SMALL, HIGH TECHNOLOGY FIRMS AND INNOVATION

HEARINGS

(INCLUDING REPORT)

BEFORE THE

SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT

AND THE

SUBCOMMITTEE ON SCIENCE, RESEARCH AND TECHNOLOGY

OF THE

COMMITTEE ON SCIENCE AND TECHNOLOGY

U.S. HOUSE OF REPRESENTATIVES

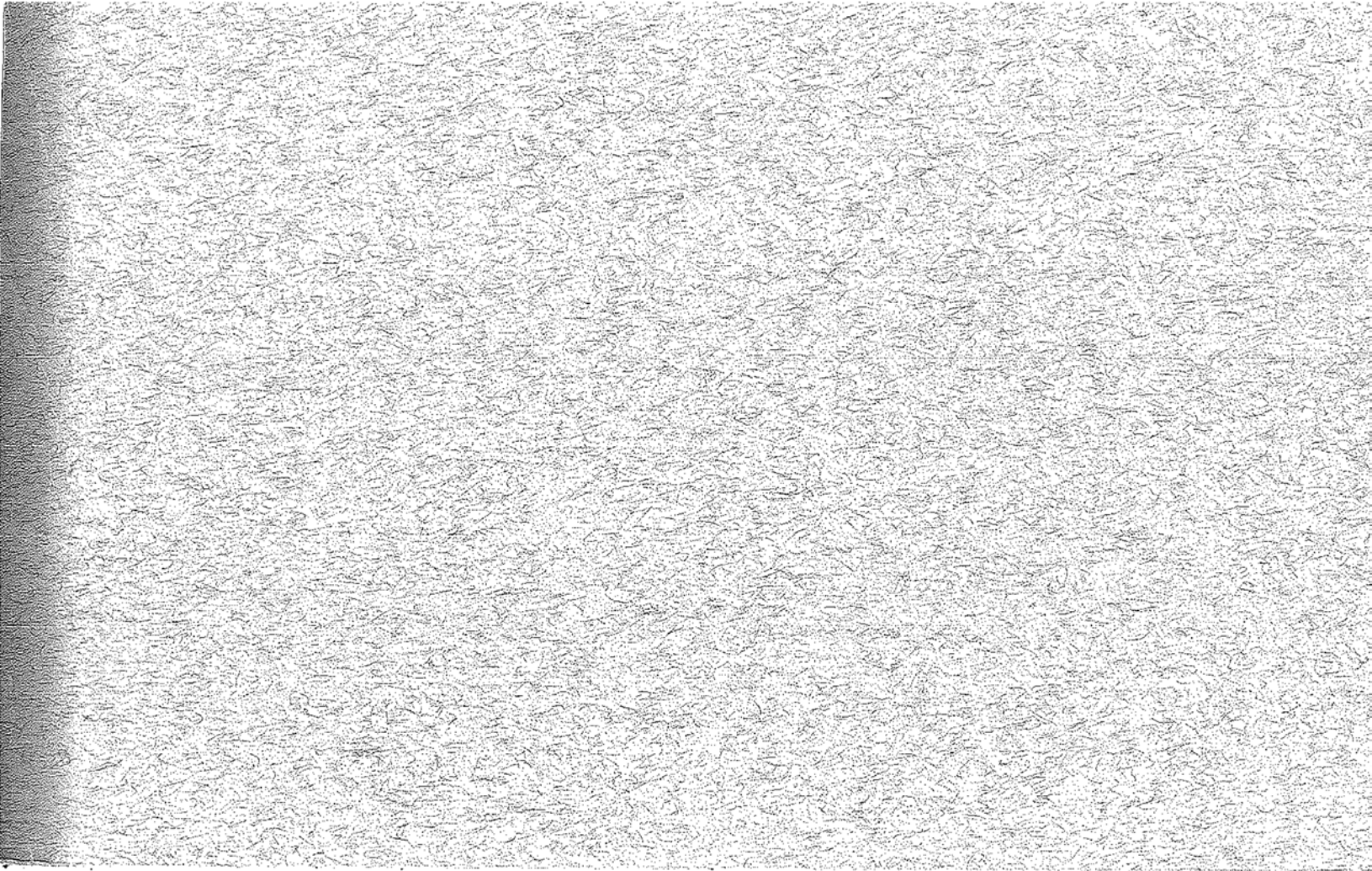
NINETY-SIXTH CONGRESS

FIRST AND SECOND SESSIONS

DECEMBER 10, 1979; JANUARY 28; FEBRUARY 23; MARCH 21; APRIL 10; JUNE 10, 12, 1980

[No. 167]

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Committee on Science and Technology



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LETTER OF TRANSMITTAL

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE AND TECHNOLOGY,
Washington, D.C, November 1980.

Hon. DON FUQUA,
Chairman, Committee on Science and Technology,
U.S. House of Representatives, Washington, D.C.

DEAR MR. CHAIRMAN: The report on the joint hearings held by the Subcommittees on Investigations and Oversight and Science, Research and Technology on June 10 and 12, 1980 accompanies the record of seven days' of hearings on the important subject of "Small, High Technology Firms and Innovation." The recommendations, if implemented, would help spur innovation and improve our Nation's rate of productivity.

Sincerely,

JIM LLOYD,
Chairman, Subcommittee on Investigations and Oversight.

GEORGE E. BROWN, JR.
Chairman, Subcommittee on Science, Research and Technology.

Introduction and Overview

The Investigations and Oversight Subcommittee held five field hearings on the subject of "Small, High Technology Firms and Innovation". The hearings were held in Appleton, Wisconsin on September 10, 1979; Long Island, New York on January 28, 1980; Patrick, AFB, Florida on February 23, 1980; Albuquerque, New Mexico on March 21, 1980; and ending in Pomona, California on April 10, 1980. As a result of these in-depth field hearings, the Subcommittee came up with conclusions and recommendations as listed on pages 58 thru 65 of the report entitled "Small, High Technology Firms and Innovation". The areas of concern were funding of federal research and development; patent policy, federal laboratories; management, technical and financial assistance; tax policy; regulations; and follow-up action. All of these areas are important but the emphasis at the June 10 and 12 follow-on hearings was on technical, management and financial assistance and federal procurement and R&D policies as they relate to small/high technology firms. On June 10th, one panel discussed the technical, management and financial assistance area. On June 12th two panels were convened. The first panel consisted of representatives from Department of Energy, National Science Foundation and the second panel consisted of Department of Transportation and NASA representatives. Presidents of two small, high technology firms participated with each panel on both days. The Science, Research and Technology Subcommittee which had attended the final field hearing on April 10th in Pomona, California and has had a long-standing interest in the area of innovation joined in these hearings on June 10th and 12th.

Summary of the June 10th and 12th Hearings

June 10th

The June 10th hearing was held in room 2318 of the Rayburn House Office Building. There was one panel consisting of five panelists: Radford G. King, Director, Western Research Application Center, University of Southern California; Dr. Robert W. Pricer, Director, Small Business Development Center, Univeraity of Wisconsin; Dr. Gilbert V. Levin, President and Chairman of the Board, Biospherica, Inc.; Dr. Thomas C. Edwards, President and Chairman of the Board, Rovac Corporation; and Paul M. Kelly, Manager, Massachusetts Technology Development Corporation. Dr. King stated the failure of many small, high technology firms occurs because of inadequate management capabilities. Usually failures are blamed on unavailability of capital, unfair procurement practices or onerous government regulations. He states the EDA's University Centers and Trade Adjustment Assistance Centers could be used as role models of effective management assistance services.

Dr. Levin's major concern is that of rekindling the innovative spirit and providing innovative firms with opportunities to innovate. He stated the recommendations in the management, technical and financial assistance section of the Investigations and Oversight Subcommittee's report are directed more toward instilling high technology capability than in providing the firms with opportunities to innovate. He stated that some of the new programs suggested by the report would impose additional regulations and constitute a major impediment to innovative high technology companies.

Dr. Robert Pricer states that oftentimes people sometimes fail to make the distinction between the process of invention and that of innovation. There is a

need to bridge the gap between the new idea evaluation and market testing stages. The Nation's universities have the appropriate knowledge and resource bases to provide the needed assistance. He goes on to say that he agrees with the recommendations contained in the Subcommittee's report, but reemphasizes the need to insure NSF's continuing assistance to small, high technology firms through its Small Business Innovation Research Program.

Thomas C. Edwards stated that one method to encourage quality innovation is through government-sponsored research and development programs which encourage the participation of the small, high technology firms who are responsible for at least half of the major innovations. Another approach would be to encourage large corporations to work with small, high technology firms. The small firms have the ideas and the large corporations have the means to commercialize them. One of the most critical and challenging periods in the innovation process is the gestation period required of such innovations. It is also the period of great financial need.

Paul M. Kelley discussed how the Massachusetts Technology Development Corporation, a public purpose venture capital corporation in Massachusetts, deals effectively with small, high technology firms. In a four-year period, it has put together financial assistance plans to assist approximately 40 innovative small businesses. The biggest problem encountered is the one of access to risk capital. He states that management, technical and financial assistance are given priority over the real problem in innovative small businesses which is acquiring risk capital. Without the right mix of risk and equity capital, the best management and technical assistance program would be marginally effective. Financial programs so far have accomplished only debt guarantees and are often tied to asset base financing. These types of programs are inconsistent with

the process of technological innovation and the cash-flow needs of early stage innovative business. The concept that capital literally flows to itself is a real problem for small, high technology firms. The company with innovative ideas but very little capital or assets to finance its operation has even greater difficulty in acquiring needed capital.

Discussion among the panelists indicated that a clear cut strategy has not been developed by DOE since many of its projects are frivolous. These projects meet the requirements of the agency but are not necessarily marketable. There does not seem to be an understanding of the process of how to take an invention from its origination to marketability. A marketable product is the raison d'etre for the innovation process. Congressman Brown indicated there is a need to stimulate a greater cooperation between government, business, and universities. A logical package is needed but a strategy to accomplish this has not been developed. It was agreed that innovation cannot follow a script and that the benefits of innovation far exceed the risk of possible loss of government monies.

The panelists set forth certain recommendations. These included the following: (1) Commercialization of innovations is risky and requirements for personal guarantees for needed capital should be relaxed or eliminated. (2) To assist small, high technology firms in obtaining sufficient management capability a special overhead item in contracts should be allowed for needed management assistance. (3) NSF assistance of small, high technology firms through its Small Business Innovation Research (SBIR) Program should continue. The appropriation bill should be amended to include a specific line item for small business innovation research and it should be funded adequately. (4) The knowledge and research base at the Nation's universities should be mobilized and used to assist small, high technology firms. (5) There should be a bill

authorizing a national technology foundation to promote technology which would work closely with the National Science Foundation. (6) Steps should be taken to encourage cooperation between the large corporations and small, high technology firms. The small firms have the innovative ideas but lack the necessary capital. The large corporations can provide the needed capital so both organizations benefit. (7) Public purpose venture firms that can provide needed capital to small, high technology firms on a collaborative basis with private venture firms should be encouraged. (8) A ten percent set aside on Federal R&D funds for small firms should be encouraged. Prompt payment is essential. (9) Federal agencies should treat the scientists and engineers from the small firms on a parity basis with his counterparts from the large corporations.

June 12th

The second day of hearings concerned Federal Procurement and R&D Policies and the involvement of small, high technology firms. The first panel consisted of: Michael J. Tashjian, Director of Procurement, Department of Energy; Roland T. Tibbetts, Program Manager for Innovation and Small Business, and Dr. Henry Bourne, Deputy Assistant Director for Engineering and Applied Science, National Science Foundation; Dr. Thomas C. Edwards, President and Chairman of the Board, Rovac Corporation; and Dr. Gilbert V. Levin, President and Chairman of the Board, Biospherics, Inc.

DOE has increased its percentage of awards to small firms from 14% in 1978 to 16% in 1979. This percentage represents approximately $1 billion is going to small business concerns. Money has been set aside to fund unsolicited proposals submitted only by small firms and DOE has worked actively with the Small Business Administration to establish an inventory of small firms that are

capable of handling R&D awards. Loan guarantees and grants have been set up exclusively for small firms in such areas as geothermal, electric and hybrid vehicle. DOE also encourages its contractors at its government owned contractor operated (GOCOs) labs to use small firms as subcontractors.

NSF's Small Business Innovation Research Program (SBIR) involves three phases. Phase I provides awards of approximately $25,000 for meritorious small firms to develop proposals during a six month period and determine whether the proposal is technically feasible. Those Phase I projects which appear not promising receive Phase II awards for in-depth research. These awards average approximately $200,000 for up to two years of research. Phase III is the development phase and the firms are encouraged to secure private funding to pursue commercial applications resulting from the NSF sponsored research. Government monies are spent solely on research meeting NSF support criteria whereas private capital or other funding is spent on pursuing new products, processes and services. This program provides small, high technology firms with the opportunity to work with NSF and fund high risk ideas that normally would be difficult to finance. The fact that NSF will support a particular proposal also gives venture capital investors more confidence in the successful outcome thereby making needed additional funds more readily available.

The SBIR program sumplifies the federal R&D proposal process for small firms by limiting the Phase I proposals to twenty pages. It provides the incentives of many topics and awards and one solicitation with a chance for a follow-on award. Patent rights are awarded to the small firms when Phase III private funding is obtained. As a result of the NSF awards at least six new firms have been started. Over half of the awards have gone to firms with 10 or fewer employees eventhough these firms competed with firms up to 500 employees. The President's

Domestic Policy Review on Industrial Innovation called for the expenditure of $150 million to expand the SBIR program to other federal agencies. To date, this expansion has not occurred. NSF stated its willingness to assist any federal agency that wanted to implement an SBIR or similar type program.

Concern was expressed over the budget cuts in NSF's SBIR program. Dr. Bourne stated that the program was increased from a level of $3 million to $13 million in the January budget but in an effort to balance the budget the final figure was reduced to approximately $6 million. Congressmen Lloyd and Brown indicated support for the program and expressed willingness to have those budget cuts restored.

The DOE program was diacussed at length. Mr. Tashjian stated that they have an active, unsolicited proposal program that was set up approximately 2 years ago to specifically set aside funds for use solely by small firms. Although the number of unsolicited proposals increased, the funding for this program decreased. Dr. Edwards said that he had submitted an unsolicited proposal to DOE many months ago and has not had any response at all.

DOE was asked by Dr. Levin why it doesn't use small, high technology firms to help spur our nation's fusion capability. Mr. Tashjian indicated that DOE encourages its Government owned-Contractor operated (GOCOs) laboratories to use small firms as subcontractors. Also, the small businessmen on the panel expressed surprise that DOE does not massively attack our Nation's critical energy problems by using the small firm to develop the needed innovations.

The second panel consisted of: Dr. Wilbur E. Cantey, Director of the Office of Small and Disadvantaged Business with the Department of Transportation; Dr. Robert Fairman, Deputy Assistant Secretary of Transportation for Administration; William J. Evans, Director of Procurement, NASA; Kenneth J. Kier, Director

of Small and Disadvantaged Business of NASA; and Dr. Thomas C. Edwards, and Dr. Gilbert V. Levin of the previous panel.

The Department of Transportation has made an effort to simplify procurement regulations by providing staff to assist the Office of Procurement Policy in developing a uniform procurement system proposal to be submitted to Congress. In order to maximize the opportunities for a small R&D firm, DOT attempts to structure R&D projects in a series of smaller projects to be accomplished sequentially. To promote the involvement of small, high technology firms, DOE has an extensive outreach program through which it publicizes direct procurement and grant programs. DOT has not set up a program similar to NSF's Small Business Innovation Research (SBIR) Program but indicated the SBIR program will be watched closely to determine if it is applicable to DOT's operation. The Department of Transportation conducts much of its research in its own labs such as: the FAA technical center, Atlantic City, New Jersey; Mike Monroney Aeronautical Center at Oklahoma City, Oklahoma; Fire & Safety Test Attachment, Mobile, Alabama; Research and Development Center, Groton, Connecticut; Transportation Test Center, Pueblo, Colorado; Vehicle Research and Test Center, East Liberty, Ohio; Fairbank Highway Research Station, McLean, Virginia; and a Transportation System Center in Cambridge, Massachusetts. However, some lab activities are performed under contract.

NASA is making a definite effort to encourage involvement by small, high technology firms by publicizing its procurement opportunities as widely as possible. In fiscal year 1979, NASA's R&D awards to small firms totaled $205.6 million or 6.6% of the agency's total R&D. In fiscal year 1979, 34% of all NASA contract awards resulted from unsolicited proposals. Of the 231 NASA contract awards resulting from unsolicited proposals, 79 or 34% of the total were awarded to small firms. Small firms also receive 32% of the total dollars involved. NASA also

made an extensive review of regulations in order to simplify the contracting procedures. The review was not particularly productive because NASA did not have the authority to change or modify many of the regulations. NASA stated that NSF's Small Business Innovation Research (SBIR) Program is not ideally suited to its needs because unsolicited proposals may not be responsive to its specific requirements.

The panelists representing small firms encouraged joint communications and efforts among the agencies to increase participation by small firms. They also voiced concern about the unpredictability of funding. If follow-on funding is uncertain, the company should be fully informed so it does not incur additional expenses on a contract. Once an award is made, payment should be prompt. Efficient evaluation and good communication are essential.

Conclusions and Recommendations

Conclusion:

The Subcommittee on Investigations and Oversight's report entitled, "Small, High Technology Firms and Innovation" is a timely report with pertinent recommendations to stimulate productivity and innovation.

Recommendation:

The recommendations contained on pages 58-65 of the Subcommittee on Investigations and Oversight's report should be implemented.

Conclusion:

Funding for R&D procurement has not always been stable. This makes it difficult for small firms to plan and adequately manage their resources. Small firms' participation in Federal R&D awards should be increased.

Recommendation:

Stable funding of R&D procurement should be stressed and the amount of R&D awards to small firms should be increased.

Conclusion:

Small firms have a difficult time competing with large firms for R&D awards. This difficulty is not based on their lack of competence but rather on the governmental roadblocks which treat small firms differently.

Recommendation:

Federal agencies should treat small firms with parity.

Conclusion:

Small firms need risk capital and the demand far exceeds the supply. The Massachusetts Technology Development Corporation has established an outstanding record of providing additional risk capital to small firms.

Recommendation:

Public and private entities should work closely together to insure more risk capital is made available to small firms. The model of the Massachusetts Technology Development Corporation should be emulated.

Conclusion:

Managerial competence is a key factor in determining the success of a small firm. It is just as important as capital availability and technical competence.

Recommendation:

Resources should be made available to assist the small, high technology firm in achieving managerial as well as technical competence.

Conclusion:

Small firms need facilities and capital and large firms need innovative ideas. Cooperation between small and large firms could provide each other's needs.

Recommendation:

Close cooperation between large corporations and small firms should be encouraged to promote innovation.

Conclusion:

The National Science Foundation promotes basic science and has established an enviable record. However, the Nation needs to harness that scientific knowledge to promote advanced technology. A National Technology Foundation could accomplish that.

Recommendation:

The proposal to establish a National Technology Foundation should be carefully studied and evaluated.

Conclusion:

NSF's Small Business Innovation Research (SBIR) program is an outstanding example of how a Federal agency can encourage and promote innovation. The SBIR program has been singled out for praise in the President's Domestic Policy Review of Industrial Innovation. However, the SBIR program has not been permitted to expand adequately.

The Committee is concerned about this and the future of applied research in the Foundation due to the planned reorganization with applied research being absorbed into the basic science directorates. Applied research is the principal source of funding for small, high technology firms and is the base for the current 12 1/2% of the applied research budget required to be placed with small firms. In recent years the NSF's budget for Applied Science has steadily decreased.

Recommendation:

The NSF SBIR program should be expanded within the Foundation, kept as a discrete entity, and given a line-item breakout in the NSF budget request.

Conclusion:

Each Federal agency could help promote innovation by establishing a program similar to NSF's SBIR program within its agency.

Recommendation:

Federal agencies should examine NSF's SBIR program and implement similar type programs which comport with their needs.

Conclusion:

These conclusions merit specific action by the agencies involved in these hearings.

Recommendation:

DOE, NSF, DOT, and NASA should report to the Committee on Science and Technology not later than June 30, 1981, the actions each agency has taken to implement these recommendations.

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SMALL, HIGH TECHNOLOGY FIRMS AND INNOVATION

MONDAY, DECEMBER 10, 1979

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE AND TECHNOLOGY,
SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT,
Appleton, Wis.

The subcommittee met, pursuant to notice, at Lawrence University, Appleton, Wis., at 9:30 a.m., Hon. Jim Lloyd, presiding.

Mr. LLOYD. It is now 9:30, and I presume we were to start about that time.

I'm pleased to be here this morning for our subcommittee's first field hearing on small, high technology firms and innovation.

Recently, joint Senate-House hearings were held on this same topic. My interest in small business and innovation has been a longstanding one. The basic reason is that I came from a small business.

Recent studies have shown the tremendous impact small business has had on innovation. In fact, small business accounted for one-half of the major U.S. innovations during the period 1953 to 1973.

Yet the capabilities of small businesses are not used effectively. Small business receives only 3½ percent of the Federal R. & D. expenditures. Based on past performance, a greater share of the R. & D. dollar must be allocated to small business.

Other areas of major concern are the impact of Government policies and programs on small business and innovation, acquisition of capital, and State and local initiatives for improving technology transfer and improving the climate for innovation.

I look forward to hearing the testimony of these distinguished witnesses. Also, I want to express my appreciation for the warm welcome we have received here in Appleton.

[Statement by George E. Brown, Jr., follows:]

" FIELD HEARINGS ON INNOVATION AND SMALL,
HIGH TECHNOLOGY FIRMS"

DECEMBER 10, 1979

APPLETON, WISCONSIN

STATEMENT BY GEORGE E. BROWN, JR.

MR. CHAIRMAN, I WANT TO THANK YOU AND MY COLLEAGUES ON THE SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT FOR THIS OPPORTUNITY TO COOPERATE ON INNOVATION AND HIGH-TECHNOLOGY SMALL BUSINESS. THESE ISSUES ARE IMPORTANT TO MY SUBCOMMITTEE ON SCIENCE, RESEARCH AND TECHNOLOGY.

ONE OF THE MOST POTENT WEAPONS IN OUR ARSENAL AGAINST INFLATION IS INCREASED PRODUCTIVITY. INCREASE IN PRODUCTIVITY IS ACHIEVED MAINLY THROUGH INNOVATIVE TECHNOLOGIES. OUR COUNTRY'S TECHNOLOGICAL INNOVATIVENESS OVER THE PAST SEVERAL DECADES AND THE RESULTING NATIONAL ECONOMIC AND SOCIAL BENEFITS DERIVED FROM THE APPLICATION OF OUR INNOVATIVE TALENTS ARE UNPARALLELED.

IMPORTANCE OF R & D SMALL BUSINESS

A NUMBER OF HEARINGS AND SYMPOSIA HAVE DISCUSSED RECENTLY THE FACT THAT INNOVATION IS THE KEYSTONE OF OUR ECONOMIC AND

SOCIAL GROWTH, AND THAT INDIVIDUAL ENTREPRENEURS AND HIGH TECHNOLOGY SMALL BUSINESSES HAVE CONTRIBUTED A DISPROPORTIONATELY LARGE SHARE OF INNOVATIVE IDEAS. A STUDY BY THE NSF CONCLUDED THAT OF THE 319 INNOVATIONS PRODUCED BY UNITED STATES INDUSTRIES BETWEEN 1953 AND 1973, 24% WERE PRODUCED BY COMPANIES WITH LESS THAN 100 EMPLOYEES, AND ANOTHER 24% WERE PRODUCED BY COMPANIES WITH 100 - 999 EMPLOYEES.*

FEDERAL R & D SUPPORT OF SMALL BUSINESS

A STRIKING DISPARITY APPEARS TO EXIST BETWEEN THE CAPABILITIES OF HIGH TECHNOLOGY SMALL BUSINESSES AND THEIR UTILIZATION BY FEDERAL AGENCIES.

- R & D SMALL BUSINESSES ACCOUNT FOR A RELATIVELY MINOR AND DECLINING PROPORTION OF FEDERAL R & D FUNDS (CURRENTLY BETWEEN 3% AND 3.5%).
- A SIGNIFICANT PORTION (64%) OF GOVERNMENT R&D IS FOR DEVELOPMENT NORMALLY INVOLVING LARGE INDUSTRIAL FIRMS.
- IN BASIC AND APPLIED RESEARCH AREAS WHERE INNOVATIVE SMALL FIRMS CAPABILITIES ARE HIGH, R & D SMALL BUSINESSES LOSE AWARDS TO INSTITUTIONS OF HIGHER LEARNING AND FEDERALLY FUNDED R & D CENTERS (FFRDC'S).

* NATIONAL SCIENCE FOUNDATION, "SCIENCE INDICATORS 1976" (NATIONAL SCIENCE BOARD, 1977).

Federal Impediments to Small Business

Federal procurement procedures also restrict the use of high technology small firms in carrying out federal agency mission R & D requirements. An Ad Hoc Interagency Panel report to the Office of Federal Procurement Policy, identified the following as examples of some of the more significant impediments encountered by small firms:

" ° It is difficult to identify and respond to Government R & D requirements. On a competitive basis, large firms have a greater capability to determine what the Government is interested in researching and to unravel the complexities of " Requests for Proposals" for R & D work.

° Preparation of Proposals is expensive and time-consuming to a point frequently exceeding the capabilities of small firms.

° A bias in favor of large firms can exist when awarding R & D contracts. The tendency is to consider awards to large well-established firms " safer" than to small firms.

° Funding for federal R & D work frequently lacks stability. This condition strains the financial capabilities of small firms.

° Submittal of unsolicited proposals is frequently discouraged.

° BURDENSOME ADMINISTRATIVE REQUIREMENTS FOR CONTRACT SOLICITATION, EVALUATION, AWARD, AND PERFORMANCE IMPAIR THE ABILITY AND DESIRE OF SMALL FIRMS TO COMPETE FOR R & D CONTRACTS." *

THE SMALL BUSINESS MEMBERS WHO PARTICIPATED IN THE DEPARTMENT OF COMMERCE'S DOMESTIC POLICY REVIEW** IDENTIFIED THE FOLLOWING ADDITIONAL FEDERAL POLICIES AS ADVERSELY AFFECTING SMALL INNOVATIVE BUSINESSES: FEDERAL TAX, PENSION FUND AND SECURITY POLICIES REDUCING CAPITAL NEEDED BY SMALL R & D FIRMS; GOVERNMENT REGULATIONS PLACING DISPROPORTIONATE AND DISCRIMINATORY COMPLIANCE BURDENS UPON SMALL BUSINESSES; AND FEDERAL PATENT POLICIES PROVIDING INADEQUATE PROTECTION TO SMALL R & D FIRMS.

JOINT HEARINGS ON SMALL BUSINESS

ADDITIONAL PROBLEMS CONFRONTING INNOVATIVE SMALL BUSINESS, PARTICULARLY DURING THE CRITICAL START-UP PHASES, WERE DISCUSSED DURING A JOINT MEETING OF THE SENATE SELECT COMMITTEE ON SMALL BUSINESS, HOUSE COMMITTEE ON SCIENCE AND TECHNOLOGY,

* "SMALL FIRMS AND FEDERAL RESEARCH AND DEVELOPMENT". AN AD HOC INTERAGENCY PANEL REPORT TO THE OFFICE OF FEDERAL PROCUREMENT POLICY, OFFICE OF MANAGEMENT AND BUDGET, FEBRUARY 1977.

** "THE EFFECTS OF DOMESTIC POLICIES OF THE FEDERAL GOVERNMENT UPON INNOVATION BY SMALL BUSINESSES". A REPORT OF THE SMALL BUSINESS MEMBERS ON THE INDUSTRIAL INNOVATION ADVISORY COMMITTEE, DOMESTIC POLICY REVIEW, MAY 1, 1979.

AND HOUSE COMMITTEE ON SMALL BUSINESS ON NOVEMBER 1, 1979. THESE PROBLEMS INCLUDED: ELIMINATION OF QUALIFIED STOCK OPTION PLANS; HIGH TAX RATES ON CAPITAL GAINS; TAX BURDEN ON SMALL BUSINESS DURING THE START-UP PERIOD; AND AVAILABILITY OF VENTURE CAPITAL IN THE EARLY R & D PHASE.

DOMESTIC POLICY REVIEW ON INDUSTRIAL INNOVATION

ON OCTOBER 31, 1979, THE PRESIDENT MADE KNOWN HIS RECOMMENDATIONS REGARDING INDUSTRIAL INNOVATION. CONGRESS, IN A COORDINATED EFFORT ON THAT SAME DAY, HELD JOINT HEARINGS AMONG THE HOUSE AND SENATE SMALL BUSINESS COMMITTEES, THE HOUSE COMMITTEE ON SCIENCE AND TECHNOLOGY, AND THE SENATE COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION TO EVALUATE AND DISCUSS THE PRESIDENT'S RECOMMENDATIONS ON INDUSTRIAL INNOVATION.

RECOMMENDATIONS MADE BY THE PRESIDENT WHICH DEMONSTRATE HIS AWARENESS OF AND SENSITIVITY TO SOME OF THE PREVIOUSLY IDENTIFIED IMPEDIMENTS FACING INNOVATIVE SMALL BUSINESS INCLUDED: INCREASING FEDERAL AGENCY-WIDE SUPPORT FOR SMALL R & D FIRMS; DEVELOPING SIMPLIFIED AND MORE UNIFORM FEDERAL PROCUREMENT POLICIES AND PRACTICES AS A SPUR TO INNOVATION; ESTABLISHING STATE OR REGIONAL CORPORATIONS FOR INNOVATION DEVELOPMENT TO ASSIST ENTREPRENEURS AND INNOVATIVE SMALL FIRMS IN OBTAINING START-UP CAPITAL; CHANGING SMALL BUSINESS ADMINISTRATION REGULATIONS TO PERMIT SMALL BUSINESS INVESTMENT COMPANIES AND PRIVATE SECTOR VENTURE CAPITAL FIRMS TO INVEST

IN SMALL BUSINESSES; AND PROVIDING UNIFORMITY TO FEDERAL PATENT OWNERSHIP BY BUSINESS AND UNIVERSITIES AS INCENTIVES TO COMMERCIALIZE INNOVATIVE IDEAS. A RECOMMENDATION CONTAINED WITHIN THE PRESIDENT'S REPORT WHICH IS OF PARTICULAR IMPORTANCE TO MY SUBCOMMITTEE ON SCIENCE, RESEARCH AND TECHNOLOGY AND ITS NSF OVERSIGHT RESPONSIBILITIES IS THE PLANNED EXPANSION OF NSF'S HIGHLY SUCCESSFUL SMALL BUSINESS INNOVATION PROGRAM BY $10 MILLION IN FY 1981 AND EXTENSION OF THIS PROGRAM TO OTHER FEDERAL AGENCIES.

