiber optics, in geological dating, hazardous waste disposal, mineral composition, surface analysis, biological analyses, and other.

The RIS technology was developed at ORNL by Dr. G. Samuel Hurst and his collaborators. The basic patent on RIS was issued in 1976, and by 1980, sufficient research had been done on the technology to show feasibility and to consider commercialization. Dr. Hurst and I joined forces in late 1980 while he was at ORNL and I was with another company.

In due course, it appeared to us that the most logical vehicle for commercialization of the new technology was to form a new company. At just that time, a number of leaders in DOE, notably Herman Postma, recognized that, in order to achieve significant transfer of Government-developed technologies to industry, new policies and procedures as well as new attitudes would have to be developed throughout both ORNL and DOE. Work was already underway in this area when we approached ORNL management with the possibility of forming Atom Sciences, and the coincidence of our interests seems to have served all sides quite well.

Let me now briefly simply list, although there is more of a discussion in the detailed writeup, those ingredients in the new initiative for technology transfer that were particularly important to us for Atom Sciences and that we were able to work out well with ORNL and DOE.

These were, one, that DOE granted exclusive commercial rights to the relevant DOE patent.

Two, that DOE and Union Carbide Corp. waived their patent rights to a related new development disclosed to ORNL and DOE just before the company was formed.

Three, the approval of participation by Sam Hurst, as a cofounder and officer of the company, and as an active scientific leader in the company, in a manner consistent with his duties and responsibilities as a full-time ORNL time employee.

Four, participation of other selected ORNL employees, as consultants to the company in a manner also consistent with their obligations as ORNL employees.

Now, to a few comments on these and other items as they may apply in policies or procedures in the future.

One, nearly all technologies that are candidates for transfer to industry require significant investment in additional development before they are truly ready for commercialization. Assignment to a company of exclusive rights to a technology is genuinely necessary in order for a company to justify commitment of the funds, time, and staff effort required for the development. The importance of this item cannot be overemphasized, nor can the need for prompt, timely action on requests for exclusive patent rights, waivers, et cetera.

Wisely, a DOE requirement for exclusive assignment of a patent or waiver is that a sound plan for commercialization be prepared and shown. I personally support this requirement as well as its strong enforcement through adequate monitoring procedures and communications after granting of exclusive rights, to assure that good technologies are in fact commercialized and not simply held without action, perhaps by companies that are threatened by them or are simply limited in their capabilities.

Two, a key ingredient in the successful transfer of technology and know-how is participation in the transfer activity by those in-

dividuals who are genuinely knowledgeable in the technology. The Government, under controlled conditions consistent with good management, now permits and should continued to permit and encourage consulting by laboratory employees under a more liberal policy than it had heretofore. It should permit and encourage stock ownership and officer positions to be held by employees in spin-off companies, and it should permit and encourage leaves of absence to be taken by employees to work with recipient companies for a period of time. Only through this kind of participation will effective transfer of technologies occur.

Three, the designation of user facilities is, I believe, another very attractive ingredient in technology transfer, although we at Atom Sciences have had no occasion to date to make use of them. An innovative approach in this area might be that a company could use user facilities fairly extensively, in cases where that might be desirable, in return for a percentage of sales, say, instead of a fee.

Four, the establishment of a Technology Transfer Office by Martin Marietta is certainly an important, indeed, key ingredient in technology transfer in Oak Ridge. The key point is that most technical staff members, no matter how competent or experienced technically, have had little or no occasion to become acquainted with business development or business strategy formulation. Therefore such assistance will be essential to them in evaluating their ideas for commercialization. Care, of course, may be necessary to be sure this office does not become a bottleneck when a good idea for commercialization originates inside the DOE institutions. And it should be able to handle the case in which an employee wants to devote his attention to commercialization as well as the case in which he wants to continue his employment, remain in his current position.

Item 5, as to the blanket advance patent waiver currently under consideration for Martin Marietta, a number of points have been made in the press and other places, but I would like to make just one, perhaps not emphasized in previous comments to you.

A blanket advance waiver will place all negotiations with outside companies in the hands of Martin Marietta staff. Special care will be necessary to assure that the terms resulting from the negotiations are in fact attractive to industry. One of the most harmful developments, in my opinion, that could occur would be a reputation in industry that technology transfer from Government laboratories is doable but that the price is too high.

Item 6, a final point concerns potentially difficult choices. Suppose, for example, that a given technology could be licensed to a large, existing company or to a local spinoff company of which the inventors may be a part, presumably because both had made application and filed a plan. In this situation it will be important to evaluate all alternatives, not just the choice of one or the other. For example, a collaboration between the two companies could be sought; this could take the form of a joint venture, a financing of the spinoff company by the existing company, an OEM arrangement or, of course, many others.

Although we want to strive for maximum effectiveness in technology transfer, we also want to build the local economy so long as

we can do so without artificial preferences and while remaining true to the principles of free enterprise.

In conclusion, spinoff of technology from Government laboratories can indeed work well, obviously it is already working well. Technologies transferred from Government laboratories to industry and commerce create real value in the economy and will be exceedingly important in the national picture. Over a period of time, technology transfer will strongly benefit the U.S. economy and will strengthen its world position. Your support, along with the support of your committee and the Congress, is greatly to be appreciated.

[The prepared statement of Dr. Schmitt follows:]

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STATEMENT TO THE U.S. HOUSE OF REPRESENTATIVES COMMITTEE ON SCIENCE AND TECHNOLOGY

Oak Ridge, Tennessee - July 15, 1985

ON TECHNOLOGY TRANSFER AND PATENT POLICY

by

Harold W. Schmitt
President, Atom Sciences, Inc.
Oak Ridge, Tennessee

Thank you very much for your invitation to comment to you today on technology transfer and DOE's patent policy. As you may already know, Atom Sciences' formation and its potential for the future are, to a great extent, a result of those policies and initiatives.

It appears that Atom Sciences has in fact played a key role in the formative stages of recent technology transfer policies and procedures at the Oak Ridge National Laboratory (ORNL) and in DOE-Oak Ridge, although this came about quite by accident: Our desire to commercialize a particular ORNL-developed technology, via the formation of a new company (Atom Sciences) for that purpose, occurred at about the time ORNL's and DOE's desires to encourage technology transfer and to develop appropriate policies and procedures were crystallizing. Thus Atom Sciences provided a real, live case study on which new policies, rules, and procedures could be tried.

The successful formation of Atom Sciences depended on working out appropriate arrangements and agreements with ORNL and DOE. Likewise the successful formulation and adoption of internal policies and procedures, especially at ORNL, depended (at least in part) on demonstration that they would work acceptably in the case of Atom Sciences. In those days in 1980 and 1981, when this territory was relatively uncharted, considerable care and a good deal of mutual trust were required in order to accompliah the objectives of all concerned, without creating substantial difficulties or problems. I want to say that it was a real pleasure to work through all of this with Herman Postma, Clyde Hopkins, and other senior managers at ORNL and with members of the local DOE patent office. They are to be commended for their trail-blazing accomplishments in technology transfer and for their continued efforts and activities in this field. / Since the arrival of Martin Marietta in 1984 its excellent initiatives in technology transfer have further developed and broadened those activities. The national recognition of ORNL currently as the leader among national laboratories in technology transfer is richly deserved.

In the following comments I will briefly outline the Atom Sciences story and comment on some aspects of the policies and procedures that I believe to be most relevant and most important in a generic sense.

The RIS (Resonance Ionization Spectroscopy) technology represents a true breakthrough in the analysis of the elemental composition of materials. It is perhaps one of the most exciting and revolutionary measurement technologies developed in recent times, in that it enables identification and counting of single, individual atoms. Indeed, it enables the determination of the elemental constituents of materials down to the few-atom level.

Both practical and scientific applications for the RIS technology are important. The most significant advantage of the RIS technology is the co-existence (in a single method) of three characteristics:

- Sensitivity (to $<10^{-9}$ for solids, to $<10^{-18}$ for gases),
- Generality (any element can be measured, except helium and neon),
- Selectivity (measurements are essentially free of false backgrounds).

Important commercial applications are found in many industries, for example in the analysis of high-purity materials such as semiconductors and fiber optics, in geological dating, hazardous waste disposal, mineral composition, catalysis and surface analysis, biological sample analyses, and other areas.

The RIS technology was developed at the Oak Ridge National Laboratory by Dr. G. Samuel Hurst and his collaborators. The basic patent on RIS was issued in 1976, and by 1980 sufficient research had been done on the technology to show feasibility and to consider commercialization. Dr. Hurst and I joined forces in late 1980, while he was at ORNL and I was with another company, to begin to ascertain and understand some of the potential needs for improved elemental analysis in industry and then, based on those needs, to determine how the technology could best be transferred from its origin in a government laboratory into the commercial world.

In due course it appeared to us that the most logical vehicle for commercialization of the new technology was to form a new company for that purpose. At just that time a number of leaders in DOE, notably Herman Postma, Director of ORNL, were stating that many technologies developed in government laboratories were suitable for commercialization and use in industry, but existing policies did not readily permit the transfer of those technologies to industry in a manner that would be attractive either to new or to existing corporations. It was recognized that, in order to achieve significant transfer of government-developed technologies to industry, new policies and procedures as well as new attitudes would have to be developed throughout both ORNL and DOE. Work was already underway in this area when we approached ORNL management with the possibility of forming Atom Sciences, and the coincidence of our interests seemed to serve all sides well.

Let me now summarize those ingredients in the new initiative for technology transfer that were particularly important to us for Atom Sciences and that we were able to work out well with ORNL and DOE. They are:

(1) Exclusive commercial rights to the relevant DOE patent, granted to the company in exchange for a nominal royalty and on condition that the technology would be commercialized, a plan outline for commercialization having been submitted.

(2) Waiver of patent rights to a related new development disclosed to ORNL and DOE just before the Company was formed; DOE and Union Carbide Corporation waived their patent rights and granted those rights to the inventors (ORNL employees) on condition that the invention would be patented and commercialized, a plan for commercialization having been submitted with the waiver application, including intended assignment of the patent to Atom Sciences.

(3) Approval of participation by G. Samuel Hurst as a co-founder and officer of the company, and as an active scientific leader in the company in a manner consistent with his duties and responsibilities as an ORNL employee.

(4) Participation of selected ORNL employees as consultants to the company, in a manner also consistent with their obligations as ORNL employees; such employees were some of the inventors on the patents and experts in various technical fields needed by the company on an occasional basis.

