STATEMENT BY RADFORD G. KING, DIRECTOR
WESTERN RESEARCH APPLICATIONS CENTER, UNIVERSITY OF SOUTHERN CALIF.
BEFORE
THE SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT AND THE
SUBCOMMITTEE ON SCIENCE, RESEARCH AND TECHNOLOGY
ON THE SUBJECT OF SMALL, HIGH TECHNOLOGY FIRMS AND INNOVATION

June 10, 1980

Mr. Chairman, Committee Members,

I wish to thank you for the opportunity to appear here today and to have participated in the in-field hearing on this important issue concerning small, high technology firms, and their impact on innovation and productivity.

I am currently the Director of Technology and Business Assistance Programs at the University of Southern California. There programs are comprised of various Centers involved in technology transfer, technical information services, business assistance, and economic development activities. The major Centers are: the NASA Industrial Applications Center, supported by the Technology Transfer Division of NASA, the Urban University Center and the Western Trade Adjustment Assistance Center, supported by the Economic Development Administration, U.S. Department of Commerce. Additional programs are supported by the Small Business Administration and various City, County and State groups.

The programs cover a 10 state area and provide direct services to over 1,000 businesses per year. Most of the businesses would be classified as "Small Business" and are in the manufacturing sector. I strongly support the conclusions and recommendations contained in

the report issued by the Investigations and Oversight Subcommittee. Although I am concerned about Patent Policy, Tax Policies, and Government Regulations, I will restrict my remarks to the areas of Technical, Management, and Financial Assistance.

Technical Assistance

During the past three-years the NASA Industrial Applications Center at USC has been conducting a cost-benefit analysis of technical information services provided to its industrial clients during the years 1976 through 1979. The analysis was based on a telephone interview and reporting technique developed by the Denver Research Institute.

A comparison of the results of the survey from two separate periods 1976-1977, 1978-1979 have indicated some interesting trends. In both surveys the sample size was approximately 150 firms. Information was gathered on: the numbers of firms that received a quantifiable benefit from services provided by the Industrial Applications Center; the distribution of those benefits by new product, old product, and time saved categories; and the estimated dollar value of the benefit in the above mentioned categories. 90% of the firms reported a benefit from the 1978-79 period. This reflects a substantial increase from the 55% benefits from the 1976-77 period. The distribution by categories was:

	1976-77	1978-79
New Products	15%	55%
Old Products	10%	12%
Time Saved	30%	23%
TOTAL	55%	90%

The dollar benefits also increased radically, from an average of $3700 per client served in the 1976-77 period to $64,000 per client served in the 1978-79 period.

The R&D type of firms had an even higher return, with 94% reporting a benefit.

It is our opinion that these increases have been brought about by the following major factors:

1. increased number of computerized data basis available;
2. the development of the Technical Co-ordinator network for retrieving non-published information; and
3. the increased competency of the staff.

I would encourage the increased availability of these types of technical information services to small R&D firms. This can only be accomplished through increased financial support for the delivery systems, such as the NASA Industrial Applications Centers and the NASA Technology Transfer Division.

Management

The failure of many small technology based companies is brought about by inadequate management abilities. Unfortunately, the blame is usually directed elsewhere, such as the unavailability of capital, unfair procurement practices, or too much government regulation. Although the above are contributors to the failure rate of major reduction of the number of failures and a corresponding increase in the number of "success" stories can be achieved through the provision of management assistance.

Programs such as EDA's University Centers, and Trade Adjustment Assistance Centers should be looked to as models of effective management assistance services. These services should be available to the small firms on an as needed basis. This can only be accomplished through increased support to those programs currently in existance.

Financial

A major gap exists in our current financial assistance programs to support increased productivity and innovation. Programs are needed to finance start-up companies based on new products and technologies. Major emphasis should be placed on the financing of product development costs. This is the transition between research and the commercialization of new technologies that is currently under-financed.

The recommendation to allow Small Business Investment Corporations (SBIC's) to make venture investments with the Small Business Administration guaranteeing 80% of any loan portion of the financial package should be implemented. In addition, it must be recognized that the commercialization of innovations has a high degree of risk associated with it, and requirements for personal guarantees should be relaxed or eliminated.

Conclusion

The management and technical assistance programs currently in existance at agencies such as NASA, EDA, Commerce, and SBA appear to be low on the priority list when it concerns budget allocations. This frequently occurs since it is difficult to quantify the results or return from such programs. However, the benefits from increased innovation and productivity are both economic and social in nature. The contributions of increased employment, increased tax return, and decreased costs of unemployment and welfare programs are instrumental to the growth of the general welfare of our Nation.

A greater emphasis must be placed on the allocation of increased budget and effort directed toward the maintenance and growth of our small business sector.

Thank you again for this opportunity of being here today.

Mr. BROWN. Thank you very much.

We will proceed with Mr. Levin, who will be the next speaker.

STATEMENT OF DR. GILBERT V. LEVIN, PRESIDENT AND CHAIRMAN OF THE BOARD, BIOSPHERICS, INC.

Dr. LEVIN. I am Gilbert V. Levin, president and founder of Biospherics, Inc., a small, high technology firm which has invented and successfully marketed several new products over its 13-year history.

Over the last 2 years, I have been studying the plight of small innovative businesses and the decline of "Yankee ingenuity" in our country. I was a member of the Small Business Administration's advocacy task force and helped draft its legislative proposal, "The Small Business Innovation Act of 1979."

I am also cochairman of region 3 of the Committee for Small Business Innovation, and have testified before the Congress several times on the subjects of small business, technology, and innovation.

My initial motivating concern in these extracurricular activities was that small, high technology companies suffered from unfair procurement, taxation, and patent policies, and from inadequate access to investment capital.

However, as I have assimilated the facts and viewed them in the context of the national scene, my concern has shifted from worrying about innovative small business to worrying about the general decline in our Nation's condition.

My appeals and testimony, therefore, are not directed at the interests of small, innovative, high technology companies, but to the broader, overriding interest of the Nation as a whole. The latter is surprisingly dependent on the former.