INNOVATION ACTIVITIES OF THE SUBCOMMITTEE ON SCIENCE, RESEARCH AND TECHNOLOGY

IN ADDITION TO MY SUBCOMMITTEE'S RESPONSIBILITIES FOR NSF, MANY OF THE RECOMMENDATIONS OF THE DOMESTIC POLICY REVIEW ON INDUSTRIAL INNOVATION AND RELATED ISSUES ARE ALSO BEING CONSIDERED CONCURRENTLY WITH OUR ONGOING SUBCOMMITTEE STUDIES OF INNOVATION AND PRODUCTIVITY. I WOULD LIKE TO MENTION SOME OF THESE BROAD RANGING INITIATIVES AND LEGISLATIVE PROPOSALS NOW UNDER CONSIDERATION BY THE SUBCOMMITTEE ON SCIENCE, RESEARCH AND TECHNOLOGY.

FIRST, I INTRODUCED H.R. 4672, NATIONAL SCIENCE AND TECHNOLOGY INNOVATION ACT OF 1979, PATTERNED AFTER SENATOR STEVENSON'S S. 1250. H.R. 4672, A SPECIFIC FORM OF UNIVERSITY-INDUSTRY LINKAGE WOULD AUTHORIZE THE SUPPORT OF CENTERS FOR INDUSTRIAL TECHNOLOGY BY NSF AND THE DEPARTMENT OF COMMERCE AND WOULD

ESTABLISH AN "OFFICE OF INDUSTRIAL TECHNOLOGY" IN THE DEPARTMENT OF COMMERCE. THREE SESSIONS OF HEARINGS HELD LAST SUMMER ON UNIVERSITY-INDUSTRY RELATIONS BY MY SUBCOMMITTEE INCLUDED TESTIMONY ON THIS BILL. SENATOR STEVENSON'S SUBCOMMITTEE HAS HELD HEARINGS ON S. 1250, THE MOST RECENT BEING ON NOVEMBER 21, 1979.

SECOND, WE ARE CONSIDERING DRAFT LEGISLATION WHICH ESTABLISHES A NATIONAL TECHNOLOGY FOUNDATION. WE ARE GIVING THIS BILL FURTHER REVIEW BEFORE DECIDING WHETHER TO INTRODUCE IT. IN ESSENCE THE BILL WOULD CREATE AN INDEPENDENT AGENCY TO PROMOTE TECHNOLOGY FOR THE NATIONAL WELFARE AND UNITE AND COORDINATE KEY ELEMENTS WITHIN THE FEDERAL SECTOR INVOLVED IN INNOVATION AND PRODUCTIVITY, UNIVERSITY-INDUSTRY LINKAGES, HIGH TECHNOLOGY SMALL BUSINESS, TECHNICAL INFORMATION AND DATA ACQUISITION, AND TRANSFER OF TECHNOLOGY AND INFORMATION TO THE PRIVATE SECTOR. THE BILL WOULD INCORPORATE ALL OF THE SUBSTANCE OF H.R. 4672.

THIRD, ANOTHER PIECE OF DRAFT LEGISLATION UNDER SUBCOMMITTEE REVIEW AND CONSIDERATION RELATES TO THE MORE EFFECTIVE UTILIZATION OF FEDERAL LABORATORIES AS NATIONAL RESOURCES (DOMESTIC TECHNOLOGY TRANSFER AND UTILIZATION POLICY ACT). THE BILL WOULD PROVIDE A NATIONAL POLICY OF ENCOURAGING SECONDARY UTILIZATION OF FEDERALLY SPONSORED R & D, WOULD REQUIRE EACH FEDERAL LABORATORY WITH A BUDGET IN EXCESS OF $50 MILLION

TO ESTABLISH A TECHNOLOGY UTILIZATION OFFICE, AND WOULD ESTABLISH A FEDERAL LABORATORY RESOURCE CENTER TO COORDINATE THE ACTIVITIES OF THE VARIOUS TECHNOLOGY UTILIZATION OFFICES AND TO SERVE AS A TECHNOLOGICAL INFORMATION CLEARINGHOUSE FOR THE PRIVATE SECTOR.

FOURTH, TO ENCOURAGE THE COMMERCIALIZATION OF INNOVATIVE IDEAS AND TECHNOLOGIES DEVELOPED AS A RESULT OF FEDERAL SPONSORSHIP OF UNIVERSITY AND INDUSTRY BASED R & D PROJECTS, PROPOSED PATENT LEGISLATION (S. 414, BAYH AND OTHERS, UNIVERSITY AND SMALL BUSINESS PATENT PROCEDURES ACT AND IDENTICAL LEGISLATION, H.R. 2414, RODINO; H.R. 5427, ERTEL, SCIENCE AND TECHNOLOGY RESEARCH AND DEVELOPMENT UTILIZATION POLICY ACT; H.R. 5715, ERTEL, UNIFORM FEDERAL RESEARCH AND DEVELOPMENT UTILIZATION ACT OF 1979) UNDER CONSIDERATION BY THE SUBCOMMITTEE WOULD EXTEND BEYOND THE INSTITUTIONAL PATENT AGREEMENT CONCEPT, WOULD PROVIDE UNIFORMITY IN FEDERAL PATENT POLICY, AND MOST IMPORTANTLY, WOULD INCREASE THE OPPORTUNITY FOR THE RESULTS OF FEDERALLY SPONSORED R & D TO REACH THE CONSUMER IN THE FORM OF TANGIBLE BENEFITS. ON OCTOBER 16 AND 17, 1979, MY SUBCOMMITTEE HELD HEARINGS ON THE PROPOSED PATENT POLICY LEGISLATION AND ITS PREDICTED IMPACT ON INNOVATION AND PRODUCTIVITY. ADDITIONAL DISCUSSION AND HEARINGS ARE PLANNED IN THE FUTURE.

THE IMPORTANCE OF INNOVATIVE SMALL BUSINESSES IN MAINTAINING OUR ECONOMIC VITALITY, IN IMPROVING OUR SOCIAL WELFARE, AND IN ASSURING OUR NATIONAL SECURITY CANNOT BE UNDERSTATED. THE ECONOMIC, SOCIAL, AND TECHNOLOGICAL PROBLEMS CONFRONTING US IN THE FUTURE ARE COMPLEX AND WILL REQUIRE THE COLLECTIVE AND COOPERATIVE EFFORTS OF CONGRESS AND ITS CONSTITUENCIES TO ENCOURAGE THE CONSENUS NECESSARY FOR A NATIONAL COMMITMENT TO INNOVATIVE SMALL BUSINESSES. THE RECENT EFFORTS BY MR. CANNON, CHAIRMAN OF THE SENATE COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION, TO COORDINATE SENATE EFFORTS ON INNOVATION, SHOULD BE BOTH AN INCENTIVE AND A CHALLENGE TO MY COLLEAGUES IN THE HOUSE OF REPRESENTATIVES. MR. LLYOD IS TO BE CONGRATULATED FOR HIS FORESIGHT AND LEADERSHIP IN ENCOURAGING THE TYPE OF COOPERATION NECESSARY TO EFFECTIVELY ADDRESS THIS NATIONAL ISSUE.

Mr. LLOYD. I want to recognize both Congressmen Manuel Lujan and Toby Roth who have displayed keen interest in this important area.

Mr. Lujan, do you wish to make a statement?

Mr. LUJAN. Thank you, Mr. Chairman. I'm pleased to be at this hearing this morning, particularly pleased to be in Toby Roth's district. The fact that we are having these hearings here today, shows the esteem in which the chairman and the rest of the committee members have for your hard working Congressman, and we don't say that about everybody because not all of them are very hard working. But Toby really is.

Mr. Chairman, I have been concerned for a number of years about what's been happening to our small businesses, especially those which have been leaders in developing the needed new technology. These businesesses are not getting the support they need when it comes to the allocation of Federal R. & D. moneys, and many of these businesses are victims of Federal tax policies that discourage investments in small firms.

Regulations also make it difficult for small businesses to compete with larger firms. And we have a patent system that needs revamping.

So as Members of Congress and the House's Science and Technology Committee, we are here today to get advice on what needs to be done to make some meaningful changes in Federal policy.

I'm sure that our distinguished witnesses will address some of these problem areas, and I look forward to hearing what our witnesses have to say today.

Thank you, Mr. Chairman.

Mr. LLOYD. Mr. Roth.

Mr. ROTH. Thank you, Mr. Chairman.

Mr. Chairman, it's a privilege for me to welcome you and Congressman Lujan to Wisconsin. To have two such distinguished Congressmen from the House of Representatives attend a hearing here is very much appreciated by us all.

Incidentally, Mr. Chairman, I think you were most impressive on the McNeil-Lehrer report the other evening. Congressman Lujan is one of the most influential members on our side of the aisle.

I'm especially pleased to welcome all the outstanding witnesses we have with us today. I have often said that our country can benefit from the expertise of people from Wisconsin, especially northeast Wisconsin. And I'm very pleased and proud that we have this hearing being held here in the Eighth District. It is the first time we have had a congressional hearing in our Eighth Congressional District, for many, many years.

The hearings about this subject that we have held in Washington have been most revealing. During those hearings we heard interesting testimony from both Government and the private sector as to why this country is starting to lose ground in the area of innovation and productivity.

I, for one, intend to do what I can to keep the United States ahead of any other country, and far ahead in the field of innovation and productivity. We want to put some snap back in our economy. We want to do what we can to stimulate our economy in a noninflationary way. Hopefully, here is an area in which Government and business can com-

plement each other. Your ideas and experiences will serve us well when we make our recommendations to Congress.

And Congressman Lloyd and Congressman Lujan, I take personal pride in the fact this is the first of the scheduled field hearings, and that it is being held here in my district, and I thank you again for coming.

We'll now hear from our first panel of witnesses.

Mr. LLOYD. Mr. Willecke, you may begin.

STATEMENT OF GERHARD W. WILLECKE

Mr. WILLECKE. Thank you, Mr. Chairman.

My name is Gerhard K. Willecke, and I live at 56 Garden Court, Appleton, Wis. I'm vice president and former research director of Miller Electric Manufacturing Co., a formerly small business, but now somewhat larger business, here in Appleton.

We manufacture arc welding equipment. I am also president of the American Welding Society, so I do get around the country quite a bit in the welding industry.

Now, I should qualify and say that this statement that I'm making here, represents my own personal opinion as a knowledgeable citizen, and does not officially represent the statements of either the American Welding Society or my company.

I understand that the intent and purpose of these hearings is to determine if the need for greater participation of small business in the scientific and technical program of the Government exists, and if so, how can we achieve these goals?

Mr. LLOYD. Could I interrupt you? I would also suggest that you address yourself to what kind of relationships you have with the Government.

Is it receptive? What kinds of problems do they create? Do you find yourself really saying, "I would rather not be involved, rather than have to do business with the Government"? Or are these regulations and rules that are being used at the present time, so debilitating that you have to eliminate certain segments of your business?

Mr. WILLECKE. As far as our company goes, I can more or less state categorically, that over the years that I have been very active in our company, which is about 30 years, we have not—emphasize that—we have not specifically gone after Government business, both in production and in research, and the main reason is just the inordinate amount of red tape that is involved.

I think without question we should avail ourselves of all of the technical skills that we have in this country. There really should be very little difference, whether it's large business or small business, if that business has something to offer, and I'm sure that you gentlemen of the committee certainly believe in this.

So I say the biggest objection that I can find, and I don't know if the other panelists will agree with me or not, is the great amount of redtape. It has also been my experience as a member of the Federal Product Regulation Committee of the National Electrical Manufacturers Association, a committee that studies proposed new governmental regulations and their potential effect on the electrical industry, that most of my colleagues in industry share this view.

Most recently much of our meeting activity has been focusing on how the proposed FTC regulations would affect the voluntary standards activity of the electrical industry. Should such proposed regulations become the law of the land and such regulations would, in my opinion, add so much redtape that the voluntary standards system would be seriously jeopardized. I think you gentlemen are familiar with FTC situations.

Most of the larger firms have established specific departments to handle the Government redtape. They do get their share of Government R. & D. work and product procurement. If you are a large firm and establish such a department, frequently you can staff these departments with ex-Government people. They know the ropes, they know how to unwrap and cut the redtape, they have the contacts and they are quite successful.

I must admit however that during the past few years, I have not had a great deal of personal experience in R. & D. procurement matters, because of two reasons:

One is that I'm getting close to retirement, so I have been tapering off a little bit in the business activities of our company, but, in turn, I have been active over 30 years in ancillary activities, such as standards development. I've served as the chief U.S. delegate at international meetings on standards for arc welding equipment, and I have served on many technical committees of the National Electrical Manufacturers Association and the American Welding Society.

So I do have a feel for these matters that concern your committee, and if I may, I'd like to make a personal observation relating to Government contracts and redtape. I get the feeling that procurement and development contracts oftentimes appear to be written not to get the job done, but rather to be used as pressure and leverage to comply with ancillary regulations; regulations in other fields that do not necessarily apply to the task at hand.

We had such a situation that I was personally familiar with. About 4 or 5 years ago when we in Miller Electric were specifically told that we had to comply with the recently established EEO regulations at that time. It was a rather short notice. Within 30 days we were supposed to have certain statements of compliance with certain procedures and policies in force. I was responsible for this. I contacted the compliance officer and said, "Look, we cannot comply with this," and they said, "Well, then you don't get Government business."

I indicated that was fine with us because we were not strong in Government business anyway. I was told however that this really made no difference and we had no recourse but to comply.

The result was that we obtained a time extension and established a department consisting of two people to continuously document our employment practices.

If you gentlemen would really look at a procurement contract, whether for a product or R. & D., and read all the fine print and all of the referenced standards and specifications you would realize the magnitude of the problem.

Let me say again that large companies which have specific departments to handle the governmental redtape are generally the ones that successfully compete for Government work but a small company that

tries to stay competitive in the commercial arena just doesn't have a chance.

I would like to comment on the genesis of the various regulations. Congress creates a new act that is designed to solve a certain problem. The preamble spells out the basic concept and purpose and most of the time these concepts are quite commendable. Now the implementation is assigned to an existing agency or department or a new agency or department is created.

The agency now makes the specific rules and regulations, many times on rather flimsy scientific or factual evidence, which gives rise to the problems we are facing. The agency now publishes the proposed rule in the Federal Register with a request for public comment within a specified time. Comments from the affected commercial community invariably create an adversary situation centering on certain sections of the proposed regulation rather than on the basic need for such a regulation.

I feel strongly about this because my work on the Federal Product Regulation Committee of NEMA is concentrated on that. We take the specific paragraphs and say what do they mean? What effect would this have? We object to that or we agree. I have said many times, "Look, the whole idea is based on a false concept."

Some Federal agencies are attempting to improve the situation by publishing what is known as an "Advance Notice Rule-making," in the Federal Register. Still the first step is always the draft of the proposed rule or regulation by the administrative agency staff, and much too often, this draft is prepared without adequate input from the public sector involved as to whether the regulation is really needed to carry out the intent of Congress.

And after the rule has become law, there are only two recourses available to the public. Take the matter to the courts and fight it, or ask Congress to intervene in its investigative and oversight activities, which you people are doing now.

Now, you gentlemen may question whether the above comments are germane to the intent and purpose of this hearing.

Mr. LLOYD. Not at all. I think they are very pertinent.

Mr. WILLECKE. But this is how the redtape is created, I believe. And I do have some specific comments that I would like to make on the patent situation, but I understand one of the other panelists has concentrated on that, and I think we can perhaps combine all of this as we go along.

So, I think as far as that goes, there's only one thing I would like to say on the patent situation, if Mr. Small does not bring it up, and that is the question of the Government holding patents on the contracts, and I think we can get to that when that time comes.

Thank you very much.

Mr. LUJAN. Mr. Willecke, if you have a prepared statement, some of the things that you might not have mentioned, would then be included in the record——

Mr. WILLECKE. There is a prepared statement, I think you have a copy of it.

Mr. LLOYD. Without objection, that is submitted for the record.

[The biographical sketch and prepared statement of Mr. Willecke follow:]

BIOGRAPHY

GERHARD K. (GARY) WILLECKE

PRESIDENT AWS, 1979-1980

Mr. Willecke is Vice President of MILLER Electric Mfg. Co. in Appleton, Wisconsin. He joined MILLER as a consultant physicist while serving as assistant physics professor at Lawrence University in Appleton. Prior to this, he taught physics and mathematics in Wisconsin high schools for nine years and had been at Lawrence since 1942.

From 1945 to 1946 he served as Chief of the Advanced Radiation Unit at Wright Field, Dayton, Ohio studying infrared and cosmic ray phenomena.

Mr. Willecke's entrance into the welding field dates back to 1947 when he joined MILLER. In 1956 he became Director of Research and was named Vice President in 1966.

For the past 30 years Gary Willecke has been active in technical and administrative committee work of the American Welding Society having served as Chairman of the Technical Papers Committee, Vice-Chairman of the Safety and Health Committee, Vice-Chairman of the Journal Committee, Chairman of the Reserved Funds Committee, Director-at-Large on the Board of Directors and, after serving his third term as Vice President, was elected President.

In addition to his AWS activities for which he was awarded the District Meritorious Certificate, the National Meritorious Certificate and in 1974 he was elected by the Board to Honorary Membership, Mr. Willecke has been very active in the National Electrical Manufacturers Association (NEMA), serving on numerous technical committees involving arc welding and served as Chairman of the Arc Welding Section of NEMA for three terms. He has also represented the United States in International Standards Organization activities involving welding standards and is also the U.S.A. delegate to the International Electrotechnical Commission in the field of welding safety.

During the past 30 years Gary Willecke has spoken to many AWS sections. His talks on technical subjects are presented in a "down-to-earth" manner that have great audience appeal.

PREPARED STATEMENT OF GERHARD K. WILLECKE
ON "IMPACT OF GOVERNMENT POLICIES AND
PROGRAMS ON SMALL BUSINESS AND INNOVATION"

My name is Gerhard K. Willecke and I live at 56 Garden Court, Appleton, Wisconsin 54911. I am vice president and former research director of MILLER Electric Mfg. Co., a manufacturer of arc welding equipment and am president of American Welding Society. This statement represents only my personal views as a knowledgeable citizen and does not necessarily represent the official position of either the company I work for or the American Welding Society. As I understand the intent and purpose of these hearings is to determine if the need for greater participation of small business in the scientific and technical programs of government exists and if so, how this goal can be achieved.

Obviously there can be no argument that we should avail ourselves of any and all technical skills or abilities that exist in this country, wherever those skills are found, regardless whether the business is large or small. If there is a dearth of participation of small high technology businesses in the scientific and technical programs of the government, and I personally believe there is such a lack of participation, then the aims of these hearings are highly commendable.

I strongly believe that the biggest bar that you will find to the greater participation of small business is simply the overwhelming avalanche of red tape involved in the process.

Large firms have established entire departments whose business it is to respond to the innumerable requirements established by government agencies with whom they carry on business. Frequently these departments are staffed by ex-government employees and these large firms in general are quite successful in securing their share of government business. Smaller firms obviously cannot afford such departments so their reaction to participate in government business is just "too much red tape."

Although I must confess that recently I've had very little direct involvement in R&D procurement matters, I am familiar with product procurement procedures and government regulations. During my years of work in the field of government regulatory procedures and procurement I have developed the feeling that frequently procurement procedures and regulatory procedures have been used not for their proclaimed intended purpose but as clout for adherence to and compliance with ancillary regulations.

As a final general comment may I consider for a moment the creation of federal rules and regulations. Much too often I believe the need for the rule or the regulation is assumed on very flimsy evidence. Congress creates a law and then mandates the administration of that law to the appropriate agency. The agency then creates the rules and regulations and much too often does so without having sufficient technical and practical background. The proposed rule is published in the Federal Register with a request for public comment within a specified time. Comments from the involved technical community

invariably create an adversary situation centering on certain sections of the proposed regulation rather than on the basic need for such regulation.

Some Federal agencies are attempting to improve the situation by publishing an "Advance Notice of Proposed Rule Making" in the Federal Register but still the first step is always the draft of the rule or regulation by the administrative agency staff and much too often this draft is prepared without adequate input from the public sector involved.

After the rule has become law, there are only two recourses available to the involved public — take the matter to the courts or ask Congress to intervene with it's investigative or oversight activity.

You may question whether the above comments are pertinent to the intent and the subject of this hearing, but this is how the "red tape" is created.

With your permission may I comment on a more specific facet of your inquiry, namely the U.S. patent system.

The basic premise of a "patent system" is to encourage innovation. It promises that the inventor is given exclusive rights to commercially exploit his innovation for 17 years.

The trend today, however, is that that view is becoming clouded. The fees have been increased so that they are becoming more burdensome to the individual inventor or the small business entrepreneur. These increases are part of the concept that government services should be self-supporting. Furthermore our technology is getting so complex and so sophisticated that protection afforded by a patent is tending to be downgraded. Nevertheless patents are issuing at the rate of about 1,000 every week and to-date the U.S. Patent office has issued more than 4,200,000 patents.

Obviously this number, even though they are broken down into classes, makes search and retrieval a very difficult and time consuming chore. Computerization might speed up the process but unfortunately to-date the search process is still too complicated and judgment oriented to lend itself readily to computerization.

Of course, in the broadest sense, a patent simply grants the inventor the right to go to court and stop the infringement and, if successful, to be awarded damages. Everytime a legal action on a patent is taken the court reviews the validity of the patent. Obviously, if patents were more reliable there would be less litigation.

The reliability could be improved by better examinations and analysis in the patent office but this would simply involve greater manpower, a philosophy that is not too popular at this time.

There is one point on which I feel rather strongly. I firmly believe that any patent, obtained by an individual working for a business under a government contract, should be assigned to the business. The government should, automatically, be granted a royalty-free license only for the use of the patent in question in the public interest. I do not believe that the government should hold title to a patent. The purpose of a patent is to provide incentive to put the invention to commercial use, and in no way can I see that the government would, or should, have any interest in the commercial exploitation of a patent.

Inventions made solely by government employees, while working for public agencies, should become public property (unless classified) and should not be patentable.

Gerhard K. Willecke

12/10/79

STATEMENT OF R. E. SMALL

Mr. SMALL. Good morning, gentlemen.

I have to give you a little background of our business. We are in a high technology business related to the machinery manufacturing function of our economy.

We build machinery for manufacturers of tissue products and various sanitary products, business forms manufacturing, packaging materials and disposable products. Our company has grown in the last 34 years from the employment of 60 people to 1,500. Much of that has been based on the development of new technology for making new products or new ways of making existing products.

There's been a significant increase in the productivity in all of these areas, and in many cases, a higher rate of productivity than there has been an increase in the cost. Much of this is based on research and development and patents.

Our company has grown from being a regional, one-product-line company to an international, four-product-line company. We have our main operation in Green Bay. We have plants in Brazil, Germany, and a significant plant in England serving Europe.

As part of this, we have had a great deal of experience with patents. We hold some 100-plus patents. We now have 20 to 30 patents in process, in that range. The basic observation I'd like to make on the motivation for small companies to invest their technical talents, their money, their resources, their time, their expertise in marketing in new technology is simply like everything else. It's the return on the investment. With the process the way it is now, it's really almost impossible for a small company to effectively deal in the patent situation. By that I mean it's easy enough to get a patent. But once you have that, all that allows you to do is be sued or sue someone else. It doesn't mean anything until it's tested in the courts, and that's where the real problem comes.

For example we have had three patent suits in my 33 years with the company. One was settled out of court before we went to trial. One we are in the discovery process now, and the other one lasted 19½ years. The life of a patent is 17 years.

In other words, basically, the definition of a patent is a 17-year legal monopoly to use that idea. In our case, it took longer than the patent life to settle the lawsuit. It took some six years just in the discovery procedure, all the depositions, interrogatories, all that. Three-week trial, 3½ year wait to get the judge's decision, go to appeal, to the Supreme Court which turned it down. Back to the judge, ten-year accounting period, and then finally the damages were settled. That's a ridiculous thing for a small company to try to face.

This particular case was against a very large company, and typically, I think, the strategy is "look, just infringe, let's just wear them down in the court process." A small company cannot afford to go up against a major corporation and expect to survive.

If our company hadn't grown in other product lines and other areas, we would have had to give up on that patent suit. We finally won it. They paid the damages and all that.

The small company starting out, particularly an individual, has a great idea. He can get a patent out of it very easily. Once he has that he's faced immediately, if it's really with someone else doing the same thing, with "Let them sue us. By the time he gets through the courts, he'll either go broke, or we'll buy him out. Something will happen so that we get a return on our investment," from the large company.

So, it's my point that there's a basic restructuring needed in order for the small, high-technology company to see in its future the return there is on the investment.

I think the patent issuing procedure could be refined and defined to make it more effective. In Germany, for example, they publish every application. People in that field are allowed to review them, make comments, and point up any prior art or any history that relates to that technology, and finally the patent is issued based on what's available from that industry in that field. And that finally comes out with patents that mean something.

Our patents really don't mean anything because they aren't examined thoroughly. They have no competitive analysis before they are issued. So consequently they don't mean anything until you go to court.

I think one of the major expenses in the whole process is that patents are tried in Federal courts. Judges are appointed certainly not for their expertise in technology or patent law. I'll tell you much of the time and expense involved in a patent suit is educating the lawyers and educating the judges. And the most ironic thing is that after you spend years doing this, any final appeal is heard in a 30-minute session in front of a Federal judge.

In the case of the circuit court of appeals the lawyers have 30 minutes to present the case. It could have taken years and miles of depositions and it comes down to the judge's impression in 30 minutes.

I don't think that is equitable, especially for a small company. So I think a separate legal procedure, people who understand technology, who have some experience in patent law, Federal judges appointed from the legal profession specializing in this field, expertise available to those judges, the results of which would be mandatory to be accepted by the two sides, would cut through a lot of the expense and delay that now happens in the process.

And, you know, it takes an enormous time in the courts now to handle these cases. But I'm sure that people who know something about technology could do it in a fraction of the time. The judges could make better decisions if they had background in patent law and technology, and we would relieve the loads of Federal courts for other cases with which they are now overburdened.

One reaction is more Federal judges. I say the reason they are overloaded is because they are dealing in a process that takes years for them to learn anything about, and then are expected to make a judgment on.

I think the rules for Federal procedure, of course, could be significantly improved. For example, I think if the lawyers were required to confine their investigation and their conclusions and their projections in a technical situation to those things that are factual and provable, you would eliminate much of the time delaying, frustrating process that it takes to now go through the process.

If the lawyers took the same oaths as the witnesses, we'd eliminate an awful lot of the expense and the delay for the small company.

Mr. LUJAN. I hope you don't apply that to politicians. If we couldn't exaggerate a point once in awhile——

Mr. SMALL. I'm suggesting this in a very limited field. Something based on facts and science.

For example, in the present rules in the Federal courts, once you have a damage assessment made, nothing in that allows for any inflation or interest.

For example, in our case, there was a 10-year period of infringement. Those damages were established, and it wasn't until 10 years later they were paid, and there was nothing allowed for interest or inflation during that period.

So a large company can say:

Let's just string it out, and by the time we pay for it, it's in cheap dollars, and in the meantime, we have used the dollars and generated other business.

In other words, the winner winds up losing, and the loser winds up winning when you come to the basic question of what's the return on the investment for this kind of development.

And the whole thing I think is based on the small company having to look at the enormous risks involved. Whether the development is going to work, whether or not there's a market for it, and then when he tries to base that on a patent structure, he has a whole other set of expenses, overwhelming expenses. He has to pay his legal bills every month. And if it's five or 10 years later before he recovers any damages, he could have gone out of business in the meantime. The question is: Does the patent system protect the small company so that he really has and can justify the investment on the basis of a 17-year legal monopoly before it then becomes public property? I think that part of it is solved. Once he's had his chance to make it, it should become public property, and everybody should be able to use it. But that period of initial return for his efforts I think is something that's really missing in the whole system for the small company.

[The prepared statement of R. E. Small follows:]

Paper Converting
MACHINE COMPANY
GREEN BAY, WISCONSIN • U.S.A.
P. O. BOX 869 ZIP CODE 54305

COMMITTEE ON SCIENCE AND TECHNOLOGY

PUBLIC HEARING
DECEMBER 10, 1979

PATENTS

My comments and suggestions will be based on my experience of 30 years in dealing with patents, both in the United States and in foreign countries. Our company currently holds over 100 U. S. patents and we generally have between 10 and 20 patent applications in process at any one time. This is the result of substantial research and development activity in machinery for the manufacture of sanitary tissue products, business forms, disposable products, and packaging materials. During the past 33 years, our company has grown from approximately 60 employees to 1500 employees, with our major research and development, engineering, and manufacturing operation in Green Bay, Wisconsin, and foreign operations in England, Italy, Germany, Brazil, and Japan.

A large share of our growth has been based on the development of new technology to increase productivity. In all of our major fields of activity, we have basic patents which are the foundation of much of the machinery we build.

During the period of time, we have never been a defendant in a patent law suit, but we have been the plaintiff in three patent suits. One of these suits covered a period of 19-1/2 years, one was settled before it came to trial, and the third is in the discovery stages.

Based on this experience, there are a number of inequities, particularly for the small company, which should be corrected if small high technology companies are to have any real incentive for their research and development efforts.

Theoretically, the patent system is based on the concept of providing a 17 year legal monopoly for the inventor. In actual practice, this is hardly a realistic description of how the patent system works.

For any small company to apply its resources, that is, technical talent, research and development funds, and marketing expertise, there must be a realistic return on the investment. Currently the small company can hardly expect the patent system to be an effective means for providing such a return and encouraging the application of its resources to new technology. Considering the risks involved in developing new technology and the prospects of expecting enough successful developments to balance those that either do not work or for which there is a limited market, there is a severely declining atmosphere for small companies to operate in successfully.