Now to a few comments on these and other items as they may apply in policies or procedures in the future:

(1) Nearly all technologies that are candidates for transfer to industry require significant investment in additional development before they are truly ready for commercialization. Assignment to a company of exclusive rights to a technology, i.e., both patents and disclosures subject to waiver of DOE's patent rights, is genuinely necessary in order for a company to justify commitment of the funds, time, and staff effort required for the development. The importance of this item cannot be overemphasized, nor can the need for prompt, timely action on requests for exclusive patent rights, waivers, etc. Although the procedures for securing such rights appear to have become progressively simpler up to the present time, attention should be given to assure that this continues.

Wisely, a DOE requirement for exclusive assignment of a patent or waiver is that a sound plan for commercialization be prepared and shown. I personally support this requirement as well as its strong enforcement through adequate monitoring procedures and communications after granting of exclusive rights, to assure that good technologies are in fact commercialized and not simply held without action (perhaps by companies that are threatened by them or are simply limited in their capabilities).

(2) A key ingredient in the successful transfer of technology and know-how is participation in the transfer activity by those individuals who are knowledgeable in the technology. The government, under controlled conditions consistent with a good management, now permits and should continue to permit and encourage consulting by laboratory employees under a more liberal policy than it had heretofore. It should permit and encourage stock ownership and officer positions to be held by employees in apin-off companies, and it should permit and encourage leaves of absence to be taken by employees to work with recipient companies for a period of time. Only in this way will effective transfer of technologies occur.

(3) The designation of "Uaer Facilities" is, I believe, another very attractive ingredient in technology transfer, although we at Atom Sciences have had no occasion to date to make use of them. These are special facilities, equipment items, installations, etc., that are made available to outside businesses or institutions for research, development, or process trials, presumably for a fee. An innovative approach in this area might be that a company could use User Facilities fairly extensively, in cases where that might be desirable, in return for a percentage of sales instead of a fee.

(4) The establishment of a Technology Transfer office by Martin Marietta is an important, indeed key, ingredient in technology transfer in Oak Ridge. Most technical staff members, no matter how competent or experienced technically, have had little or no occasion to become acquainted with business development or business strategy formulation. Therefore such assistance will be essential to them in evalusting their ideas for commercialization. In addition, the activities of that office in seeking to identify technologies that may be candidates for commercialization and in trying to arrange mechanisms for commercialization should be encouraged. Care of course may be necessary to be sure it does not become a bottleneck when a good idea for commercialization originates inside the DOE institutions.

(5) As to the "blanket advance patent waiver" currently under consideration for Martin Marietta: Such s device can indeed speed the transfer of technology into the commercial sector, and because of that I want to support it. As a citizen and taxpayer, however, I would hope that care is taken to avoid the appearance (and the actuality) of "cream-skimming" whereby Martin Marietta could preferentially place selected technology rights with its divisions or affiliated enterprises. Not that this would be bad necessarily, but it should be objectively shown in each case that this is the preferred route to commercialization.

Further to this point, a blanket advance waiver will place all negotiations with outside companies in the hands of Martin Marietta's staff. Special care will be necessary to assure that the terms resulting from the negotiations are attractive to industry. One of the most harmful developments that could occur would be a reputation in industry that technology transfer from government laboratories is do-able but that the price is too high.

(6) A final point concerns potentially difficult choices. Suppose, for example, that a given technology (e.g., a patent) could be licensed to a large, existing company or to a local spin-off company of which the inventors may be a part, presumably because both had made application and filed a plan. In this situation it will be important to evaluate all alternatives, not just the choice of one or the other. For example, a collaboration between the two companies could be sought; this could take the form of a joint venture, a financing of the spin-off company by the existing company, an arrangement whereby the spin-off company supplies an OEM product to the existing company, or others. — Although we want to strive for maximum effectiveness in technology transfer, we also want to build the local economy so long as we can do so without artificial preferences and while remaining true to the principles of free enterprise.

In conclusion: Spin-off of technology from government laboratories can indeed work well, obviously it is already working well. Technologies transferred from government laboratories to industry and commerce create real value in the economy and will be exceedingly important in the national picture. Over a period of time, technology transfer will strongly benefit the U. S. economy and will strengthen its world position. Your support, along with the support of your committee, is greatly to be appreciated.

Ms. LLOYD. Thank you very much, Dr. Schmitt. It seems to me the impact of a lack of funding for the centrifuge technology has been pretty important to your businesses. Would you like to comment on that?

Mr. SANDERS. Well——

Ms. LLOYD. It is pretty obvious for you, Mr. Sanders.

Mr. SANDERS. Yes, I think it is pretty obvious to us.

The abruptness with which the termination was executed, I think, was a shock to all and has created some problems that are very personal to our employees in terms of timely placement and those sorts of things.

So, I think it goes without saying that we feel that a more prolonged termination would have been in our best interest, if you will. By the same token, let me move back to the idea of the security implications of lots of the centrifuge information.

We actually have people who have devoted as much as 10 years of their career to a technology and then find that they cannot openly discuss it in a meaningful way with potential employers even within the present company or without the company. So, it gives you pretty much of a 10-year gap, or whatever the period of time may be——

Ms. LLOYD. Mr. Sanders, have you discussed your recommendations of declassifying centrifuge technology with DOE?

Mr. SANDERS. I think, Madam Chairman, you know Mr. Grant, our president, and he has been working this issue very diligently to the maximum extent for the past 2 years. So I would say there was a pretty strong attempt to declassify certain portions of the technology.

Ms. LLOYD. Or do you think that we need legislation to advance this cause? How do you suggest that we handle this?

Mr. SANDERS. It seems to me like there are always—is a problem, that of classification, becomes almost as emotional an issue as nuclear or atomic power becomes.

To suggest that something be declassified seems to suggest that we want to risk the national security. Oftentimes classification is a pure matter of judgment, and the most expeditious and the most convenient judgment oftentimes is to say it is classified, particularly when there is no oversight activity. I think if all classification issues were forced into the scrutiny of, for instance, a peer review, if you will, or that type of oversight activity, or if it became as difficult to classify something as it was to declassify something, the information I mean, I think we would see a great deal of the information that is presently classified turn up in the category of unclassified information.

So I think within every agency there should be much, the sort of activity of an inspector general or that sort of arrangement whereby that classification issues are justified on the basis of national need and not left up, oftentimes, to individual managers or individual participants relative to the classification of the materials that are——

Ms. LLOYD. I certainly agree with you that there has certainly been a lot of technology that has been developed that could certainly be used for very vital programs such as biomedical research and even work on SDI, and other areas, as well as materials.

Would the cooperation of Martin Marietta and Boeing working together really help to further the interest of centrifuge technology?

Mr. SANDERS. Well, it would be antimotherhood and apple pie to say that cooperation never works, but I think we are very pragmatic organizations, and we have to get on with our lives, so to speak. And our problems today are very pressing. We have people to place, we have jobs to save, and so the issue of cooperation over the near term is kind of a hollow issue, I think, to us. And I don't wish to sound negative to the whole idea, but I think the whole technology transfer issue that we talked about here today in so many characteristics implies, as you have very well seen, and it's a very time-consuming process, oftentimes takes years, if you will.

And so we find ourselves today in a position of having to react to the situation that faces us today. I think your committee hearings, hopefully, will prevent this from happening again. And I refer primarily to the abruptness of the terminations.

Ms. LLOYD. I agree with you on the abruptness of the terminations. You know, it was the policy of this member that we should continue to fund AGC technology at a more modest rate, and I felt that would have been prudent, but nevertheless, the administration prevailed in this instance. And I am very sorry that our committee did not get a bill out. But, as you know, the Senate didn't pass the counterpart legislation to make this a reality. We will continue to see what we can do to further, at least capturing the knowledge that we have developed.

Dr. Schmitt, I appreciate the kind words that you had to say on behalf of ORNL and I share your enthusiasm.

How do you envision the national laboratories really participating in the process of technology transfer? Is this what the Oak Ridge National Laboratory is doing?

Dr. SCHMITT. Oh, yes, it is, as a matter of fact. And I think the technology transfer office or organization that Martin Marietta has set up enhances that. Now, that's outside of the Laboratory. Within the Laboratory, within Oak Ridge National Laboratory, I think what is required, at least in part, is an education of staff members that technology transfer is good, that is to say, that it is desirable to commercialize technology.

Historically, that has not been the case; it has not been a desirable item to transfer technology. I am talking about many, many years of history, and there is a whole culture built around that. It now needs to change that and I think is in the process of doing so.

I think Atom Sciences, in its formation, at about the same time that the management was trying to establish new policies and make that possible. I think all that blazed the right kinds of trails, and that is not to say that they can't be refined. They certainly can be refined and improved. I think that is well under way.

Ms. LLOYD. We are going down the road.

Dr. SCHMITT. Yes.

Ms. LLOYD. Thank you.

Mr. Fishman, why does ENI feel that it needs the Government to participate in technology transfer? In other words, if there is that much opportunity, why isn't ENI willing to pay the bill?

Mr. FISHMAN. That is a very good question. Historically we have been willing to pay the bill, and we have invested many more dollars than the Government had, where we were participating in technology transfer activities. As an example, that centrifugal blood analyzer which I related to, the Government spent, I understand, about $3 million in bringing it to the prototype stage. The industry, ourselves, and about four other companies, from what I understand, have spent about $45 million in commercializing that, which is about 15 times the Government's investment.

I think we have a unique situation here. The Gas Centrifuge Program was a massive program. All of us have been devoted singularly to making it work for uranium enrichment. Now we have an abrupt cutoff. There has been very little thought given to commercialization.

You have a number of stumbling blocks to get through. The classification one that Mr. Sanders mentioned is one major stumbling block. The fact that none of the technology has been demonstrated in a technical manner to be able to make commercial reviews of—there are no prototypes for some of the ideas that we see having potential. For example, we also see biomedical centrifuges the new generation of both analytical and production centrifuges are possible.

But, typically, what is appropriate for Government to do is to put the first bit of money in to demonstrate the technical feasibility. Then industry can step up, and we would be certainly willing to do that. We feel the opportunity is unique now. I mean, this was a jarring experience in having the centrifuge terminated. Our participation is relatively small compared to Boeing, but as a percentage of our people involved in it, it is probably the same percentage. Not as jarring as the situation that happened to you back in the cafeteria, I noticed, but it was still jarring.

What we see as necessary is a bridge to, as part of the termination activities, take some of this money that would be used to terminate, to shut down facilities, to relocate people, to terminate some people, and use them for some technology transfer efforts as a bridge, for first base. Once that is done and there are then prototypes available, there are demonstrations, at that point my company, I know, and probably others, would be willing to put dollars in to bring it to the commercialization phase, which costs many more dollars, but at least then the risk is understood.

Ms. LLOYD. That's really great.