I have been asked to address the management and technical assistance program, and I will address my verbal remarks to that area, but I believe there are other aspects of the report which are more important to helping the innovative process. Accordingly, I have supplied written testimony on these matters, and I would like to request they be made part of the record.

Mr. BROWN. Without objection, they will be made part of the record.

Dr. LEVIN. The key point is that the rebirth of innovation is necessary to solve our country's major problems. I do urge that you view these hearings and the proposed legislation as a means toward obtaining essential help for the country not as a means toward aiding small, innovative, high technology business.

Now, with respect to the general comments on the management, technical, and financial assistance section of the report, I believe this section and its recommendations are directed more at instilling high technology capability into small firms than to giving innovative firms an opportunity. I do not see the former as a paramount need.

I think there are a lot of innovative people, competent in high technology, around today. What they need is adequate opportunity and adequate incentive.

With reference to the specific recommendation for the "hands on" approach, again, I think that this is directed more toward manufac-

turers than innovators; that is, as far as the innovator is concerned, I do not know that the "hands on" approach is going to be of much value to him.

With respect to the recommendation concerning the loan of management and technical assistance to a small firm for preparation of a RFP response, this may give an exaggerated view to the agency of the firm's capabilities. If the assistance is not available throughout the performance of the contract, the contract may produce a failure which would be adverse for the entire small business high technology field.

Now, recommendation No. 4 advocates an advisory monitorship function to provide management and technical assistance to small firms. Here, again, I think that this would impose additional regulations because, every time you get assistance from the Federal Government, you are told how to use it and you must write reports on what you did with it. I think that Federal report requirements constitute a major impediment to innovative, high technology companies at the present time. As reported at an earlier hearing, our small company prepared 130 reports in response to Government regulatory requirements last year. Now, if this management capability is lacking in a small firm that is otherwise technically competent, why not provide a special overhead item in the contract to pay for the needed management, that is, without the Government supervision that would accompany the recommendation as initially drafted?

I think a center for financial assistance is desirable, and I think the outstanding case was the National Science Foundation's innovative research program for small businesses. I think this should be expanded. I know many people have advocated all Federal agencies adopt such programs. I am particularly concerned to see unwise budget considerations eliminating the expansion of that program that was planned for the coming year.

With regard to the recommendation of the SBIC insurance, I really view the SBIC's as another type of business, and I am not adequately informed as to their needs to make a meaningful comment. Certainly recommendation No. 7, to encourage banks to lend money for debt or equity, would be most helpful.

Capital is always in short supply to a small, innovative firm that is trying to introduce a new idea. Any way that private capital can be rolled into that to leverage the bank's lending capabilities sounds fine to me.

I agree that SEC registration should be simplified. The cost for attorneys and accountants is out of hand, and it takes the management of a small company the better part of several months to half a year of almost full-time attention to prepare a registration statement, even though they are paying for the attorneys and the accountants.

I just looked at two red herrings that came out a couple of weeks ago. I was shocked to find that the underwriters', accountants', and attorneys' fees ran up to 14 percent of the amount of money to be raised by the issue.

I appeal to you to view these hearings from that standpoint. We must increase our productivity to combat inflation and the only way

that we can do that is through innovation. Our ability to do this has been amply demonstrated by the electronics industry. If we do not broadly increase productivity, I think we are in for very serious times.

That is why I ask you to view this not as a partisan hearing, but as a hearing for the Nation.

Thank you very much.

[The prepared statement of Dr. Levin follows:]

JOINT CONGRESSIONAL HEARINGS

HOUSE SUBCOMMITTEES

INVESTIGATIONS AND OVERSIGHT

SCIENCE, RESEARCH AND TECHNOLOGY

COMMITTEE ON SCIENCE AND TECHNOLOGY

ROOM 2318

RAYBURN HOUSE OFFICE BUILDING

1:00 p.m., June 10, 1980

Testimony of Gilbert V. Levin, President

Biospherics Incorporated, Rockville, MD 20852

I am Gilbert V. Levin, President and founder of Biospherics Incorporated, a small, high technology firm which has invented and successfully marketed several new products over its 13 year history. Over the past two years, I have been active in studying the plight of small innovative businesses and the decline of "Yankee Ingenuity" in our country. I was a member of the Small Business Administration's Advocacy Task Force and helped draft its legislative proposal, "The Small Business Innovation Act of 1979." I am also co-chairman of Region III of the Committee for Small Business Innovation, and have testified before the Congress several times on the subjects of small business, technology and innovation.

My initial motivating concern in these "extracurricula" activities was that small, high technology companies suffered from unfair procurement, taxation and patent policies, and from inadequate access to investment capital. However, as I have

assimilated the facts and viewed them in the context of the National scene, my concern has shifted from worrying about innovative small business to worrying about the general decline in our Nation's condition. My appeals and testimony, therefore, are not directed at the interests of small, innovative, high technology companies, but to the broader, overriding interest of the Nation as a whole. The latter is surprisingly dependent on the former.

Technological innovation has always been inextricably entwined with our national progress. Indeed, the first mass-produced item in this country was the revolutionary musket. Thus, "the shot heard round the world" announced the dual births of our Nation and our modern technology. The growth of the country and its assumption of world leadership were directly tied to our astounding technological progress. Americans became the richest, best fed, best clothed, best housed and, for quite some time, best liked people in the world as a result of our technological cornucopia. American products were the standards of the world, and the world's nations, believing we could achieve any goal, looked to us for leadership and example. Our position at home and abroad has deteriorated drastically making many of us fear that the second item mass produced in this country, the clock, is running down.

Our recession and rising unemployment, our declining productivity, our loss of our formerly world-wide acknowledgement as technology leader, our energy crisis, our adverse balance of foreign payments, declining respect for our Nation abroad, inflation, our falling standard of living, our self-doubt

about our future are all related and, in large measure, stem from our decline in innovation.

The surest way to reverse the downward trend is to develop innovative means to increase our productivity. Increased productivity is the direct route to defeat inflation. (The electronics industry has amply demonstrated this.) With productivity rising and inflation declining, all the other woes mentioned above will fall in line. Thus, innovation holds the key.