Once some new technology is developed, it is a relatively simple matter to apply for a patent and have it issued. However, most patents are meaningless or of little value. Ultimately they must be tested in the courts and proven to be valid and infringed if the patent holder is to have benefit from his "legal monopoly". It is in this process that the small company is very severely limited.

For example, in our 19-1/2 year suit, it took 6 years of interrogatories, depositions and pre-trial discovery to get the suit through the trial at the Federal District Court level. 3-1/2 years were consumed waiting for the trial decision, the defendant appealed to the Circuit Court, and ultimately denial by the Supreme Court. Only then was an injunction established after which it took 10 years for the accounting procedure, the trial on the accounting, the District Court decision, and the Circuit Court of Appeals decision.

Obviously this is an enormously expensive process for the small company to face. Legal fees mount and must be paid every month because the ordinary small company does not have its own in-house legal department. In contrast to this, the large corporation with its own legal staff and patent attorneys, plus funds available for outside counsel, can readily establish a strategy that simply will wear down and exhaust the resources of the small company. This is done through the very long and arduous delay procedures built into the current system.

To improve the patent system and provide a realistic atmosphere for the small high technology company, the following recommendations should be considered.

1. Patent Issuing Procedure

Publication of the patent application for review and comment by industry before the patent is granted. This would enable small companies with expertise in a particular field to have the patent examined in light of the prior art by experts in a particular field of patents. Upon examination of all the evidence, the patent department could then issue a meaningful patent which could be expected to stand up in court. This system would be similar to the procedure now used in Germany where once a patent is granted, it has much more strength and meaning in the courts.

2. A Separate Patent Court System

The major reason for the heavy overload of the Federal Courts and the long expensive delays in patent suits is that the Federal judges are not generally familiar with the patent system, nor are they qualified to judge the technical merits of a case. Therefore, much of the time is spent in educating the lawyers and the judges on the individual elements of each case. A very limited patent judicial system with judges appointed from experienced patent attorneys would significantly expedite the procedures and provide more accurate analysis and judgment on technical matters. Such courts should have available to them experts in technical questions, accounting methods, and marketing values. Both plaintiff and defendant would be bound by the factual determinations researched by the experts and decided upon by the judge.

3. Rules for Judicial Procedures

Clear and concise rules for operation of patent courts, including reasonable time limits for each phase of the process, would eliminate much of the present confusion and time delays.

While it would be abhorrent to the legal profession, much of the process could be streamlined by requiring the same oath from lawyers that is now required from witnesses. In other words, if the lawyers had to limit their inquiries and charges

to factual provable statements and subject to the same rules of perjury that a witness is now under, I believe there would be an enormous reduction in the legal process.

One of the most ridiculous aspects of the current system is that there is no allowance made in the accounting for inflation or interest on the damages. For example, in our case, the infringement took place from 1959 to 1969, but the final damages were not paid until 1978. For the ten year period that the accounting took, there was no adjustment in the damages for inflation or interest. Basically, the reason given is that there is no case law which supports such a contention. However, it is not realistic to say that damages paid out in 1978 compensate for an equal amount established in 1969. The defendant, therefore, has the use of the money during the accounting period and the plaintiff is denied these funds for investment in the development of his business. In effect, the large corporation can come out ahead simply by delaying the process long enough to pay off with cheap dollars. In the final analysis, the inventor is penalized and the infringer reaps the benefits caused by the inequities in the system.

Unless there are drastic changes in the patent system, the industrial future of the United States will be adversely affected. The reward for creativity will be so severely limited that small companies especially will not have the incentive to develop new ideas. In the long run, this has a negative impact on the productivity of U. S. industry and makes our products less competitive in world markets. Since there obviously is a major imbalance of trade for our country in the foreseeable future, we should restructure our system in a way that will regain our leadership in new technology and increased productivity. A sound and fair patent system would be a large step forward in that direction.

R. E. Small
Vice President

RES:mg

Mr. LLOYD. That does it? Thank you very much, Mr. Small. Mr. Groth?

STATEMENT OF PAUL H. GROTH

Mr. GROTH. My name is Paul Groth, and I'm president of the Riverside Paper Corp. in Appleton, Wis.

First of all I want to congratulate the committee for coming and bringing the subcommittee to this area, and it's refreshing that someone in Government is willing to ask for our views on any subject, and certainly we appreciate that.

We are concerned about our country and our citizens, our community, our employees, and our business.

Riverside is a small, privately held company with operations in this area and Atlanta, Ga. We employ about 325 employees here and about 70 in Atlanta. Our business is producing paper and converted school products; and for school uses, as well as products that are used in packaging, wall covering, labeling identification.

My role is chief operating officer. I am not an owner; I joined Riverside 3½ years ago after a lot of experience in the major corporations of Kimberly-Clark and Phillip Morris, and came to a small company.

The differences between the small company and the large company are graphic, and there are some very specific differences in terms of what you can do as a small company versus a very large company.

For a small company, or while our company does not produce highly technical products necessarily, many of our problems are the same in terms of changing our business direction and changing the type of business mix in which we are involved.

We have been making a major effort to change our product mix to serve more technically oriented requirements, to change the basic directions such as this requires people who are properly trained, equipment, trial and development costs, resources to pay for failures while learning, and capital.

The very size of the company and limitations on resources, makes it difficult to support research and development efforts in addition to effectively managing the business.

The challenge for the small businessman is made even greater by some of the Federal policies.

First of all, the administrative burden imposed by Federal regulations or the whole spectrum of the type of things that impact on a business such as taxes, pension funds, environmental regulations, safety regulations, traffic, pricing, administration, and on and on, impose a heavy burden on a small business.

The second area that I'm sure that I know you are familiar with, but I want to make a specific point of it because it makes a very serious impact on a small business as opposed to a large business, is the area of tax policies.

I was recently in France and Germany and went through some plans that are very much like the kind of businesses that we are in in this country. The comparison was very similar, almost to the extent of being nearly a carbon copy.

I was impressed with the modern equipment and the investment that had been made in plant and equipment, and, therefore, the ca-

pability of those businesses to be technologically competitive and up to date in the market that they were serving, and their markets were not regarded as X European markets, but they continually, and are competing in the world markets.

The principal difference is how can you afford to invest in this kind of equipment? And the principal difference is in the tax policies. The piece of equipment, new equipment that, when we buy and install it in our company here, we are looking at the ability to write it off or recover the cost of that equipment in 12 to 16 years; to recover the cost of plant, the buildings, and so forth in 20.

In France and in Germany, they are looking at the ability to recover on either in France, either one of two options. Over 5 years on equipment versus 12 or 16. And the option also of instead of taking it on straight-line basis of recovering 40 percent the first year, 24 percent the second, and the balance over 3 years.

So, they are looking at the ability to recover the cost of that equipment in 2 years, 64 percent.

And Mr. Small made reference to the difference in recovering in dollars that are inflated versus over a period of time, and, of course, that is the major impact in terms of being able to keep a business competitive and technologically equipped in that when you are looking at recovering the cost of equipment at the end of 16 years versus the end of 2 years, you are not dealing in the same dollars or the same cost of equipment. You are looking at having to have earned and provided for the addition of at least double and sometimes multiples of the original investment in order to just replace that equipment. This is a significant factor in the ability of businesses around the world and people with whom we compete to be more competitive than U.S. industry, and I think we have to be very aware of this, because you become very much impressed with the fact that as proud as we are of our country, and as much as we are inclined to feel that we are the best, that is no longer true. We have lost our competitive edge in the world markets, and it isn't a case of losing them or beginning to lose it, we have lost it.

And if we don't do something to correct the incentive to invest and to keep modern and technologically competitive, we are going to see ourselves, the United States, in an increasingly deteriorating position beyond which one of which we are in right now.

Our particular company's exposure to Government business is not great. And we, to some extent, as Mr. Willecke tends to avoid Government business for the very reason he has outlined, to the extent that it requires an awful lot of more administrative procedures and whatever you want to call it, redtape, or administrative burden in terms of getting the product to the Government. We do supply some items to the Government, and we know how to deal in that, and to supply the Government, but it is more complex than serving our regular customers.

I'd like to make one other comment, and that is that in the information that was submitted to me and to the rest of the panel here for preparation for the hearing today, there was a list of a number of subjects which dealt with comments on Federal R. & D. policies,

Federal procurement policies, patents and National Science Foundation, and interaction with small business.

I'd just like to comment that there's a tremendous flow of information that comes to a business, and in the position where I sit, I see most of that that comes in. I get a lot of information about the social legislation and the things that are taking place in wage and price guidelines in terms of OSHA, in terms of safety regulations, in terms of tax laws, proposed changes. But I get very little information about what kind of programs there are in terms of small business, programs available to small businesses in terms of the availability of programs that might deal with the kind of policies that you are talking about, R. & D. policies in terms of information that might deal with financing and the availability of programs that were designed to provide equity capital or development programs for a small businesses. I think there is a void in the kind of information that flows to businesses in these areas.

The principal flow is in the area of the other kinds of information as I see it from where I am. Whether we are large or small companies, as I say, I think that it's unfortunate that American business is losing or has lost the competitive edge in the world.

And hence, the problem that we are addressing today is one which there is a compelling need to address it. And I certainly am pleased that the committee is here today to talk about some aspects of it that we are touching on here.

Thank you.

[The biographical sketch and prepared statement of Mr. Groth follow:]

Biography - Paul H. Groth, President
Riverside Paper Corp., Appleton, Wis.

Paul H. Groth was born in North Dakota July 30, 1919. He is a graduate of St. Olaf College, Northfield, Minnesota. As a former career officer in the U. S. Marine Corps., he served in World War II and Korea.

His business experience includes extensive experience in manufacturing operations, marketing, distribution, purchasing, personnel and general management with Kimberly-Clark Corporation.

Prior to joining Riverside Paper Corporation as President in April 1976, he was Vice President and General Manager of Philip Morris's Nicolet Paper Co., DePere, Wisconsin.

Paul H. Groth - President, Riverside Paper Corporation, Appleton, WI

Testimony before House Science and Technology Subcommittee on Investigations and Oversight December 10, 1979, Lawrence University, Appleton, Wisconsin.

My name is Paul H. Groth, President, Riverside Paper Corp., Appleton, Wis. First of all, I want to congratulate Congressman Roth for bringing this Subcommittee to our area. It is refreshing that someone in government is willing to ask for our views on any subject. We are grateful for this opportunity because we are concerned about our country and its citizens, our community, our employees and our business. Thank you.

Riverside is a small privately held company with operations in this area and Atlanta, Ga. It produces paper and converted products for business and school uses as well as for packaging, wallcovering, labelling and identification. We employee 325 employees in this area and approximately 70 in Atlanta.

My role is Chief Operating Officer but I am not an owner. I joined Riverside three and a half years ago. While our company did not produce highly technical products, we have been making a major effort to change our product mix to serve more technically oriented requirements. For a small company to change its basic direction such as this requires people who are properly trained, equipment, trial and development costs, resources to pay for failures while learning, and capital. The very size of the company and limitations on its resources makes it very difficult to support a research and devlopment effort in addition to effectively managing the existing business.

However, the challenge for the small businessman is made even greater by many federal policies:

- The administrative burden imposed by federal regulations for taxes, pension funds, environmental regulations, safety regulations, traffic regulations, pricing administration, and on and on and on impose a heavy burden on a small business.

- Current tax policies - particularly as they apply to depreciation on equipment and new facilities tend to discourage modernization and to restrict our ability to keep technologically competitive in world markets.

  i.e., we can recover the investment in new equipment in 12-16 years, so that it can be replaced. However, Germany and France can recover that investment in 5 years and France can choose an option that permits them to recover 64% in two years. Those governments provide an incentive for their buainesses to develop and acquire new equipment which makes them more competitive in world markets.

The preliminary information on this hearing proposed several sub-headings to be considered in our discussion today including such as:

- Federal R&D policies
- Federal Procurement Policies
- Patents
- NSF/NASA's interaction with small business

Our companies exposure to items on that list is limited to some knowledge of Federal procurement policies and to patent applications and use. We have not been and are not now exposed to much, if any, information on Federal R&D policies, many aspects of federal procurement policies, and NSF/NASA's interaction with small business. However, we do receive a great deal of information concerning environmental issues, tax laws and proposed changes, labor laws and regulations, wage and price guidelines, etc.

Hopefully, this hearing today and the testimony we will hear will provide a better understanding of the opportunities and the role for small business to contribute to the growth of our country thru innovation, productivity, and ability to compete in world and national markets.

Whether we are large or small companies, American business is losing, or has lost, its competitive edge in the world and U. S. markets. Hence, there is a compelling need to address this problem.

This committee hearing today appears to be a hopeful start.

P. H. Groth
12/10/79

Mr. LLOYD. Thank you very much, Mr. Groth.
Mr. Shade?

STATEMENT OF ROBERT SHADE

Mr. SHADE. I am Robert Shade, founder and president of Shade Information Systems. We manufacture business forms for computers. We are 14 years old. And I probably cannot be classified in your general terms as a high-technology company, and that's my first concern area.

I think we as a government have a tendency to think of high technology in terms of product or service. Yet, our little company, which now employs 300 people, started 14 years ago when there were some 400 business form manufacturers in the United States. Today there are 600. We have grown from 400th, if you will, to about 25th. We didn't do that by coming out with a generally different product, but rather by innovation in terms of manufacturing and marketing.

I hope that the committee and the subcommittee addresses itself to technology, not just in terms of end product or end service, but rather in terms of method of manufacture, method of distribution.

In the final analysis, the marketplace determines whether companies will succeed or not. And the fact that a company such as ours has succeeded in a very competitive atmosphere, suggests we are innovative in terms of something we do, and we certainly feel that way.

My concern that I want to express to you today has to do with a philosphical concern about our Nation eating its young, if you will.

I think we have put ourselves in a position as a Nation where we have almost guaranteed the demise of the emerging company. I say that from the standpoint, I'm going to try to describe it by describing our company and what has transpired with it.

When the company started, 14 years ago, I scraped together the money I had, sold my IBM stock, having worked for them for 10 years, got four other people to invest amounts in the company.

Mr. LLOYD. Could I interrupt you?

When you worked for IBM, were you in the software or the hardware area?

Mr. SHADE. At that time there was no differentiation. If you were with the Data Processing Division, which it was called at that time, you were in both.

My history with IBM started in 1952, and then I was in data processing sales and subsequently in management, and left to go to work for a little company in Green Bay called Paper Converting Machine Co., of which Mr. Small is president.

I could only take 3 years of that, however. Anyhow, I got four other relatives to invest in the company. The stockholder list has grown to approximately 60.

I am going to mention my parents invested when Dad was 65 at a time when most people are retiring. He invested an amount, to him, that was quite sizable, and he now is at the lovely age of 80, and would like to tap into some of that money because it's represented by some paper that would look good on the wall, but has no real value in the marketplace.

You have heard that small companies are precluded from going public in today's investment community, and I would submit that

any company is presently precluded from going public at this time.

So how does one go about compensating investors for having invested in a very high-risk situation? Small companies are generally precluded from buying back their stock by their loan covenants. The bankers say, "Hey, you may not buy back your stock."

They are also precluded from paying dividends by their loan covenants. I have nothing against the bankers because I sit on the board of a bank, and I understand their need to protect their investment, if you will, in the small company. But if you can't buy back the stock, if you can't declare a dividend, and if you can't go public in this particular personal instance, how do I compensate my parents for having tied up a sizable investment to them for 15 years as they approach their declining years?

I'm trying to be altruistic by describing it from my parents' standpoint. I'd like to get my hands on some it it, too.

I would propose that I think there's a politically and economically feasible method of dispensing or paying stockholders or paying investors for their risk. And I would submit that if we just had a classification of small manufacturing, I say manufacturing advisedly because I think we should be talking about products rather than services, if they were allowed to do a number of things, one of which was declare dividends pretax and receive a credit, a tax credit for the amount of dividends they paid out, I think it would generate so much interest in the small emerging companies, that people would fight to invest in them rather than saying, "Why should I? When am I going to be paid?"

So, whether it's high technology in the output or high technology on this side, the small company would have a chance then to compete with his big brother.

My choice today is very simple. Mom and Dad, sorry, you don't get anthing. There's nothing I can legally do to get you any money for the risk you have taken. Either that or say yes to any one of five major, major companies, two of them international, who want to buy us out.

I don't choose to do either. But I have no choice. I'd appreciate it if the committee would come up with one in the very near future.

Thank you.

Mr. LLOYD. OK.

Mr. Lujan?

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

Mr. Groth, you talked about recovery of the cost of a building, for example, or a machine, or something like that.

Mr. GROTH. Yes, sir.

Mr. LUJAN. When you talk about recovery of that capital, are you talking about recovery from tax sources or from profits, or what kind of recovery are you talking about?

Mr. GROTH. I'm talking about recovery from the earnings of the company in terms of depreciation laws. The depreciation laws provide that you can depreciate equipment over 16 years, which means that you can take the cost of that equipment and you can divide it by 16 and you can then take from your earnings of that company, pretax earnings, that amount of money to which in a sense you are

accumulating those funds in order to buy a new piece of equipment at the end of its predicted life.

Mr. LUJAN. You are talking about recovery then as depreciation?

Mr. GROTH. Right.

Mr. LUJAN. The other question, Mr. Small, that I had was on the long-term involvement in patents and lawsuits.

You say you're involved in five. Is it usual or unusual that, when you file for a patent and start using it, you can usually look forward to a court fight?

Mr. SMALL. No; I don't remember the statistics, but of all the patents issued, it's something like 5 percent are ever adjudicated, ever go to court one way or another, and of that, there's only something like one-tenth of 1 percent that are ever decided in favor of the patent, the inventor.

The statistics are just abhorrent as far as upholding the concept of the inventor having a legal monopoly.

But in our case, 3 out of well over the 30 years I'm familiar with, I suppose we have had probably 400 patents issued to our company. I hold half a dozen or so. And in that situation, there have only been three times where we have seen enough justification to say this guy is infringing, we are going to sue him.

Now, there have been others of which we have said it isn't important, it isn't worth it, we'll never win, it isn't worth the 5-, or 10-, or 15-year exercise. And we don't go after it.

Mr. LUJAN. Speaking in terms of setting up, as you suggest, almost a whole legal system for deciding patent suits and whether it's a big enough problem to do that——

Mr. SMALL. When we first started, I asked our patent attorney why don't we just forget all this legal business. We'll take one expert in this business on our side and one on their side and one impartial, and whatever he says.

Mr. LLOYD. Well, you'd be denied justice that way.

Mr. SMALL. My feeling is we have been denied justice by the process that's supposed to develop it. The problem is the lawyers and the courts. Really you can't blame them. They have no understanding of what the technology is. It's just like if we were talking about some entirely different element of the legal system. I don't know anything about it. But they don't know anything about the technology.

Mr. LUJAN. We have just passed a bill on Friday designed to resolve small disputes, kind of the same thing that you are talking about. You don't have to go to court and jam up the court calendar, and I don't know if this comes under that kind of a small dispute. I suppose in some cases it could be.

Mr. WILLECKE. Was this for patent matters?

Mr. LUJAN. Just general law. We are looking for some system by which we can resolve them.

Mr. WILLECKE. If I may, Mr. Chairman, I'd like to place emphasis on what Mr. Small said.

Interestingly enough our two companies parallel each other time and employee wise.

One of my first assignments, after I joined Miller nearly 30 years ago was the involvement in a patent suit. I am not an attorney but

since I was knowledgeable technically it fell upon my shoulders to guide the defense of this patent fight.

We were being sued for infringement. The other side was a very large company compared to ours. We were about teetering on the brink of either getting over the hump and growing as we have done, or dropping back and going under.

And this large firm sued us, as I said, for patent infringement.

I happened to know the inventor, a good personal friend of mine, and I knew exactly what his patent was. It was a commendable patent. It was a good idea. The inventor, privately indicated we were not infringing. However, the attorneys indicated that they had a good case against us. That suit lasted 4½ years.

We finally won, and we were awarded legal costs which were a very small part of the total cost. A few years later I talked to one of the vice presidents of this other firm and compared notes. We found that the two companies had spent approximately $900,000 over those 4½ years. And this was in 1958 dollars and most of it went to the attorneys.

When we were found not infringing and were awarded costs, our boss Mr. Miller, founder of the company, took the check and framed it since it wasn't really worth cashing.

The tremendous amount of time that was spent by attorneys on this case and the fact that I personally spent nearly 50 percent of my time for 4½ years on the matter is difficult to appreciate.

Since I was qualified as an expert in the case I testified for nearly 5 days during the trial and much of the testimony was an education for Judge K. Grub who had just been elevated to the Federal bench. This was his first patent case. It was a very complex technical case involving the theory of magnetism and Judge Grub indicated that he knew absolutely nothing about electricity before the trial started but it was up to him to make the decision since this was not a jury trial.

I cite this example simply to point out the problems of litigating a complex technical matter, such as patent cases are, in a nontechnical judicial system.

Is it any wonder then that the patent issue is becoming more and more clouded and many companies are saying that they will not seek the protection of a patent but use other means such as secrecy and security.

Still patents are being issued at the rate of about 1.000 patents per week and to date the U.S. Patent Office has issued over 4,200,000 patents.

Furthermore, here's one thing I think is of some importance to the small inventor, the costs are getting higher and higher because of the philosophy that we have that a Federal agency should be self-supporting.

So, as a result, the fees have taken substantial jumps. So that at least part of the cost of the Patent Office is paid for by the applier for the patent.

Mr. LLOYD. Thank you very much.

Mr. Roth?

Mr. ROTH. Thank you, Mr. Chairman.

I was very much impressed by all of your testimony this morning. and I say that not because you are from this area, but because I know that you have certainly put some time and effort into your testimony.

I had a question about patents, and it comes in this fashion. We have many people, people working in their garages, or people working in small businesses who are making, I think, quite some unique inventions; how to increase your gas mileage in a car, or how you can extract alcohol from chemical wastes and so on.

Suppose we had Rudy Small working in his garage. How do you protect yourself? How do you protect your invention?

Mr. SMALL. The only legal way is first of all hire a patent attorney to go over the invention. Develop the application and apply for a patent.

Now, that generally would take, depending on how complex it is, 6 months to maybe 1 year.

You apply for the patent. It will take you generally 2 years for it to issue.

At the end of that point, if somebody has copied the idea, then you can sue him. But then you are faced with this, I suspect, the 3-year minimum, the 20-year lawsuit to defend your position.

The small, individual person I would say has no chance at all of sustaining that time and effort. He has to take it out of his business, not just to pay the lawyer. He has to spend his time.

I spent 16 months of my time on this case, for example. He isn't doing his other thing.

Mr. ROTH. What you are saying is, it's not feasible for a small inventor to positively protect himself?

Mr. SMALL. The only chance he has is get the patent and sell the idea to some company that has the resources to protect it.

To build a business around a patent today is certainly impossible.

Mr. SHADE. Tying in with that. I think there's a tendency of large companies to use their patents as offensive weapons—if I can say it that way.

We were sued for a patent infringement by one of the major paper companies in the United States last May. They have a patent that is patently anticipated by another patent, which if Rudy's suggestion that we publish patents and the application for them rather than after the fact, would have been caught. But here they are using a very, very weak or untenable patent to sue us, and they were operating on the assumption that it was much to our benefit to go ahead and pay a minor licensing fee to them rather than the major protection fee to fight them.

What they didn't know was that we had received a license from a very major company, and they have to pay the protection for us.

So this was strictly, and I say this openly, a harassment-type infringement suit, which was designed to scare off the little guy.

Mr. SMALL. That's more of the reason that large companies get families of patents so they have the clout against the small inventor.

Mr. ROTH. Well, it certainly has been eye opening for me.

Mr. SMALL. To give you a little detail on this, in our case, not only did we sustain the validity of the patent and infringement, but it was willful infringement.

In other words, they determined this is a patent, we were going to infringe it. That increased the damages 50 percent.

But referring to the numbers that we are talking about before, we got $25,000 costs as part of this award. It cost us over $1½ million

in legal fees. The damages were $2.1 million. Now, this is a willful infringement.

The other side, I suspect, spent over $1 million on legal fees. They had 12 lawyers. The little guy facing $1½ million in costs on a chance that he might recover and get $25,000 costs, it's ridiculous. He can't justify going ahead with the patent suit.

Mr. SHADE. Tying in with another factor, I think that the patent examiners in the Patent Office have a tendency to say if the patent is from Xerox or IBM, obviously it's worthy of attention. However, if it's from a relatively small, unknown company, let's question a little bit more. Business is good in this philosophy. We have an example of a patent——

Mr. LLOYD. Could I interrupt you there, Mr. Shade? Are you intimating that you feel there's a collusion between the——

Mr. SHADE. No. What I'm saying is that philosophically we as Americans appear to equate bigness with goodness, and it carries over into the examiners in the patent office.

I'm not suggesting collusion. However, in this particular case, four foreign countries have already issued our patent, and the examiner now has himself in the distasteful position of trying to prove to his peers that he was right in not approving our patent.

I have a feeling that had it been Xerox Information Systems rather than Shade Information Systems, it might have been whistled on through on the first application.

Mr. WILLECKE. May I comment on that?

I had a long discussion after I heard about this with our patent attorney. He pointed out that the examiners are doing as good a job as they can under the circumstances.

However, they are under a quota system (whether this is official or unofficial, I don't know). And if you are a patent examiner, you are expected to get out so many patents or so many responses during a given week.

Now, I can't vouch for that. This is only what I hear. When you consider that approximately a thousand patents are issued every week, quite obviously the time is not available for the diligent search that ought to be done.

Computerization has been tried, however it has not worked out to date, because there's still pretty much of human relationship—analysis and judgment—involved that makes a computer system not the answer at the moment.

Now, we could improve the reliability of patents by better examination, as Mr. Shade more or less pointed out. But the only way that we can see to do that now, is to increase the manpower, and it is obviously not a popular subject at this time to increase the manpower of the Patent Office.

I think we have to look at this patent system from a philosophical standpoint. The patent system originally was created, not for big business, but for the little guy in his workshop who could come up with something. A patent could be obtained pretty easily. There weren't too many patents issued. It had significance because everyone in the field could recognize his patent and the significance of it.

Complicating the numbers game is the fact that the larger companies, as Mr. Shade pointed out, simply go after a family of patents. Their inventor gets an idea and their attorneys cover every base since they have the legal staffs and funds to do so. Quite obviously the patent situation is really becoming ever more clouded.

And so the point is that people are really saying, "Look, we haven't got a chance." The little guy really doesn't have a chance, and even some of the medium-sized companies say, "We are not going to bother with it. We are going to use other protection methods rather than the patent."

Remember the idea of the patent is to give a person a limited monopoly so that he can exploit his idea. This is the thing, commercial exploitation. And this brings me up to one final thing that I'd like to say on this patent situation, if you don't mind, and that is that the question was asked, should small business be given title to inventions made under Government contracts?

My answer to that is emphatically, yes. I believe that any patent, obtained by an individual or working for a business under a Government contract, should be assigned to the business or the inventor. The Government should automatically be granted a royalty-free license. This takes care of the situation so the Government can say, "Look, you used our money, the public's money, we have a right to use it."

But the commercial exploitation, that should be done by the individual. I don't believe that the Government should hold title to a patent on that basis.

The purpose of a patent is to provide incentive to put the invention into commercial use, and no way can I see that the Government would, or should, have any interest in the commercial exploitation of a patent.

Mr. SMALL. I think the real question here is that many people look at this word "exploitation" of the commercial aspect of it and the whole antitrust aspect. The idea that people, consumers, finally wind up paying because one guy has the right to do something, he can charge what he wants for it, therefore, it's to the disadvantage of our country to allow this monopoly.

I think the history of patents and the development of this country will indicate that there have been more significant changes made by new ideas and new increases in productivity and to the advantage of the consumer.

However, without the incentive in this clouded atmosphere we have today, I think it's fair to say that the future of this creativity, this new development, the aggressiveness in investment it takes to develop these things, I think the consumer is harmed by that in the long run. And I think that's a political and emotional kind of situation that needs to be addressed.

For example, there are Federal courts in this country that haven't sustained the validity on a patent for over 20 years because they feel that patents are bad. The consumer should have the advantage of people stealing other people's ideas, and the costs are then down. That's the concept you are faced with, I think.

But I think you have to look at the history of the development of this country industrially to see whether or not it's a valid concept; the whole structure of patents and the purpose for them.

Mr. LUJAN. You mean you wouldn't use a good idea if you couldn't use it exclusively?

If you developed a way of doing something better than you thought—you build more machines, and if some other company wants to use it, so be it?

Mr. SMALL. You have to look at what's the return on the investment. Are you going to spend the $100,000 that it takes to pay R. & D. guys and to provide the facilities and the tools and all for them to generate the idea?

Are you going to do that if you figure the first time that that's out in the market, somebody who hasn't spent that money can do the same thing?

That's the problem you are into with determining what's the return on that investment going to be? And without some kind of protection for getting a return on investment, I submit small companies are just going to go out of the business of creativity. They can't afford to make the investment.

Mr. LLOYD. Don't you think they have already done that; not only are they going out, they have gone out?

Mr. SMALL. To a very large degree, they have. Unless there is some reversal of this whole concept, you are not going to see the small companies form, not going to see new ideas coming out, and it's going to be because they don't think it's worth the risk and investment.

Mr. SHADE. Let me speak to that further, if I may.

This idea that we are trying to get a patent is a very unique idea, and it has great potential.

However, we have 45, 50 salespeople covering the northeastern segment of the United States. If we came out with that idea without patent protection, I have no question that a major business equipment manufacturer, any one of a number of them, would throw their sales force of 10 or 15,000 people onto a similar idea and inundate us. We'd be forgotten as we are trampled.

Also I would point out to you to bring this idea to market is going to require several million dollars; probably a goodly portion of it in the form of investment or equity capital.

To go out and talk to a venture capitalist or any investor and say, "We've got this great idea," their first question they ask quite logically is, "How good is your patent protection?" You're damned if you do, and damned if you don't.

The alternative to the patent is secrecy, and secrecy does not work on a method. Secrecy only works on the design basically, and that's a point that should be brought home to you gentlemen.