One final question, I know I have overused my time. Could you explain your proposal relative to the E-series centrifuge, and other applications that you might have in mind? If you would briefly review that for me.

Mr. FISHMAN. Certainly. The E-series centrifuge is a proposal that has been put in by a number of organizations cooperating together. Martin Marietta has been the lead contractor for that. We are participating as well as Argonne National Lab and a number of other institutions and consultants. It aims toward a development of a new analytical centrifuge that is designed to try to find new viruses, new disease-causing agents, and to identify those agents and to separate them so that diagnostics and therapeutics can be found to combat them.

As an example, the AIDS virus took a long time to find. And from the scientists that we have talked to, if this kind of centrifuge would have been available, it would have shortened the period dramatically.

So, the E centrifuge is one of the projects that not only appears attractive, but the whole program proposal that has been in place and we have it before DOE for a decision. And that would be one of the projects that we would strongly urge be funded in this technology effort.

Ms. LLOYD. Thank you very much. Your testimony has been excellent.

Mr. Morrison.

Mr. MORRISON. Thank you, Madam Chairman. I appreciate your questions because it gave me time to read everyone's testimony.

Ms. LLOYD. Are you saying I talked too long? [Laughter.]

Mr. MORRISON. No, it was just right.

Thank you. I do sense the direction you were each taking, based on your own experience, and that is very valuable to us.

I would like to ask only one question and perhaps might seek responses from each of you.

There is proposed legislation up on Capitol Hill that is decided to return royalties to the laboratories for inventions sponsored by the Federal Government at these laboratories. I was just wondering if any of you had a response to that. Is this a backdoor way of funding additional research, or providing for broader dissemination of the technology that is available? I am interested in your reaction to it as business people.

Dr. SCHMITT. I addressed that point, but not quite so directly, in what I wrote there.

But, basically, my only concern is that the national laboratories and Government institutions not get too greedy. I think if we want to do effective technology transfer, we must make it attractive to industry, not just neutral, not just something called fair, but it must be attractive.

We have kind of a barrier to get over, a historical barrier to get over, and we must make it attractive in order for industry to take those technologies.

Mr. MORRISON. Dr. Schmitt, since you are answering first, I notice you talked about exclusive agreements and perhaps even innovative things like percentage of sales, this sort of thing. And you are saying those are mechanisms which, in fact, could make it attractive to industry, even though there was a fee assigned to your private utilization of the technology.

Dr. SCHMITT. Sure, sure, certainly. As a matter of fact, in our negotiations with DOE we did such a negotiation. We have a very nominal royalty agreement with DOE, that they were happy with and was satisfactory to us and our investors. And we went with that.

Mr. MORRISON. I think there would be a tendency, probably not so much for DOE to get greedy, but for Congress to get its hands into this. I appreciate the answers from the others.

Mr. FISHMAN. I would agree with Dr. Schmitt's comment, basically. We had negotiated under our technology transfer programs back in the late 1960's nonexclusive licenses and, as such, did not

feel that a royalty was appropriate because we were going to be in competition with lots of people. We do have in the centrifugal analyzer a small royalty that we pay—we have paid AEC for each system that we sell. I think in the exclusive license that a larger royalty would be appropriate. But still I agree that the Government shouldn't attempt to get greedy. The best way for the Government to return money to the taxpayer is through employment, through taxation of profits that they achieve.

Mr. MORRISON. We found a supply-sider, Madam Chairman.

Thank you, Mr. Fishman.

Mr. SANDERS. I think I'll stick with Mr. Fishman's answer. It seems to me like that. Since most of these things we are talking about were basically developed with taxpayer money, that the thing that we should do is try and maximize the employment potential and not worry about the royalty fees. Perhaps there are a number of Government-owned patents that I am not aware of that are returning significant royalties, but I just don't happen to be aware of that.

So I think it is an issue that is not terribly important as to what the royalty is, unless there are many that I don't know about, but, rather, that the whole issue of the royalty should be directed in such a way that it creates jobs for the community or for the taxpayer or increases the number of taxpayers.

Mr. MORRISON. My sense of response, particularly at least two out of three, which isn't bad, saying let the marketplace determine what happens in fact to this investment the taxpayers have made in research and make it available essentially on a nonexclusive basis. Or, if you do make it exclusive, that there should logically be a price tag associated with it.

Thank you very much. Thank you, Madam Chairman.

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

One clarification, Mr. Fishman. You said royalties would be paid back to AEC?

Mr. FISHMAN. Yes; we negotiated the original license with the Atomic Energy Commission for the centrifugal analyzer. What they did with that money I don't know. But we have paid them over the past number of years for every analyzer that we have sold.

Ms. LLOYD. Thank you, very much.

Thank you, gentlemen.

It certainly is a great pleasure for me to welcome our next witnesses. Mr. Gene Joyce—Gene is here representing the Roane-Anderson Economic Development Council. I must say that I don't think there is any individual that has given more of himself and devotion to this community than Mr. Joyce. We are grateful for his civic minded endeavors and all he means to this community.

Also, we are happy to have David Patterson, welcome to you also. Mr. Patterson is president of the Tennessee Technology Foundation. He is also representing the commissioner of Economic Development for Tennessee.

So we welcome both of you. We have your testimony and you may proceed.

STATEMENT OF EUGENE L. JOYCE, REPRESENTING ROANE-ANDERSON ECONOMIC COUNCIL

Mr. JOYCE. I appreciate the opportunity to appear before you, and I would like to say that I am appearing here sort of as a private citizen. I am a specialist in no field. I have been a resident of Oak Ridge for many, many years, and have been affected as an individual, and as doing community work, by the patent policy. It is with that background that I hope I can add something without being too redundant to the hearing.

Oak Ridgers have always been proud of the missions they have performed for the Government. We find ourselves, however, held somewhat captive, in a very real sense, by these missions. The policies of the Department of Energy have a very real and immediate impact on the economic viability of this community. Our economic fortunes rise and fall with the shifting winds of energy and defense policies. We are rapidly approaching the time when the legacy of the DOE will become one of our unfulfilled expectations. The breeder reactor, ELMO Bumpy Torus, Koppers' Synfuel plant, Exxon's fuel reprocessing plant—and the list goes on and on. And we are now told that DOE is shutting down the K-25 plant and discontinuing research on Advanced Gas Centrifuge.

Someone has come up with a law of Oak Ridge industrial expectations. It seems by this law if the project is over a billion dollars and is promised to become a reality in Oak Ridge within 5 or 8 years in the future, you can bet on it, it will never get here.

With this background, we have to naturally be apprehensive of other Government projects that have been announced such as the MRS. It is big in the headlines now, and it is a multibillion-dollar project. It is to come to fruition in 5 to 10 years. One must wonder whether it will be another Breeder, or Koppers' or Exxon or GCEPS. During the past 15 years, while these billion-dollar projects were announced as coming here and receiving headline publicity, small private industry naturally shied away from here.

I am sure you are familiar with the economic problems we face in Oak Ridge. We do not have an industrial infrastructure to support our tax base, as our taxes are higher than our neighboring communities.

We have long recognized the need to expand and diversify our industrial base in this community. This is a long and difficult process even under the best circumstances. Yet we are faced with the lack of available land because of DOE's presence here. Not only are our taxes high, but our land sells at a premium. These problems are made worse by the recent revelations of the mercury and uranium pollution in the area. This scenario presents quite a difficult task in convincing a company, a private company to locate here.

We in Oak Ridge were bolstered with new hope when Martin Marietta immediately began taking a very visible and active role as a corporate citizen and is now working to promote a positive image for Oak Ridge. They are helping attract new business and expanding existing businesses in the community as evidenced by their investment in MAXIMA.

But the single most impressive feature of their economic development activities has been their commitment to the creation of new,

small, high-technology businesses in the community. These are the kind of businesses that we, and the State of Tennessee, have been promoting as part of the Technology Corridor. They promise new jobs and fewer environmental concerns. We feel these companies are a natural outgrowth of the research activities in this region. Further, we believe these companies will find a supportive environment by locating close to the technical talents in Oak Ridge and Knoxville.

Martin has already made substantial contributions toward this goal in that they are developing a technology park and creating a Tennessee innovation center. The technology corridor is also making many initiatives toward these same regional goals.

One key tool to assist them and help us to diversify was, hopefully, to be the new patent policy. However, we now hear that everyone is being constrained in these efforts because of the conservative interpretation of this policy.

At this point it might be helpful if I were to give you my thumbnail perspective of the history of Oak Ridge and how it has been affected by the Government policy on patents.

For the past 30 years, we have recognized that the best hope for diversifying has been to take advantage of the transfer of technology from the laboratory to the private sector, provided of course that the particular technology was not secret and was not going to be used by the Government. We have worked toward this goal in the Roane-Anderson Economic Council for many years, have done this, together with appearing in Washington pursuing this goal.

We were heartened in recent years when the new patent law was passed in the 1980's, in 1984. Up until 1980, from my view at least, it was the Government's policy to keep Government-funded technology in Government hands and not give it away to private industry at the expense of the taxpayers. Under this policy, the only thing that really happened was that the viable patents languished in Government vaults while foreign countries caught up and passed us in many areas in the industrial world.

We were hopeful that the new policy on patents would allow us to convert laboratory technology to the private sector. Indeed as a part of Martin Marietta's bid for the contract replacing Carbide, Martin indicated that they, through the new patent policy and the innovation center heretofore mentioned, would create many new private businesses in the region.

In fact, I remember when DOE's Mrs. Martha Hesse came to Oak Ridge, she gave what was one of her reasons for choosing Martin Marietta was that because of their proposal to transfer technology to the private sector.

It is critically important that access to these technologies be not impeded. Through the high-technology companies we hoped to diversify in Oak Ridge along with the technology corridor. To do this, we must be dependent on the flow of technologies from the DOE facilities. This is how Silicon Valley and Route 128 got started.

At the moment, this does not now appear possible—I hope it's a temporary thing, but that's the way it appears at the moment, because of the current interpretation of the law.

If I understand what I read, the problem now is that Martin Marietta is not technically a nonprofit organization. I know you

are familiar with that, so it would be redundant if I read all of that, except to say that we are in a more serious situation now for diversity than we were when Martin bid on the contract over a year ago. I am, of course, referring to the major layoffs that we are having here.

We are now in the same situation that the Richland, WA, facility was in back 15 or 20 years ago when they closed down many of the reactors out there and laid off some 2,000 people. At that time, there was a massive Government assistance to Richland. Part of that assistance was a liberal interpretation of a very old and very conservative patent policy to the extent that Batelle Northwest Research Organization came to Richland and invested some $15 million. That was a distinct variance from the patent law and to the advantage of Batelle and to Richland. What is being asked for here for Martin is of no profit advantage to Martin, but a major advantage to Oak Ridge.