As amply demonstrated and widely acknowledged, innovation thrives best in the peculiar environment of the small business. Most of our important inventions are made there.

We often hear,"You can't keep an inventor down." But this is not so. Innovation is a beautifully flowering plant, but it is frail and can only make its way through a thin layer of overburden. The golden era of American innovation made itself seem the normal state. We forget the many centuries and areas of the world unblessed by the flowering of innovation. And we miss the message the archeologist uncovers with his ruins: when technology disappears or fails, society will do likewise.

Like other precious commodities, innovation obeys the law of supply and demand. Our problem is that the United States has reduced the offering price to the point where the supply is failing. The life of the innovator and the small, high technology company has been made so difficult and the rewards so limited that much of our taken-for-granted native ingenuity is either discouraged or diverted to ferreting its way through government taxation and controls. The climate for innovation is wrong.

Our Nation needs to restore its innovation and technological leadership to resume its upward motion. Innovative small business can play a major role in accomplishing this. This hearing should not be viewed as an evaluation of measures to aid the "vested interest" of innovative small business. Instead, I hope you gentlemen view it as a means to bring desperately, immediately needed aid to our country.

I have examined the conclusions and recommendations section of the report issued by the Investigations and Oversight Subcommittee concerning the management, technical and financial assistance that can be given to small, high technology firms to promote and encourage innovation. Adoption of the general and specific recommendations would be an excellent step in restoring a beneficial climate for innovation in small, high technology companies.

The funding recommendation for a one percent per year increase in federal agency set-asides, up to 10 percent of total R&D expenditures, is not only good for small business, but is an excellent economic measure for the federal government to take. The productivity, innovation and cost-effectiveness records of small high technology companies strongly indicate that the federal agencies will benefit. The present state of funding-only three percent of government R&D expenditures going to small firms-is incongruous with the fact that more than 50 percent of our major innovations come from small firms. While multiple contract administration may be more demanding of the federal administrators, the improved economic and technological results will off-set this many fold.

I heartedly endorse the National Science Foundation's Small Business Innovation Research Program and regret to learn that its proposed expansion for the coming fiscal year has fallen victim to a misconceived "economy" drive. From personal experience, I know that this program is highly effective in getting innovators, at their own expense, to sit down and think through new ideas to propose. The small amounts of "seed" money and the requirement for private sector support for additional funding are excellent devices to keep the cost to the government low, in effect, applying the private sector concept of "leverage" to innovation.

The elimination of the contract "stretch-out" by allowing for continuity of effort and payment is a very important factor for small businesses, especially those which are in the start-up phase.

I believe the recommendation for government agency receptivity of unsolicited proposals is most important. Innovation does not flow in well-defined channels thought up by government bureaucrats. Fresh ideas outside the research areas specifically targeted by an agency may prove to be of great importance. Such new ideas should not be discouraged, but should be welcomed and examined for merit with funding available when warranted.

Task type agreements are useful and help small companies plan. However, a failing in these agreements has been that the minima set are frequently only ten percent of the nominal program setforth in the proposal request. Thus, the small firm must maintain capabilities for performance at 100 percent

of the indicated amount, but is only assured of 10 percent. Our own experience with these contracts has been that they generally adhere to the minima. I would suggest that the range of dollar performance be restricted to, say, two-fold instead of the current prevailing range of ten-fold.

In the area of patent policy, I agree most wholeheartedly with the recommendation that the courts be more expert in technology and patent related matters. Frequently, that lack of expertise, and an apparent prevailing philosophy against the innovator, result in what amounts to permission of infringement. The patent policy was conceived to protect the innovator and is, in my view, an essential component of the government's system to encourage innovative small businesses. Without such protection the innovator will restrict or eliminate his efforts. He knows that he will not be able to hold onto his product, his market or position if that product succeeds and large companies infringe.

The government's undue concern for patent ownership is unreasonable and counterproductive to both innovation and tax revenues.

Federal laboratory competition with small business occurs in a variety of forms. An agency-wide policy should be established under which this competition is controlled by a specific set of standards and code of ethics.

Under the tax policy recommendations, I believe that the "roll-over" treatment for reinvested profits from the small, high technology firms would aid greatly in their growth. I also believe that the provision for a tax-exempt reserve for

R&D would be extremely helpful to the initiation of new projects in-house. Government agencies should allow an overhead expense for a certain level of in-house R&D for small companies as they do for large firms.

I would like to conclude with my own recommendations for parity for private scientists and engineers. By that, I mean that the government agency should treat the private technological sector with the same credibility and respect that it extends to government, university, and nonprofit R&D and high technology organizations. We have just concluded a decade in which the words "entrepreneur" and "for profit" have had strong adverse impact on contract opportunities and proposal reviews by government agencies. If the suspicions of the government agencies which led to this atmosphere were correct, the outstanding record of achievement of small high technology firms could never have been created. I hope the decade of the 80's will correct these inequities and do so in time for the Nation to benefit from the direly needed benefits which would flow.

Thank you very much for this opportunity to express my thoughts.

Mr. LLOYD. Thank you very much.
Dr. LEVIN. Thank you.
Mr. LLOYD. Again, we appreciate you coming here.
Now, Dr. Pricer may proceed.

STATEMENT OF DR. ROBERT W. PRICER, DIRECTOR, SMALL BUSINESS DEVELOPMENT CENTER, UNIVERSITY OF WISCONSIN

Dr. PRICER. Mr. Chairman, members of the committee, it is a pleasure to be here to testify in support of university assistance to small, high technology firms.

I would like you to refer to the last page of the red covered written statement that I have submitted.

Sometimes we fail to make a distinction between the process of invention and that of innovation. If you look at the left-hand side of the table, on the last page of my written statement, starting with the idea generation stage to the market introduction stage, you will notice the negative profit line due to the heavy investment in premarket new product development.

Today we have the capability for evaluating new ideas for their market feasibility through the small business development center program. We can also help with market testing. However, what we need to do is bridge the gap between new idea evaluation and the market testing stage. I feel that our Nation's universities, with their knowledge base and their human resource base, are in a position to provide that particular assistance.

It must be realized that there is tremendous cost associated with this process.