If, for instance, we come up with a formula in our coding process for paper, the last thing we want to do is to apply for a patent, because all we do then is advertise, "Hey, fellows, this is how you do it. Change Item A to B," or change it from 12 inches per ton to 13 grams per ton, then you have not infringed.

So method patents, the ones that you are really after, the thing that our technical society is built on, you must have the patent or the big boy will chew you up and have you for breakfast.

Have I made my point?

Mr. LLOYD. We hear you. Thank you very much.

We'll recess for 10 minutes. We do appreciate your presentations this morning, gentlemen.

Mr. LLOYD. We'll continue the hearings at this point. The next witness will be discussing the acquisition of capital.

Mr. Banner, we'd like to take this opportunity to welcome you, and as with the other witnesses, you may submit any statements for the record. At this point, the Chair recognizes you for whatever statements you may have.

STATEMENT OF ROBERT L. BANNER

Mr. BANNER. I welcome the opportunity of being able to discuss with you the availability of venture capital.

I'm one of the organizers of Capital Investments out of Milwaukee, Wis., that was licensed under the Small Business Investment Act of 1958. We organized back in 1959, and went public in 1960.

I would like to preface my remarks that I, in referring to the small businessman, I am referring to the SBA's definition of small business, which is now $6 million in net worth, $2 million averaged after-tax earnings for the last 2 years.

In my opinion, there is an excess of venture capital available above and beyond that of the demand. There are various factors that affect the desirability of venture capital to small business concerns.

I would also like to comment that I'm referring to what SBA refers to as equity capital, which may be subordinate capital debentures, preferred stock, capital notes with equity options, and documents of this variety.

Perhaps the major problem in the dissemination of venture-type money is the reluctance of the small businessman to employ this capital if equity options are required in connection with obtaining those funds.

The actual or implied cost of funds must be absorbed by either the borrower or the lender if purchase equity is purchased; namely, inadequate opportunity to recover funds invested when in a minority position in a small concern. Regardless of the success or failure of the small business, this problem can, and usually does exist.

Other problems that occur that really stem from the small businessman is his lack of understanding of organizing or in preparing projections that can be submitted to a venture capitalist.

I find in my experience somewhat lack of knowing what the cost is in preparing these projections. I also find lack of knowledge in knowing a corporate organization. And, of course, I have heard this referred to before this morning, and that is the matter of cost of attorneys, accountants, and availability of knowledgeable consultants.

There is a reluctance on the part of SBIC's to supply funds to extremely venturesome situations. The rate of failure per newer, more inventive firms with less experienced management speaks for itself. Failure of small firms that cannot be condoned by an SBIC or any other venture.

Prudent SBIC management, therefore, avoids this type of small business concern. Undoubtedly, many small business concerns that could have been funded successfully, usually are not. I do not believe

that the public marketplace is correct for the small businessman. The majority of small businesses as defined by the Small Business Administration, could not meet current SEC disclosure requirements.

To exempt the small businessman from the SEC, while even forcing him to utilize the public market, exposes the unsophisticated investment public to unreasonable risk, and makes them prey to uncrupulous issuers.

Some of the factors that affect the availability of venture capital dollars to the small businessman is one, the access to the public market. The underwriters have steered away from the small offerings primarily because of regulations as imposed by the SEC and State departments of investment.

One of the major problems even with successful offerings, have been the cost of the attorneys, accountants, printing and filing fees. What I'm getting at is the cost of attorneys, accountants, and filing fees for $500,000 or $1 million or $2 million can be almost the same as if the offering was for $20 million.

I believe that the availability and desirability of venture capital funds could be proved by permitting licensed SBIC's to make venture-type loans or investments with a conventional SBA guarantee up to 80 percent of the total transaction.

The SBIC in turn provide SBA with a share of the equity rights proposed to be guaranteed. Also the impact of the SBIC program would be strengthened if they were permitted to provide subordinated funds to a small business concern in connection with conventional SBA loans, or loans from other Government agencies.

What I'm referring to is presently an SBIC cannot work in concert with other Government agencies that are willing to provide funds to a small business concern.

For example, FHA, the Farmers Home Loan Administration, would be desirous to provide a particular small businessman with a loan. However, alongside of that transaction, a company such as ours would not be able to provide the company with a nickel. It just doesn't make sense, and I will later relate to several situations that, if this were permitted, there could have been two businesses in the State of Wisconsin that, as of today, could have been off and running.

Someone must pay for the cost of capital funds. If Government is disposed to provide small business with a subsidy, then SBA should provide SBICs with lower cost funds. Limiting the interest and other charges, the SBIC could pass on to the borrower to not more than 2 or 3 percent above their cost. The lower cost of funds for the small businessman would perhaps encourage many to view the equity option included in the loan package more favorably.

The SBA guarantee would allow the SBIC to supply funds to more venturesome small business situations.

I think the Government could and should consider the institution of a program similar to the FHA program of the early 1930's which was provided for the home building industry. It would seem that the establishment of an insurance or guarantee program for venture-type dollars to the small businessman would be very simple to establish and administer inasmuch as of March 1979. 305 small business investment companies regulated by the Small Business Administration were

in existence. This would provide the machinery necessary to implement such a program.

Granted, it would require the introduction of some new legislation to supplement the Investment Company Act of 1958. However, it would merely be an embellishment of the original purpose of the act.

Now, above and beyond an SBIC or venture capitalist, there are in existence and have been venture capital firms that have worked out of the woodwork prior to the 1930's. And since that time, others were organized.

However, they were primarily funds of very wealthy families who, because of tax implications, felt that they wanted to put some of these dollars to risk in the establishment of some new ideas.

However, in most cases, they were looking for a control factor, and they also wanted a very strong voice in management. And knowing the small businessman as I do, this has always been very unpalatable to him, and I can totally understand why.

In the event that the small businessman would take the route of a public offering or sell shares to investors, he always runs the risk of disclosure problems, if not with the SEC, with the State department of investments. Primarily, if he sells the stock to 10 or more people, and then it falls under State regulations, and here again he only creates a situation that involves large legal fees, days in the Commissioner's office, and you name it.

I related and stated that I felt that there ought to be some Government support to this venture capital in the way of a program similar to FHA. Either program could be used, either the insurance approach, or the guarantee approach.

Most venture capital firms as licensed under the Small Business Investment Act of 1958 have a group of shareholders of their own, because in order to qualify, there had to be that they raised a given amount of private capital themselves. Right at the present time, that minimum requirement is $500,000. So they have a shareholder responsibility themselves.

If there was a $100,000 situation and their involvement was, say, 20 percent, and they could get a guarantee on the 80 percent, their feeling as to what degree of risk they'd be willing to take would certainly be helped.

The other situation that I feel that there can be some help from Government, is the cleaning up the regulations permitting the participation in situations by several Government agencies.

I refer to a situation here in the State of Wisconsin that was organized and in operation, so it has a track record; a track record of 3 to 5 years, of the cleaning of oil. I'm talking about the drain oil from automobiles, cutting oil from industry, and eliminating the need for virgin oil.

They are going to establish a new plant in northern Wisconsin and approach the Farmers' Home Loan Administration and receive a blessing that yes, they would guarantee and be willing to participate in the 80 percent, $2 million. And, of course, as you understand, they only guaranteed 80 percent of it. Those 20 percent, that would be open.

Now, they expected and felt that some bank in the State would pick up this situation. Now, in all truthfulness and all fairness to the

banks, this was not a bankable situation. It was pure and simply a risk situation.

We became involved and said yes, we like what we saw. We went to SBA and they said, "Oh, no, you cannot hold any document that has another agency's guarantee." We said, "Well, look, let's reverse this. We'll let the banks hold the 80 percent guarantee, and we'll hold the at-risk portion, namely, the 20 percent."

And because of what was existing on the books, both agencies came to a loggerhead and no deal was made. The situation is still out there.

Gentlemen, that concludes my remarks. It is my understanding that I'm now available for questioning, and I could expect most anything.

[The biographical sketch and prepared statement of Mr. Banner follow:]

BIOGRAPHICAL SKETCH
ROBERT L. BANNER

Robert L. Banner is Vice President and a member of the Board of Directors of Capital Investments, Inc., a Milwaukee-based Small Business Investment Company (SBIC).

Capital Investments, Inc. is a publicly-held corporation, first offering its securities to the public market in the fall of 1959. Capital Investments, Inc. has approximately 530 shareholders, with the control of the company being held by the Marshall & Ilsley Corporation of Milwaukee, Wisconsin and a number of its constituent banks.

Mr. Banner has lectured on the SBIC program at the University of Wisconsin-Milwaukee and Marquette University School of Business Administration.

Prior to joining Capital Investments, Inc., Mr. Banner was District Manager for the First Wisconsin National Bank. For the seven years that he was associated with the First Wisconsin, that bank increased its consumer credit outstandings from approximately $100,000.00 to $24,000,000.00.

While at First Wisconsin, Mr. Banner's responsibilities included business development of what was then known as the Time Credit Division and assisted the bank in development a Consumer Credit Division.

Before joining First Wisconsin National Bank, Mr. Banner was the manager of the Beloit, Wisconsin office of Commercial Credit Corporation, working in accounts receivable and inventory financing.

Mr. Banner has attended Oxford University, Oxford, England; Marquette University, Milwaukee, Wisconsin; University of Wisconsin-Milwaukee; ABA School of Banking, University of Wisconsin-Madison; School of Banking, University of Wisconsin-Madison.

As a result of Capital Investments, Inc's small business investments, Mr. Banner served on the Board of Directors of eight corporations, one of which is publicly held.

The Small Business Administration appointed Mr. Banner to serve on the National Small Business Investment Advisory Council for the years 1968 through 1970.

In addition, Mr. Banner presently serves on the Board of Directors of the Milwaukee Economic Development Corporation.

WRITTEN STATEMENT

TO: House Science and Technology Subcommittee on Investigations and Oversight

FROM: Robert L. Banner, Vice President
Capital Investments, Inc.
515 West Wells Street
Milwaukee, Wisconsin 53203

RE: Hearings on Small High Technology Firms and Innovation
December 10, 1979
Lawrence University
Appleton, Wisconsin

DATE: December 5, 1979

Venture capital, as it applies to the small business concern, is defined as long-term subordinated debt acquired at a market rate of interest. This definition could be expanded to include subordinated convertible debentures or preferred stock. It is my opinion that, at the present time, there is a disparity between the supply of and demand for this type of funding.

There are various factors that effect the desirability of venture capital to the small business concern. Perhaps the main problem is the reluctance of the small businessman to employ venture capital if equity options are required in connection with obtaining those funds. The actual or implied cost of funds must be absorbed by either the borrower or the lender, if pure equity is purchased. In this type of situation, a still greater problem can develop, namely, inadequate opportunities to recover funds invested when in a minority position in a small business concern. Regardless of the success or failure of the small business, this problem can and does exist.

There is also a reluctance on the part of the SBIC to supply funds to extremely venturesome situations. The rate of failure for newer, more innovative firms with less experienced management speaks for itself. Failure of funded small business concerns can doom the SBIC. Prudent SBIC management, therefore, avoids this type of small business concern. Undoubtedly, many small business concerns that could have been funded successfully were not.

In addition, I do not believe that the public market place is correct for the small businessman. The majority of small businesses, as defined by the Small Business Administration, could not meet current SEC disclosure requirements. To exempt the small businessman from the SEC while forcing him to utilize the public market, exposes the unsophisticated investment public to unreasonable risk and makes them prey to unscrupulous issuers.

I believe that the availability and desirability of venture capital funds could be improved by permitting licensed SBICs to make venture-type loans or investments with a conventional SBA guarantee of up to 80% of the total transaction. The SBIC could, in turn, provide SBA with a share of the equity rights proportional to the guarantee. Also, the impact of the SBIC program would be strengthened if they were permitted to provide subordinated funds to a small business concern in concert with conventional SBA loans or loans from other governmental agencies.

Someone must pay for the cost of capital funds. If government is disposed to provide small businesses with a subsidy, then the SBA should

provide SBICs with lower cost funds, limiting the interest and other charges the SBIC could pass on to the borrower to not more than 2 or 3 percent above their cost. The lower cost of funds for the small businessman would perhaps encourage him to view the equity options included in the loan more favorably. The SBA guarantee would allow the SBIC to supply funds to more venturesome small business situations.

I think the government could and should consider the institution of a program similar to the FHA program of the early 1930's which was provided for the home building industry. It would seem that the establishment of an insurance and/or guarantee program for venture-type dollars to the small businessman would be very simple to establish and administer, inasmuch as there is, as of March 1979, 305 Small Business Investment Companies regulated by the Small Business Administration. This would provide the machinery necessary to implement such a program. Granted, it would require the introduction of some new legislation to supplement the Investment Company Act of 1958, however, it would merely be an embellishment of the original purpose of that Act.

Mr. LLOYD. We hope to be somewhat kind.

Mr. Lujan?

Mr. LUJAN. Thank you, Mr. Chairman.

Is Capital Investments an SBIC?

Mr. BANNER. We are a licensed SBIC. We were No. 2 in the State to be licensed in 1959.

Mr. LUJAN. And as an SBIC, when you lend out money, 25 percent of that money is yours, and 75 percent is on loan from the SBA is that correct?

Mr. BANNER. No, sir. Capital Investments has $14 million in footings. We have private capital of $2½ million. We have leverage from SBA of $7 million.

Now, the situation being that SBA has established various levels of how they will provide us dollars depending upon what your outlook is.

If you are in the business just to make loans, they will merely match capital. If you're in the business to make venture-type situations, and I will explain what they are talking about there, they will lend you three times.

Now, if you are in another category, they will lend you four, and they are even talking five.

A venture situation is a situation that you have taken an equity-type situation position in the business. And that is that you are either in common, preferred, or in a loan in excess of 5 years with a 3-year moratorim on principal whereby the company merely pays interest. That is, by their definition, a venturesome firm.

Our cup of tea is that type of situation where we'll make a deal that will be a minimum of 5 years in duration, and will have at least a 3-year moratorium on a receipt of principal.

Now, there is one thing that I'd like you to know that I didn't relate in my remarks. By regulation, an SBIC may never take control of the company. So as I have discovered, a small businessman is concerned with that. If I was a small businessman, I think I would be too.

An SBIC must be a professional minority holder.

Mr. LUJAN. What happens supposing you make one of these 5-year loans and you are on 3-to-1 participation, SBA money and the private capital, and you don't recover?

Do you have to pay back that 75 percent?

Mr. BANNER. The loss is totally ours.

Mr. LUJAN. The whole $2 million in this case would have been——

Mr. BANNER. See, the SBA merely loans us the funds. They expect the repayment of 100 percent of what they loan us.

So in answer to your question, if we made a $500,000 deal, and it was a total loss, we don't share that loss with SBA.

Mr. LUJAN. Without the guarantee, that makes you too conservative?

Mr. BANNER. Yes.

Mr. LUJAN. Thank you.

Mr. Lloyd. Mr. Roth.

Mr. ROTH. From your testimony this morning, I gather that you are having problems with governmental agencies competing with each other; is that right?

Mr. BANNER. I don't think they compete. I think they each want to have their own situation, and they don't like the idea that it makes sense for one to work with the other.

As in the situation with the oil, I want to say rejuvenator, that is not the word; reclaiming. As you know, oil, filling stations, industry in the way of cutting oil, have a problem of what to do with the waste product. Here was a situation where the company would come and pick up the waste oil, refine it, and have a new market for it. But because two agencies could not get together, he's still out there in limbo.

Mr. ROTH. I think it's fair to say that the problem you have had with agencies is not unique to your particular situation. We hear this all the time.

Mr. BANNER. I'm sure that is true.

Mr. ROTH. What do you think that Congress should do about something like that? Or what can Congress do?

Mr. BANNER. Well, I don't think that I have gotten in that particular problem to the degree that you people have, and you say you have heard it all the time.

The thing that hits me, is there maybe should be some, and I hate saying this, creation of another agency that has some court of last resort. Because this was really a problem of the legal department of SBA and the legal department of the Farmers' Home Loan Administration saying this is the regulations. Where do you go with something of that variety?

If it was a court of law, you'd go to the Supreme Court.

Mr. LUJAN. I think maybe we have to change that particular law that says one Government agency cannot guarantee the funds. Because in this particular case, they are not really guaranteeing SBA funds, they are guaranteeing capital investment funds. I'm sure you borrowed it from SBA.

Mr. BANNER. We borrowed it, but they didn't guarantee it.

Mr. LUJAN. If you hadn't borrowed it from SBA, could you get a guarantee?

Mr. BANNER. However the loss developed, the total loss is ours.

Mr. LUJAN. I didn't realize that. I thought that if the loan wasn't paid back, you told SBA, sorry.

Mr. BANNER. You are thinking of the conventional SBA loan program.

Mr. LUJAN. No; I'm thinking of SBIC where you get 3 to 1. I was under the impression when you were unable to pay back the loan.

Mr. BANNER. There is times where I would have liked that situation. But we had to eat it.

Mr. ROTH. If I could make this observation, we are the Committee in Oversight, and I might suggest that with the permission of the Chairman, that we take a look at your particular case; and I think in this way, Congress may not be able to resolve every problem, but certainly zero in on the problem you have suggested.

Mr. BANNER. I'd be delighted, and there'd be many people in the State of Wisconsin who would be delighted if that situation were corrected.

Mr. LLOYD. I think that would be a good idea. I presume, Mr. Banner, that you and some other people would not be adverse to traveling to Washington to make that presentation?

Mr. BANNER. No, sir. I'm sure that is correct, because we have done that before.

Mr. LLOYD. I have no questions.

Mr. ROTH. Thank you, Mr. Chairman.

Mr. LLOYD. Mr. Banner, we thank you very much for joining us here today.

Do you have any further questions?

I thank you very much.

As indicated, we'll probably take up the specific case, and see if we cannot find out why two agencies cannot communicate with one another. This is obviously one of the major reasons for having these hearings, to hear, I prefer to hear these stories, but we'll take war stories also.

At this time we will have Mr. Nacker and Mr. Wilberg and Mr. Pricer. And if they would please come forward, this will cover the suggestions for improving the climate for innovation.

Now, we have heard the problem, and we have heard some of the horror stories, and these gentlemen are going to bring us a solution.

Mr. ROTH. Mr. Chairman, if the committee had some solutions or something, we are always interested, so I'll be listening as I'm sure you will with great anticipation.

Mr. LLOYD. Is there anyone who wishes to start first?

Mr. Pricer, you seem to be the man, so the Chair recognizes you and your colleagues. We look forward to hearing your testimony.

Mr. PRICER. Mr. Chairman and members of the committee, it's a pleasure to be here today to testify in support of university based innovation centers.

I'd like to start today by indicating that I have a prepared statement. I won't read that, but I'd like to highlight some of the major points.

Mr. LLOYD. Very well. The committee will accept your statement without objection. It will be submitted for the record.

STATEMENT OF DR. ROBERT W. PRICER

Dr. PRICER. First of all, there's no question but that inventions and innovations are declining nationally. The United States ranks fifth in the number of patents issued on a per capita basis. Japan, Sweden, Switzerland, and Germany are ahead of the United States. We are on a par with the Soviet Union that, interestingly, issues individual patents.

If we look at small businesses since World War II we see that they have provided about 50 percent of all inventions and innovations.

Also, small business is 24 times more efficient in the development of new inventions and innovations for each dollar of research and development spent. Yet small business receives only 3.4 percent of all Federal research and development money.

When we look at the small business sector, we see that small, highly technical firms have employment growth 10 times that for large, technical firms, and 60 times that of large, nontechnical firms.

Small business provides 88 percent of all new, private sector jobs.

With that I'd like to turn to an overhead that shows the invention and innovation process. The process of invention is really misunderstood by most people.

There are two distinct phases, and if we look at the first phase, premarket, we start with new ideas. You can think of these new ideas as inventions.

As you look at the top graph, you see that out of every 100 inventions or new ideas, that somewhere over 95 of those are not feasible or commercial. So, the small business inventor and the individual inventor faces a very difficult and expensive task of bringing a new idea to market.

Right now there is a new idea assessment service provided by the University of Oregon Center for Evaluation of Inventions and Innovations. Also there is a program through small business development centers that assist business with the marketing stage of new invention introduction.

What we lack today is assistance in the premarket stage; prototype development, testing products, and developing feasibility studies for those markets. This is the area that I think we need to focus in on.

We have heard about the expense of developing a new product. If you look at the negative cash flow generated in the premarket phase, you can see that it's in this area that we need to do something.

Mr. LUJAN. Didn't the Department of Transportation have something up here to test energy saving devices somewhere in this general Midwest area?

Dr. PRICER. I'm not familiar with a DOT program.

Mr. LUJAN. DOE.

Dr. PRICER. I'm not familiar with either of those.

I contend that we really need two specific programs, and with that, two bills. I think one bill would stimulate new technological innovation at the left of the graph shown. And that we need a second bill that would bring the resources of our Nation's universities to the assistance of small business in the premarket stage.

Now, the first bill should contain the following features: First of all, there should be a provision for small business set-aside on all Federal research and development contracts.

I mentioned before that small businesses are 24 percent more efficient in the use of research and development dollars, yet they receive only 3.4 percent of all Federal R. & D. dollars.

A second provision would allow for the transfer of Federal patents to small business, and these are not just patents that are developed by small business when they are working on government contracts, but the actual transfer of patents to small business when they are developed in the public sector.

A third feature would be a provision for the reduction of litigation costs of patent disputes. We heard some testimony this morning about that. The average cost today to litigate patent disputes is $250,000. That's just beyond the reach of most small businesses.

Mr. LLOYD. Could I interrupt you there?

The previous witness, Mr. Banner, indicated that small business as described by the SBA, when you say small business, are you saying the same thing, or do you do as I do when someone talks $6 million, that sounds like a pretty good-sized business?

Dr. PRICER. The figures that I use are those businesses with fewer than 200 employees.

Mr. Lloyd. You could be down to five employees, and that would still be applicable?

Dr. Pricer. That's right. And as you look at the process of new idea development, you see that the small business really faces the same process that an individual inventor does.

In fact, many new highly technical companies are developed by inventors around specific products for the protection of a new invention or innovation.

So, I think that we can really talk about individual inventors and small business at the same time.

Another provision that I think should be in this first bill is a capital gains deferral on the sale of a small business if the proceeds go back into another small business.

Recognizing that small, technical firms oftentimes are developed around a given product, it would be a real incentive to the inventor if he could sell that business, take the money and put it back into another small, highly technical firm.

Another provision would be to extend the loss carryforward to 10 years for small business. It's 7 years currently. The provision would allow small firms to write off research and development costs in 1 year, and to write off research and development facilities over 10 years.

The seventh provision would be a formal system for identifying smaller firms for Federal research and development projects when you have a contract of $100 million and greater. Something similar to the PASS system that is used by SBA for procurement would work, and I think we should aim for a 50-percent share of Federal research and development dollars for small business.

And the most important provision of a bill of this nature would be a provision that would require all Federal agencies to consider the size of the firm when regulating businesses.

I feel that Federal regulation oftentimes hampers innovation and development.

The second program that we need is one that would mobilize the knowledge and resource base of the universities of our Nation to assist small business.

The University of Wisconsin——

Mr. Lloyd. Could I interrupt you?

You mentioned that twice. Do you feel that small business and the academic world have not been together?

Do you think, for instance, small businessmen see the university as a friend, a partner, and a colleague in this business venture?

Dr. Pricer. Not in every State. I think they do in this State. This State has a long history of business extension and university outreach.

Large businesses have used the facilities of universities for years. At the University of Wisconsin Engineering Testing Lab in Madison, there are testing procedures that can be performed at only four different locations in the United States. They are used frequently by large business. But the cost is prohibitive for small business.

State statute requires that cost recovery be charged for the use of these facilities.

I think that we could develop legislation that would assist small business in the premarket stage; prototype development, testing of products, determination of market feasibility, and that's what we need.

I'd like to mention that fortunately Congress has gone a long way toward meeting these objectives; not totally.

Wisconsin Senator Gaylord Nelson has introduced two bills: S. 1860, which deals with the premarket stage problem, and S. 918 that deals with the mobilization of university resources.

We need more, but it's a beginning. With this kind of help, I think we can, in fact, stimulate innovations by the small business sector, and we really cannot take our technical superiority for granted. It has slipped, and we do need to take effective action.

Thank you.

Mr. LUJAN. I just wanted to ask, is this SBDC concept peculiar to the State of Wisconsin, or is it pretty general?

Dr. PRICER. No; it isn't. It's a demonstration project. There are, right now, 16 States that have pilot SBDC programs, and they are designed to test whether university resources can be moved to meet small business needs, and whether the resources are acceptable to the small business community.

Mr. LUJAN. In your spoken testimony as opposed to your written testimony, you have these suggestions as to legislative changes.

Do you have anything written you could give to the committee that we might peruse?

Dr. PRICER. I can provide that.

Mr. LLOYD. You also mention that you were one of four universities, if I recall correctly, that cooperate so closely with the business sector.

Why don't you describe that uniqueness, and tell us about it.

In other words, how do you involve yourself? How do you communicate with the businessmen out there who may think you are unable to understand their problems?

Dr. PRICER. On the educational side, the noncredit programs and workshops for small business, these are designed to develop management skills. We have on each of the 4-year campuses, with a business school or college, an individual with a business outreach job. Last year they had, in the small business area, some 15,000 enrollments in noncredit courses and workshops.

In addition to that, we have extension offices that are located in every county of the State.

The county extension staff determines the needs of people in their community, including the business community. They refer clients to the university system for assistance. We provide one-on-one counseling to these businesses through the use of student teams and faculty members.

This year the University of Wisconsin SBDC will have 450 in-department clients, that is businesses that receive 12 hours or more of direct counseling. We'll have another 5,000 clients of shorter counseling duration; maybe just a one-time contact, and we'll have enrollments of about 17,000 in workshops and seminars.

Mr. LLOYD. Very interesting.

[The prepared statement of Dr. Pricer follows:]

Statement
of
Dr. Robert W. Pricer
Director
University of Wisconsin
Small Business Development Center
before the
Subcommittee on Investigations and Oversight
Committee on Science and Technology
U.S. House of Representatives

Appleton, Wisconsin
December 10, 1979

Mr. Chairman, members of the Committee, it is a pleasure to be here to testify in support of university innovation centers.

Throughout our history, independent inventors and small firms have been the backbone of American technological innovation. However, during the past two decades, increasingly sophisticated technology and high investment costs associated with invention and innovation have made it increasingly difficult for the individual and small business to make this contribution. For example, the percentage of patents issued to private citizens has decreased by 22% since 1963. As a result, four countries (Sweden, Switzerland, Germany, and Japan) now issue more patents on a per capita basis than the United States. Another alarming fact is that the rate of invention and innovation in the United States has declined slightly, while the number of U.S. patents issued to foreign nations has grown by 85%.

This decline is occurring at a time when technological innovation is urgently needed by our country. Acute energy shortages, pollution of air and water, crowded cities, urban sprawl, diminishing natural resources, inflation and unemployment all require innovative solutions. In such a trying time, we should realize that the small business sector--now largely ignored--has been most productive in generating significant

technological innovations.

The lack of assistance to the small, innovative firm is at least partially due to a failure to differentiate between invention and innovation and to understanding the new-product-development process. To understand this difference, it must be realized that invention is the act of creating something new, whereas innovation refers to the process of translating an invention into a usable product, process or service and establishing it in the marketplace. Simply stated, the distinction is one of creation as opposed to implementation. Even though invention is often time consuming and expensive, the majority of the cost and complexity is associated with innovation. Productivity during the innovation stage requires a stimulating environment with adequate financial and technological resources.

Although we recognize that small business plays a significant role in technological innovation, the United States has done little to provide assistance in spanning the gap between invention and innovation. (One notable exception is the Experimental Center for the Advancement of Invention and Innovation, University of Oregon, which is directed by Dr. Gerald G. Udell and funded through the National Science Foundation.) While the gap between invention and innovation is wide, it can be effectively bridged. The cost and complexity of innovation can be decreased by following a structured process of evaluation, research, development, and commercialization.

Unfortunately, this remedy of a structured innovation process is beyond the scope of most small businesses. Typically, the small business lacks either the financial resources or the educational background and experience necessary to identify and use this process. As a result, small business as a source of technological innovation is grossly underutilized.

The University of Wisconsin Small Business Development Center has been designed to mobilize the knowledge and resource base of the University system to meet small business needs. At the present time, there are eleven SBDC management assistance service centers located on the following four-year UW campuses: Eau Claire, Oshkosh, Whitewater, Green Bay, Stevens Point, Superior, La Crosse, Parkside, Platteville, Milwaukee, and Madison. The SBDC system coordinates the resources of colleges and schools of business, engineering, and law. The SBDC has submitted a grant under the National Science Foundation's Research and Development Incentives Program to provide specific assistance to inventors and innovators.

The innovation process includes an array of activities necessary to develop a successful product from an original idea. The phases of this process are: (1) evaluation, (2) planning, (3) research, (4) development, (5) commercialization, (6) management assistance. The Small Business Development Center is designing services to meet these innovation phases.

Evaluation

Most small businesses find it difficult to accept the possibility that their new idea or invention might not lead to a successful product. However, well over 90% of all inventions are not commercially feasible, and it is essential that an effective evaluation of new ideas be provided in order that time, money, and energy be directed to those new products with a high probability of success. The University of Wisconsin uses the University of Oregon Innovation and evaluation process to assess the feasibility of new ideas. This service is provided at no cost and over 200 individuals and small businesses have participated in the program during the past year.

Planning

If a new product idea is deemed feasible, the Small Business Development Center staff will assist in the development of a master plan for the product. This plan establishes the steps needed to bring the product through the pre-market innovation process.

Research

After a master plan has been completed, the SBDC staff assists the small business clients in determining the complexity and nature of the anticipated market for the product. When the research activities are completed, a report summarizing the activities performed, findings, and recommendations is sent to the client.

Development

The level of development assistance provided by the SBDC is dependent upon the degree of support from the National Science Foundation or other funding sources that are received. With appropriate funding, the resources of UW-Stout and the Milwaukee and Madison engineering schools will be used for prototype development and testing. The Small Business Development Center will also assist in the identification of appropriate distribution channels or in a search for buyers of the innovation or patent rights.

Commercialization

The Small Business Development Center will assist in the preparation of a professional presentation to help sell or license a new invention. The complexity of this service depends upon the nature of both the product and the market.