Now that we are under a more liberal patent policy than Richland was in the 1960's and potentially a more severe layoff than in Richland, I hope we can be granted similar liberal interpretation of the current patent law, and help us diversify.

[The prepared statement of Mr. Joyce follows:]

ELJ-Testimony

U.S. HOUSE OF REPRESENTATIVES

TECHNOLOGY TRANSFER & PATENT POLICY

BEFORE THE SUB-COMMITTEE ON ENERGY RESEARCH & PRODUCTION

AND THE SCIENCE, RESEARCH AND TECHNOLOGY COMMITTEE

OAK RIDGE, TENNESSEE

JULY 15, 1985

My name is Eugene L. Joyce. I am Chairman of the Board of the Energy Bank and Chairman of the Roane-Anderson Economic Counsel. I appreciate the opportunity of appearing before you today.

Oak Ridgers have always been proud of the missions they have performed for the government. We now find ourselves, however, held somewhat captive, in a very real sense, by these missions. The policies of the Department of Energy have a very real and immediate impact on the economic vitality of this community. Our economic fortunes rise and fall with the shifting winds of energy and defense policy. We are rapidly approaching the time when the legacy of the DOE will become one of unfulfilled expectations. The Breeder Reactor, ELMO Bumpy Torus, Koppers' Synfuel plant, Exxon's fuel reprocessing plant--the list goes on and on. And now we are told that DOE is shutting down the K-25 plant and discontinuing research on Advanced Gas Centrifuge in the same day!

Someone has come up with a law of Oak Ridge industrial expectations. If the project is government funded, is over $1

Billion, and is promised to become a reality within 5 to 8 years in the future-- it will never happen!

With this as a background, we are naturally apprehensive about the future of the monitor retrievable storage (MRS). It is big in the headlines now and it is a multi-billion dollar project to come to fruition in about 7 to 10 years. One must wonder whether it will be another Breeder, another Koppers' Synfuel plant, another Exxon's fuel reprocessing plant or an Advanced Gas Centrifuge that went to Ohio.

I am sure you are all familiar with the economic problems we face here in Oak Ridge. We do not have an industrial infrastructure to support our tax base. Thus, our taxes are higher than our neighboring communities. During the past 15 years, while these billion dollar projects were announced as coming here and receiving headline publicity--small private industry naturally shied away from here.

We have long recognized the need to expand and diversify our industrial base in this community. This is a long and difficult process even under the best of circumstances. Yet we are faced with the lack of available land because of DOE's presence here. Not only are our taxes high, but our land sells at a premium. These problems are only exacerbated by the recent revelations of mercury and uranium pollution in this area. This scenario presents quite a difficult task in convincing a company to locate here.

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But the single most impressive feature of their economic development activities has been their commitment to the creation of new, small, high-technology businesses in the community. These are the kind of businesses that we, and the State of Tennessee, have been promoting as part of the Technology Corridor. They promise new jobs and fewer environmental concerns. We feel these companies are a natural outgrowth of the research activities in this region. Further, we believe these companies would find a supportive environment by locating close to the technical talents in Oak Ridge and Knoxville.

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At this point it might be helpful if I were to give you my thumbnail prospective of the history of Oak Ridge and how it has been affected by the government patent policy.

For the past 30 years we have recognized that the best hope for diversifying Oak Ridge was to be able to take advantage of the transfer in technology from the laboratory to the private sector--provided the particular technology was not secret and was not going to be used by the government. We have worked towards this goal in the Roane-Anderson Economic Council for many years and have appeared in Washington pursuing this goal.

We were heartened in the recent years when the new patent law was passed in the 80's and amended in 1984. Up until 1980 it was the government's policy to keep government funded technology in government hands and not give it away to private industry at the expense of the taxpayers. Under this policy only one thing happened and that is that viable patents languished in government vaults while foreign countries caught up and passed us in many areas of the industrial world.

We were hopeful that the new patent policy would allow us to convert laboratory technology into the private sector here in this region. Indeed as a part of Martin Marietta's bid for the contract replacing Carbide, Martin indicated that they, through the new patent policy and the innovation center heretofore mentioned, would help create many new private businesses in this region.

In fact I remember when DOE's Mrs. Martha Hesse came to Oak Ridge and gave her reasons for choosing Martin Marietta, one was because of their proposal to transfer technology to the private sector.

It is critically important that access to these technologies not be impeded. Through the high tech companies we hoped to diversify in Oak Ridge and along the technology corridor will be dependent on the flow of technologies from the DOE facilities. This is how Silicon Valley and Route 128 got their start.

At the moment this does not now appear possible because of the current interpretation of the law.

If I understand what I read, the problem now is that Martin Marietta is not technically a non-profit organization or a university and the government is saying that they cannot therefore take advantage of this opportunity. To combat that, Martin has suggested that they will, by contract, guarantee that they will operate exactly the same as universities and non-profit corporations and further that they will not make a profit themselves and allow the government to audit their efforts to be certain of this. Their proposal in broad terms calls for reinvesting this money in further development of Oak Ridge and not go into corporate profit.

We are in a more serious situation here that has developed even since Martin's contract was granted. I am referring to the announced prospect of two or three thousand people being laid off.

We are now in the same situation that the Richland, Washington facility was in back 15 or 20 years ago when they closed down their reactors and laid off some two thousand people. At that time there was a massive government assistance to Richland. Part of that assistance was a liberal interpretation of the old very conservative patent policy to the extent that Batelle Northwest Research Organization came to Richland and invested some $15 million if I am not mistaken. That was a distinct variance from the patent law and to the advantage of Batelle and to Richland. What is being asked for here for Martin is of no profit advantage to Martin, but a major advantage to Oak Ridge.

Now that we are under a more liberal patent policy than Richland was in the 60's and potentially a more severe layoff here than in Richland, I hope we can be granted a similar liberal interpretation of the current patent law.

Ms. LLOYD. Thank you very much, Gene.
Mr. Patterson.

STATEMENT OF DAVID A. PATTERSON, PRESIDENT, TENNESSEE TECHNOLOGY FOUNDATION, KNOXVILLE, TN

Mr. PATTERSON. Thank you, Ms. Lloyd and Mr. Morrison.

I am David Patterson, president of the Tennessee Technology Foundation, a private, nonprofit corporation charged with the responsibility of helping to generate jobs based on the high-technology economic base in this region.

The most important aspect of that job generation, particularly the long-term aspect, relies on being able to homegrow our own businesses based on new products and processes that are a natural outgrowth of investment in research at Government laboratories and universities. These new products or processes may be the result of a direct application of the results of that research. In many cases, they represent synergisms, new ideas that were not sought for or even thought of before the research began. In every case, if these new ideas can get to the market in the form of commercial products or processes, they add, in some small or large way, to the overall welfare of the people in this country and perhaps to mankind in general.

In the past, for a variety of reasons related to excessive regulation, socioeconomic conditions, and a limited access to sources of capital, technology growth depended almost entirely on very large firms and a few hearty individuals that somehow or another were able to overcome the various barriers. Many of these barriers are now gone. Whether by wit or good luck, this country is returning to the entrepreneurial spirit and the drive for new products or new processes that made the United States the world leader in the past. While this movement was led first by the developments that occurred in what we now call Silicon Valley and Boston's Route 128, it is appropriately enough spreading across the country wherever there is a major university and/or a major Federal research center. The Oak Ridge area is certainly becoming a perfect example of what can happen when Federal policies toward technology transfer become positive rather than negative, as they were in the past.

I first began to study this question as an economics professor in 1965. I tried to determine why the number of new firms started in this area as spin-offs from the Oak Ridge National Laboratory and other DOE facilities was so small. There were so few, in fact, that they tended to be described almost as anomalous; and their creators were regarded with a mixture of awe and suspicion, the awe that a scientist or engineer could somehow successfully enter the world of business, and the suspicion derived from the assumption that he or she had perhaps broken the administrative rule, if not the law, in—quote—"stealing"—end quote—the technology funded by Federal funds and turning it to private gain.

Thank goodness that stealing the technology has now developed a euphemism for that, it's called technology transfer.

Today, those are one or two or three startups a year that I could count from the period of 1965–75, have been replaced by more startups than we can keep track of. The awe is still there, although

much diminished, since the ability to get into business yourself or to at least commercialize your technology has been well enough demonstrated. The suspicion has been replaced by a sense that the system is working. Capitalism and Federal funds are doing what they should do, unleashing the talent and energy of human beings to better the life of all of us.

In every way, this new movement must be supported. Particularly, the aspects of current policy that encourage new business formation must be strengthened and, if possible, expanded. The effect will be a strengthened local economy, not just in Oak Ridge and Knoxville, but any place where there are Government facilities or Government-funded research programs. Necessarily, then, there will be also be a continued growth in the contribution that science and engineering can make to the growth and prosperity of the country.

I have no specifics to add to those that have already been suggested other than the use of great caution in tampering with our tax structure; a plea for strengthening, not weakening, small business innovation research programs; and a request that policymakers concerned about abuse of the technology transfer privilege take great care not to return to the time when we threw the baby out with the bathwater. The gains in new products, new processes, and the value of general entrepreneurial spirit far outweigh the occasional, inappropriate advantage that someone may take of their position in a federally-sponsored research program.

Once in a while, there will be a problem. But it is a lot better to get the gains and live with the problem.

Thank you.

[The prepared statement of Mr. Patterson follows:]

Prepared Statement of David A. Patterson

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In the past, for a variety of reasons related to excessive regulation, socio-economic conditions, and a limited access to sources of capital technology growth depended almost entirely on very large firms and a few hearty individuals that somehow or another were able to overcome the various barriers. Many of these barriers are now gone. Whether by wit or good luck, this country is returning to the entrepreneurial spirit and the drive for the new product or new process that made the United States

the world leader in the past. And while this movement was led first by the developments that occurred in what we now call Silicon Valley and Boston's Route 128, it is appropriately enough spreading across the country wherever there is a major university and/or a major federal research center. The Oak Ridge area is certainly a perfect example of what can happen when federal policies toward technology transfer become positive rather than negative as they were in the past.

I first began to study this question as an economics professor in 1965. I tried to determine why the number of new firms started in this area as spin-offs from the Oak Ridge National Laboratory and the other DOE facilities was so small. There were so few, in fact, that they tended to be described almost as anomalous; and their creators were regarded with a mixture of awe and suspicion--the awe that a scientist or engineer could somehow successfully enter the world of business--the suspicion derived from the assumption that he or she had perhaps broken the administrative rule, if not a law, in stealing the technology funded by public funds and turning it to private gain.