With me today is Robert Bachmann, associated director of the University of Wisconsin Small Business Development Center, and he will be available to answer specific questions members of the committee may have.

Mr. LLOYD. Welcome to the committee.

Mr. BACHMANN. Thank you.

Dr. PRICER. We agree totally with the recommendations that summarize the results of your hearings. We would like to see three specific actions take place as a result of these hearings.

No. 1, to insure NSF assistance to small, high technology firms, their appropriation bill should be amended to include the following language:

> The Industrial Program that is funded under the line item of Small Business Research and Industrial Innovation shall have a minimum of $5.2 million. (This request includes the base program of NSF plus $2 million authorized under the President's Industrial Initiative Domestic Review.)

This is important because NSF originally proposed $18.2 million under their engineering and applied science program. Through an internal reprograming, they reduced that amount by $9.2 million. Of the $9.2 million, $7 million came out of the small business program and $2 million came out of the innovation center program.

If you look at the language in the authorization bill, the intent of the Congress is clear and the $9.2 million reduction was restored. The appropriation bill, however, is much less clear. If the appropriation

bill were amended, we could all feel more comfortable that NSF would follow through on this very important program.

The second action that we would like to see is a bill drafted to provide for the mobilization and transfer of the tremendous knowledge and resource base of our Nation's universities to assist small, innovative firms. I think of one of our clients who developed a new company around a new product idea. This client was only able to raise $150,000 to establish the business.

One of the tests they needed for development of the product involved a highly specialized microscope. The cost of that one piece of equipment was $100,000. However, the university owns the equipment and staff has the knowledge and the ability to provide assistance, but there is no clear access point for the small business person.

In this particular case, the microscope is owned by the geology department. If a business person were to contact the physics department and request assistance, for example, they would find that there is a policy against accepting work from the outside. The only possible access to the equipment and assistance is through the engineering school. This illustrates that it is very difficult for an individual to know the appropriate point of contact they should use. The SBDC Center could be used as it's a one-stop shopping point for assistance for the small, innovative firms or inventors.

The third, and probably the most important recommendation or action that we would like to see is a bill that would stimulate new technology or technological innovation by small firms. This bill, very briefly, should include the following provisions:

One, there should be a small business set-aside on all Federal research and development contracts;

Second, there should be a process and provision for transferring Federal patents to small business;

Third, you must find a way to reduce the cost of litigating the patent disputes. (I think you know that the average patent litigation runs in excess of $250,000.);

Four, there must be a rollover provision on capital gains deferral on the sale of a small business if the proceeds are being invested in another small business. (When you look at high technology firms, often they are organized around a single product and after that product is developed the rights to the product are sold. Without a rollover provision, you discourage formation of new organizatins or new technology.);

Five, you need to extend the loss carried forward to 10 years (it is now 7 years), and allow small firms to write off research and development costs in 1 year and to write off R. & D. facilities in 10 years;

Six, this bill should authorize all Federal agencies to consider the size of firms when they are regulating.

In summary, 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 together with you for the development of a prgram that will stand the test of time in providing quality assistance to small businesses and inventors.

Mr. LLOYD. Thank you. Your complete statement will be included.

[The complete prepared statement of Dr. Pricer is as follows:]

Statement
of
Robert W. Pricer, Director
Robert W. Bachmann, Associate 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
June 10, 1980

Mr. Chairman, members of the Committee, it is a pleasure to be here to testify in support of university assistance to small high-technology firms.

Throughout our history, independent inventors and small firms have been the backbone of American technological innovation, productivity, and employment creation. Recent studies have shown the tremendous impact small business has had on innovation. In fact, small business accounted for almost one-half of the major U.S. innovations during the period 1953-1973, and technological innovation is at the heart of our free enterprise system. More innovation means more jobs. A recent MIT study showed that there was an increase of 12.6 million private sector jobs between 1969 and 1977; of this number two out of three, or a little over 8 million of these jobs, were created by small businesses employing 20 employees or less.

More innovation also means more productivity. It is common knowledge that among the industrialized nations of the world the U.S. ranks far down the list in productivity per man hour of work per unit produced. It is unlikely that we can expect greater production from the American work force. Rather, any increase in productivity will result from future investments in research and development of more modern methods and processes and new and innovative equipment.

However, during the past two decades, increasingly sophisticated technology and high investment cost 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%.

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 lack of understanding of the new-product-development process. To understand this distinction and this process, we must realize 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, most of the cost and complexity is associated with innovation. Productivity during the innovation stage requires a stimulating environment with adequate financial and technological resources (refer to Table I).

Although it is commonly recognized 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. Unfortunately, this program is being phased out and will not be available after July 1, 1980.) 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 mobilized the knowledge and resource base of the University system to meet small business needs. At this 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 these 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 received from the National Science Foundation or other funding sources. With appropriate funding, the resources of UW-Stout

and the Milwaukee and Madison engineering schools are used for prototype development and testing. The Small Business Development Center also assists 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 assists 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.

Based on the innovation process and to stimulate invention and innovation among small high-technology firms, the following addition to your "Congressional Hearing Conclusions and Recommendations" are suggested:

1. Authorize all federal agencies to consider the size of a firm when regulating.
2. Allow small firms to write off research and development costs in one year and to write off research and development facilities in ten years.
3. Directly fund university-based Small Business Development Centers to provide management and technical assistance to small high-technology firms and to coordinate and publish the availability of all sources of assistance.
4. Increase funding for the NSF Applied Technology Program.

5. Insure the stimulation of small high-technology firms by adding the following wording to the NSF Authorization Bill: "The Industrial Program that is funded under the line item of Small Business Research and Industrial Innovation shall have a minimum of $5.2 million. (This request includes the base program of NSF plus $2 million authorized under the President's Industrial Initiative Domestic Review.)"

All other recommendations appear to be appropriate and are fully supported by us.