Management Assistance

During the innovation process, small businesses often need many management assistance services. The Small Business Development Center is capable of providing, at no cost, management, finance, personnel, inventory, marketing, and other small business assistance.

The University of Wisconsin Small Business Development Center has been organized to assist in the stimulation and development of new inventions and innovations. We look forward to working with the Congress in the development of a program that will stand the test of time in providing quality assistance to Wisconsin's small business inventors and innovators.

Thank you.

STATEMENT OF ROGER M. NACKER

Mr. NACKER. Thank you very much for the opportunity to be here this morning.

I also have some prepared testimony which I'd like to submit.

Mr. LLOYD. Without objection, we'll submit that for the record.

Mr. NACKER. I would simply paraphrase some of the material that's in there.

In terms of background, I'm a Ph. D. in Natural Resource Economics from Purdue University in 1971.

I was a senior economist with the Canadian Forest Service, and also taught at Purdue University. I am currently the research director for the Wisconsin Department of Business Development in Madison.

The department functions to promote the growth and development of the State's economy. In my professional capacity, I am concerned with ways in which government can effectively influence economic growth.

This morning before this session started, a gentleman alluded to you looking to this session to provide some conclusions. I hope you won't let the fact that I'm an economist color your thinking. If you laid all the economists in the world end to end, you still couldn't reach a conclusion.

Mr. LLOYD. I'm glad they don't have jokes like that about politicians.

Mr. NACKER. The department of business development is a promotional agency and assistance agency to the companies in the State of Wisconsin.

We serve as an informational clearinghouse. We also perform an ombudsman-type role.

One of the things that happens, though, in our department is I'm continually amazed by the resourcefulness and strength of motivation exhibited by the private sector. A constant source of amazement to us is that companies are so resourceful; the fact that they do attack and succeed in almost all types of problems.

I was reading something the other day that said there are approximately 10 million small businesses in the United States. I think it would be a fair guess to say there are probably 10 million, even 20 million who would like to be small businessmen.

Really, then, I think what we are talking about in terms of government and its interface with the private sector, is how can government provide the motivation for and/or provide for the feasibility for companies to do what they do best?

As a guardian of free enterprise, government singularly is, in fact, for creating and maintaining an environment in which business can successfully operate. This is probably the main factor in which government is responsible in terms of its relationship with business.

Quite recently there have been a number of studies which have come out, the results of which are very surprising. I'll just excerpt a few of the results, a few of the highlights of it.

One of the studies determined that small businesses create the most jobs, which is a study financed through MIT by the Economic Development Administration, a Federal agency.

One of their findings was that small businesses, businesses with less than 20 employees, create something like 60-some-odd percent of all

new jobs, net new jobs which are created in the Nation which, if in fact this is true, is a truly remarkable finding.

Another study; young, innovative companies expand rapidly. This is something perhaps we have observed from time to time, but needless to say, this here again is another quite amazing finding.

From a standpoint of study of invention and innovation, another study to determine that important society influencing inventions and innovations come mostly from independent inventors and small technology-based companies. Small firms get more major innovations from each dollar of their R. & D. expenditures. This is something that's been alluded to already this morning.

Also, another study determined that high technology firms have rapid employment growth, and their output growth rate is high. Their productivity increase is fast. Here again is something which is national in terms of the American productivity rate vis-a-vis other countries, and also that their prices are relatively stable.

This interfaces quite importantly with inflation, which we are experiencing in our economy.

If we can thusly characterize the growth segment of our technology dependent economy, why is our Nation's R. & D. commitment investment in this segment so minuscule?

And what can Government do to increase it?

Before we get into this, we should separate R. & D. expenditures into two types of projects. The first type of project, and this is the one in which Government is probably the most qualified in which to operate, is very similar to the space program. Here Government's overriding interest is in the public good. The Government has the requisite amount of resources, the large amount of resources required to complete the project, and the Government really should extend, take the forefront and advance these types of projects.

However, there's another type of R. & D. project, and one that just doesn't fall into this set of categories. It is essentially characterized by the fact that projects are not necessarily motivated by public policy. Here Government's lack of qualification to make investment decisions in this category is not Government's alone. It's also shared by other large institutions, including large companies.

The reason for this is because these are large institutional bureaucracies, and large institutional bureaucracies are often neither innovative nor daring, and they are unwilling to take risks.

For one thing, authority is too diffuse to move quickly, and rigid structure provides no incentive to risk taking. Indeed, it is because small business is not burdened with these deterrents to innovation that it is the source of most new technology.

Small business is by contrast generally quick to respond to changing needs, assuming risk in pursuit of perceived profits.

As we have seen, the innovative potential of this sector is large. Attempts to centralize investment decisions within the confines of Government, necessarily funnels this larger group through a much smaller group of deciders.

Better to retain as large a group of investors as possible, and let those investors meet inventors and innovators in the marketplace of their choosing, with government describing the rules under which they

effect their agreements. If size of firm is, as indicated, an important variable in the success of investments, then perhaps there should be different rules for different sizes of companies.

Direct Government interaction with R. & D. investment decisions hampers the innovation process in yet another way. Small business is already heard to complain loudly of the burdensome paperwork required by Government. Extensive recordkeeping, and compliance procedures, which would no doubt accompany any Government-sponsored program, would in themselves act as a deterrent to business participation, unless these hindrances are recognized and removed.

Where the small business sector is concerned, Government can probably do best by doing least. However, Government can play a positive role in encouraging R. & D. by providing tax incentives and other forms of indirect aid, which would encourage private enterprise to undertake ventures which might otherwise be impossible on the basis of size or risk.

In addition to indirect measures, Government can also assist small business by encouraging a positive climate for investment in new technology. National mood and focus of interest are strong forces shaping the psychology of investment decisions. Investors convinced of the efficacy and profitability of modern technology will be more receptive to these types of investments.

Again, the space program provides an example, in this instance, of Government's positive role in creating a feeling of national purpose around the issue of technological achievement.

To digress for a moment, profit is a word, which has of late, acquired a negative social connotation. Strictly speaking, however, profit is a generic word for pecuniary returns from the factors of production: land, labor, and capital.

In the private sector, these factors of production are employed wherever the returns are the greatest.

Government should remain cognizant of the fact that this is the essential element of capitalism.

Profitmaking is analogous to biological growth processes. For example, before a fruit tree can grow and become productive, an initial commitment of resources, planting, is required. In business this planting is called investment. It requires a conscious decision that balances real costs and opportunity cost against potential rewards. Implicitly, the Investment Act requires deferred consumption. As a Nation, we must make the potential rewards from deferred consumption at least commensurate, if not greater, than the gain derived from current expenditures. And this effort must be targeted toward those sectors and endeavors which will produce the maximum returns to society.

If the recent studies are correct, small business produces relatively more jobs, is more highly produetive, and as such is a candidate for special Government efforts. These efforts will be more costly on the average: 10, $25,000 programs are more costly to allocate and administer than 1, $250,000 program.

Clearly, though, this change in program administration is needed. To the extent that it can, Government should recognize and budget for these extra costs.

Small business set-asides in R. & D. funding and in procurement are positive constructs, even though their effect is limited.

So then, to the extent that Government can foster national capital accumulation and investment, in direct the use of these funds to, and provide responsive services for innovative small businesses, Government can effect the positive social and economic changes which are now needed.

In Wisconsin as well as nationally, there is now considerable interest in small business and its relationship to Government. Hopefully, this concern will result in an objective determination of the role of small business in the economy, and whether or not Government should explicitly recognize this role.

If current studies are correct, the answer to the latter question should be "Yes."

The Department of Business Development is actively assisting and promoting small business in Wisconsin. Such promotional programs as the Governor's new product awards give explicit recognition to technological advances by Wisconsin companies. Our international marketing programs bring Wisconsin companies face to face with world markets.

The cross-fertilization of ideas from this contact is immensely valuable. A new, small business ombudsman program assists companies with problems in the public-private sectors interface.

We believe all of these programs strengthen and foster our economy, and our department is pledged to continue these efforts.

Thank you very much.

[The biographical sketch and prepared statement of Mr. Nacker follows:]

BEFORE THE

U.S. HOUSE OF REPRESENTATIVES
SCIENCE AND TECHNOLOGY

SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT

"Small High Technology Firms and Innovation"

STATEMENT

WISCONSIN DEPARTMENT OF BUSINESS DEVELOPMENT

By: Roger M. Nacker
Research Director
Department of Business Development
Room 650, 123 W. Washington Avenue
Madison, Wisconsin 53702

608/266-1386

Dated: December 10, 1979

My name is Roger M. Nacker. I received a doctorate in Natural Resource Economics from Purdue University in 1971. I was a senior economist with the Canadian Forest Service, and also taught at Purdue University. I am currently the research director for the Wisconsin Department of Business Development in Madison. The Department functions to promote the growth and development of the state's economy. In my professional capacity, I am concerned with ways in which government can effectively influence economic growth.

There is little doubt that government policies and programs have an impact on small business and innovation. As a guardian of free enterprise, government is in fact responsible for creating and maintaining an environment in which business can successfully operate. What is debatable, however, are the means government should employ to achieve this end.

What we are here to discuss today are the means government has at its disposal to best foster the development and dissemination of technology and innovation. That there is a need for discussion of this topic is obvious. American productivity is falling, inflation is increasing, and the relative costs of food and raw materials are increasing -- all of which detract from our standard of living and relative economic strength. We are also witnessing a decline in our nation's role as a major source of new technology. We are paying the price for this decline now, in the form of inflation, and we will pay more heavily in the future. How can government reverse this trend?

To answer this question, we might first look at what we know about the source of most new technology and innovation. Recent studies have shown that:

1. small businesses create most new jobs;
2. young innovative companies expand rapidly;
3. important, society-influencing inventions and innovations come most from independent inventors and small technology-based companies;
4. small firms get more major innovations from each dollar of their R&D expenditures; and

5. high technology firms have rapid employment growth and their output growth rate is high, their productivity increase is fast, and their prices are relatively stable.

If we can thusly characterize the growth segment of our technology-dependent economy, why is our nation's R&D commitment and investment in this segment so miniscule? What can government do to increase it?

Before addressing this question, we should distinquish two types of R&D projects. The first type are those projects which provide diffuse payoffs and require a large investment of resources. An example of this type of project is the Space Program. Because of the nature of these projects, government is best qualified to make investment decisions relating to them. Only government has the requisite resources at its command. Government's overriding interest in the public good also makes government the best qualified to make these decisions.

The second type of R&D project is that which does not fall into the first category. These are essentially projects which are not motivated by public policy. In the case of this type of project, government is not best qualified to make investment decisions. Government's lack of qualification here is shared by many large institutions, including large companies. Large institutional bureaucracies often are neither innovative nor daring, that is willing to take risks. Authority is too diffuse to move quickly, and rigid structure provides no incentive to risk-taking. Indeed, it is because small business is not burdened with these deterents to innovation that it is the source of most new technology.

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innovative potential of this sector is large. Attempts to centralize investment decisions within the confines of government necessarily funnels this larger group through a much smaller group of "decidera". Better to retain as large a group of investors as possible and let those investors meet inventors and innovators in the marketplace of their choosing... with government describing the rules under which they effect their agreements. If size of firm is, as indicated, an important variable in the success of investment, then perhaps there should be different rules for different sizes of companies.

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Where the small business sector is concerned, government can probably do best by doing least. However, government can play a positive role in encouraging R&D by providing tax incentives and other forms of indirect aid, which would encourage private enterprise to undertake ventures which might otherwise be impossible on the basis of size or risk.

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Profit-making is analoguous to biological growth processes. For example, before a fruit tree can grow and become productive, an inital commitment of resources, planting, is required. In business, this planting is called investment. It requires a conscious decision that balances real costs and opportunity cost against potential rewards. Implicitly, the investment act requires deferred consumption. As a nation, we must make the potential rewards from deferred consumption at least commensurate, if not greater, than the gain derived from current expenditures. And, this effort must be targeted toward those sectors and endeavors which will produce the maximum returns to society.

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extra costs. Small business set-asides in R&D funding and in procurement are positive constructs, even though their effect is limited.

So then, to the extent that government can foster national capital accumulation and investment in, direct the use of these funds to, and provide responsive services for innovative small businesses, government can effect the positive social and economic changes which are now needed.

In Wisconsin, as well as nationally, there is now considerable interest in small business and its relationship to government. Hopefully, this concern will result in an objective determination of the role of small business in the economy and whether or not government should explicitly recognize this role. If current studies are correct, the answer to the latter question should be "yes".

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We believe all of these programs strengthen and foster our economy and our Department is pledged to continue these efforts.

Mr. LLOYD. Thank you very much.

Mr. Lujan?

Mr. LUJAN. It seems like the small business climate in Wisconsin, as both of you gentlemen have stated, is quite favorable.

Do you have programs of technical assistance?

Is your failure ratio smaller than it would be in other States, generally?

Mr. NACKER. I looked at some figures—some of that data. The reason I didn't want to respond immediately is I find some of the data to be a little soft.

The numbers indicate that the ratio of failures is less. But here again, I am not sure about the data. But it would seem to infer that there is an innovative spirit here, if you will.

Mr. LUJAN. From what you say, that is true.

The other part of my question was the technical assistance to small business.

Do you have that kind of program, I guess, through the university—accounting practices, managerial practices?

Dr. PRICER. I'd like to respond to that, and say we work very closely with the department of business development, and receive many referrals from the ombudsman, and we do in fact provide that service.

Mr. NACKER. In terms of our department, the department has served as an informational clearinghouse, and the net result, while we don't have a formal program in innovation, we do, we are impressed with development and provide that sort of assistance.

It's surprising how much we do get involved in these projects.

Mr. LLOYD. Mr. Roth.

Mr. ROTH. Thank you, Mr. Chairman.

Mr. Nacker, I was especially interested in your comments where you talk about the social aspects and profits having negative social connotation.

Do you find that changing here in Wisconsin?

Mr. NACKER. I think so. Generally, the word used to mean a whole lot of different things. I think people are much more circumspect when you use the word "profit," to allude to the fact they are talking about some sort of return on investment.

And I see more of that now than I did a few years ago, because profit itself is sort of a meaningless word; and you have to talk about profit in relation to something, in relation to capital investment or whatever.

Mr. ROTH. I was interested in a question before by either Mr. Lujan or Chairman Lloyd.

You mentioned how a businessman in Wisconsin perceived the university, and how they dovetail. And I know from not only in this area, but in other areas of the country, it seems to me that many of the business people feel that the students are not getting a fair picture of the free enterprise system at universities.

Do you feel that is still a major problem here in our State?

Mr. NACKER. No, I don't think so. I think the total picture is changing; most recently within the last few years. And that people are peering a little bit deeper into the meaning of the word "profit" rather than accepting it at face value for whatever quickie meaning that was assigned to it.

Mr. LLOYD. I do have a couple questions.

Should the States' modify purchasing requirements to support innovative firms located within its borders? Do you think this is a State function, or a Federal function?

Mr. NACKER. Well, we do have some procurement policies within the Wisconsin State government.

I think right now it's only—well, we have a small business—we have a minority set-aside in the State government.

The question I was dwelling on the last couple of days was, how do you define technologically innovative firms? And I would say——

Mr. LLOYD. Are you asking me that?

Mr. NACKER. That is a rhetorical statement.

I would say if we could, yes, that would probably be very good. The problem is, how you define the—the gentleman from Shade mentioned earlier his company is technologically innovative, but in turn the product itself was not.

Would you, by coming up with a form of definition, preclude these kinds of companies from bidding on Government procurements?

I don't know. I think that's one of the hazards. It would be good if you could, but I think there's an inherent danger involved.

Mr. LLOYD. Should there be a State development bank funded by financial institutions which is operated as a semipublic corporation?

I should also ask Dr. Pricer this.

Mr. NACKER. That's a very good question.

I don't have the answer to it right now. It's one of the things being talked about within the confines of the Wisconsin State government.

There's a small business legislative committee within our Government which is taking a look at many of the problems pertaining to small business and financing, and I don't know how successful that would be simply because I don't know the amount of funding that would be allocated to it.

If the funding initially starts from Government, the initial bankroll is probably not going to be very sufficient to have large impact.

On the other hand, just to point out in the municipal and industrial revenue bonding program, which our department monitors in the State, because everything happens within the private sector, and all we do is sort of oversee it; the amount of participation, the amount of dollars committed to capital investment through this program is very, very good, very successful program.

It's largely because it has not been pushed through a funnel in terms of small number of deciders. It's a private market.

I'd say a program like a development bank could work if its funding were large enough, or depending on how it was structured. I think the suggestion is that certain money might not be.

Mr. LLOYD. Dr. Pricer, would you like to comment?

Dr. PRICER. I served on a committee with Roger that looked into this whole issue, and I believe that the suggested legislation would have a greater impact on innovation.

Mr. LLOYD. I have one last question, and I'll let you go.

How can existing local, State, or Federal programs be improved so that greater assistance can be given to small, high technology firms?

Obviously, that's the final question of this whole hearing. What can we do to help?

Mr. NACKER. The only thing we can do is summarize it in terms of what I have mentioned earlier, that the Government is ultimately responsible for creating the environment in which business operates. And if we are seeing that Government rules, regulations, procedures, whatever it is, impact negatively simply because of the size of the firm, then perhaps there should be different rules of the game for different sizes of firms.

One of the problems that occurs with a bureaucracy—and the best way to define bureaucracy is any time you are more concerned with procedure than you are with results, any time the procedural compliance becomes primary, results become secondary.

Mr. LLOYD. Are you indicating that the Federal, State, and local governmental entities, are becoming so involved with the mechanism they are no longer worried about what the machine is supposed to do?

Mr. NACKER. Precisely. And I think as I said when I started off my comments, that I'm continually amazed by the resourcefulness, the amount of ingenuity which exists out in the real world.

I think really all this entrepreneurship, if you will, really needs is simply an opportunity to exhibit itself; and if there are things which are hindrances in this procedure, then those things should be removed. And I think that's the best way to get the maximum impact from small businesses, from technologically innovative small businesses.

Mr. LLOYD. Do you have any other comment on that?

Dr. PRICER. On that point I feel very strongly that we need to formalize the assistance available to small business. I think of a firm in Waukesha where the owner has developed technology that would lower the effective temperature from solar panels from around 100 degrees that you can transfer down to about 50 degrees.

It has tremendous implications for northern climates.

His idea has been evaluated. It is technically feasible. He cannot find support for a prototype development and testing. And it's a shame, because the university can provide that assistance. That's the kind of help that we need to provide.

Mr. LLOYD. Any other questions?

Mr. Wilberg, we have kind of left you hanging out there all by yourself.

Mr. WILBERG. I have no concern about that. Thank you very much.

Mr. Chairman, I have also prepared a statement that I have submitted to you in advance.

Mr. LLOYD. Without objection, we'll accept that statement.

You may paraphrase it.

STATEMENT OF WILLIAM R. WILBERG ON BEHALF OF THE WISCONSIN ASSOCIATION OF MANUFACTURERS AND COMMERCE

Mr. WILBERG. Primarily, the prepared statement says that we are a Wisconsin Association of Manufacturers and Commerce, statewide organization that probably serves the small business community more than any other organization I know of.

In the last 60 days we have attended 55 different meetings with business representatives and people all over the State of Wisconsin in just about every community. We do this annually. We have been doing it now for 10 years.

I came out of American Motors Corp., which I thought was small, but I got an education. I was appreciative of the statements you made as you defined what small is, since I, like so many others have a very difficult time understanding its meaning when used in the media and press.

Travel the State, get out and visit 55 communities, and you will find what small business is. The vast majority of them are very reluctant to come forward, and I'm talking about the vast majority.

We have 8,000 manufacturers in the State of Wisconsin. Of that, approximately 25 or 30 that would fit into the medium to large category. The rest of them have 100 employees and under, and a vast majority of those are 50 and under; this is the heart and soul of small business.

You, as the Federal Government, Wisconsin as a State government, and we, as a manufacturers association, haven't even begun to penetrate that circle yet. All of the regulations, the help available through the Small Business Administration, the universities, the tech systems, and I could go on and list dozens and dozens of them, create a myraid of things that are supposed to assist small business but of which they are not even aware.

They are also very reluctant to come in contact with any of them because every time they attempt to take that first step, it's a very negative experience. They back off with the comment, "We are doing better on our own."

And by the way, around the State of Wisconsin, these people are feeling good. Our economy is sound, and the recession as you talk about it nationwide, is not here in Wisconsin.

It is, granted, in the auto industry. We are feeling a little bit in the construction industry; but across the board, our industries in the State of Wisconsin are giving us a good message. They are reluctant, on the other hand, to be too optimistic.

When you talk about what can you do, what new programs or what innovations can you come up with that's going to directly assist them, I've got to go back to the old song and dance that you have heard and know more about than I do, it is: "Get off my back!"

What they have been doing in the last 6 or 7 years is trying to survive. We have got to get them off the survival kick and get them onto the offensive.

We are called by small business into hearings throughout the State and Nation just about every day. Small business doesn't have time to come forward. You are going to get only token representation that will come forward. You also have to admit that very few of them are well equipped to come before you and tell the story you want to hear, because they don't have time to do the homework. What you want to hear is a day-by-day, blow-by-blow description of what they are confronted with. That's what you have to look at.

To an extent they deal with labor, the tax situations, et cetera, et cetera. On top of that they have to deal with their consumers, the consumer market, et cetera, et cetera. The ramifications of small business are no longer simple. It's complex, and I would say this, that optimistic as they are, they are no longer as resilient as they were 10 years ago. They are getting tired. They really, truly are, and I'm con-

cerned about that. They are saying, "What's the use? Why fight it anymore. Let's withdraw. Let's keep what we've got and secure what we have. Let's not advance any further than that."

That's what I'm concerned about, and I think that's what you are and should be concerned about.

I don't have all the answers. I can't list them out A, B, C, D for you. All I know is, if we hope to help them at all, No. 1, we seriously—and I mean seriously—have to take a look at what we have already done to them.

All of the so-called collisions that we have already provided for, I can't begin to read and understand all of the so-called solutions that we have already provided for those people.

One example is a jobs program for minorities. I received several phone calls from small business asking us to help them to first understand the program and then second to get involved. In calling Washington they told us the State is supposed to handle and direct the program.

Then you end up calling the State, and the State says: "I heard something about it." The employer has got to make inquiries into the employee situation to see what their background is as to whether or not they qualify for it. I've got one company, for example, that's got eight divisions. It started out as a small company. They sincerely thought they would get into that program. After about 6 or 8 weeks, they said, "We don't have the time nor the money to fool with it. Let's back off. Get out of it."

The same thing as far as equipment is concerned; as far as availability of equipment that is supposed to be attained through the Small Business Administration.

Did you ever try to get any type of equipment? Forget it, it's an impossible task. Keeping in mind, you understand, that a small business entrepreneur, and, I might add, men and women, because we've got a lot of women opening businesses in the State of Wisconsin, are saying, "I don't have the time. I don't have the staff or the money to do the research on all of these things. I am just going to go my own way."

As far as research is concerned, and expertise in that area, even though there are some things available through universities, and so forth, small businesses are using their peer groups. They are working with each other, and they feel more secure and more confident with them than going anyplace else.

One result of our many meetings is they get to know one another. They're beginning to talk to one another. Not so much to exchange information on products because of competitive situations, but on some of the research problems they have in the operation of their plants, the environmental situations, and so on. I see this as a really good partial answer. They trust one another. They don't trust anybody else. They just don't.

If you are going to do anything, you've got to bring it down to the local level. You've got to bring it back to where they are dealing with people they know and can relate to.

The moment you start dealing on a Chicago basis there is suspicion. Even Milwaukee is looked at with great suspect as you travel throughout the State, and understandably so. Because as you deal with a small

company who has to go out and hire an attorney from the local community, and then that local attorney has to go and do battle with large banks or large law firms, and the like, they just get eaten up.

Not so much that they overpower them, but that it becomes so complex that they can't cope with it.

So anything you are going to do or hope to do to achieve any kind of solution, has got to be brought as close to home as possible. I submit that it should be dealt with on a State level through State government, if nothing else. That is the highest we should go as we deal with small business. Beyond that, they can't cope with it.

I think the university is certainly a potential. Also, we have local chambers of commerce which I think are at the heart and soul of dealing with small business, they are trusted by small business, and they have rapport with them. They too should be considered in future programs.

Beyond that, you've got to go back and see what you have done to them already, and begin to give them some relief in those areas.

I agree wholeheartedly with what was said earlier, that agencies appear to be more concerned with the procedure and process than they are with the objective. We find that time and time again.

I've got a company down in Milwaukee right now that had an environmental problem. They are going to be closed down. They have adhered to every governmental standard, in fact, the water is coming out of the plant so clean that they can drink it. However, due to a procedural situation 1½ or 2 years ago, they are withholding a permit to operate that plant. It's like a pound of flesh; they said 1½, 2 years ago, we went into the courts, and until we get that cleared up, we won't issue you a permit. Even though there are a thousand jobs in jeopardy.

The procedure must be adhered to, and if it isn't, to hell with the objective. I could go on and on obviously.

The answer is to take a look and see what we have done already, and see if we can't cut some of it out, and simplify it, restructure it.

In numbers, in mass, cut it down to something they can cope with, recognizing that you are not reaching small business. You are reaching just a token element.

That's all you are really reaching, and beyond that, I repeat, if you are going to do something, direct it back as close to the local level as possible. Put it within their reach with people they know, and they understand, and they can relate to.

I think that's it, Gentlemen.

Mr. LLOYD. Thank you, Mr. Wilberg.

Mr. WILBERG. The Wisconsin Association of Manufacturers & Commerce (WMC) is the trade association representing business and industry in Wisconsin. We have 2,817 members, accounting for approximately 90 percent of the industrial employment in this State.

Our membership also includes 132 local chambers of commerce throughout Wisconsin through which, and in cooperation with, we coordinate most of our activities. These local chambers are the vital link that assure us an ongoing rapport and access to those whom we represent and serve.

In this context, it is important for you to know that the vast majority of our time and efforts are directed toward those who make up the major part of our membership, specifically the employer with fewer than 100 employees. It is they who are confronted with the daily challenge of existing in what has become a most complex economy.

As we look to their survival, we would be totally remiss if we failed to recognize their need for growth, not only in size but numbers. Unfortunately, but understandably, the greater emphasis has been toward the concerns which directly relate to their survival.

For that reason, we are most pleased that you as a committee are addressing what we believe can be a more positive effort in recognizing the need to maintain, regain and further the cause of research and development within the backbone of our Nation's economy; small business.

As an organization (WMC), we are prepared to work with you in reevaluating the present structure. We must work together to place the needs of small business into perspective and to develop an assurance of equal opportunity in research and development for those small entrepreneurs who can best provide this country with a proper balance of positive growth and expansion.

Mr. LUJAN. Just in closing the hearings, I think that it was fortunate we came to Wisconsin because there seems to be a good climate here for small business. We get the message loud and clear; get off our backs.

Second, give us some tax incentives so we can make some money and expand our plants, and that's where the jobs are going to come from. And that pretty much sizes up what you gentlemen have said.

I think perhaps that's the thing that we need to look at. And we thank you.

Thank you, Mr. Chairman.

Mr. LLOYD. Thank you.

Mr. Roth?

Mr. ROTH. Thank you, Mr. Chairman.

I would also like to comment about what Congressman Lujan has mentioned. I'm most pleased and delighted with the testimony received here this morning. I know you all prepared well. You have known your subject, and I think we have learned a great deal from you.

And I want you to know that we are going to take your message back to Washington and do what we can. There are 435 Members in the House, and we are three, but we will voice your opinions, and I think that we are getting together to assist with the tasks you had mentioned before—how Government can help. And I think we in Government are becoming much more cognizant of what we have done to business, and I'm confident those corrections are going to be made. But we always want to remember that business and Government should not be at loggerheads, that we should work in unison. I think that's the direction we want to go.

Thank you, Mr. Chairman.

Mr. LLOYD. I thought that your presentation was really very impressive, Mr. Wilberg, particularly the fact that you are obviously reaching the people that we would like to talk to.

I think your observations were very good, and I'm sorry we didn't have more time with you because I think the points you were bringing out were very good.

Do you maintain any kind of records of your meetings with these people each year?

Mr. WILBERG. We do.

Mr. LLOYD. Why don't you, if it's not unreasonable, give us a copy of that record, and let us look it over while we are back in Washington?

Mr. WILBERG. We'd be more than happy to submit some to you. Probably not totally, but we'll give you highlights.

Mr. LLOYD. Why don't you select some of the highlights, and without objection, we would accept that as part of this record. Would that be all right?

Mr. WILBERG. More than happy to do that.

Mr. LLOYD. I think that would be very beneficial because I was very excited that you are going out there and talking to the people. I happen to have been in business myself, and my wife is sitting right back there. She and I went into business together, and managed to have a successful business. The point that I'm making is that many of these businesses are based on the drive of the individual. And what we really are trying to achieve in all of this, is also to get the Federal Government to aid, and assist wherever possible.

And, of course, the very problems that we have created with Government, have been created because people have demanded that we put big businesses down. Big business may be the local automobile sales. Now, we are talking about the possibility of having airbags, or we are going to continue seat belt and shoulder belt restraint? There's no question about the fact that the belts are very necessary or have been proven very satisfactory.

Do we then have to mandate the airbag? If, indeed, we do mandate an airbag, does that mean do we mandate it for every automobile that comes into this country? Whether it comes from Japan or Germany or Sweden or England, or wherever it may come from?

And if we don't do that, do we then debilitate our local entities, in this case, the large car manufacturers, to such a point that they go out of business?

Interestingly enough, all of you are here today, and after the program if any of you would like to bend our ear a little bit on the Chrysler bailout, we'd be most pleased to hear you on that, because that is indeed a question which we are going to respond to within the next few weeks.

I'm sure that you all recognize that if it were one of the gentlemen here, say, Mr. Shade and his business, we probably wouldn't bail him out. But since it's Chrysler, we are now talking about the ramifications. I could give you a bunch of facts and figures, but this is a very volatile situation.

Another thing that occurs in dealing with bureaucratic government, we always have political attitudes. We have, for instance, come full circle since 1973–74 in the aftermath of the Vietnamese war where it was bad to be involved in any kind of business, particularly as it pertained to the armed services or weapons systems at all.