Today, those one or two or three start-ups a year that I could count from the period of 1965 to 1975 have been replaced by more start-ups than we can track. The awe is still there, although much diminished, since the ability to get into business yourself, or to at least commercialize your technology, has been well enough demonstrated. This suspicion has been replaced by the

sense that the system is working. Capitalism and federal funds are doing what they should do--unleashing the talent and energy of human beings to better the lives of all of us.

In every way this new movement must be supported. Particularly, the aspects of current policy that encourage new business formation must be strengthened and, if possible, expanded. The effect will be a strengthened local economy, not in just Oak Ridge and Knoxville, but any place where there are government facilities or government-funded research programs. Necessarily, then, there will be continued growth in the contribution that science and engineering make to the growth and prosperity of this country, i.e., a strengthened U.S. economy.

I have no specifics to suggest other than the use of great caution in tampering with the tax structure; a plea for strengthening, not weakening, small business innovation research programs; and a request that policy-makers concerned about abuse of the technology transfer privilege take great care not to "throw the baby out with the bath water." The gains, the new products, the new processes, and the general entrepreneurial spirit far outweigh the occasional, inappropriate advantage that someone may take of their position in a federally-sponsored research program.

Thank you.

Ms. LLOYD. Thank you very much, Mr. Patterson.

Gene, I couldn't have done any better if I had written this myself. You have done a beautiful job. It is a very sad appraisal of the situation but it is so very factual.

It occurred to me that we spent about $6 billion in Department of Energy projects here that have never been finished, from CRBR to MFTFB—the list can go on and on—that it is certainly time now for action, and the time to allow for technology transfer to move, to get on with making this community what it should be, certainly, with the vast wealth of talent that we do have here, now, with the interaction with the university as well.

I think you would agree that we need to move fast to see that we can grant the waivers to Martin Marietta so they can move ahead with the transfer of technology with a more liberal patent policy. Can you think of any other ways that the community can work with ORNL to try to move on to be more productive?

Mr. JOYCE. You mean with reference to the patent policy, or in general?

Ms. LLOYD. In general, in addition to the patent policy provisions.

Mr. JOYCE. Of course, we are in a crisis situation here and now. We are trying to do something to bridge this tremendous impact of layoffs that, apparently, is going to happen this fall. And it is hard to say that anything can quickly be done. I hope we can get more work in here for others, other agencies, or other aspects of the DOE which would be some bridge over to it. The patent policy and its interpretation would be another. And efforts like that, I would hope, would have some effect on our easing the pain of the layoffs.

Ms. LLOYD. Is there any specific—If you could choose one way to go at the present time to redirect this community, to get out of this economic morass, what would be your recommendation?

Mr. JOYCE. First, I think we have to look at it realistically, the pragmatisms of this. We would like in the community to be able to diversify, to be able to get small and large private industry in here, to be able to no longer become dependent almost completely on the Federal Government. Twenty-five years, a quarter of a century, of real effort to do this, we have been unsuccessful, but we have had real accolades from everybody from the U.S. Engineers to the AEC, ERDA, DOE, everyone has said we have done our best. They have monitored us as a condition of the payments and of the taxes, and we have tried our best. We have been unsuccessful. We must look at the immediate future. If we are going to avoid immediate—if we are going to get immediate help, it will have to come from the Government. The Government did not impact this community like it does most communities. The Government created this community from a town of 75. The policies of the Government, like the ones we have just discussed, the business of big private industry concerned about the union activity concentrated in ALCOA, and TVA, and Oak Ridge, are things that make them pause before they come here when they have other people who are courting them maybe without that situation that they might or might not like.

So, we have very many real problems, to the point now that I think our tax base—and I don't have these numbers; I think it's around 5 percent of our tax base comes from private industry in this community, after 25 years of effort. So, if you can look to the

past to project the future, if everybody is working as hard as they can, we have a difficult time ahead of us for private industry. We should work toward that and will continue to make every effort. I think the State should make an effort, and we should redouble our efforts.

Ms. LLOYD. Well, I think you know that this member is certainly encouraging the Department of Energy to look into the areas of technology transfer, especially in relation to the AGC activities that have been here. I will continue to do so. I think there are tremendous potentials in centrifuge technology, not only to move ahead in this community, and the SDI initiative, but also in the biomedical and materials research as well. And I will continue to work in these efforts.

Thank you very much.

Mr. Patterson, in what ways can the State improve the benefits that it derives from the unique capabilities which we have right here in this laboratory?

Mr. PATTERSON. I wish I could give an easy answer to that question because we certainly are worried about it. The State of Tennessee is not in a position to give some of the big subsidies that some other States give to industry. We do not have some of the types of programs that are springing up now in other parts of the country. The Governor has worked hard to improve our educational system, and the university has done a great deal to upgrade its programs and to publicize its programs that were already well upgraded but nobody knew about them.

We are just hard pressed to come up with anything that can solve our short-term problem. Over the long term, I think what is going on in the educational system, from the very lowest level up through the university system, the efforts being made to stimulate and support homegrown business, over the long term that will pay off.

In the short run, I really do not have any suggestions of things that the——

Ms. LLOYD. We are certainly looking forward to working with you in a cooperative manner, to see that more people are retrained. And I do want to compliment the Governor on the initiative that he has made to establishing retraining centers. I look forward to working with the Governor in this endeavor as well.

Mr. Morrison.

Mr. MORRISON. Thank you. I really appreciated the statements of both of you.

Mr. Joyce, I can assure you that the Oak Ridge law, as you referred to it, fits Hanford to a T as well. It seems to be universal among these towns.

I keep telling my good constituents in the city of Richland that they still are waiting around for the government to come in and change the light bulbs.

I wish I could see an answer coming down the road. Both of you, I think, have eloquently made the case for an area that has been impacted recently with some very negative announcements.

I am almost tempted to say, let's devise a formula of some kind so that when you terminate significant programs in an area, that there is a triggered opportunity fund that might provide at least

the capital incentive for people to pick up the opportunities that exist in technology transfer. But I have to share with you perhaps one slight misconception. I don't see the diversification that occurred at Hanford in the mid-1960's as really coming from technology transfer. There was a forced, if you will, diversification within the community that, if you get a piece of the Government action, you have to plow back, in essence, a percentage of the take in the building of a motel, a cattle feed lot, you know, some other things that were efforts to diversify.

I wish, having gone through it in that community, I could give you some better examples. In fact, I have to compliment the work that has gone on here because I sense that the actual utilization of technology here exceeds dramatically the utilization of spinoff technology from what we have seen in the primarily plutonium handling, which is our forte in that immediate area.

So, I guess, rather than a question, I would say, whatever you can devise in your minds, we will be most interested in sharing with you and working with Ms. Lloyd, who has worked without pause on attempting to solve the immediate economic problem that you face.

I guess maybe one question. That is, as you have listened to the presentations on technology transfer or as you watched, do you, both of you, either of you, see particular obstacles that are in the way that would lead to a small business investor coming in and picking up some of that technology and creating the job and investment opportunities that you sense you need here?

Mr. PATTERSON. I work most closely in that area, I guess, than anything else. And I would say that, since I was here and looked at the situation and used to work at the lab as a consultant back in the days when somebody like Hal Schmitt went off and started a business, he was regarded as, you know, really probably kind of a shady character; there was a lot of mistrust of what must have happened there. And I say that quite advisedly. People told me that that really was a bad thing that they did. So if I compare that to where we are today, it is like you've died and gone to heaven. People are supportive of getting out and starting businesses. We are having—I guess 3 years ago I could count maybe 10 startups. This year I don't have any idea how many. I can count—the ones I have counted I could probably count 15 or 20, 25, but I hear of new ones every day. I literally used to know about every one of them. That is just not true today.

The expected, or the hoped for changes that might liberalize the patent policy even more, I think that could help. Efforts to get more positive attitudes on the part of the people that are concerned about abuse could help.

The bureaucratic concerns that everybody must have in a large organization can sometimes slow down a transfer. I really don't see that happening to a great extent here now.

Mr. MORRISON. Mr. Patterson, do you sense that a more fixed procedure in place for this transfer would alleviate some of the concerns that somebody is ripping someone off?

Mr. PATTERSON. I think it's a little more trust, and when you do find someone who really has done it, maybe a good whack across the head perhaps. But I think that we have come a long way, and I

just want to be sure that it continues along that same way, with the kinds of things that I am concerned about; and that is that small business startup, those kinds of economic transfers. And then, of course, the policies of allowing large companies to come in, or any companies to come in and work at the lab and work with the scientists and engineers, is a terrific way to maximize the dollar value of——

Mr. MORRISON. Do you agree with the concept that Martin Marietta seems to be putting in place, and that is that they will encourage their people to step out and serve as advisors or even moonlight?

Mr. PATTERSON. Not only encourage it, I pray for it daily. It is a terrific thing. It has helped us in trying to recruit businesses in here. It has helped new businesses get started. Where a scientist, for instance, has an idea, he or she does not want to go into business themselves, but they are the technical base of that business. Then they can consult. They can help somebody get the business started, just as Hal described a little earlier. And there is more and more of that going on. I think it needs to be encouraged.

Mr. MORRISON. OK. I thank you. And I sense that the reason we are here, of course, is because we think something additional is going to happen within the congressional halls; and we want to make sure that it fits the need. And you certainly have established a pattern here that I think all of us should be pleased to follow.

I guess the moral of the story is that it takes a lot of those small entrepreneurial efforts to make up for a big kick in the shins.

Mr. PATTERSON. That's right. And you can't do it overnight. You got to have some other way to do that.

Mr. MORRISON. I guess I am chairman again, and, with that, we thank you very much for your comments and your attendance here today.

We call the next panel. We will handle these separately: Chancellor Jack Reese of the University of Tennessee at Knoxville.

We look forward to your statement, Dr. Reese, and, as before, the full statement will be part of the record.

STATEMENT OF DR. JACK REESE, CHANCELLOR, UNIVERSITY OF TENNESSEE, KNOXVILLE

Dr. REESE. Thank you, Mr. Morrison.

I should like to begin, if I may, with a few general comments about the role of universities in technology transfer. Although the phrase is relatively new, that role has always been very significant, because most of the basic research in the United States has been carried out at universities. And they have been the primary source for the scientists, engineers, and managers who have traditionally produced economic and technological progress.

In the past decade, however, universities have begun to play, I think, an even more important and increasingly direct role in technology transfer. At research universities such as UT, Knoxville, one finds a growing realization that the economic health of the nation depends upon appropriate partnerships among the Federal Government, private business, and higher education.