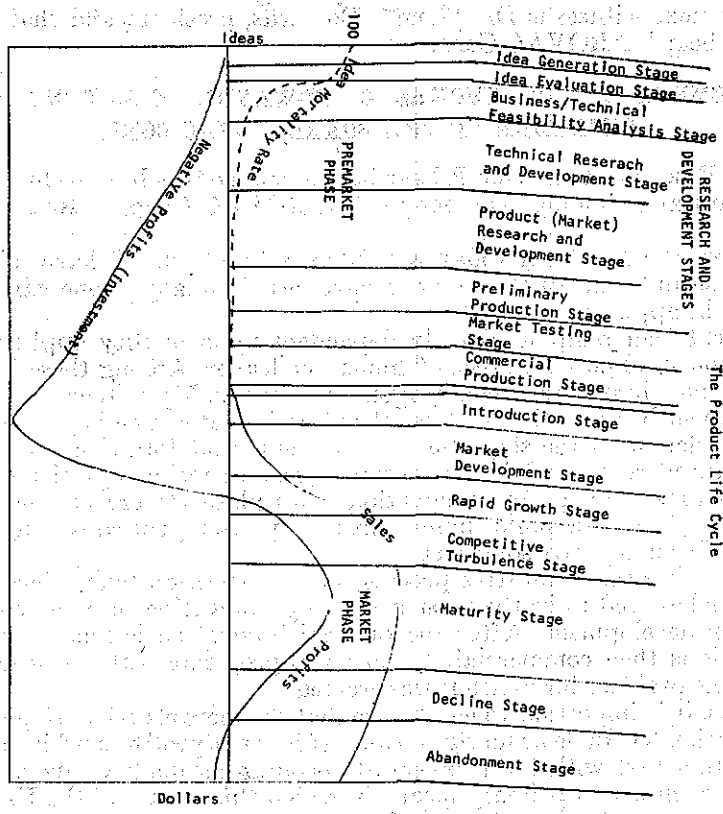
The University of Wisconsin Small Business Development Center has been organized to assist in the stimulation and development of new inventions and innovations. We look forward to working with the Congress in the development of a program that will stand the test of time in providing quality assistance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

Thank you.

Table I

THE INNOVATION PROCESS

The Product Life Cycle



Source: Innovation Center, University of Oregon, Eugene, Oregon 97403

Mr. LLOYD. I want to thank you for joining us today.

Our next witness is Dr. Thomas Edwards, president and chairman of the board of ROVAC Corp.

STATEMENT OF DR. THOMAS C. EDWARDS, PRESIDENT AND CHAIRMAN OF THE BOARD, ROVAC CORP.

Dr. EDWARDS. I am Tom Edwards, chairman of the high technology, mechanical technology company called ROVAC Corp. in Rockledge, Fla.

Much of what I say today will be an echo of what I have said in the past and some of the things I have heard already. Some will be a little like apple pie.

World leadership is directly dependent upon quality applied innovation in almost all areas of human endeavor. Among these is one of the most important: technological innovation. My statement is confined to such innovation with emphasis on how it can be improved.

In order to set the stage for the comments that follow, a brief and generalized review of the sequential aspects of technological innovation is presented. Before innovation takes place, generally a need is recognized. At this point, human creativity often generates a myriad of possible innovative solutions.

Following the innovative process, specific selection takes place and what is believed to be the most promising innovations are chosen for further development. After the optimal innovation is finally developed, it is then commercialized on an appropriate scale in order to solve the problem for which it was created.

Thus, it is important to emphasize that the mere creation of quality innovation has little or no significance if it is not proliferated in force.

Dealing first with the problem of encouraging quality innovation, there are now two primary means in which this occurs in the United States. One method is through Government-sponsored research and development programs. In this connection, it is recommended that a formal prioritized national need listing be created through the auspices of a suitable Government agency and disseminated throughout the technical community.

The creation of such a listing would be the springboard for formal and intensive Government participation increasing and enhancing national priority innovation and the proliferation of such innovation. Special status could then be bestowed upon key participants in such programs. Concise problem statements would be an extremely important facet in creating required innovations. The result would be a selection of possible solutions to these stated problems.

At this early stage, innovations are, generally speaking, merely conceptual in nature and require adequate funding for study and further definition and consideration in order to increase the probability of the innovation effectively and efficiently providing the required solution. In order to do this, not only should funding be adequate, but it should be continuous and predictable—often a nonexistent characterization of many Government-funded technology development programs.

Because small high technology companies have a remarkable record for innovation, it is recommended that a significant portion of Govern-

ment R. & D. moneys be allocated to small, high technology organizations, on a parity basis with the established record of innovation. Prompt payment policies are essential.

The second means of innovation generation involves private industry, directly. Generally, the marketplace will force large corporations to innovate, at least to a degree, in order to maintain market share and growth goals.

However, such market pressures are rarely directed specifically to total national goals and needs. Therefore, one cannot look directly to large corporate entities for innovation that may be required on a national level.

Thus, much must be done to encourage the great engines of our economy to participate with small, highly innovative corporations. The most obvious, and perhaps most appropriate, means is to establish minority ownership in small companies through investments by large corporations. Such a union could provide a most important step in the proliferation of innovation.

The reason for this is clear. The small company tends to generate the bulk of innovations and, generally, does not have the means to commercialize or proliferate new innovative technologies.

On the other hand, the large corporation often has great development capabilities, as well as very large manufacturing, commercialization and marketing power. Therefore, something as simple as a direct tax credit for dollars invested in small corporations could not only spur further innovative creations, but, in addition, would set the stage for the commercialization of such innovations.

One of the most critical and challenging periods in the material realization of innovation is the gestation period required of such innovations. That is, the development period and screening process where ideas of unknown merit are evaluated is generally very intensive and highly ridden with risk.

Therefore, during this gestation period, sponsoring Government agencies are often the only means of financial support insofar as small companies are concerned. However, other means, such as private capital investment, has traditionally been a major factor in the early development periods of technology.

Therefore, all methods that would encourage such investment should be used for companies that develop or are in the process of developing technology that would have benefit to the Nation at large. This includes such items as reduced SEC regulations and reporting requirements and special tax incentives. Again, such incentives should apply only to prioritized and well-defined and considered problem areas insofar as the Nation is concerned.

Even after a satisfactory period of gestational development has transpired, it is often very difficult for a small company to market its idea or development to large corporations or to commercialize the innovation by itself. Often this marketing difficulty is closely related to the fact that many innovations are, by definition, competitive with established products.