All of a sudden I hear as a result of the Iran situation, a heightening of, shall we say, national pride, and it's not a bad thing now to talk about weapons systems.

We see a reversal, for instance, on the part of the administration in systems that it wouldn't talk about 2, 3 years ago. Today we get an utterance that why don't they, meaning Congress, do something about it.

Another thing that I would like to point out to you, and I'll be through with this little lecture in a moment, and that is, you as businessmen must clearly understand maybe what we need to do is get you to go back and take Government–I one more time. There, indeed, is a separation of powers, and this is a very difficult thing for people to understand, that I do not run the Small Business Administration. I certainly have very little to do with social security. The armed services are going to make decisions without the benefit of input from Jim Lloyd or any of the members on this panel. And as a result, I have some of the same frustrating experiences that you do.

I use the recent Iranian situation as a perfect example. I clearly wanted to get information. I called the security group and I happened to be—I'm speaking as a person who has spent his life at one time at the highest forms of clearances. I even had the pleasure some years ago when I was a director of covert activity, I wrote a report on the Cuban situation, and I was involved in both the Cuban missile crisis and the Bay of Pigs situation, and I wrote a report, which later I wasn't allowed to read because it was too highly classified.

So I do understand a little bit of the problems. And I do have some of the frustrations, but I remind you we in the legislative branch don't run these administrative functions. We help if we can in the areas of taxes, social security, Veterans' Administration, small business loans, the Ways and Means, et cetera, but we really don't run those specific departments per se.

And I would say that one of the major problems we have in not only these hearings, but in talking to people is for the people in business to understand clearly the relationships which exist between the courts, between the executive branch and last but not least, the legislative branch. And I know both of you have made these same statements time and again. But I think they are worth repeating because it is in this kind of understanding that we'll have a better partnership.

We have probably been uncommunicative in the legislative branch as well as in the other branches. That's the reason for these hearings. We want to talk to you, because when we finish it all off, you, indeed, are my constituents just as you are Mr. Roth's, and what I do affects your business, just as what Mr. Lujan does, and his voting record, and his application of interests, and so forth.

So that's the reason for the hearings today. I think that they were very, very informative. I think that we have had just an awfully good group of people here today, and one of the best that I have ever seen, and I think that it will be not only informative, but also enable us to achieve some specific good.

Maybe we can relieve the problems of getting a couple of agencies to finally talk to one another. You know, that does happen to be one of our problems.

So with it all, I think that we have done very well—and I'm supposed to make some announcement.

Do I understand that you have invited everybody to lunch, and that you are buying?

Mr. ROTH. Partially correct. Probably be dutch treat.

We are going to have a small group, and whoever would like to join us at the Gold Room in about 20 minutes. Since there is limited capacity, they tell me, and that only those that have preregistered will be able to attend, the hall is located a block across the campus, and someone will be at front door to give us directions.

I want to again say I very much appreciate, Mr. Chairman, you bringing the committee to Appleton, and I also appreciate, of course, Congressman Lujan accompanying us. I think you can tell from what these two gentlemen have said this morning, that they are two of the leading Congressmen. It's a great honor for me to have them here, and it's a real pleasure, and I'm proud of all the people who came, and especially the people who testified today.

I agree, it's probably some of the best testimony I have heard since I have been in Congress.

I want you to know I'm very proud of you.

Mr. Lujan.

Mr. LUJAN. Thank you.

[A biographical sketch and prepared statement of William R. Wilberg, on behalf of the Wisconsin Association of Manufacturers and Commerce follow:]

WILLIAM R. WILBERG
Vice President/Operations
Wisconsin Association of Manufacturers and Commerce
111 E. Wisconsin Avenue, Suite 1600
Milwaukee, WI 53202

William R. Wilberg has served as a Vice President of the Wisconsin Association of Manufacturers and Commerce (WMC) since 1970. In addition, he also serves as Chairman of WMC's Small Business Committee and President of a state-wide management - union organization. The organization includes Wisconsin's top labor officials and key management executives.

Prior to his association with WMC, Mr. Wilberg was a Commissioner with the Wisconsin Employment Relations Commission. From 1951 to 1967 he was employed as a Director of Industrial Relations for the American Motors Corporation.

STATEMENT OF WILLIAM R. WILBERG ON BEHALF OF THE WISCONSIN ASSOCIATION OF MANUFACTURERS AND COMMERCE TO THE HOUSE SCIENCE AND TECHNOLOGY SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT.

DECEMBER 10, 1979

THE WISCONSIN ASSOCIATION OF MANUFACTURERS AND COMMERCE (WMC) IS THE TRADE ASSOCIATION REPRESENTING BUSINESS AND INDUSTRY IN WISCONSIN. WE HAVE 2,817 MEMBERS, ACCOUNTING FOR APPROXIMATELY 90% OF THE INDUSTRIAL EMPLOYMENT IN THIS STATE. OUR MEMBERSHIP ALSO INCLUDES 132 LOCAL CHAMBERS OF COMMERCE THROUGHOUT WISCONSIN THROUGH WHICH, AND IN COOPERATION WITH, WE COORDINATE MOST OF OUR ACTIVITIES. THESE LOCAL CHAMBERS ARE THE VITAL LINK THAT ASSURE US AN ONGOING RAPPORT AND ACCESS TO THOSE WHOM WE REPRESENT AND SERVE.

IN THIS CONTEXT, IT IS IMPORTANT FOR YOU TO KNOW THAT THE VAST MAJORITY OF OUR TIME AND EFFORTS ARE DIRECTED TOWARD THOSE WHO MAKE UP THE MAJOR PART OF OUR MEMBERSHIP, SPECIFICALLY THE EMPLOYER WITH FEWER THAN 100 EMPLOYEES. IT IS THEY WHO ARE CONFRONTED WITH THE DAILY CHALLENGE OF EXISTING IN WHAT HAS BECOME A MOST COMPLEX ECONOMY.

AS WE LOOK TO THEIR SURVIVAL, WE WOULD BE TOTALLY REMISS IF WE FAILED TO RECOGNIZE THEIR NEED FOR GROWTH, NOT ONLY IN SIZE BUT NUMBERS. UNFORTUNATELY, BUT UNDERSTANDABLY, THE GREATER EMPHASIS HAS BEEN TOWARD THE CONCERNS WHICH DIRECTLY RELATE TO THEIR SURVIVAL. FOR THAT REASON, WE ARE MOST PLEASED

THAT YOU AS A COMMITTEE ARE ADDRESSING WHAT WE BELIEVE CAN BE A MORE POSITIVE EFFORT IN RECOGNIZING THE NEED TO MAINTAIN, REGAIN AND FURTHER THE CAUSE OF RESEARCH AND DEVELOPMENT WITHIN THE BACKBONE OF OUR NATIONS ECONOMY; SMALL BUSINESS.

AS AN ORGANIZATION (WMC), WE ARE PREPARED TO WORK WITH YOU IN RE-EVALUATING THE PRESENT STRUCTURE. WE MUST WORK TOGETHER TO PLACE THE NEEDS OF SMALL BUSINESS INTO PERSPECTIVE AND TO DEVELOP AN ASSURANCE OF EQUAL OPPORTUNITY IN RESEARCH AND DEVELOPMENT FOR THOSE SMALL ENTREPRENEURS WHO CAN BEST PROVIDE THIS COUNTRY WITH A PROPER BALANCE OF POSITIVE GROWTH AND EXPANSION.

Mr. LLOYD. There being nothing further, I declare the meeting adjourned and await the call of the Chair.

[Whereupon, at 12:15 p.m., the subcommittee was adjourned.]

SMALL, HIGH TECHNOLOGY FIRMS AND INNOVATION

MONDAY, JANUARY 28, 1980

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE AND TECHNOLOGY,
SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT,
Farmingdale, N.Y.

The subcommittee met, pursuant to notice, at 9:35 a.m., in Polytechnic Institute, Farmingdale, N.Y., Hon. Jim Lloyd presiding.

Mr. LLOYD. I'm glad to be here and I would like to say that we, in December, held hearings at the Lawrence University at Appleton, Wis. I would also like to take this opportunity to welcome all of the witnesses and guests who are attending today's hearing on the topic of small, high technology firms and innovation, and particularly, I would like to take this opportunity to welcome Congressman Ambro and Congressman Carney and certainly, my colleague, Congressman Lujan, who are members of the Subcommittee on Investigation and Oversight, and, of course, Mr. Ambro and Mr. Carney are Congressmen from this area.

I would also say my own interest in small business is a longstanding one, because I was a small businessman just before I came to Congress and when I said small, I'm talking about my economic involvement. Small, high technology firms have accounted for approximately one-half of the major U.S. innovation during the 1953 to 1973 period and small firms produce about 24 times as many innovations per R. & D. dollar as do large firms, yet they receive only 3½ percent of the Federal R. & D. expenditures.

Increasing small firms' share of the Federal R. & D. expenditures can, in my opinion, encourage innovation and also encourage small business. Today, we will be talking to three panelists of expert witnesses. The first panel consists of small businessmen and venture capitalists. They will be discussing the impact of Government policies and programs on the small, high technology firms and innovations and suggestions for improvement.

The second panel is comprised of the Director and two members of his staff from Brookhaven National Laboratory. They will be discussing technology transfer from Federal laboratories to small, high technology firms.

And the third panel consists of representatives from the community who will talk about suggestions for improving the climate for innovation.

Again, I would like to thank you very much for the warm welcome which we have received and I'm looking forward to hearing from the experts. Mr. Ambro, do you wish to make a statement?

Mr. AMBRO. Thank you, Mr. Chairman. I'd like to welcome you to Long Island. I've had the opportunity to do that before. We came here on another occasion and you're most familiar with this area and welcome, as well, my other friends on the subcommittee, Mr. Carney and Mr. Lujan.

I feel we sit here in one of the most innovative, small, high technology areas in the United States. It's particularly fitting as well that we hold these hearings in this room at this institution, which graduates one of the largest number of engineers in the Nation.

I know that the witnesses we'll be hearing from today will give us an insight into what's happening in this area of high technology development and will shed light on certain problem areas that need the attention of Congress.

Innovation, new and better ways to make and do things, has always been taken for granted, has made this Nation great and it was believed that this inventiveness, ingenuity, and innovation would just go on expanding and flourishing in the United States.

Now, we encounter disturbing evidence. Percentage of patents granted, percentage of innovations, characterized by radical breakthroughs, foreign trade in manufactured goods, output per hour, industrial and governmental expenditures for research and development, productivity, all declining; thereby jeopardizing our economic viability in our position in the world.

Small business is the primary source of innovation in the United States and the relationship between small business and these trends is something that must be explored in depth and to the extent possible within our legislative jurisdiction—dealt with, and reversed.

This concern was the principal reason for establishing in the House of Representatives the task force on industrial innovation which I have the honor to co-chair and this serves as some backdrop to some of these hearings.

We've all known for some time, as the chairman points out, that small businesses have not been getting their fair share of Federal R. & D. moneys, even though they account for most of the needed technology in the country. It's time we corrected this imbalance in the allocation of R. & D. expenditures which stems from the Congress recognition that small businesses are the backbone of the national economy. Small, high technology firms have thrived on Long Island, despite Federal tax policies that discourage investment in small firms, despite a patent system that's badly outmoded and despite an overburdening of Federal regulations that are only obstacles to overcome.

So, as a member of the Long Island congressional delegation, I want to thank the subcommittee for accepting our invitation to conduct this hearing, especially Mr. Carney, who is one of the prime movers in all of this, and I thank the witnesses who are taking their valuable time to give us the benefit of their testimony. We look forward to hearing what each of you have to say and we certainly shall take your suggestions back to Washington in an attempt to make meaningful changes in Federal policy. Thank you very much, Mr. Chairman.

Mr. LLOYD. Mr. Carney?

Mr. CARNEY. Thank you, Mr. Chairman, and I am also pleased to welcome you and the ranking minority member, Mr. Lujan, to Long Island. I welcome all of the outstanding witnesses who will be giving us the benefit of their experience and the thinking on these important aspects of small business and technology this morning.

I join with my colleague from Long Island, who serves on the Science and Technology Committee, Mr. Ambro, and who is here today in welcoming you from California, and of course, Mr. Lujan from New Mexico.

Gentlemen, Long Island is not in the Sun Belt which both of you represent out West, but when it comes to the subject of innovation or productivity and the problems of small business, I think we all have something in common. Today's hearing is the result of hearings last fall on the same subject which were held in the House Science and Technology Committee with other committees of both the House and the Senate.

During those hearings, we heard interesting testimony from both Government and private sector as to why this country is starting to lose ground in the area of innovation and productivity.

It was revealed in Washington hearings that there has been little effective action on the part of the Federal Government to encourage innovation in the small business community. In fact, many Federal policies from taxes to regulations to patent procedures, as my colleague, Mr. Ambro, just mentioned, adversely affects small business.

In Washington, just this month, the White House Conference on Small Business completed its meetings and submitted a series of 60 recommendations for action in the small business sector.

With this added attention from the executive branch, our discussions here today will provide a useful national forum. I know at least one of the witnesses this morning was a delegate to the conference. In fact, he's probably the first witness up, Mr. Abrilz, and perhaps we will learn from him, the issues which we can also address.

Our Investigation and Oversight Subcommittee has decided that now is the time to come out into the field to get the input from small business representatives as to what Congress can do to help and I'm proud to be part of this and I'm glad, certainly, that we have taken the initiative to come to Long Island, which as Mr. Ambro has said, can compete with any area in the Nation as far as turning out people who are qualified to work in high technology areas and people who have the resources to be qualified in the field of innovation. Thank you very much, Mr. Chairman.

Mr. LLOYD. Thank you, Mr. Carney. Mr. Lujan.

Mr. LUJAN. Thank you, Mr. Chairman. Just briefly, I'm pleased to be here. We've been to several sites around the country holding this kind of a hearing. Some of the things we might be interested in are the capital formation of a small company, getting it moving, what kind of response, what kind of problems you have with different Federal agencies in trying to get different kinds of contracts, and what are the rules and regulations that impede progress. Those sorts of things are some of the things that we will be looking for, and would like to learn from your experience as to what some of the difficulties are and how we might, with legislation or by directing attitudes, if

we can, amongst the various agencies to help the small company in moving on ahead, because after all, that's really the backbone and that's the direction that we have to move in. So, Mr. Chairman, again I'm most happy to be here and look forward to listening to the witnesses.

Mr. LLOYD. Our first panel will be comprised of Mr. Abrilz, who's president of APOCA Industries, Dr. Daly, who's president of Quantronix Corp., and Mr. Fialkov, a venture capitalist of Venture Capitalists. Mr. Abrilz.

STATEMENT OF SANTOS ABRILZ, APOCA INDUSTRIES

Mr. ABRILZ. Mr. Chairman, and members of the subcommittee, good morning, I am Santos T. Abrilz, Jr., president of Apoca Industries, Inc., Deer Park, Long Island, N.Y.

Apoca Industries, Inc., is a small electronic manufacturer specializing in the design, development, and manufacture of telecommunication equipment for both the commercial and Government market.

I am also serving as president of the Long Island Forum for Technology, a group of corporations on Long Island who are interested in furthering the expansion of the high technology industry currently in place on Long Island via mutual cooperation between industry, institutions of higher learning, laboratories and local, State, and Federal Government.

Mr. Chairman, I have a statement on the impact of Government policies and programs on small, high-technology firms and innovation with several suggestions for improvement.

To save the subcommittee's time, I propose to submit the statement for the record and give you a brief oral summary of its main points, after which I will be pleased to respond to any questions on my statement that the subcommittee may have.

A key point to remember is that there is a need to make a distinction between the processes of invention and innovation, since incentives and barriers to one may not be to the other. Basically, invention is the conception of the idea, whereas innovation is the process by which an invention or idea is translated into the economy.

It is well known that innovation is not limited to technological products and processes in the business world, but that is the principal sense which this statement addresses.

Innovation is an essential ingredient for creating jobs, controlling inflation and for economic and social growth. Small businesses make a disproportional large contribution to innovation. There is something fundamental about this unusual ability of small firms to innovate that must be preserved for the sake of healthy economic and social growth.

If the United States decides to bring inflation under control, to create better jobs, new and better jobs, and to continue to enjoy the economic and social benefits of innovation, individual entrepreneurs and their small companies must be free to innovate. Unfortunately, the environment for small business innovation has greatly deteriorated in the past decade.

The creative processes in small businesses are pronouncedly different from large corporations and institutions. There is a lack of aware-

ness within Government of how small independent innovators create and how Federal policies determine the climate for small business innovation.

A recent study by the National Science Foundation concluded that in the past three decades firms with less than 1,000 employees were responsible for one-half of the most significant new industrial products and processes. Firms with 100 or fewer employees producted 24 percent of such innovations. In addition, the cost per innovation in a small firm was found to be less than in a large firm, since small firms produced 25 times more major innovations per research and development dollar expended than did large firms. Yet, small firms conduct only 3 percent of the U.S. research and development.

The benefits of investment in small innovative ventures are large—jobs are created and these jobs are kept at home, exports are created instead of imports. This large and powerful flow of benefits starts soon after the investment is made, and the benefits are substantially greater than those of the larger corporations.

There is a wide array of Government policies that adversely impact upon small business entrepreneurs that have resulted in the arrest of this heretofore highly innovative sector of our society. The Government policies that determine the entrepreneurial climate are in the following areas:

CAPITAL AVAILABILITY

Unlike large corporations that fund R. & D. and other innovations from cash flow that result from mature products, a small business innovator must acquire capital from outside sources. Federal tax, pension fund and security policies have virtually eliminated all forms of seed, startup, and expansion capital from small innovative business ventures.

REGULATION

Two essential requirements for the creative individuals are time and the freedom to create. Both time and freedom are being consumed with the ever increasing scope of Government regulatory activities that have emerged since 1970. Interference and delays by Government compound the innovator's struggle, saps his creative energy and increases the risk of failure. Many small firms are unable to understand and comply with Government regulatory processes and to effectively participate in the law and rulemaking that have a life or death impact upon their firms. The present system of applying regulations equally to large and small businesses heavily discriminates against small businesses.

GOVERNMENT FUNDING FOR R. & D.

In recent years, Government support for R. & D. has declined as a percentage of the Gross National Product and has become highly concentrated in a few large companies, universities and Federal laboratories. While direct support for applied research and development at these institutions has grown, the most innovated sector of the American economy, small science and technology based enterprises, are virtually excluded from effective participation in federally funded applied research.

GOVERNMENT PROCUREMENT

The largest buyer of goods and services in the world is the U.S. Government. The process of selling in this market and meeting Government specifications chews the small innovative businesses to bits. There is little room for innovation within Government supply specifications and procurement procedures. The effect of these procedures is to prevent small business participation and deny the Government of potential sources of innovation that will lower procurement costs and provide new and improved products and services.

Innovation in large corporations is largely financed from the flow of earnings from mature products, and in many cases, sophisticated rate-of-return analyses are used to allocate this cash flow into promising areas of research, product development and facility expansion. In addition, the profitable corporation receives an immediate income tax benefit of approximately 50 percent for research and innovation related expenses, and a 10 percent tax credit for related capital expenditures.

In contrast, the small independent innovator without a cash flow from one or more mature products must usually acquire his capital from external sources, often in several increments. No tax credits are available to the independent innovator until his new product becomes profitable. The net effect is that the small guy must raise from outside sources more than twice the amount of capital for the same innovation as a large corporation.

The disparity between the small business and the large corporation is further increased since debt capital is unavailable to a small firm to finance innovation, at least not until first profitability for the new product occurs. While debt is an important source of capital for large corporations, it is less available to small firms.

Furthermore, during the capital intensive stage of early and rapid expansion where initial profitability occurs, the high corporate income tax rate structure prevents the small firm from accumulating sufficient retained earnings to finance the internal expansion of its new product. In order to expand and protect its new market successes, the small enterprise must often turn to outside sources for capital. In contrast, the large corporation with mature business lines is usually able to supply all stages of capital from earnings of existing products.

Patents. Yes, sir?

Mr. LLOYD. Oh, OK. I was going to say, we will accept your statement for the record. Go head, sir.

Mr. ABELE. I'll read it for the record then.

Patents, one of my pet peeves. The historic keystone to inventiveness and information transfer has been our U.S. patent system. Patent grants have provided the small innovator protection against competition by large resourceful firms and this protection has often provided incentives for captial acquisition. Unfortunately, in recent years, the value of patents has weakened considerably due to inadequate patent and trademark office procedures resulting in adverse judicial decisions. In addition, substantial uncertainty has emerged as a result of a wide range of interpretations within the Federal judiciary of patent law. At the present time, over 50 percent of patents contested at the circuit court level are invalidated, and the cost of defending such suits is prohibitive for a small firm.

This committee should realize that you need not speculate on what innovators consider the higher priority elements for a national innovation policy, since these views are readily available from task forces that have thoroughly researched it. What should be clearly understood by Congress is that small business innovators, although prepared to state priorities, the emphasis should be on the fact that the entrepreneurial environment result from the cumulative impact of taxes, capital and credit policy, regulatory reform, R. & D. funding, procurement and patent matters. Remember that for small business, all are necessary. None will be sufficient without the others.

We small businessmen and women do not believe that our success rate with Federal procurement is lower than that for large businesses. We also believe that those individuals who are responsible for the procurement of research and development have something to answer for when it is clear that cost-effectiveness data argue for giving small business as much R. & D. work as is practical.

There are numerous recommendations that have been made, along with bills in Congress effecting small business innovation. The following recommendations would materially assist the process of halting and reversing the decline in small business innovation:

One: National Science Foundation innovation project.

The expansion of the National Science Foundation small business innovation research program. The National Science Foundation should work with other agencies to help start similar programs. The program conception is good and should be expanded by having agencies having budgets which exceed $100 million target an R. & D. procurement set-aside of prime contracts equivalent to 1 percent. These funds would be used to start a small business innovation research competitive solicitation program such as the one currently underway at the National Science Foundation.

Two: Allowing small businesses the right to retain, under certain provisions, patent rights on inventions made under Federal supported research.

Establish small business patent counsels to assist inventors by providing advice not ordinarily available from private patent counsel.

Three: Federal departments and agencies should target a 1-percent increase in R. & D. procurement set-asides of prime contracts, on an annual basis, until small business receives a prime contract dollar volume equal to at least 10 percent of the department's total R. & D. budget.

Four: The development of a task force to examine ways to stimulate investment in small technology-based firms by nontaxable pension and endowment funds.

Five: The definition of allowable costs with respect to small business firms and Federal contracts should be expanded.

Six: A Federal acquisition regulation for all Federal procurement agencies to provide one single, uniform, simplified regulation.

Seven: Offer tax incentives for small scale R. & D. in recognition of the risks taken by small business. Get a tax deferment if reinvested for any small business which:

Spends 6 percent of gross revenue in 1 year for R. & D., or

Maintains an average R. & D. investment over 3 years of 3 percent.

Gains would be taxed at half rates, losses could be carried forward for 10 years in lieu of present 7 years.

Increase the period of exercising stock options from 5 to 10 years.

Institute faster write offs for specialized R. & D. equipment.

In conclusion, I would like to ask where are we going to find the competitive new products to break the inflationary-prone grip of a few individual companies on markets in industry after industry if not in places where America has always found them before, outside the industry effected, in independent small firms with no vested interest in existing technology. There will be no free enterprise system for large business unless we quickly find a way to restore strong, viable and competitive small businesses across this nation.

Mr. Chairman, this completes my statement. I have appreciated this opportunity to give the subcommittee the views of small business on such an important subject.

I will be pleased to answer any questions you might have with respect to my statement or any other aspect of the impact of Government policies and programs on small, high technology firms.

[The prepared statement of Santos Abrilz, Jr., follows:]

Statement of Santos T. Abrilz Jr. President, APOCA Industries Inc. before the U.S. House Science and Technology Subcommittee on Investigation and Oversight. 28 January 1980.

Mr. Chairman, and Members of the Subcommittee:

Good morning, I am Santos T. Abrilz Jr., President of APOCA Industries Inc., Deer Park, Long Island, New York.

APOCA Industries Inc. is a small electronic manufacturer specializing in the design, development, and manufacture of tele-communication equipment for both the commercial and government market.

I am also serving as President of the Long Island Forum for Technology- a group of corporations on Long Island who are interested in furthering the expansion of the high technology industry currently in place on Long Island via mutual cooperation between industry, institutions of higher education, laboratories, and local, state, and federal government.

Mr. Chairman, I have a statement on the impact of government policies and programs on small, high technology firms and innovation with several suggestions for improvement.

To save the Subcommittee's time, I propose to submit the statement for the record and give you a brief oral summary of its main points, after which I will be pleased to respond to any questions on my statement that the Subcommittee may have.

It has been fairly widely recognized that technological innovation has been the driving force for human civilization. The relationship between technological innovation and economic growth has been the subject of intensive study in recent decades and although progress has been made, there is still no generally accepted satisfactory, theoretical structure for this relationship. Progress occurs in our society because those functions in society that employ new technology produce economic growth by providing these functions at lower cost thus freeing resources for some other needed function. In todays economy the process of research and development has been institutionalized as the mechanism for seeking new technology.

A key point to remember is that there is a need to make a distinction between the processes of invention and innovation, since incentives and barriers to one may not be the other. Basically...Invention is the conception of the idea..whereas Innovation is the process by which an invention or idea is translated into the economy.

It is well known that innovation is not limited to technological products and processes in the business world, but that is the principal sense which this statement addresses.

Innovation is an essential ingredient for creating jobs, controlling inflation, and for economic and social growth. Small businesses make a disproportionately large contribution to innovation. There is something fundamental about this unusual ability of small firms to innovate that must be preserved for the sake of healthy economic and social growth.

If the United States desires to bring inflation under control, to create ne and better jobs, and to continue to enjoy the economic and social benefits of innovation, individual entrepreneurs and their small companies must be free to innovate. Unfortunately the environment for small business innovation has greatly deteriorated in the past decade.

The creative processes in small businesses are pronouncedly different from large corporations and institutions. There is a lack of awareness within government of how small independent innovators create and how federal policies determine the climate for small business innovation.

A recent study by the National Science Foundation concluded that in the past three deacades firms with less than 1000 employees were responsible for one-half of the most significant new industrial products and processes. Firms with 100 or fewer employees produced 24% of such innovations. In addition, the cost per innovation in a small firm was found to be less than in a large firm since small firms produced 24 times more major innovations per research and development dollar expendedas did large firms. Yet small firms conduct only three percent of the United States Research and development.

The benefits of investment in small innovative ventures are large....jobs are created and these jobs are kept at home, exports are created instead of imports. This large and powerful flow of benefits starts soon after the investment is made, and the benefits are substantially greater than those of large corporations.

There is a wide array of government polocies that adversely impact upon small business entrepreneurs that have resulted in the arrest of this heretofore highly innovative sector of our society. The government polocies that determine the entrepreneurial climate are in the following areas:

Capital Avaialability.... Unlike large corporations that fund R & D and other innovations from cash flow that result from mature products, a small business innovator must acquire capital from outside sources. Federal tax, pension fund and security polocies have virtually eliminated all forms of seed, start-up, and expansion capital from small innovative business ventures.

Regulation.... Two essential requirements for the creative individual are time and the freedom to create. Both time and freedom are being consumed with the ever increasing scope of government regulatory activities that have emerged since 1970. Interferences and delays by government compound the innovator's struggle, saps his creative energy, and increases the risk of failure. Many small firms are unable to understand and comply with government regulatory processes and to effectively participate in the law and rule-making that have a life or death impact upon their firms. The present system of applying regulations equally to large and small businesses heavily discriminates against small businesses.

Government Funding for R & D.... In recent years, government support for R & D has declined as a percentage of the GNP and has become highly concentrated in a few large companies, universities and federal laboratories. While direct support for applied research and development at these institutions has grown, the most innovative sector of the American economy, small science and technology based enterprises, are virtually excluded from effective participation in federally funded applied research.

Government Procurement..... The largest buyer of goods and services in the world is the United States government. The process of selling in this market and meeting government specifications chews the small innovative business to bits. There is little room for innovation within government supply specifications and procurement procedures. The effect of these procedures is to prevent small business participation and deny the government of potential sources of innovation that would lower procurement costs, and provide new and improved products and services.

Innovation in large corporations is largely financed from the flow of earnings from mature products, and in many cases, sophisticated rate-of-return analyses are used to allocate this cash flow into promising areas of research, product development, and facility expansion. In addition, the profitable corporation receives an immediate income-tax benefit of approximately fifty percent for research and innovation related expenses, and a ten percent tax credit for related capital expenditures.

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Patents.... The historic keystone to inventiveness and information transfer has been our U.S. Patent system. Patent grants have provided the small innovator protection against competition by large resourceful firms, and this protection has often provided incentives for capital acquisition. Unfortunately, in recent years the value of patents has weakened considerably due to inadequate Patent and Trademark office procedures resulting in adverse judicial decisions. In addition substantial uncertainty has emerged as a result of a wide range of interpretattins within the federal judiciary of patent law. At the present time , over fifty percent of patents contested at the circuit court level are invalidated, and the cost of defending such suits is prohibitive for a small firm.

This committee should realize that you need not speculate on what innovators consider the higher pririty elements for a national innovation policy since these views are readily available from task forces that have thoroughly researched it. What should be clearly understood by Congress is that small business innovators although prepared to state priorities the emphasis should be on the fact that entrepreneurial environments result from the cumulative impact of taxes, capital and credit policy, regulatory reform, R & D funding, procurement and Patent matters. Remember that for small business.... all are necessary.... None will be sufficient without the others.

We small businessmen and women do not believe that our success rate with federal procurement is lower than that for large business. We also believe that those individuals who are responsible for the procurement of research and development have something to answer for when it is clear that cost effectiveness data argue for giving small business as much R & D work as is practicable.

There are numerous recommendations that have been made, along with bills in congress affecting small businees innovation. The following recommendations would materially assist the process of halting and reversing the decline in small business innovation:

1. National Science Foundation Innovation Project.....
The expansion of the National Science Foundation Small Business Innovation Research Program. The National Science Foundation should work with other agencies to help start similar programs. The program conception is good and should be expanded by having agencies having budgets which exceed 100 million dollars target an R & D procurement set-aside of prime contracts equivalent to 1%. These funds would be used to start a small business innovation research competitive solicitation program such as the one currently underway at the National Science Foundation.