Faculty have undergone some interesting transitions themselves. They are much more interested in this topic than they used to be. I believe that they are motivated only partially by the possibility of personal gain; they are attracted also to seeing their research brought to useful conclusions, providing leadership in local economic development, creating employment, and providing a visible legacy of their research.

It would be useful, I believe, to summarize some of the local developments, many of which have been already mentioned today; I will gloss over those quickly.

No. 1 is that in concert with the changes which have taken place in the Federal Government concerning technology transfer, UT Knoxville, like most research oriented universities around the country, has for the first time clearly defined its own patent policies. The procedures reflect a significant increase in patent disclosures. In 1982, for example, 1 such disclosure was filed; in 1984, 14 were processed.

A number of new corporations have been established, the result of faculty research and initiative. These include locally Phyton Technology, Perceptics Corp., Biocarriers, Ptarigan, Veritec, and Reprotech. Very high-technology sounding names.

The State of Tennessee, under the leadership of Governor Alexander, as you know, appropriated $2 million as an endowment for the establishment of the Tennessee Technology Corridor, headed by Mr. Patterson.

Next, the Tennessee General Assembly has approved and funded a limited number of Centers of Excellence at public universities in the State. The top-ranked and best-supported such center is the Science Alliance, which is a cooperative effort between The University of Tennessee, Knoxville, and the Oak Ridge National Laboratory. A very important feature of that effort, one feature of it is the Distinguished Scientist Program, the intent of which is to employ 30 truly distinguished researchers with joint appointments at the University and the Laboratory over a number of years.

Mechanisms for effective technology transfer have been created or significantly enhanced. Our own UT Research Corp. has become much more active. Very recently, a private venture capital firm established close, but not exclusive, ties with the UT Research Corp. And the Tennessee Technology Foundation and Martin Marietta's Innovation Center will play an important role in the university's history.

Another important mechanism is ORAU, Oak Ridge Associated Universities. UTK, for example, is part of a proposed program which will transfer knowledge in supercomputer applications directly to industry from a consortium of 49 universities.

The University has also established a number of research centers which are closely tied to ORNL and which have, or plan to have, heavy corporate involvement. Two have been designated as Centers of Excellence, the Center for Material Sciences and the Center for Hazardous Waste Management. Other centers have been established in Instrumentation and Controls, Automated Manufacturing Systems, and Biotechnology.

Corporate sponsorship of research, which is very germane to the present discusson, that research has increased sharply. Such spon-

sorship a few years ago provided about 5 percent of the research funds coming to the University; this year that percentage will be something over 10 percent.

All of these are very important to technology transfer and to the quality of the research and training at The University of Tennessee, Knoxville. Equally important, if not more important, however, is the emerging principle of coordination and cooperation among the major agencies and corporations in the region. We genuinely believe that alliances have become increasingly important.

The most visible symbol of that new attitude of cooperation and coordination is the Consortium of Research Institutions, made up of the University of Tennessee, Knoxville, the Oak Ridge National Laboratory, the Tennessee Valley Authority, Martin Marietta Corp., and the Oak Ridge Operations Office of the Department of Energy. Top management and research staff from these organizations meet twice yearly to discuss opportunities for joint research and training programs in the region.

I will conclude my testimony with a few brief comments about the role of the Federal Government as envisioned from the University.

The first point seems obvious but perhaps is the most important. That is, the primary support historically for basic and applied research in the United States has come from the Federal Government. And the scientific, technological, economic strength of the country depends primarily on continuation, improvement of that support.

Public Law 96-517, The Patent and Trademark Amendments of 1980, allows us, as a nonprofit organization, as you know, to retain title to innovations. Without that we could never have seen the increase in the number of patent disclosures.

Corporate tax incentives for supporting research at universities, as provided in the Economic Recovery Act of 1981, have significantly increased the university's role in technology transfer, not simply because of the investment of funds, but because of the relationships with companies which were established.

Consequently, we strongly support House Bill 1188, Senate 58, which makes this R&D tax credit permanent and which provides for a few other things such as deduction provisions for corporate donations of the state-of-the-art equipment for educational and research purposes.

I feel impelled to say that we have been very pleased with all of our relationships with Martin Marietta Corp., and we urge appropriate action by the Congress and/or the Department of Energy to provide the company sufficient latitude to make the operation of the Innovation Center truly and quickly successful.

We must never lose sight of the fact, in all this activity, that the systems we devise, the policies we develop should be designed to nurture creativity, that ultimately we are dealing with an individual. And our joint responsibility at the University, Martin Marietta, the Federal Government, the laboratory, is to nourish that sense of creativity, provide the best possible environment for people of great talent to exercise that talent.

And finally, without reference to any specific legislation, I should like to encourage the Congress to recognize, applaud, and support

the cooperative relationships which one finds in this region—and I am not embarrassed about the chauvinism—which one finds in this region among higher education and the Federal Government and private industry.

We have the opportunity to create in this area a national model for effective, coordinated, cooperative technology transfer and economic development; and the Congress and Federal agencies can participate significantly in that effort.

Thank you.

[The prepared statement of Dr. Reese follows:]

My name is Jack Reese, and I am Chancellor at The University of Tennessee, Knoxville. I am pleased to have been asked to present testimony on the subject of "Technology Transfer and Patent Policy."

I should like to begin with several general comments concerning the role of universities in technology transfer. That role has always been significant; most of the basic research in the United States is carried out in universities, and they have been the primary source for the scientists, engineers, and managers who have produced economic and technological progress.

In the past decade, however, universities have begun to play an even more important and increasingly direct role in technology transfer and economic development. At research universities such as The University of Tennessee, Knoxville, one finds a growing realization that the economic health of the nation depends on appropriate partnerships among the federal government, private business, and higher education. Further, such alliances lead to enhancement of university research.

Faculty at these universities have taken a more active role in technology transfer and commercialization of ideas and discoveries. I believe that they are motivated only partially by the possibility of personal gain; they are attracted also to seeing their research brought to useful conclusions, providing

leadership in local economic development, creating employment, and providing a visible legacy of their research.

It would be useful, I believe, to summarize briefly some of the specific developments in technology transfer which have occurred in this region and in which the University of Tennessee has taken a leading role.

1. In concert with the changes which have taken place in the federal government concerning technology transfer, The University of Tennessee, Knoxville has for the first time in its history clearly defined its own patent policies. Those procedures reflect a significant increase in patent disclosures. In 1982, one such disclosure was filed; in 1984, fourteen disclosures were processed.

2. A number of new corporations have been established as a result of faculty research and initiative. These include Phyton Technology, Perceptics Corporation, Biocarriers, Ptarigan, Veritec, and Reprotech. Other local high-technology commercial developments in which UTK faculty participate are Elegraphics, Atom Sciences, and Computer Technology and Imaging.

3. The State of Tennessee, under the leadership of Governor Lamar Alexander, appropriated $2,000,000 as an endowment for establishment of the Tennessee Technology Corridor, whose primary responsibility is the encouragement of high-technology commercial development in the Knoxville-Oak Ridge area.

4. The Tennessee General Assembly has approved and funded a limited number of "Centers of Excellence" at public universities in the state. The top-ranked and best-supported such center is the "Science Alliance," a cooperative effort between The University of Tennessee, Knoxville and the Oak Ridge National Laboratory. A very important feature of this effort is the "Distinguished Scientist" program, the intent of which is to employ thirty truly distinguished researchers with joint appointments at the University and the Laboratory. An inevitable by-product of the "Science Alliance" will be the creation of additional discoveries and products of potentially commercial value.

5. Mechanisms for effective technology transfer have been created or significantly enhanced. The University of Tennessee Research Corporation has become much more active in seeking out patentable ideas and discoveries and aiding inventors in obtaining the funding required for commercialization. Very recently, a private venture capital firm established close (but not exclusive) ties with the UT Research Corporation. Also very significant to University faculty has been the establishment of the Tennessee Technology Foundation and Martin Marietta's Innovation Center. It appears that a serious historical deficiency in this region, the lack of local private venture capital funds, is about to be corrected.

Another important mechanism is the federally-supported, non-commerical Oak Ridge Associated Universities (ORAU). UTK, for instance, is part of a proposed program at ORAU which will transfer knowledge in supercomputer applications directly to industry from a consortium of 49 universities. I should point out that none of these entities is in competition with each other; I view them as complementary.

6. The University has established a number of research centers which are closely tied to ORNL and which have, or plan to have, heavy corporate involvement. Two have been designated as "Centers of Excellence"--the Center for Material Sciences and the Center for Hazardous Waste Management. Other centers have been established in Instrumentation and Controls, Automated Manufacturing Systems, and Biotechnology.

7. Under study and consideration is a research and training facility on the new campus of State Technical Institute on the Pellissippi Parkway linking Knoxville and Oak Ridge. The intent is to provide state-of-the-art, hands-on technical training for students of State Tech, along with space for UTK research projects and "incubator" facilities for small, start-up companies.

8. Corporate sponsorship of research at the University has increased sharply. A relatively few years ago, such sponsorship

provided approximately 5% of the research funds coming to the University; this year that percentage will increase to over 10%.

All of these developments are very significant to technology transfer and to the quality of the research and training at The University of Tennessee, Knoxville. Equally, if not more important, is the emerging principle of coordination and cooperation among the major agencies and corporations in the region. Alliances have become increasingly important. They play an important role in producing technology transfer; they build strengths through shared resources; they keep scientists and engineers informed about research trends and opportunities; they allow agencies to be better informed about federal priorities; they allow regional approaches to technological issues and problems; and they provide a convenient mechanism for the federal government to focus resources so as to achieve the most effective results.

The most visible symbol of this new attitude of cooperation and coordination is the Consortium of Research Institutions, made up of The University of Tennessee, Knoxville, the Oak Ridge National Laboratory, the Tennessee Valley Authority, Martin Marietta Corporation, and the Oak Ridge Operations Office of the Department of Energy. Top management and research staff from these organizations meet twice yearly to discuss opportunities for joint research and training programs in the region.

The last part of my testimony deals with the role of the federal government in all these activities. I should like to make seven brief points:

1. The primary support for basic and applied research in the United States has come from the federal government, and the scientific and economic strength of the country depends primarily on cultivation and enhancement of that support.

2. A milestone in technology transfer occurred with P. L. 96-517, "The Patent and Trademark Amendments of 1980." Under the provisions of this act, The University of Tennessee, Knoxville is able to retain the title to innovations developed by its scientists and engineers working on federally-sponsored grants and contracts. The University could never have increased as dramatically as it has the number of patent disclosures and filings without this alteration in federal policy.