Again, ownership in new technology by large corporations may be a strong incentive to integrate new innovations into product lines. This, of course, would greatly decrease the marketing problems associated

with small and generally poorly financed high technology corporations.

Government-funded programs that would aid in the management, packaging, and selling of new technological ideas could have a very powerful and profound impact upon the realization of truly deserving and nationally beneficial new technology. The power and stature of the Government could be used to influence those in positions of corporate power to bring an innovation to the level of a mass produced product.

In summary, the following generalized actions are recommended:

Establishment of a small and versatile national priority technology sponsoring agency whose prime mandate is to define clearly present and future national technological needs;

Insure that these prioritized needs are disseminated to the proper technical organizations;

Evaluate and fund the most promising innovative candidates;

Screen the results of initial innovative activity and fund further developments until the optimized solution is recognized; then fund the full development of the solution; and

Participate in focusing the attention of large corporate organizations on the developed technology and encouraging its commercialization or proliferation.

In general, liberal patent ownership policies, minimal regulation and reporting requirements, and a positive and powerful attitude of support must pervade a national priority technology sponsorship activity.

Thank you, Mr. Chairman. That is my formal statement.

I would like to add a few items that I have noted. Certainly some of them come from being not well informed, but a few of them I think are worth mentioning.

Mr. LLOYD. Proceed.

Dr. EDWARDS. One of the very important points that I think should be considered by the Government is what happens to the post-retirement period of Government workers who are specifically directed toward technology development programs, such as buyers and technical administrators and so forth.

I think it is not uncommon for such individuals upon retirement from the Government to find places in large corporations. There they have a more secure position than they might in a small corporation.

It is my belief that there may be a very human and natural bias as far as supporting the technology is concerned. I have noted a very frustrating "pass the buck" attitude as I went from agency to agency seeking support. I would just as soon have them say no, we are not interested rather than being sent somewhere else.

I have often found that our company will hang on to delayed, if not sometimes false, hopes which keeps people on our payroll. Then it becomes a catch-22. If you do not have the people onboard, you cannot get the contract; if you keep them onboard without having to pay them, you are going out of business. It makes it rough.

I believe that large companies, by definition, can pretty well take care of themselves, and small companies do need help to help themselves and the Nation. If such an agency or subagency or one with a

slightly different mandate were created, I certainly agree there would be shortfalls. On the whole, I believe it may be an improvement because it would focus the efforts that we have, I think, as a nation, which is to grow and not falter or at least not continue to falter.

Now, just as a closing point, the ROVAC Corp. is involved in energy conservation devices and pollution devices. I am very sure that this technology will probably be commercialized by foreign governments and their corporations, and this makes me a little sad.

Thank you.

Mr. LLOYD. Thank you very much.

Your complete statement will be included in the record.

[The complete prepared statement of Dr. Edwards is as follows:]

STATEMENT OF THOMAS C. EDWARDS, CHAIRMAN THE ROVAC CORPORATION

World leadership is directly dependent upon quality applied innovation in almost all areas of human endeavor. Among these is one of the most important: Technological innovation. My statement is confined to such innovation with emphasis on how it can be improved.

In order to set the stage for the comments that follow, a brief and generalized review of the sequential aspects of technological innovation is presented. Before innovation takes place, generally a need is recognized. At this point, human creativity often generates a myriad of possible innovative solutions. Following the innovative process, specific selection takes place and what is believed to be the most promising innovations are chosen for further development. After the optimal innovation is finally developed, it is then commercialized on an appropriate scale in order to solve the problem for which it was created. Thus, it is important to emphasize that the mere creation of quality innovation has little or no significance if it is not proliferated in force.

Dealing first with the problem of encouraging quality innovation, there are now two primary means in which this occurs in the United States. One method is through government-sponsored research and development programs. In this connection, it is recommended that a formal prioritized "National Need Listing" be created through the auspices of a suitable government agency and disseminated throughout the technical community. The creation of such a listing would be the springboard for formal and intensive government participation in creating and enhancing National priority innovation and the proliferation of such innovation. Special status could then be bestowed upon key participants in such programs. Concise problem statements would be an extremely important facet in creating required innovations. The result would be a selection of possible solutions to these stated problems.

At this early stage, innovations are, generally speaking, merely conceptual in nature and require adequate funding for study and further definition and consideration in order to increase the probability of the innovation effectively and efficiently providing the required solution. In order to do this, not only should funding be adequate, but it should be continuous and predictable - Often a non-existant characterization of many government-funded technology development programs.

Because small high technology companies have a remarkable record for innovation, it is recommended that a significant portion of Government R & D monies be allocated to small high technology organizations - on a parity basis with the established record of innovation. Prompt payment policies are essential.

The second means of innovation generation involves private industry, directly. Generally, the marketplace will force large corporations to innovate, at least to a degree, in order to maintain market share and growth goals. However, such market pressures are rarely directed specifically to total National goals and needs. Therefore, one cannot look directly to large corporate entities for innovation that may be required on a National level. Thus, much must be done to encourage the great engines of our economy to participate with small highly innovative corporations. The most obvious, and perhaps most appropriate means, is to establish minority ownership in small companies through investments by large corporations. Such a union could provide a most important step in the proliferation of innovation. The reason for this is clear: The small company tends to generate the bulk of innovations, and generally, does not have the means to commercialize or proliferate new innovative technologies. On the other hand, the large corporation often has great development capabilities as well as very large manufacturing,

commercialization and marketing power. Therefore, something as simple as a direct tax credit for dollars invested in small corporations could not only spur further innovative creations but, in addition, would set the stage for the commercialization of such innovations.

One of the most critical and challenging periods in the material realization of innovation is the "gestation" period required of such innovations. That is, the development period and screening process where ideas of unknown merit are evaluated, is generally very intensive and highly ridden with risk. Therefore, during this gestation period, sponsoring government agencies are often the only means of financial support in so far as small companies are concerned. However, other means such as private capital investment has traditionally been a major factor in the early development periods of technology. Therefore, all methods that would encourage such investment should be used for companies that develop or are in the process of developing technology that would have benefit to the Nation at large. This includes such items as reduced SEC regulations and reporting requirements and special tax incentives. Again, such incentives should apply only to prioritized and well defined and considered problem areas insofar as the Nation is concerned.

