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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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 centrifuge and we cannot pursue their potential commercial and military applications to the fullest extent.

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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:

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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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Bob White, 202/252-5810

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 accomplish 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 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 in this way will effective transfer of technologies occur.

(3) 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. 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 evaluating 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 a 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.

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

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

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,

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

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:]

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 would find a supportive environment by locating close to the technical talents in Oak Ridge and Knoxville.

Martin has already made substantial contributions towards this goal in that they are developing a technology park and are creating a Tennessee Inovation Center. The Technology Corridor is also making many initatives towards the same regional goals.

One key tool to assist them to 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 a conservative interpretation of the policy.

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.

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.

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.

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

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.

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Prepared Statement of David A. Patterson

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The most important long-term aspect of that job generation relies on being able to home-grow our own businesses based on new products and processes that are a natural outgrowth of the public and private investment in research in government laboratories, universities, and in some cases, private companies. These new products or processes are 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 sometimes to mankind in general.

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

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:]

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 S.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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