3. The corporate tax incentives for supporting research at universities, as provided in the Economic Recovery Act of 1981, has significantly increased the university's role in technology transfer. Increased corporate sponsorship of University-based research has meant increased translation of basic research into commercial activity, with each partner in the industry-university relationship playing its differentiated and appropriate role.

4. The University thus strongly supports H. R. 1188 and 5.58, legislation which makes this R & D tax credit permanent and which

also creates a new, small tax credit for corporate support of University/independent institute basic research and enhances deduction provisions for corporate donations of state-of-the-art equipment for educational and research purposes.

5. The University of Tennessee, Knoxville has been very pleased with all of its relationships with Martin Marietta Corporation and urges appropriate action by the Congress and/or the Department of Energy to provide the company sufficient latitude to make the operation of the Innovation Center truly and quickly successful.

6. We must not lose sight of the fact that all systems we devise and all policies we develop should be designed to nurture creativity, to allow the individual flash of genius to be developed, and to ensure the freedom of the independent thinker to search and to discover those principles or ideas or truths on which all scientific and technological progress depend.

7. Finally--without reference to any specific legislation--I should like to encourage the Congress to recognize, applaud, and support the cooperative relationships which one finds in this region among higher education, the federal government, and private industry. We have the opportunity to create in this region a national model for effective, coordinated, cooperative technology transfer and economic development; and the Congress and federal agencies can participate significantly in that effort.

Ms. LLOYD. Thank you so much, Dr. Reese. It is always a pleasure to be associated with you. We not only appreciate you as an individual but as a great leader in the field of education here in Tennessee. We appreciate your input on our hearings this afternoon which we think are very valuable.

I think you know that the subcommittee that I chair has provided funding for the universities to further research and development. So we think that you are very special people that can certainly contribute much not only to the economy of our region but for the benefit of mankind.

Do you have any special training programs at the university in the area of technology transfer? For example, are there courses that would provide training to either industry or Federal employees for enhancing their capabilities now that we are at the crossroads here and we are winding down AGC and K–25, to see that we could have some transfer from the technological base that we see rather eroding?

Dr. REESE. The best program we have, Ms. Lloyd, is a newly designated Center of Excellence in the College of Business Administration. That is in the MBA Program, the Master of Business Administration. And we received, for the current fiscal year, special funds to upgrade the entrepreneurial activities and training within the MBA. It is a good route for such activity.

Ms. LLOYD. This morning Dr. Drucker of Argonne discussed their program to set up a separate, nonprofit corporation with the University of Chicago, to transfer the Argonne technology to the marketplace. What do you think about such a corporation being setup between the UT and ORNL?

Dr. REESE. I believe, Ms. Lloyd, there are good mechanisms in place through the UT Research Corp. which is specifically designed to be able to handle such patentable ideas. That group is now strengthened by the presence of a private venture capital firm which, as I indicated in my statement, has close, but not necessarily exclusive ties with the Research Corp.

We are also looking forward to working with the Innovation Center. I think there is a misconception that somehow or other the Innovation Center is to serve only Oak Ridge. We assume, and I think correctly, that the Innovation Center would serve Oak Ridge and the University.

Ms. LLOYD. I think that is certainly true. If you remember, that when the RC's were being sort of put together, when we knew that we were going to have a new GOCO here in Oak Ridge, that we worked with then Secretary Hodel to mandate the interaction between the University of Tennessee and the lab so we could take advantage of the expertise at both institutions.

And I think that is working very well, and we will be looking forward to hearing more of your cooperative ventures with the laboratory and the institute.

Thank you.

Mr. Morrison.

Mr. MORRISON. Dr. Reese, as an outsider looking in, I would say you can afford to be very chauvinistic about the advances you've made within your university system here.

Let me start with this question.

You indicated in your testimony that the university had clearly defined its own patent policy. It was one of the positive steps you have made forward. And then later you indicated that the patent and trademark amendments of 1980 were a significant step forward. What changes did you make in patent policy that went beyond the Federal Government's authority for you to preserve your title to innovations under that congressional act? Were there other changes that might be shared with other institutions in similar positions?

Dr. REESE. I think so. Most of that, of course, is for internal purposes. We clarified the relationship between the university and the inventor. But I think, even more importantly, we indicated that corporately the university was interested in that activity and in helping the individual. There was some apprehension that the university was simply sitting there with its paw out, and trying to get hold of potential profitable enterprises.

That is not really the case. We do not view that activity as any great source of income in the future. We simply do not. We are very, very much interested in making sure that the inventor is adequately protected, adequately compensated. And then, we are very, very much interested in seeing that those ideas get translated into reality.

Mr. MORRISON. Have you, by any chance, looked at the sort of a revolving fund that Martin Marietta is setting up in this regard? Because they don't intend to make a profit out of royalties, but, instead, to plow that back to encourage additional innovation.

Dr. REESE. Yes. The Research Corp. will never build up any large reserve. What money does accrue from royalties or holding equity positions in companies, most of that money will be returned to the inventor and to the department or college, so that further research will be enhanced.

Mr. MORRISON. One last question. I sense that you have been around for a few years, and I'd like to have your assessment of what I see happening to, not necessarily in the technical arena, but I've seen it happen more often in agriculture. And that is our basic university system. I concur with the opening paragraph of your statement that that is where most of the basic research in America has come from through the years. But I sense, now that I am in Congress, that there is a drive to say those institutions should preserve the—the basic research should be there. You know, the germ plasm, the very basic elements of—because no one else is going to do that.

Then I hear in the next breath we have to push harder and harder toward the development of things so that you can show something for your work of all these years. I sense a whipsawing back and forth which leads to some inefficiency. Do you feel that same thing as an administrator?

Dr. REESE. No, not really. The basic research is going to be there. And the really exciting things which are happening now have to deal with the fact that scientists and engineers are seeing some ways in which their work can be applied in a very practical way.

The university will need to maintain these mechanisms for taking an idea at a particular point and moving outside the university, because there is understandable reluctance in UTK and other

research universities around the country to do the sort of applied research which is immediately applicable to a commercial product. That is why the research corporation is there. That is why the Innovation Center is there. We can move those out at a certain stage.

Mr. MORRISON. Thank you. I appreciate that very much.

Madam Chairman, if it will make you feel any better, we are discussing the farm bill in the Agriculture Committee. The conclusion from the dairy representatives from Wisconsin and Vermont and elsewhere was that applied research is moving ahead so rapidly that we are going to have one cow per congressional district within just a few years.

Ms. LLOYD. Well, maybe the subsidy will come from your district.

Mr. MORRISON. Well, maybe so. Let's not get into subsidies because the South would be in trouble.

Thank you very much.

Ms. LLOYD. Thank you very much, Dr. Reese. We appreciate you.

Our next witness, our last witness is Philip Kannan, who is general counsel for the Oak Ridge Associated Universities. Certainly Oak Ridge Associated Universities is one of our great treasures. We look forward to your testimony.

Please proceed.

STATEMENT OF PHILIP M. KANNAN, GENERAL COUNSEL, OAK RIDGE ASSOCIATED UNIVERSITIES

Mr. KANNAN. Thank you. Let me give you a brief summary of the nature of ORAU.

We were incorporated as a not-for-profit corporation by the State of Tennessee in 1946, and we were founded by universities and colleges. And today we are made up of 49-member universities and colleges.

We are and have been, since our beginning, a management-operating contractor for the Department of Energy and its predecessor agencies. At present, our budget from the Department of Energy is about $17.5 million, and we do quite a bit of work for other Government agencies and for private corporations. And our total budget is approximately $25 million for this fiscal year.

Our rights to patents for inventions that are developed under our Government contract are, of course, controlled by the terms of the contract that we operate under, and that has had a given history. Presently we are looking to Public Law 98-620 as the controlling force in our patent policy. We view that public law as a great improvement. Under it, nonprofit corporations like ORAU, which are management contractors for the Department of Energy, have the right to elect patents, subject to a license by the Government for inventions conceived or first reduced to practice under the contract. We believe that this gives us sufficient exclusive rights to make it practical to attempt to inject the inventions that we make under our contract into the commercial world.

Briefly, the procedural work is as follows:

ORAU must disclose to DOE all inventions conceived or first reduced to practice under our contract. This is a continuation of the old practice, and we believe it is beneficial to both the Government and ORAU to make this disclosure.

Second, ORAU has the right to elect to own the patent for such inventions.

Third, the Government will retain a license to practice for its own purposes any such invention or discovery to which we elect title.

Fourth, the Government can file patent applications on any invention which ORAU does not elect to claim title to.

There are also rights which give the Government rights to force ORAU into a licensing procedure if the Government decides that we are not commercializing any patents to which we take title.

We believe that this overall allocation of rights is beneficial to both the Government and ORAU. It represents a balance under which the Government is able to ensure that it can use for its purposes all inventions it has paid the cost to develop. At the same time, ORAU will have sufficient exclusivity to develop interest in the commercial world. That is, we will be able to offer a commercial firm the protection of a patent. The commercial firm would know that it could deal not with a Government agency which is reluctant to grant exclusive rights, but with a private company which has a financial and scientific interest in developing and marketing a product. We expect that we will be able to attract interest and conclude arrangements to put our inventions into the stream of commerce.

Under the regulations which are proposed to implement Public Law 98-620, ORAU is required to use any funds that might result from our licensing activities on DOE's activities at facilities we manage or pay the money into the U.S. Treasury. That is, none of this money goes to the benefit of any program except the Government's programs. We do not disagree with this policy. However, the requirement that all the money go to the benefit of the Government and its work is reasonable only if there is a recognition and acceptance by the Government that the policy has cost consequences.

Any regulation or order which made costs incurred in our licensing activities unallowable, that is, not paid for by the Government, under our contract would be illogical. For example, a cost principle that made the cost of filing patent applications, evaluating the commercial potential of an invention, evaluating the marketability of an invention, soliciting interest in potential licensees, or selecting and negotiating with a licensee and similar expenses unallowable, we think, would be unreasonable. We believe it is unrealistic to expect us to expend our private money to cover such expenses when no funds that may result would go to our private benefit.

The risk and the cost should be borne by whomever may receive the funds that may be returned.

Since all the returns go to the Government's facilities and programs or to its Treasury, all costs of obtaining them should be allowable. We would urge that DOE not attempt to shift the risk to the contractor while retaining the potential benefit. Of course, we hope that in time, the licensing program will produce funds sufficient to cover the then current costs. Until that occurs, the question of who pays the costs is a serious one and threatens the program.

With this one limitation, we support the program that has resulted from Public Law 98-620. We believe that it will result in the infusion of the results of our research into the corporate world.