Even after a satisfactory period of gestational development has transpired, it is often very difficult for a small comapny to market its idea or development to large corporations or to commericalize the innovation by itself. Often this marketing difficulty is closely related to the fact that many innovations are, by definition, competitive with established products. Again, ownership in new technology by large corporations may be a strong incentive to integrate new innovations into product lines. This, of course, would greatly decrease the marketing problems associated with small and

generally poorly financed high technology corporations. Government-funded programs that would aid in the management, packaging, and selling of new technological ideas could have a very powerful and profound impact upon the realization of truly deserving and nationally beneficial new technology. The power and stature of the government could be used to influence those in positions of corporate power to bring an innovation to the level of a mass-produced product.

In summary, the following generalized actions are recommended:

- Establishment of a small and versatile National priority technology-sponsoring agency whose prime mandate is to define clearly present and future National technological needs and -
  - Insure that these prioritized needs are disseminated to the proper technical organizations
  - Evaluate and fund the most promising innovative candidates
  - Screen the results of initial innovative activity and fund further developments until the optimized solution is recognized - then fund the full development of the solution
  - Participate in focusing the attention of large corporate organizations on the developed technology and encouraging its commercialization or proliferation

In general, liberal patent ownership policies, minimal regulation and reporting requirements and a positive and powerful attitude of support must pervade a National priority technology sponsorship activity.

Mr. LLOYD. We did enjoy your testimony.
And now we will hear from Mr. Kelley.

STATEMENT OF PAUL M. KELLEY, MANAGER, VENTURE DEVELOPMENT, MASSACHUSETTS TECHNOLOGY DEVELOPMENT CORP., BOSTON, MASS.

Mr. KELLEY. I want to thank you, Mr. Chairman, and I want to thank Ray for his assistance in seeing that I got here.

My name is Paul Kelley. I am with the Massachusetts Technology Development Corp. (MTDC) in Boston. I hope that my written testimony can be included in the record, and I will summarize it.

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

Mr. KELLEY. The MTDC is one of the two development banks or public purpose venture capital corporations in Massachusetts. The other is the Community Development Finance Corp. There are only a handful of such organizations in the country.

These types of organizations are, in place, and operating with a good deal of effectiveness in just about every industralized country in the world. MTDC implements one of the recommendations that was made in your committee report.

State or regional development banks capitalized with both public and private funds should be encouraged wherever practical to provide additional debt and equity funding for startup and growth of small, high technology firms. Such banks could reduce their risk by leveraging their investments with other private capital.

The predecessor of MTDC provided management and technical assistance to innovative, small companies, leveraging private equity capital, mostly with SBA guaranteed loans. That initiative involved putting together technology for which there was user demand, or a market need, with an entrepreneur, and capital which is the mortar that puts the package together.

Over a 4-year period, we have put together 40 innovative, small businesses which, in the next 3 to 5 years, are expected, Mr. Chairman, to have revenues of between $20 million and $40 million. One of them was recently sold to Xerox for over $8 million.

The major difficulty that we have encountered in this experience is the problem of accessing risk capital. MTDC was created in 1978; 18 months before it was enacted into law in Massachusetts—the legislative proposal that is the basis of the organization was copied and implemented in Japan as the Venture Enterprise Center; within 18 or 20 months that organization had funded over 31 deals.

In March of 1979, we received a $2 million grant from EDA to invest in innovative small businesses. We wake investments on a co-venture basis with private investors, in Massachusetts companies which are small, technology-based firms with high growth prospects, but inadequate access to capital. The difficulty in accessing capital, often referred to as the capital gap, is that period, in an evolution of a business, where the capital requirement is beyond the resources of entrepreneur or the entrepreneurial team, and where the business does not yet meet the investment criteria of institutional sources of capital.

I want to point out that we do not invest in products; nor do we invest in technology. We invest on a collaborative basis with private capital in people who can make the relationship between a technology and a market need. Without a market there is no basis for a business.

To illustrate our role and how we participate directly in a situation, I would like to excerpt from a letter Mr. Wayne Griffith, president and chief executive officer of a company called Xylogics, Inc. The letter was sent to me while we were in the process of analyzing that situation, prior to committing the capital.

In 1980, this company expects to add an additional 50 people and to acquire an additional $150,000 in capital equipment. The company had made extensive effort over a 9-month period to attract venture capital. Their efforts had gone unrewarded. They had visited over 20 venture capital companies without coming up with any additional capital.

The president of the company could not understand the lack of positive response. Mr. Griffith pointed out that the company had a good organization with an expanding family of innovative products which incorporated a micromodule design for an intelligent controller—a device that fits between a central processing unit and peripheral equipment—good financial controls, and an effective sales organization with some ambitious plans.

We made a commitment of $250,000 to that business. Our commitment leveraged $750,000 from American Research and Development, which is the venture division of Textron, and another venture firm in New Jersey.

Our participation was in the form of "near equity—that is unsecured, subordinated, long-term debt at 10 percent interest with a 2-year moratorium on principal—our participation also leveraged an additional $800,000 from a bank of record of this company.

Understandably, we are in a very risky business; we expect failures of 20 to 50 percent. To compensate for our risk, we take an equity kicker or equity component which hopefully will enable us to maintain and expand our investment fund. In the Xylogics illustration, we have warrants to purchase approximately 3 percent of the stock of this company.

Relative to the level of leveraging in the Xylogics illustration, our $250,000 brought in $750,000 in additional equity capital and $800,000 in additional debt capital—a leverage of 6.2 times.

Because we have a different orientation, that is, public purpose, and a different perspective, the principals of Xylogics, Inc., gave up less equity than would have been the case if they had to deal exclusively with the private equity venture community. Owner equity is an important incentive for the entrepreneur.

A few comments about the management, technical, and assistance section in the report of the committee: I think that management and technical assistance, although admittedly important, are often given priority over the real problem in innovative, small businesses, namely, the issue of accessing risk capital.