2.(a) Allowing small business the right to retain, under certain provisions, patent rights on inventions made under federally supported research.

(b) Establish Small Business Patent Counsels to assist inventors by providing advice not ordinarily avaialable from private patent counsel.

3. Federal departments and agencies should target a 1% increase in R & D procurement set-asides of prime contracts, on an annual basis until small business receives a prime contract dollar volume equal to at least 10% of the departments total R & D budget.

4. The development of a task force to examine ways to stimulate investment in small technology based firms by non-taxable pension and endowment funds.

5. The definition of allowable costs with respect to small business firms and federal contracts should be expanded.

6. A federal acquisition regulation for all federal procurement agencies to provide a single,uniform, simplified regulation.

7. Offer tax incentives for small scale R & D in recognition of the risks taken by small business. Get a tax deferment if reinvested for any small business which:
(a) spends 6% of gross revenue in one year for R&D, or
(b) maintains an average R&D investment over 3 years of 3%.

Gains would be taxed at half rates, losses could be carried forward for 10 years in lieu of the present 7 years.

Increase the period of exercising stock options from 5 to ten years.

Institute faster write-offs for specialized R & D equipment.

In conclusion I would like to ask where are we going to find the competitive new products to break the inflationary-prone grip of a few individual companies on markets in industry after industry if not in places where America has always found them before.... outside the industry affected, in independent small firms with no vested interest in existing technology. There will be no free enterprise system for large business unless we quickly find a way to restore strong, viable, and competitive small businesses across this nation.

Mr. Chairman, this completes my statement. I have appreciated this opportunity to give the Subcommittee the views of one small business on such an important subject.

I will be pleased to answer any questions you might have with respect to my statement or any other aspect of the impact of government polocies and programs on small high technolgy firms.

Mr. LLOYD. Thank you very much. We'll go now to Dr. Daly and at the conclusion of the panelists' statements, we will ask questions. Dr. Daly.

STATEMENT OF DR. RICHARD DALY, QUANTRONIX CORP.

Dr. DALY. Thank you, Mr. Chairman.

On behalf of Quantronix Corp. and for myself personally, I want to thank you and the members of the committee for this opportunity to present our views on some aspects of the interaction between Government and high, technology companies like ours.

In recent days, increased attention has been given to the many aspects of Government-small business interactions. I want to confine my comments to just three: The first is on the topic of capitalization of the small, high technology company; the second, the development and maintenance of a skilled labor force; and finally, the encouragement and facilitation of exports.

This last topic, in particular, seems to have received little attention.

But before commenting on these, specifically, I'd like to make clear a personal view on the general subject and at the risk of coming out for motherhood, applie pie and puppy dogs, let me say that in my view, any program by Government to alter and improve our socioeconomic performance should operate to involve the free enterprise marketplace in the decisionmaking process. In particular, the Government should not itself directly select one or another technology company or profession for support, but should provide the climate and incentive which encourages the private sector to do so. Thus, for example, Government R. & D. labs, except in support of the Nation's defense effort, should not pursue R. & D. activities, but should be relegated to the role of supporting the private sector with, among other things, analytical and library and facility pools.

But, indirect Government influence of the private sector, should be exercised internally by taxation policies and externally by foreign policy.

With respect to the specific areas mentioned earlier, I should like to begin with the issue of capitalization of small, high technology companies. It has been my personal experience that the private venture capitalists, who have in times past, provided much of the initial funding for companies like Quantronix, generally are aware, well-informed and sensitive to marketplace opportunities. And since marketplace opportunities represent an expression of our social needs, the venture capitalist is responding to these needs. If greater support of small, high technology companies is the Government's objective, it ought to avail itself of this discriminating group in the allocation of capital investment by liberalizing its tax policies. Perhaps a more liberalized form of regulation A registration incorporating the downside mitigation, downside risk mitigation of a subchapter S organization and the upside gain augmentation of tax-free municipal bonds would serve the purpose. But, in any event, the investment should come from the venture capitalists and not directly from the Government. And in this connection, in my view, the SBA-guaranteed bank loan, is a no-no.

Next, I want to comment on the problem of developing and maintaining the skilled labor force which is essential for the high technol-

ogy company. I'm not referring here to degreed professionals, but rather to the important supporting crafts and skills: Machine tool operators, computer programers, optical, electronic and mechanical technicians, and assemblers. The difficulty in obtaining the quality and quantity of workers in this area is, I feel, a reflection on our educational system's structure. If I correctly understand it, the Germans have found an answer in their "Lehrling" or apprentice program. This is a cooperative effort between a craft-oriented educational institution and the local industry. In this country, the CETA program was a limited step in this direction and it should be expanded to combine tax incentive, on-the-job activity with a continuing formal program of classroom instruction. Quantronix Corp., for one, would enthusiastically support such a local program. We cannot operate efficiently or grow without these skills.

Finally, I wish to touch on the problem facing the smaller companies like Quantronix when they seek to export. Here, several important factors should be recognized. The first concerns the nature of the high technology product: It is complex and expensive. It cannot be successfully marketed through advertising brochures or data sheets. It requires an on-the-ground organization for presentation and promotion.

The second factor is the circumstance that the United States historically has not been an exporting nation, certainly not when our exports as a fraction of the GNP are compared with those of the other industrial companies. The result is a low level or complete lack of formal training for our business managers in matters of foreign trade. I think the weak and continually declining emphasis in our educational system on foreign language, culture, and history reflects this.

The third important circumstance is our technological lead. In laser technology, for example, with which Quantronix is concerned, this lead is more than 2 years.

Finally, the United States must export an increasing volume of manufactured goods, if only to dry up the ocean of Euro dollars before they return as a tidal wave aggravating inflation and buying up our industrial facilities.

Thus, we need to export, we have the products to export, we see the market's demand, but we don't have the broadly based foreign trade expertise to capitalize on this situation.

Six years ago, Quantronix faced up to this problem by creating a sales and service subsidiary in West Germany. Based on this experience, I have a concluding recommendation to help overcome our deficiencies in foreign trade cited earlier.

I recommend that the Government create an export trade park in each of the major industrial areas of the world: Europe, Southeast Asia, China, and Japan to name a few. These "parks" would provide, for a fee, physical facilities and pooled services to the local staff and the small U.S. company seeking to sell products into the area. The physical facilities would serve for sales, demonstration, and field service of the company's product.

The pooled services, the more important part of this plan, would provide, legal, customs, labor, accounting, travel, language, and communications advisory services. Payment for these services and facilities would be tied into the present DISC structure.

In providing these facilities on a pooled basis, the Government would encourage small companies not now exporting to do so and increase the scale and efficiency of existing efforts.

Utilizing the tax credits generated by the DISC structure, I believe this plan represents a self-liquidating Government investment.

I want to thank you for giving us this opportunity to present our views.

Mr. LLOYD. Thank you, Dr. Daly. Mr. Fialkov.

[The biographical sketch and prepared statement of Dr. Daly follows:]

Dr. Richard T. Daly - Biographical Data

Born:	March 23, 1925, Bronx, N.Y.
Education:	Elementary schools in Boston, Mass., New Haven, Conn., and East Rockaway, N.Y.
	High School: Bishop Loughlin Memorial H.S., Brooklyn, N.Y.
	B.S. (physics) 1950: Mass. Inst. of Technology, Cambridge, Mass. Ph. D. (nuclear physics) 1954: Mass. Inst. of Technology, Cambridge, Mass.
Employment:	1954-1956 - National Company, Malden, Mass. Developed cesium beam atomic clock
	1956-1967 - TRG, Inc., Melville, N.Y. First commercial development of laser.
	1967-pres.- Quantronix Corporation, Smithtown, N.Y. Co-founder, President. Quantronix develops and manufactures lasers and laser-based systems.
Military Service:	1943-1947 - First Lieutenant, Airplane Commander, bombardment reconnaissance, Pacific theater.
Residence:	Huntington, L.I., N.Y.

Statement prepared by Dr. Richard T. Daly for presentation to the House Science and Technology Subcommittee on Investigations and Oversight, January 28, 1980, Farmingdale, N.Y.

Gentlemen:

On behalf of Quantronix Corporation and for myself personally, I want to thank the Chairman and members of the Committee for the opportunity to present our views on some aspects of the interaction between government and high technology companies like ours.

In recent days, increased attention has been given to the many aspects of government-small business interactions. I want to comment on just three:

(a) Capitalization of the small, high technology company,

(b) The development and maintenance of a skilled-labor pool and

(c) The encouragement and facilitation of exports.

This last topic, in particular, seems to have received little attention.

But, before commenting on these, specifically, I should like to make clear a personal view on the general subject.

Any program by government to alter and improve our socio-economic performance should operate to involve the free-enterprise marketplace in the decision-making process. In particular, government should not, itself, directly select one or another technology, company or profession for support but should provide the climate and incentive which encourages the private sector to do so. Thus, for example, government R&D labs, except in support of the nations' defense effort, should not pursue R&D activities but should be relegated to the role of supporting private sector efforts with, among others, analytical and library facilities pools.

But indirect government influence of the private sector should be exercised internally by its taxation policies and externally by its foreign policy.

With respect to the specific areas mentioned earlier, I should like to begin with the issue of capitalization of small, high technology companies. It has been my experience that the private venture capitalists who have, in

times past, provided much of the initial funding for companies like Quantronix, generally are aware, well-informed and sensitive to marketplace opportunities. Since marketplace opportunities represent an expression of our social needs, the venture capitalist is responding to these needs. If greater support of small, high technology companies is the government's objective, it ought to avail itself of this discriminating group in the allocation of capital investment by liberalizing its tax policy. Perhaps a more liberalized form of Regulation A registration incorporating the down-side risk mitigation of a Subchapter S corporate organization and the up-side gain augmentation of tax-free municipal bonds would serve. But, in any event, the investment should come from the venture capitalist and not directly from the government. The SBA-guaranteed bank loan is, within this concept, a no-no.

Next, I want to comment on the problem of developing and maintaining the skilled labor force which is essential for the high technology company. I am not referring here to degreed professionals, but rather to the important supporting crafts and skills--machine tool operators, computer programmers, optical, electronic and mechanical technicians and assemblers. The difficulty in obtaining the quality and quantity of workers in this area is, I feel, a reflection on our educational system structure. If I correctly understand it, the Germans seem to have found an answer in their "Lehrling" or apprentice program. This is a cooperative effort between a craft-oriented educational institution and local industry. In this country, the CETA program was a limited step in this direction, and it should be expanded to combine tax-incentive, on-the-job activity with a formal, continuing program of classroom instruction. Quantronix, for one, would enthusiastically support such a local program. We cannot operate efficiently or grow without these skills.

Finally, I wish to touch on the problem facing the smaller companies like Quantronix when they seek to export. Here, several important factors should be recognized. The first concerns the nature of the high-technology product: complex and expensive. It cannot be successfully marketed through advertising, brochures or data sheets--it requires an "on the ground" organization for presentation and promotion.

The second factor is the circumstance that the U.S., historically, has not been an exporting nation, certainly not when our exports as a fraction of GNP are compared with those of the other industrial countries. The result is a low level or complete lack of formal training for our business managers in matters of foreign trade. I think the weak and

continually declining emphasis in our educational system on foreign language culture and history reflects this.

The third important circumstance is our technological lead. In laser technology, the lead is more than two years.

Finally, the U.S. must export an increasing volume of manufactured goods if only to dry up the ocean of Euro dollars before they return as a tidal wave aggravating inflation and buying up our industrial facilities.

Thus, we need to export, we have the products to export, we see the market's demand, but we don't have the broadly-based foreign trade expertise to capitalize on the situation.

Six years ago, Quantronix faced up to this problem by creating a sales and service subsidiary in West Germany. Based on this experience, I have a concluding recommendation to help overcome our deficiencies in foreign trade expertise cited earlier.

I recommend that the government create an "export trade park" in each of the major industrial areas of the world--Europe, Southeast Asia, China and Japan to name a few. These "parks" would provide, for a fee, physical facilities and pooled services to the local staff of the small U.S. company selling products into the area. The physical facilities would serve for sales, demonstration and field service of the company's product.

Pooled services, the more important part of this plan, would provide legal, customs, labor, accounting, travel, language and communications advisory services. Payment for these services and facilities would be tied into the present DISC structure.

In providing these facilities on a pooled basis, the government would encourage small companies not now exporting to do so and increase the scale and efficiency of existing efforts.

Utilizing the tax credits generated by the DISC structure, I believe this plan represents a self-liquidating government investment.

Thank you for giving us this opportunity to present our views.

STATEMENT OF HERMAN FIALKOV

Mr. FIALKOV. Thank you, Mr. Chairman.

To a venture capital specialist, venture capital is neither synonymous with capital for small business nor capital for technologically innovative ideas. The most important aspect of a venture investment is the potential for high return on the investment. The important differentiating feature between venture investing for high return and an investment in a portfolio of public companies is that in portfolio investing, risk is both measured and contained by the ability to sell if the development of the company is unsatisfactory.

In a venture, market ability is either nonexistent or severely constrained and risk can only be contained by a capacity to influence the development of the company. A venture is, therefore, a potentially high return corporate investment one cannot readily sell and where risk is contained only through a careful evaluation of the fundamentals before going in and a capacity to exert some form of direct influence on the situation thereafter. In addition to money, the venture capital specialist invests important segments of his time and energy into the successful development of the company. He is as much a builder as an investor.

In the 1950's, the venture capital specialist was exemplified by the funds established by the old line private fortunes. Examples were Lawrance Rockefeller Associates, Payson & Trask, J. H. Whitney, and Bessemer Securities. There were a few publicly held venture companies like American Research and Development. These were joined in the 1960's by Davis & Rock, Goodman & Mautner, and Geiger & Fialkov. Also, during the 1960's, banks, large corporations, and investment banking firms started funds and organized venture staffs.

The capital markets in the United States played an important part in attracting institutions to venture investing. They provided the small rapidly growing company access to sources of equity in public markets and made it easier for investors to realize desirable capital gains on small company investments. With the ease of access to capital markets, the emphasis on performance, the dramatic records of successful venture capital partnerships, venture capital appeared to be a very attractive means of investment.

To most venture capital specialists, their roles are regarded as the "raisons d'etre" of a capitalistic society, and they continue to work at their trade whether or not large or small amounts of money are available to support their efforts.

What determines the availability of money for venture investing? The most important factors, in my opinion, are the incentives or disincentives resulting from the tax laws of our Nation.

During the 1950's and 1960's, the path to wealth was capital gains. The road to capital gains included venture investing, and funds were plentiful. In 1968, Geiger & Fialkov raised $7 million to finance a venture partnership in less than 60 days. But in 1969, the increase in capital gains tax rates coupled with the decrease in the maximum tax on earned income caused higher income earners to shift their goals from capital gains to increasing their earned income and then seeking to

shelter their earnings from taxes. During the 1970's, professional fees and executive salaries soared, the market for nonproductive tax shelter schemes soared and capital for small private and public companies became scarce. Underwriters vanished and only the most deserving and fortunate ventures were able to seek out financing.

Tax laws were promulgated which resulted in the practical elimination of capital gains tax treatment for stock options. Executives were now interested in earnings, bonuses, deferred compensation plans, pensions, and tax shelters. Small companies with growth potential no longer could use stock options to attract key employees. It would be difficult to quantify the inflationary effect of the incentive to maximize earned income and the disincentive to invest savings in productive enterprises, but I am certain that these played a role in the inflation of the 1970's.

The recent reduction in captial gains tax rates has had a salutary and dramatic effect on the flow of institutional funds into venture capital pools. Whether the public market for securities will be sufficiently stimulated remains to be seen. Despite the increase in maximum amounts of money that can be raised in regulation A public offerings, the small company underwriters have not yet emerged from a long hibernation.

An engineer learns to examine, and reexamine, each proposed change in order to avoid adverse effects on the system. Our economic system is very complex, and sometimes the effects of changes take a long time to become evident. Our lawmakers should restudy the tax structure which existed during periods of high productivity, low inflation, and satisfactory capital formation.

That's the end of my statement, Mr. Chairman, but I'd like to add my reaction to some of the items which were mentioned by my fellow panel members.

My reaction to the idea of providing more Government research money for the small companies is that I think there is very little that can be done to improve the competitive ability of small companies to seek these funds. I think that these funds, going to the large companies and universities, can really not be changed. I think that's where the cadre of small business entrepreneurs come from. That's a breeding ground for small business entrepreneurs. They get their training. Small business entrepreneurs just don't come out of the air and so these funds are doing their work, notwithstanding the fact that it's difficult to channel some of them to small business.

I think on another statement by a panel member that SBA guarantees are a no-no and that it should all be left to the venture capitalists, the venture capitalist isn't looking to fund companies that are not very, very high potential companies. There are many companies which are low and modest potential companies, which nevertheless, deserve financial aid and I think that to whatever extent the Small Business Administration can provide guarantees of such financial aid. I think that it's a benefit to our free enterprise system and society. Thank you.

[The prepared statement of Mr. Fialkov follows:]

HERMAN FIALKOV
Suite 375, One Old Country Road, Carle Place, N.Y. 11514
Telephone: (516) 742-9527

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Tax laws were promulgated which resulted in the practical elimination of capital gains tax treatment for stock options. Executives were now interested in earnings, bonuses, deferred compensation plans, pensions, and tax shelters. Small companies with growth potential no longer could use stock options to attract key employees from the very large companies. It would be difficult to quantify the inflationary effect of the incentive to maximize earned income and the disincentive to invest savings in productive enterprises, but I am certain that these played a role in the inflation of the 70's.

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Respectfully submitted,

Herman Fialkov

Mr. LLOYD. Thank you, Mr. Fialkov. I appreciate all three of you being here today.

Mr. Ambro, do you have any questions?

Mr. AMBRO. Well, Mr. Chairman, I'd like to compliment the witnesses on the comprehensiveness and the conciseness of their statements. I wonder if you would ask if the witnesses will respond to written questions if we go through these most comprehensive statements and develop those questions so we'll be able to round out the record.

Mr. LLOYD. So asked and they can respond.

Dr. DALY. The answer is yes.

Mr. FIALKOV. Yes; certainly.

Mr. ABRILZ. We'll also be pleased to answer any questions you may have.

Mr. AMBRO. Well, I understand that. I'd just like to say that we were somewhat sandbagged in these hearings by the Congress deciding to get into a rather lengthy debate today on a water resources bill that is of considerable interest to us on Long Island, in particular, and to the Nation, in general, for a variety of reasons.

Mr. LLOYD. If the gentleman would yield on that, I would remind you that California has had its problems in the areas of water resources and we have an ongoing interest.

Mr. AMBRO. Well, without question. So, I won't dwell on the statements or many questions. I'm just fascinated, though, by something that Dr. Daly said, in this one paragraph: "Any program by Government to alter and improve our socioeconomic performance should operate to involve the free enterprise marketplace in the decisionmaking process."

Now, the first question I'm going to ask is how you do that? Then, you go on to say: "In particular, Government should not, itself, directly select one or another technology, company or profession for support", so on and so forth and except for the defense effort of the United States, should merely provide the climate incentive which encourages the private sector to get involved.

Would you exclude energy R. & D. with respect to that as well? So, if you'd just expand on that statement a little bit, how you would get the private sector involved in the decisionmaking process and with respect to energy research and development, would you exclude that from your general statement?

Dr. DALY. Congressman Ambro, we're dealing here with a question of resource allocation in every case. Our capacity to innovate in any area is limited. The engineering to scientific manpower and so forth represents a scarce resource. I'm concerned that we, in allowing the Government to make this allocation, we may not be availing ourselves of the marketplace voting; that is to say, in this allocation, it's a critical decision and it should involve the broadest spectrum of thinking in our society and not just Government. And to be very direct in answering your question, yes, I would exclude energy research from a proper Government activity, other than within the context that I mentioned; namely, that the Government should provide the climate and the incentive for the private sector to undertake this development.

I would again, repeat my statement that, defense interpreted broadly, and that would include space activity, for example, is a

proper province of the Government, but not in a broad area of R. & D. activities and that includes energy.

Mr. FIALKOV. May I add, sir——

Mr. AMBRO. Well, if I could just ask you to tell me how you'd get the private sector involved. What mechanism would you set up? How would you do that?

Dr. DALY. Well, we have among us some very large companies whose job it is to provide energy for our society. Let's let them operate. Let's let them——

Mr. FIALKOV [continuing]. May I give you a different perspective on that?

Mr. AMBRO. Well, if——

Mr. FIALKOV. I think, I think, speaking from the investment point of view, if the payoff is in the 5- to 7-year range, you can depend upon the private sector to spend the R. & D. money. However, if you've got projects, where the payoff is 20 years or 15 years, you can't expect the private sector to make that investment without substantial decisionmaking and encouragement from the U.S. Government. I would doubt that large segments of the private sector would be investing in fusion, for example.

Mr. AMBRO. Precisely.

Mr. FIALKOV. And so, I would not categorize energy very, very broadly. It is just those aspects of energy where the payback is in the very distant future, we need Government direction with the assistance and help and counsel of private industry towards programs which will assure our Nation what it needs during that time frame. You just can't expect private capital to make the invesment where there's a very, very distance payback.

Mr. AMBRO. Mr. Chairman, I suppose we're operating under the 5-minute rule. I could go on with this at length, because I don't seem to have it clear in mind, but I'll defer.

Mr. LLOYD. Well, we'll wait, if you'd like to——

Mr. AMBRO. No, no.

Mr. LLOYD [continuing]. Go further. Mr. Carney.

Mr. CARNEY. Thank you, Mr. Chairman. I, too, would like to thank our panelists for their testimony here and concur with Mr. Ambro. I'd like to have an additional opportunity to go over it and will submit questions to them in the future so we would have it for the record, but right off the top, I have a couple of questions about both the cooperation of the Government and dealing with the Government. I know the two gentlemen who are not involved in financing, have, at times, dealt with the Government and you're both small businesses located on Long Island.

Do you feel that you are at a distinctive disadvantage because you are a small business as compared to a larger business who might have greater resources to get into the Government programs and how, in that area, can we help. Mr. Daly?

Mr. DALY. Well, first of all, I stand on my previous statement that I don't think small business and small, high technology business ought to be asking the Government for direct funding for their activities. On the other hand, in other areas, let me cite one. As a publicly held small company, we are bounded by the same rules, for example, in

accounting procedures that very large companies are subject to and this is a very costly procedure. I sometimes wonder whether the detail and the effort that goes into preparing our financial reports on our scale is a cost-effective procedure; that is, the Government makes no differentiation between Exxon, for example, and Quantronix, where the difference in size of the company may be a hundred thousandfold. In that respect, I think that the Government has failed to recognize the needs of the small, high technology company in its regulatory areas.

Mr. CARNEY. I think the point that I was trying to make and I can understand the problem that you have, but the point I was trying to make, if the Government is looking for R. & D. or for research and development into a particular area to address a problem of our society and you believe that we shouldn't be in the business of doing the R. & D., it should be done by the private sector, I'm asking the question what problems does a small part of the private sector, small business in the private sector, do you face that are not faced by the larger companies. For instance, applications, justification, the fact that you perhaps cannot—maybe, I'm answering the question. Perhaps you don't have the scientists on your staff that the Exxon's do to apply for an application that is within your company's realm. You might be the company that could be best suited to answer this question that we're looking for. Maybe it's even military technology. What problems do you have as a small company with small staff, with small capital?

Mr. FIALKOV. It can't afford to make the investment and the proposal that's necessary to win the funds.

Mr. CARNEY. That's what I'm saying.

Mr. ABRILZ. Congressman, let me respond to that. I think I take, maybe not the opposite view, but I guess the other side of the coin on this. I do believe that Government should offer R. & D. programs to the small business sector of this Nation with respect to clear, concise requests for technical answers to technical problems. What I don't feel should happen is that you treat us all alike, because we're not alike.

Two-tier regulation is long overdue in this Nation. In a straight supply service type of contract, one set of regulations would handle everything, but in an R. & D. program, we get the same package that an IBM would get and invariably in the clauses within the contract, they start excluding small business in clause after clause, so if you would just learn to tailor your proposals to the entity that you're asking the proposal for, instead of just cutting up specs, pasting them together and sending them out to 40 different companies, you would not only get a more viable response from small business, but you would get more small businesses to respond. When I get a 15-inch thick stack of specifications from an agency, I'm not even going to bother to read them and propose on them, because I don't have the time, even though it may be a great program, to read through it, to determine the efficacy of the program with respect to our business. We are small businesses. We are owner-operators, a lot of us, and we're still in the process of establishing a two-tiered structure within our company trying to bring in the middle management group to be able to handle the proposal process, so if you want our input, start simplifying your regulations,

start decreasing the verbiage and clauses that do not effect small business and start coming out with 1-, 2-, 3-page proposals. You need this and you need it at this time, these are the requirements, instead of coming with all the whereas and forthwith, et cetera, et cetera.

Mr. CARNEY. I have one last question, Mr. Chairman, and in deference to the time, I would kind of like a very quick answer from everyone. It's the $64,000 question. What constitutes a small business? Where is the cutoff? Where does Government recognize this to be a small business or this to be a large business?

Mr. ABRILZ. At the White House Conference for Small Business, we introduced a resolution and the resolution states that we will consider a small business as any enterprise in America having 500 or fewer employees. What we then did was graduate the number of employees into quantities from four different ranges. It would be something like 0 to 9, 10 to 49, 50 to 249, and 250 to 499, but we all concurred, across the Nation, that 500 employees is the maximum for a small business. It was adopted as resolution No. 8 at the White House Conference on Small Business in January 1980.

Mr. CARNEY. Mr. Daly, would you like to take a crack at that?

Mr. DALY. No, I agree. I agree completely.

Mr. FIALKOV. That's an SBA definition, is it not?

Mr. ABRILZ. No, it's not. It's a definition hammered out over 3 days between 2,100 small business people.

Mr. FIALKOV. The difficulty that we've seen in connection with being defined as a small business is that if a small business has less than a hundred employees and yet, one of its venture capital investors, which is regarded as an associate by the Small Business Administration, is either a larger firm or a large investment banking house and they'll couple the two of them and not treat them as a small business.

Mr. CARNEY. I thank you all for your input.

Mr. LLOYD. I thank you very much for being with us today and I would also add that you will be getting written questions which I intend to submit. Again, I would say to the audience, I am deeply sorry for this kind of hasty involvement, when, in reality, we're discussing a very important subject as it pertains to the future of this Nation. Both Mr. Ambro and Mr. Carney have already pointed out to me, there is some real tenseness in the stomach on the part of all four of the Congressmen up here, particularly as it pertains to a water bill, which is currently on the floor as of 12 noon today and so we are going to rush back there and I do thank you for your understanding, but most importantly, I thank you for your involvement today. Thank you, gentlemen. Next panel please.

If anybody in the audience feels the overwhelming desire to stand up and stretch, don't miss this opportunity.

At this time, as the gentlemen are coming up, we will have Dr. George Vineyard, who is a director of Brookhaven Laboratory; Tom O'Hare, who is with the Department of Energy and Environment and Associate Chairman; and Robert Whisker, who is a patent attorney and I notice that you bear the emblem of your name.

While he's doing that, I'll tell you what, Dr. Vineyard, why don't you just go ahead and we'll get it all done here.

STATEMENT OF DR. GEORGE VINEYARD, BROOKHAVEN NATIONAL LABORATORY

Dr. VINEYARD. Thank you very much, Congressman Lloyd. Let me also express my appreciation to you and to the other members of the committee for taking the time to come here and investigate what we agree is an extremely important series of problems. We have prepared statements for the record.

Mr. LLOYD. Without objection, that statement will be accepted into the record.

Dr. VINEYARD. So, I think we can help you with your time problem by paraphrasing and being rather brief.

We approach this from the standpoint of what the National Laboratories, such as Brookhaven, are doing about technology transfer, particularly to the small, high technology firms.

I want to say just a few things about what we are and then about the chief ways in which we accomplish technology transfer, and then turn the floor over to my colleagues to amplify.

As I'm sure most members of the panel know, Brookhaven is one of the large Department of Energy National Laboratories; we're devoted to doing energy research in order to further the problem of providing adequate energy supplies for the Nation and to improve the safety and acceptability of these energy supplies.

Underlying that is a whole series of problems of long-range research which are naturally the province of the Government to fund, because they exceed the capabilities of most industries and they require large aggregations of scientific talent.

We have programs in basic energy sciences and in that most basic part of physical science which it is the executive responsibility of the Department of Energy to foster: that is, high energy physics.

We also work in the life and environmental sciences and in selected areas of energy technologies. We do have a clear understanding that our part is at the greatest in the basic areas and that it is the Department of Energy policy that as projects move from the basic stage through into development, engineering development, demonstration, and commercialization, the role of laboratories such as Brookhaven, sharply diminishes and a handoff to industry must be made, because the commercialization belongs in the industrial sector.

Therefore, we give a great deal of attention to this and it is our thoroughly understood policy that we butt out as rapidly as we can as that stage is approached. However, the handoff must be done with some care and we have a number of means by which we attempt to make information available and to make the handoffs go more smoothly.

First of all, we work in a goldfish bowl. Our work is unclassified and not proprietary, and we are anxious to publish it. We participate in conferences and scientific meetings, and we put out reports and disseminate them just as widely as we can.

Second, we sponsor workshops and conferences on special topics as appropriate to bring people into the laboratory to show them at first hand what's going on.

Third, we have a number of special facilities of large magnitude which is the particular specialty of Brookhaven. We have the National Syncrotron Light Source under construction which will provide beams of electromagnetic radiation for research purposes and which we expect will be of special interest to a wide variety of industries. We encourage these people to come in and use these facilities under suitable felicitous conditions. We have a scanning transmission electron microscope which is of a uniquely high resolving power for biological scientists and anyone in industry who can make use of it. We have a couple of research reactors which provide special beams and activation facilities, et cetera, et cetera.

I must mention that we are not a testing laboratory nor a management consulting firm and we do not intend (nor are we allowed) to compete with the many private enterprises that do provide those broad services.

Fourth, we provide technological stimulation to industries all across the country through special devices, instruments, et cetera which we need and which we procure from industry. Many times a pilot development will go on in our laboratory for something which is quite novel and then we will hand that over to industry and ask them to make it. In other times, we buy forefront equipment from industry and subject it to particularly searching conditions of use, find out its weaknesses and help the industry that makes it to improve their product for our own purposes. We procure about $60 million a year of various goods and services and constructions, and of that $60 million, this year, we intend to spend about $24 million of it with small industry. We have special programs for encouraging the participation of small industry in these procurement activities.