[The prepared statement of Mr. Kannan follows:]

STATEMENT OF PHILLIP M. KANNAN, GENERAL COUNSEL
OAK RIDGE ASSOCIATED UNIVERSITIES

Oak Ridge Associated Universities appreciates the opportunity to appear at this hearing and present its views on the patent and technology transfer policies of the Department of Energy.

Let me give you a brief summary of the nature of ORAU. It was incorporated as a not-for-profit corporation in Tennessee in 1946 by colleges and universities interested in the new technology, atomic energy, being developed in Oak Ridge and how it would affect science and education. At present we have 49 member universities and colleges.

ORAU has been a management-operating contractor for the AEC, ERDA, and DOE continuously since 1946. We manage major projects for DOE in the fields of science and education under that contract. The budget for our work in FY 1985 under the DOE contract is approximately $17,500,000. We do work for other government agencies and for non-government entities. Our present annual budget is approximately $25 million.

ORAU's rights to inventions have been determined by the terms of our contract. Briefly, there have been three phases to this.

1. The Government retained all rights.

2. The Government retained all rights, but there was a waiver provision under which a license could be granted. This was in effect from 1954 to 1984. Under this policy, DOE issued certain general waivers covering such situations as the use of AEC services available to the public. In research and development contracts, the authority to waive title to inventions was tempered by a policy of not wanting to allow

any company to establish a monopolistic or dominant position in atomic fields.

3. Right of ORAU to elect ownership with the Government retaining a license. This is the result of P.L. 98-620, which I will now discuss.

We view the enactment of P.L. 98-620 as a great improvement. Under it, non-profit corporations like ORAU which are management contractors have the right to elect patents, subject to a license by the Government, for inventions conceived or first reduced to practice under the contract. We believe this gives us sufficient exclusive rights to make it practical to attempt to inject certain of our inventions into the commercial world.

Briefly, this is how the system the Government is preparing under PL 98-620 will work:

1. ORAU must promptly disclose to DOE all inventions conceived or first reduced to practice under the contract. This is a continuation of the old practice and we believe it is very beneficial to both the Government and ORAU.

2. ORAU has the right to elect to own the patent for such inventions.

3. The Government will retain a license to practice for its purposes any such invention or discovery.

4. The Government can file patent applications on any invention not elected by ORAU.

We believe this over-all allocation of rights is beneficial to both the Government and ORAU. It represents a balance under which

the Government is able to ensure that it can use for its purposes all inventions it has paid the cost to develop. At the same time ORAU will have sufficient exclusivity to develop interest in the commercial world. That is, we will be able to offer a commercial firm the protection of a patent. The commercial firm would know that it could deal not with a government agency with reluctance to grant exclusive rights, but with a private company which had a financial and scientific interest in developing and marketing a product. We expect we will be able to attract interest and conclude arrangements to put inventions into the stream of commerce.

One feature of P.L. 98-620 we believe is very positive -- we are authorized, indeed required, to share royalties in excess of our expenses with the inventor. This will encourage employees to identify inventions and make them more willing to devote time to patent disclosure forms and applications. It will also encourage them to evaluate the commercial importance as well at the scientific value of their work.

Under the regulations which implement P.L. 98-620, ORAU is required to use any funds that might result from our licensing activities on DOE activities at the facilities we manage or pay it to the U. S. Treasury. We do not disagree with this. However, this requirement is reasonable only if there is recognition and acceptance by DOE that it has cost consequences. Any regulation or order which made costs incurred in our licensing activities unallowable (i.e., not paid by the Government) under our contract would be illogical. For example, a cost principle that made the cost of filing patent applications, evaluating the commercial potential of an invention, evaluating the marketability of an invention, soliciting interest in potential licensees, or selecting and negotiating with a licensee and similar expenses unallowable would be unreasonable. We believe it is unrealistic to expect us to expend our private money to cover such expenses when no funds that may result would go to our private benefit.

The risk and the cost should be borne by whomever may receive the funds that may be returned.

Since all the returns go to the Government's facilities and programs or its treasury, all costs of obtaining them should be allowable. We would urge that DOE not attempt to shift the risks to the contractor while retaining the potential benefits. Of course, we hope that in time, the licensing program will produce funds sufficient to cover the then current costs. Until that occurs, the question of who pays the costs is serious and threatens the entire program.

With this one limitation, we support the program that has resulted from P.L. 98-620. We believe it will result in the infusion of the results of our research into the commercial world.

Ms. LLOYD. Thank you very much, Mr. Kannan. We appreciate your testimony.

I was looking back over the statements of Congressman Fuqua last year, when H.R. 5003 was being considered. He stated:

> While these laboratories, such as Oak Ridge National Laboratory, which are run for the Government by large companies, are not formally covered by this section, it is hoped that the Department of Energy, using Federal Non-Nuclear Act authority, will develop a standard patent policy consistent with this title for all its GOCO facilities.

Would you comment on his statement? Do you feel that including big business adds some complications that are not prevalent otherwise?

Mr. KANNAN. No, I think that that—I agree with that statement. I think that that is a beneficial statement. I think that especially the philosophy that Martin Marietta is demonstrating, namely, the philosophy of putting all of the funds that may result back into the laboratory, which is the same as ORAU is required to do under our law, make the two programs supportive, make the nonprofit and the profitmaking activities supportive rather than competitive.

In other words, there wouldn't be any reason for a company to choose one over the other based on a profit motive because it's not there for either.

Ms. LLOYD. Well, I think, of course, it is true that what the taxpayer pays for kind of belongs to the taxpayer, but the same thing, I think, can be oversimplified because there is such a thing as intellectual property as well.

Mr. KANNAN. That is right. And intellectual property—the other side of intellectual property, which one or two of the witnesses have referred to today, namely the copyright side, for ORAU is perhaps the more important of the two.

Ms. LLOYD. On the role of ORAU, can you think of any interaction that could take place now with ORAU that could certainly speed up the transfer that will help move ahead to develop more innovative technology so we can get our industry on track here?

Mr. KANNAN. Yes. I think the question which has to be cleared up, of who is going to pay these initial costs, really needs to be clarified because it becomes a drag on this first step. That is, we've got some technology which we think is very good. We've got some drugs, some chemicals which we think are very promising. But it costs a great deal of money to take the first step on the commercialization of that. Until we are clear on who is going to cover those costs, we are reluctant and hesitant to do that.

Ms. LLOYD. Are we losing our competitive edge by foot- dragging and trying to decide who is going to do what?

Mr. KANNAN. We are losing time. I don't know whether the time would be sufficiently long to say, yes, it loses competitive edge. But it certainly is going to cost time. It is a major concern with the other not-for-profit corporations with——

Ms. LLOYD. We know what the technical community in other countries are doing, and I don't think they sometimes have the impediments to develop their technology that we do.

Mr. KANNAN. I agree.

Ms. LLOYD. I certainly appreciate your being with us today.

Do you know of any specific legislation that would enhance the university's participation in the technology transfer efforts?

Mr. KANNAN. No. I think the legislation is in place. The regulations which have now been proposed but not finalized need to clarify several of the very practical nuts-and-bolts steps that have to be taken in getting the technology out. And that, of course, is being done. The first draft is out for comments.

We have met with the Department of Energy and expressed our wholehearted support to the program, and our one minor reservation, and I think that perhaps that will be addressed.

Ms. LLOYD. Thank you very much.

Mr. Morrison.

Mr. MORRISON. Mr. Kannan, you have indicated a requirement that you share anything over your costs with the inventor.

Mr. KANNAN. Yes, yes. That is part of the law and we think it is very sound.

Mr. MORRISON. Therefore, if they play games with what they allow you to write off as expenses, it could totally remove any incentive you would have as an institution to proceed with patents or technology transfers.

Mr. KANNAN. That is exactly correct.

Mr. MORRISON. Good. I understand that. And it makes so much sense.

I have not kept up with the regulation process. I asked this morning about timing on it. Can you enlighten me further as to where these regulations are and if it is timely now for us to influence their preparation?

Mr. KANNAN. It is timely. I think they were—the first draft was published in the Federal Register in early April. Comments were due sometime in June. I am not certain what the date was, but I know that the process is now at the point of considering and responding to the comments. In other words, final regulations have not been issued.

Mr. MORRISON. In their draft form were those regulations punitive as far as your organization is concerned?

Mr. KANNAN. No, the only section that dealt with the cost question—well, first of all, by and large, they were very positive. They were broad in nature and they were liberal in most ways. They did state very clearly, perhaps clearer than the statute itself, that the returns that might come must be spent not just in the area of research and development but at the facility operated for the Government. It made that very clear. And we agree with that. That is where we want to spend the money, with the Government's work here in Oak Ridge.

But it did discuss, in a fairly unclear fashion, the question of costs. I think there is enough room for the Department of Energy, for example, because these are Department of Commerce regulations, for the Department of Energy to interpret the regulations as saying that the costs of patenting and licensing the products, those are allowable costs. We believe that the flexibility is there. It is just a question of earlier discussions with Department of Energy people who are unclear as to which interpretation they are going to give to this important question of allowability. And we would

simply urge that they not give it the restrictive and unrealistic interpretation that such costs are unallowable.

Mr. MORRISON. Thank you. Madam Chairman, in that light, I am not sure what is proper for us to do, but I certainly would like to have, as a result of this hearing, that we share with Chairman Walgren a concern in this immediate area during this time when regulations are still a little bit plastic.

Ms. LLOYD. That point is well taken, and I think that is one of the good benefits of the hearings today. We gained a wealth of knowledge today.

Thank you very much, Mr. Kannan.

Ms. LLOYD. I want to thank all of you who have been a part of our hearings today. We appreciate all that everyone has done in making this facility available for us.

I want to thank the folks of Martin Marietta that have been so good to us today, and their great hospitality.

I would also like to thank the staffs that have worked to make this hearing a reality as well, beginning with my staff director, Dr. Jack Dugan—Jack, we thank you for all of your efforts—as well as Jim Turner, who is the counsel for the majority.

I want to thank Mr. Bill Bibb of DOE, who has always been so good to us. Bill, we thank you for all you do at all times.

Malcolm, we appreciate you, and Tim Peckinpaugh, thank you very much, counsel of my staff, and Debbie Johnson, who has worked behind the scenes, from our subcommittee staffs. And I would also be very remiss if I didn't mention my local staff that have worked very diligently, also. Joanne Garrett, who is my administrative assistant here in Oak Ridge. Robert Barlow and and Tina Walters, we thank you.

And for the press that have covered the hearings, we also want to give you a special thank you, and to Katharine, good work, thanks a lot. We appreciate your good help today.

If there are no further comments, the subcommittee stands adjourned.

[Whereupon, at 2:56 p.m., the subcommittee hearing was adjourned.]

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