Thus, there is a broad range of technological stimulation in which we engage. Finally, as a fifth matter, we have many direct collaborations with scientists and engineers from industry. I believe this kind of face-to-face interaction is the most efficient and the most important means of spinning off and commercializing things that go on in our laboratory.

I would remark on this that there are sometimes procedural and patent difficulties—a little more about these will be mentioned by my colleagues subsequently. There also is sometimes a lack, I think, of sufficient interest on the part of industry in having their people spend some time at a place such as Brookhaven, and by time, I mean anything from a few days to a year or more. A close interaction like that is enormously beneficial. Some industries don't have enough people to spare, others have worries about patent compromises or patent leakages and others simply are indifferent to the opportunity. To me, it's slightly ironic that we have many more people from abroad interested in coming and doing such collaborations than we have from our domestic industries.

I think that completes a quick summary of what is in my statement, Mr. Chairman, and I would like now to call on my colleague, Mr. O'Hare, to talk about some specific examples of technology transfer.

[The prepared statement of Dr. Vineyard follows:]

STATEMENT BY DR. GEORGE H. VINEYARD

DIRECTOR, BROOKHAVEN NATIONAL LABORATORY

BEFORE THE SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT

OF THE HOUSE SCIENCE AND TECHNOLOGY COMMITTEE

JANUARY 28, 1980

First let me thank the Chairman of the Committee, Congressman Lloyd, and the other members for holding this hearing on Long Island and inviting us to testify. We believe that technology transfer from federal laboratories to small businesses is a timely matter and most important.

The Brookhaven National Laboratory, which I represent, is one of the Department of Energy's National Laboratories, and like the others conducts varied programs of research to develop better energy supplies, to increase the efficiency of energy use, to increase the safety of that usage, and to avoid adverse health and environmental impacts. At Brookhaven, our charter includes a strong program of research in the basic energy sciences which underly energy technologies, and other technologies as well. This includes nuclear physics, solid state physics, chemistry, and materials sciences. It also includes the most basic part of physical sciences, for which the Department of Energy has the lead responsibility, namely high energy physics. Brookhaven has from the beginning specialized in developing and operating very large research facilities for use by all qualified scientists. We also have extensive programs in life sciences, environmental sciences, and human health, and we have a number of applied programs in selected areas of energy technology.

The Department of Energy and its Laboratories recognize that as ideas and processes move up the chain from research to development, and from development to demonstration, the laboratory role diminishes and the role of

industry comes to dominate. Commercialization is the goal of most energy research, and industry is the necessary agency for its accomplishment. Thus the goal of technology transfer is deeply ingrained in our policies.

We, along with the other DOE laboratories, accomplish technology transfer in many ways. Results of our research are freely published in the open literature of science and technology, and in reports which are circulated widely. We are eager to bring them to the attention of as many people as possible. At intervals we sponsor conferences on subjects of interest to particular industries which facilitate technology transfer. Not long ago, for example, we ran a workshop on coal substitution in process heating, and another on research planning in industries which have a limited tradition of research.

Brookhaven performs services for industry by providing specialized facilities for use by their scientists. While most of this activity is in basic research and usually, therefore, is of lesser interest to smaller industries, there are still many examples where small or medium sized firms have benefitted. Our reactor facilities have long been used by industries for radiation damage studies and for activations and activation analyses. Recently an aircraft industry has been using our Medical reactor to make neutron radiographs of graphite-epoxy aircraft parts, for which x-rays are inadequate. A project is now underway at Brookhaven to test the health effects of mineral fibers of varioue sizes. The test uses rats in our animal exposure chambers, and is being done for the Thermal Ineulation Manufacturers Association. We expect the National Synchrotron Light Source, which will be completed by the end of next year, to be heavily used by a variety of industries.

In reciting these examples of assistance to industry, I must also point out that they involve use of highly specialized facilities not available elsewhere. We do not function as a general testing laboratory and, in fact, are expected not to compete with the many private firms that are set up to provide such services.

Another kind of technology transfer from federal laboratories such as Brookhaven occurs when our scientists design or ask industry to design an instrument or device needed in our research and turn to industry for production of the device. Such activities enable industry, often small industry, to develop, improve, and market new products. Counters and detectors, monitoring devices, logic circuits, and many other things are in commercial production in industry because of such processes. There is a substantial industry in the country, mostly small firms, devoted to radioactive isotopes for medical uses. A large share of these isotopes were developed at Brookhaven and other DOE laboratories and handed over to industry.

One of the best mechanisms for transferring technology out of the laboratory is through direct collaboration of laboratory and industry in R&D projects. There have been a reasonable number of these collaborations at Brookhaven, and more are expected. They range from informal collaborations on basic problems in physics and chemistry to developmental projects for hardware. An interesting example is a collaboration between scientists from an energy company and two of our chemists who have devised a simple analytical procedure for determining the oxygen content of coal. Normally this is hard to measure, and the new process uses ^{3}He ions from a cyclotron to activate the oxygen and thus detect it. The procedure is rapid and inexpensive.

These face to face collaborations in which scientists from industry visit

the laboratory for substantial periods of time are the best possible means for technology transfer. The interaction is hands-on, direct, and effective. Unfortunately it does not occur as often as we would like because industries are sometimes worried about patent questions in such collaborations, or do not have the qualified staff, or if they do have such staff they may be reluctant to let them out of the plant for the reasonable period that such work requires. It is ironic that we have many more applications by scientists and engineers from foreign industries to come to Brookhaven than from domestic firms. It may be that the domestic specialists already have enough avenues of access to the high technology they want, but I suspect there is shortsightedness in our own industries.

Patent problems have been mentioned as an occasional barrier to technology transfer. Recent developments to improve the situation will be discussed at more length this morning by our patent attorney, Mr. Robert H. Whisker. There is another barrier we have sometimes encountered: the concern of the government that a joint project between the laboratory and a particular company may confer unfair advantage on that company over its competitors. Greater institutional flexibility in this regard seems to be needed.

The foregoing discussion has dealt with the overall picture of the Laboratory and has considered technology transfer and assistance to both large and small industry. More details on how technology transfer has been accomplished in illustrative projects with attention to small industry will be supplied next by Mr. Thomas O'Hare, Associate Chairman of the Department of Energy and Environment at Brookhaven.

Thank you for the opportunity to state my views.

STATEMENT OF TOM O'HARE

Mr. O'HARE. Thank you very much. I, too, would like to thank you for this opportunity to talk this morning.

We have material contained in the boxes up front and some samples. I feel like a salesman with packing cases here today.

Mr. LLOYD. Without objection, we accept your statement for the record.

Mr. O'HARE. Thank you.

Mr. AMBRO. Not the material in the boxes, though.

Mr. O'HARE. Well, we've been hauling this material around like delivery men and we'd be pleased to have some of you take it with you if you like. We have samples of some of our work and then we have some sheets which is our key to the material and if you'd like to sign your name on any of the sheets, with the subject number and the name of the subject, we'll be pleased to send you more.

Mr. LLOYD. I think, if I could interrupt, sir, for the audience that was his pitch to you. If you wish to take any of this material and look at it, you're most welcome to do so. If you wish additional amplification, sign your name, and they will forward it to them at a later point.

Mr. O'HARE. Right, right.

Mr. LLOYD. Thank you, sir.

Mr. O'HARE. Now, we don't wish to become a publishing company in the process, but we would be pleased to send these reports out to you.

As you realize, many of these reports are available in what's called NTIS and there are listings published by the Government which indicate where these reports are located and who you can write to to get them and I'd like to mention that the diligent entrepreneurship is particularly necessary in small business as small business tends to be a transition phase on the way to big business or on the way to the bankruptcy courts and you need to have entrepreneurial capital as well as human capital and as well as financial capital.

An aspect of entrepreneurial capital, is knowing where material is and going after it and reading it and sorting it and making use of it and the National Laboratories system does provide a tremendous resource for material of this type that can be utilized in various business ventures.

Now, the material that we brought with us today covers subjects such as polymer concrete, oil burner testing and development, hydrogen technology development, fuel cell work, a workshop on innovation and industry, solar technology transfer programs, energy conserving architectural design, energy conserving control systems in buildings, medical technology, power transmission and so forth. This is a large range of subjects and I'm not going to go through all of it, but I have selected just a few to kind of explain how the laboratory inter-phases with business, in general, and with small business in particular.

Polymer concrete is a process that was developed as a function of the radiation work that was done at the laboratory and it's a means whereby, the ordinary properties of concrete can be improved. Polymer concrete will have improved strength, it will have better weathering resistance. It will resist corrosion and it can be used in forms such as sewage pipe. It can be used for airport runways. It can be used for patching roadways.

One of the interesting uses that's developed is for taking care of bridges. We have hundreds of thousands of bridges in the United States that need repair or are about to fall down we're told, and this is a means of patching decks and assistance in maintaining decks without shutting the bridge down and without rebuilding the bridge. Polymer concrete itself involves adding a very expensive chemical to an ordinary cheap building material and you would think it would not be economic. As a material itself, it probably isn't economic, but in terms of its use when you combine the material properties, they'll be expensive, but with the labor efficiency associated with its installation and the fact that you do not have to rebuild the facility, but can repair an existing facility, it appears that the economics are there and it would appear to be good business.

Now, this material was transferred from the laboratory through all kinds of means. It was transferred through other departments of the Government, such as the Department of Transportation, but we put together booklets such as and I'll quote to you: "The Introductory Course on Concrete-Polymer Materials, Polymer Concrete Overlay, Polymer Concrete Patching Materials, a users manual for Polymer Concrete, a method of using Polymer Concrete." These books have gone all around the world. They're used in foreign countries, local contractors on Long Island, contractors in big cities, such as Chicago and New York or Philadelphia, California et cetera.

The next program is what we'll call Oil Burner Testing and Development. This arose from a perception on behalf of ERDA——

Mr. LUJAN. Tom, before you move onto that, could I ask a question at this point. If I were in the concrete business and wanted to use this polymer concrete, if the Atomic Energy Commission or Nowerdine has the patent to it as indicated, how would it be made available to me? Would I have to pay someone? Could I start a company using that process?

Mr. O'HARE. Yes; you could start a company using the process. It was developed with taxpayer dollars. It has been rendered useful to taxpayers. They can use it free. They can get the information on how to do it or they can consult with members of the laboratory, if they wish, which will not cost them anything. We will be pleased to instruct them and show them applications, give them literature and they can go ahead and go into business and make use of the material.

Mr. LUJAN. Can I do that with almost any patent that you apply for and get at Brookhaven or any of our laboratories?

Mr. WISKER. I was planning to get the questions of patents and licenses when I spoke.

Mr. LUJAN. Oh, all right.

Mr. AMBRO. I wonder if I could make a comment here, Mr. Chairman.

Mr. LLOYD. Yes, Mr. Ambro.

Mr. AMBRO. With respect to the question of my friend, Mr. Lujan, this process where you could use, for example, ground-up Heinekin's bottles and as I understand it, mix it with a manomer and polymerize it and make all kinds of things, all of which was brought to the attention of the town of Huntington, when I was supervisor, by Dr. Steinberg caused us to put or install a test sewer line in Centerport. Now,

that sewer pipe is billed as being less porous than, more durable than, and cheaper than, conventional sewer pipe. The innovation that comes from the interaction between a municipality and a national laboratory isn't the—not the innovation, the reaction that comes between us, isn't generally that which is done in the country. I think at this point, it's a good time to say that it seems to me that small businesses must have an intellectual proclivity toward utilizing innovation developed at places like a laboratory. It seems to me as well, I'll be contentious that a Japanese businessman and in this case, Italian businessman who took this process, brought it back to Italy and utilize it commercially as a result of this handoff that Dr. Vinyard was talking about, have that bent far more than our own people do.

We've been most reluctant to take this process and do all kinds of things with it in the private sector as we have been, I think, remiss in this country in utilizing the kinds of innovations that come from Government R. & D. programs, let's say in the solar area in which you're an expert. That's why we set up 2,000 demonstration projects to get the private sector to understand the kinds of things that we have and the Solar Energy Research Institute as well.

So, I think you stopped at a fine point in order to elevate the consciousness of the audience about a process which is relatively simple, which is available to the private sector, but which in this country, that private sector has not seen as something that they want to get into, as they haven't seen, and that's our big problem, the development of solar.

Now, I recognize there are tax problems and all kinds of other problems with it and I recognize too, that the development of an adequate photovoltaic cell is something that costs us hundreds of millions of dollars and we're moving in the direction of all the time, which would inhibit the private sector from utilizing, but I think those kinds of things have to be said at a meeting like this so that we don't believe that it's just inhibitive Government policy that doesn't move us in the direction of innovation It's inhibited mentality on the part of private sector managers that might be retarding this kind of expansion as well. I'll get blasted for that, but I thought I'd say it.

Mr. LUJAN. I didn't want to know that much about it.

Mr. LLOYD. Mr. O'Hare.

Mr. O'HARE. OK; I'll continue.

Well, about 5 years ago, ERDA, the predecessor to DOE, and Brookhaven recognized that one of the big oil users, particularly in the Northeast, was the home oil burner and so they decided to investigate to see how a home oil burner worked. Well, it turns out, when it's working, it's about 65 percent efficient, but it cycles quite a lot and they're oversized in their nozzles and so the burner responds up and down. And when you look at its overall efficiency, it's much lower, because it's constantly shutting itself off and on. Well, through a program at the laboratory, they set up a testing facility to encourage inventors, people with new concepts, new ideas, to bring their inventions in prototype form and Brookhaven would be pleased to test them. At first, the reaction was slow. Not too many people came, but we've tested some 40-odd burners. The burners that come in are uniformly good these days. Now, most of the burners that we look at have efficiencies between 71 and 77 percent. They are somewhat smaller. The nozzle size is a little smaller.

There are new combustion concepts contained in the burners and so, in this method of testing these oil burners and having the facility and encouraging the people to send their products to us, we seem to have served the function of lifting the level of efficiency of this particular consumer product and, in addition, we seemed to be encouraging innovation and thoughtfulness on behalf of the people who manufacture and develop and design these particular products.

Now, we've done similar things for what you would call flue dampers. You've heard of flue dampers and we've examined now new ways to heat the home as the price of oil continues to rise. The fact that oil burner is 77 percent efficient is no longer that attractive. One needs to try to get to 90 percent efficiency. Perhaps that means putting in condensing systems where you take the chimney out in return for the additional money that you spend or it may mean that you're going to have to put in diesel heat pump systems where you can increase your thermal efficiency by a factor of two; but this type of thing is done at the laboratory. Ideas are funded through the laboratory and they go out to the private sector relatively quickly and easily because this is a problem that the consumer can perceive and the multiplicity of people in this business perceive the problem also.

The next one I'll talk about briefly is a workshop where the laboratory deals with large industry. In 1978, we held a workshop down in Reston, Va., to see what we could do about upgrading the technology of heavy industry to try to see if we could determine what research programs and/or projects we should start to put in place now to develop a 21st century technology.

Now, for the record, these industries were agricultural technology, forest products, pulp and paper, iron and steel, cement and ceramics, chemicals and polymers, textiles, information processing, machine intelligence, technological edueation, manufacturing, raw materials, nonferrous metals processing and construction. We assembled a payroll of about $1 million for 2 days. Lots of vice presidents of corporations, mutants from universities, deans, interesting type people, and we set up a research agenda that we thought would be interesting for various Government agencies to fund for the private sector itself to look at and see if they would be interested in putting some basic research dollars in, either on their own or on a cost-sharing basis with the Government.

So, it's not just small business that needs a little help here and there. All kinds of business need help with researeh and we, more or less, see that as one of our roles.

Now, the next item I'd like to mention is what we call, at the laboratory, energy architectural design. There are some 50 bulletins up here about what you may know of as the Brookhaven House, which is a very simple, ordinary, "cape-coddish" sort of home that you would find to be pleasant to live in. I think you would call it a home, rather than a house. It seems to be very pleasing, but what we thought is that architecture is a pleasurable experience but it must have attractive economics as well. This particular home uses annually about 300 gallons of oil for something like 1,800 square feet, located in the Northeast.

Now, some of you are going to ask me what about the hot water and what about the eleetricity. Well, we haven't gotten to that yet. We're

still dealing with the heat, but we're building this house on lab property. We're going to instrument the house. We're going to examine the house and see how it behaves in the climate seasons and we're going to determine how good or how bad it is and then we're going to see if we can set up a generation of new passive solar homes. All of which, without any major capital expenditure and without any major investment in heavy industry, give you a home that utilizes conventional, scientific, and engineering principles without a large investment, just proper concepts.

Now, the last item I thought I'd mention is medical technology. That's something that some of you may not know. Most of the medical use of radioisotopes that I'm aware of were developed at Brookhaven and the work included the production of isotopes in accelerators and reactors, their chemical purification and their incorporation in pharmaceuticals and their experimental use in humans.

Now, some of these are used in hospitals across the United States, in medical centers, in diagnostic test facilities. Some of these would be technitium 99 for labeling red blood cells; thallium 201 for myocardial imaging; carbon 11 for pulmonary studies. The manufacture of many of these isotopes has been transferred to the private sector. We no longer have anything to do with them and they've become conventional and ordinary in daily use. You may also realize that L-Dopa treatment for Parkinson's disease was developed at Brookhaven, as were the primary studies on sodium chloride, salt ingestion and its effect of hypertension. Most of these were written up. The hypertension work, for example, has gone on for about 19 years and that is one of the foundations of the salt, hypertension diagnostic treatment that is now conventional.

The last thing I'd like to mention to you is something that should give you pause and I was hoping we'd have a VuGraph, but we don't and so I'd like to refer you to a table at the back of my presentation which is entitled: "Innovation Incubation Intervals" and I'd like to read you some numbers: Ball-point pen, 7 years; cellophane, 12 years; grease-resistant fabric, 14 years; dry soup mixes, 19 years; filter cigarettes, 2 years; frozen foods, 15 years; gyrocompass, 56 years. If you look through this list which is available to you, you're going to find out that research is a hard business. It doesn't depend on just grants from the Government. It does depend on the uniqueness of an individual. It requires a good deal of effort, dedicated over a long period of time, with substantial funding and capability of the people who are doing the work, and if you do all that and you're successful, and then I suppose you get the money and you raise the funds, and you have the advertising budget and the salesmen you will win, but it's not easy and I hope this little presentation will help you in your thinking. Thank you.

[The prepared statement of Mr. O'Hare follows:]

STATEMENT BY THOMAS E. O'HARE, ASSOCIATE CHAIRMAN
DEPARTMENT OF ENERGY AND ENVIRONMENT, BROOKHAVEN NATIONAL LABORATORY
BEFORE
THE SUB-COMMITTEE ON INVESTIGATIONS AND OVERSIGHT OF THE
HOUSE SCIENCE AND TECHNOLOGY COMMITTEE ON THE
SUBJECT OF TECHNOLOGY TRANSFER AT BROOKHAVEN NATIONAL LABORATORY

JANUARY 28, 1980

We would like to thank the Chairman and the Committee Members for this opportunity to speak to you and bring to your attention some examples of technology transfer emanating from Brookhaven National Laboratory.

For this purpose, let's define technology transfer as both the exploitation of concepts that were researched and developed at the Laboratory as well as the intellectual interaction and idea generation that takes place in the normal research process between the Laboratory and universities, institutions and industrial firms during the execution of applied research programs.

With this definition in mind, some of the examples that we will touch on today are as follows:

1. Polymer concrete
2. Oil burner testing and development
3. Hydrogen technology development
4. Fuel cell
5. Workshop on Innovation in Industry
6. Solar technology transfer program
7. Energy conserving architectural design
8. Energy conserving control systems in buildings
9. Medical technology
10. Power transmission

As you can see, it covers a wide range of subject matter. If any of you in the audience have a keen interest in any of the topics, we have brought with us some illustrative material which you can peruse. If you wish further information, please sign your name and address on the topical sheets provided and we will send it to you.

Now I would like to run through these examples, highlighting and perhaps explaining the significance of the ideas contained in the subject matter.

1. Polymer Concrete

This program has been in progress for about the last ten years and involves the strengthening and improvement in the properties of concrete materials by impregnating porous structures with various available polymer materials. Polymer impregnated concretes have improved strength, weathering (e.g., freeze-thaw) as well as corrosion and wear resistance. In addition to concrete, ground glass, sand and various waste cellulose materials have been so treated and fabricated into useful forms.

Brookhaven has been working on polymer-impregnated concrete (PIC) since 1965. BNL developed the monomer material formulations and the methods of impregnation, measured the structural and durability properties, and initiated development of practical applications. The basic patent on PIC, U.S. Patent 3,567,496, March 2, 1971, obtained by BNL is assigned to the U.S. Atomic Energy Commission. Initially, the material was produced by radiation polymerization. However, the thermal-chemical means of initiation is more economical and readily applied, and the patent covers the thermal-chemical process.

Concrete-polymer material has been utilized in many applications, as follows:

- new precast bridge decks
- repair of bridge decks and highways
- chemically resistant PIC for operation at elevated temperatures in multi-stage flash distillation vessels in large seawater desalting plants
- improving the stability of roof and wall structures in mines
- stronger and more durable pipe requiring little or no steel reinforcing bars.
- non-corrosive lining for geothermal brine service.

Several manuals have been prepared by Brookhaven for distribution by the U.S. Department of Transportation:

- Introductory Course on Concrete-Polymer Materials December 1974 - BNL 19525
- Polymer Concrete Patching Materials Implementation Package 77-11, Vol. I and Vol. II
- Polymer Concrete Overlays, Interim User Manuals - Method A FHWA-TS-218 and Method B FHWA-TA-78-225.

These materials and techniques are in daily use throughout the U.S. and many foreign countries. The present program has served as a source and focal point for new ideas for companies which have actively interacted with the program.

A development which came out of this work was a pumpable rock bolt for use in deep mining operations. They were intended to replace steel bolts. They were easier and safer to apply and would be as effective as the units they replaced.

2. Oil Burner Testing and Development

Five years ago ERDA/BNL recognized the need to evaluate the performance of oil fueled home heating equipment. This industry, which developed in the

1920 to 1930 time period, has remained an effective, but technically unsophisticated industry. It had, until recently, virtually no R&D in progress and only primitive equipment test capability.

During the course of the oil burner test program, BNL has built a sophisticated test facility which allows automatic data gathering and data processing to gain performance data. A heating unit can be tested in the BNL laboratory facility in a space of less than 10 working days to give its annual performance over a full heating season in any selected region of the country.

This program has effectively interacted with the national, state and local oil industry interests. It has stimulated the adoption of improved equipment, been instrumental in raising the expectation of the industry and consumers for improved equipment. This program now forms the technical base upon which the DOE is implementing a national oil fueled equipment refit program. Through subcontract efforts, BNL is supporting the development of improved residential space heating equipment which makes use of advanced combustion techniques, i.e., pulsed combustion, prevaporization (blue flame), and other techniques.

3. Hydrogen Technology Development

Early in the 1960's the Laboratory recognized the potential value of hydrogen as an energy delivery medium tied to abundant (e.g., nuclear) non-fossil, or renewable energy resources (e.g., solar, geothermal, hydro, wind, etc.) The need to derive a useful, clean, storable and portable fuel, aside from electricity, was evident to BNL.

Initial programs on hydrogen focused on the problem of storage and were later expanded in the early 1970's to encompass electrolytic production of hydrogen.

This effort has stimulated major programs at INCO, Air Products and

Chemicals, Solar Turbine Division of International Harvester, and Standard Oil of Indiana, on the use of metal hydrides for industrial applications such as storage of hydrogen, hydrogen compression, extraction of hydrogen from gas streams, heat pumping, power cycles, as well as interest in the automotive use of hydrogen, and hydrogen storage for electric utility energy storage applications and stimulated interaction with electric and gas utilities, e.g., Public Service Electric and Gas Company of New Jersey.

A major thrust of the present program is to establish an electrolytic equipment manufacturing industry in the U.S. via programs in place at the General Electric Company and Teledyne Energy Systems. This program on electrolytic production of hydrogen has stimulated other organizations who now sponsor portions of the above programs. These include:

Electric Power Research Institute (EPRI)

Gas Research Institute (GRI)

Empire State Electrical Energy Research Corp. (ESEERCO)

Niagara Mohawk Corp.

New York State Energy Research & Development Authority

In addition, this program has allowed interaction between the U.S. and foreign firms engaged in similar efforts as it is part of an International Energy Agency (IEA) cooperative program on hydrogen production.

In connection with this activity, a major program is now getting underway to produce hydrogen from underutilized hydroelectric sources of energy. This program involves New York State ERDA and two commercial suppliers of hydrogen, i.e., Air Products and Chemetron.

4. Fuel Cell

The fuel cell is now recognized for its potential as a utility electric generator. Major development programs are underway at United Technology

Corporation (UTC), Energy Research Corporation, and Westinghouse. BNL is presently doing research in support of various fuel cell concepts under development, e.g., phosphoric acid and high temperature solid oxide systems. The work emphasizes frontier efforts to identify and examine improved catalytic materials, especially for the oxygen electrode.

Aside from stationary applications, the fuel cell is recognized in the electric vehicle act for its potential as an automotive propulsion device, e.g., Public Law 94-413; however, unlike battery systems, no major efforts are in progress. In recognition of the need to consider this option as an alternative or companion electric transport system, a small automotive fuel cell program is now in place at BNL. A goal of the program is to demonstrate to industry the potential of the fuel cell as a very efficient energy conversion device for transportation systems, i.e., with a factor of 2-3 improvement in fuel use over the best internal combustion engines.

5. Workshop on Innovation in Industry (1978)

This workshop was designed to provide insight into research programs that might lead to major reduction in usage of energy and industrial raw materials in the development of 21st century technology. The working panels covered agricultural technology; forest products; pulp and paper; iron and steel processing; glass, cement and ceramics; chemicals and polymers, textiles; information processing and machine intelligence; technology education and engineering practices; manufacturing; raw materials, exploration and extraction; construction; and non-ferrous metals processing. The participants were composed of responsible industrial research executives, key university researchers and staff members from the Department of Energy and Brookhaven National Laboratory. Results of the workshop deliberations will issue, in the form of a recommended research agenda within which long-term research

initiatives and appropriate institutional structures for cooperation among industry, universities, and government, can be identified.

6. Solar Technology Transfer Program

In early 1977 the DOE Office of Conservation and Solar Applications provided funding to BNL for the Northeast Solar Technology Transfer Program. Its purpose was to accelerate the utilization of solar energy in the 11 northeastern states by disseminating technical and economic findings of DOE-sponsored solar R&D. It was staffed with four professionals, one or two professional consultants, and a secretary.

A review of the solar technologies approaching market readiness resulted in the selection of two as offering opportunities for accelerated utilization: domestic water heating and passive solar buildings design. Both were aimed at the building industry, requiring architectural and heating systems engineering experience. The program plan called for the recruitment of architects and heating engineers for term appointments of one to two years, rotating them through the program and returning them to practice in the private sector to continue the work with the program.

Two main accomplishments of the program were the analysis of field performance problems of solar water heating systems for the solar industry, and the presentation of passive solar design seminars to architects and builders.

In 1977 the marketing of solar water heaters was being retarded by the poor results shown by one hundred residential systems installed and monitored by the New England Electric System and by the resulting acrimonious debate between that utility, the Solar Energy Industries Association, and solar advocacy groups. As a competent, neutral party, BNL was given access to the data and prepared, through consulting contracts, a detailed review of the problems, enabling the solar industry to correct its procedures, thus providing

substantially more efficient and reliable systems. It is noteworthy that that is one of the very few energy programs by the national laboratories referenced by Stobaugh and Yergin (Energy Future, Report of the Energy Project at the Harvard Business School).

The second phase of the Solar Technology Transfer Program was the presentation of seminars on passive solar building design to architects and builders. Some 400 persons attended the seminars which were run in collaboration with local chapters of the American Institute of Architects in five northeastern states. The program was continued by the Northeast Solar Energy Center.

7. Energy Conserving Architectural Design

BNL conducts a program for DOE and R&D directed toward design of residential buildings with very low heating requirements. The ultimate goal is to provide knowledge to innovative architects and builders to assist and encourage them in designing and building more energy-efficient houses.

A major project in this program was a design study of a house making optimal use of thermal storage capacity in the structure of the house to reduce heating needs. The study was awarded, on a competitive basis, to Total Environmental Action, Inc. The study concluded with design of a passive solar house, with a Trombe wall, which is thermally efficient, architecturally pleasing, and which can be built at little or no cost premium by builders in the Northeast. A report describing the house is now being disseminated widely and a film of the project is being prepared. The first model of the house is being built by a local builder on the BNL site for monitoring of performance and demonstration to architects and builders.

A second activity in this project is the preparation by BNL of case studies of innovative energy-efficient houses. BNL studies the design, installs

instruments to monitor the performance, and issues report to publize the design and assist the architect or builder in gaining acceptance of his work.

A third activity is to provide no-cost consultation to qualified builders. This was done with a Long Island builder in his planning of what is probably the first passive solar townhouse project in this country. The project was completely redesigned based on BNL suggestions. Sales of the houses, called Sunscape, are now being made.

8. Energy Conserving Control Systems in Buildings

For the past three years, BNL has managed the DOE program for improved control systems for conserving energy in buildings. The program is planned by BNL and implemented through subcontracts with industrial firms. A major thrust of the program is to encourage and assist small companies in developing and marketing effective new control systems.

A key project in this program was a study, performed by Honeywell, Inc. on Automated Energy Management Systems for Small Buildings (contract awarded on a competitive/RFP basis). A comprehensive final report, completed in FY 1979, was distributed widely to companies (many of which are small high-technology companies) with an interest in development or manufacture of energy-conserving building controls. Several of these companies have written to BNL stating that they found the study to be of great value in their planning. The report identifies the size of the market for such controls and possible design features, including use of microprocessors.

A more recent project is a major study of zone controls for retrofit in single-family homes. The contract was awarded, on a competitive basis, to Technology and Economics, Inc. in October 1979. Technology and Economics, Inc. is a small, high technology consulting organization in Cambridge, Massachusetts.