Without access to the right mix of debt and equity capital, even the best management and technical assistance program will be marginally

effective. In the early stages of innovative, small businesses, they often, as I mentioned with the example I gave, have a major problem in securing the risk capital. Without the right mix of capital, innovative, small businesses are doomed to failure with or without management or technical assistance.

Until recently I think that financial assistance to these kinds of companies and financial assistance, in general, has been a stepchild. Most programs have encompassed only debt guarantees or debt capital and they are often tied to asset-based financing. These types of programs are inconsistent with the process of technological innovation, the cash flow generating capability, and the needs of early-stage and rapidly growing technology-based ventures.

I think it is unrealistic to assume that private capital can, by itself, stimulate the process. I think that it is improper for public capital to try to do this by itself, as well.

I do think however, that it is essential that we look into collaborative public and private efforts to stimulate new enterprise development. They can make a difference, and based on the MTOL experience and the experiences of other countries, they make a lot of sense.

In closing, Mr. Chairman, I would like to make two points. Over the years I think the task of commercializing new technology has changed dramatically. After World War II commercial ideas often found ready markets waiting for them. The idea of an entrepreneur often meant a new business. One could work days to provide for family support, and at night in a cellar or in a garage one could start a business.

At that time, ironically, Federal funds were often available to technical entrepreneurs or embryonic venturers that sometimes started as spinoffs from the Lincoln Lab at MIT and elsewhere. That process through which Federal funds were made available has become institutionalized and the task of raising early stage "seed" capital has become more difficult.

Capital is incestuous. As a banker friend told me, it flows to itself. I think Federal funding for technological innovation has, in some respects, also become incestuous and that it often flows to places where it has already been; namely, the large company or institution. Successful development of an innovation now, as many years ago, requires experience and ability, but now more than then, it requires substantial financial backing.

I think that we can look at the experience in other industrialized countries; we can stand by and watch as the Japanese, the Germans, and the French and others comercialize and market the technology in this country, which often is conceptualized here. We can do more studies or we can recognize that the sensitive variable is accessibility of capital, and implement some of the recommendations and the conclusions of your committee:

Specifically, (1) private initiatives to make capital more accessible, that is, tax policies, such as the rollover provision on capital gains and the change in ERISA to allow a certain amount of pension funds to be invested in innovative situations; (2) public-private initiatives, given the risks associated with technological innovation and its importance in creating jobs, and the role of small business as a source of in-

novation, development finance mechanisms and development banks should be funded to provide risk capital on a collaborative basis with private venture firms; (3) public initiatives, such as the 10-percent set-aside on Federal R. & D. for small businesses, and another program, the NSF small business innovative research program, NSF–SBIR. In Massachusetts we have worked with very closely with this program and found it to be effective. It is probable that one of our next investments will be one that received early funding support through the NSF–SBIR program.

I think the conclusions and recommendations of your committee, particularly those that I have noted above, make a great deal of sense and can make a difference. They were supported by the SBANE Committee on Innovation, as well as the White House Conference on Small Businesses, in which I participated, and I think it is critical that they be implemented.

Thank you.

Mr. LLOYD. Thank you very much.

Does that conclude your statement?

Mr. KELLEY. Yes, sir.

[The prepared statement of Mr. Kelley follows:]

PREPARED STATEMENT OF PAUL M. KELLEY, MASSACHUSETTS TECHNOLOGY DEVELOPMENT CORP. (MTDC), BOSTON, MASS.

MTDC is one of two Development Finance Mechanisms, Development Banks or Public Purpose Venture Capital Corporations in Massachusetts, the other being the Community Development Finance Corporation (CDFC).

Before talking about the Recommendations and Conclusions of the report issued by this Committee specifically the Management, Technical and Financial assistance programs for innovative small firms, Federal Labs etc., I would like to briefly tell you about MTDC, the concept which is the basis of the organization and the role that Federal Agencies have had in providing support for the initiative.

MTDC evolved out of the Mass. Technology Exchange (MTE) which was an activity of the Mass. Science & Technology Foundation. The Foundation was created under Chapter 843 of the General Laws of the Commonwealth. As the name connotes, the MTE was involved in Technology Transfer. It was my responsibility to run the organization. I think that because I had a business background, and had been involved in large and small businesses, rather than being technically oriented, it became apparent that technology transfer was not the process but an element in *a* process; the others being an entrepreneur, a market, and capital being the mortar that puts them together to form a new enterprise or to enable an on-going enterprise to generate additional revenues and employment.

MTE provided management and technical assistance to innovative small companies leveraging private equity capital mostly with SBA guaranteed loans. That initiative involved putting together technology for which there was a market and an entrepreneur as well as capital and helped launch over 40 companies in 4 years. The major difficulty in that initiative was the difficulty in accessing high-risk seed capital. To look into that problem area, the governor established the Task Force on Capital Formation. Among its objectives was the task of investigating the environment in Massachusetts for innovative small companies and the issue of the accessibility of risk capital. The Task Force concluded that Massachusetts did indeed have an environment to stimulate innovation i.e. technologically oriented universities, institutional and individual sources of venture capital, and entrepreneurs . . . and that there was a "capital gap" roughly defined as that point in the evolution of an innovative small business where the capital requirements were beyond the resources of the entrepreneur but did not meet the criteria for institutional sources of capital ($50,000–$250,000).

A legislative proposal was drafted to abolish the Foundation and create MTDC. MTDC had the additional capability to provide direct financial assistance to innovative small companies in Massachusetts. Nearly 18 months before the legislative proposal was passed by the Massachusetts General Court as Chapter 497 of the General Laws of the Commonwealth, it was copied and implemented in Japan as VEC . . . the Venture Enterprise Center. I think it is important to note that NSF, EDA and the state government provided funding support during this period. This support was critical in that new enterprise development is a complex process and the time frame over which the process occurs—i.e. over which the enterprise starts, grows, prospers and creates jobs—differs from the political term of some elected officials.

MTDC created in July, 1978, was signed into law in November of that year. In March of 1979, MTDC received a $2 million grant from EDA to invest in innovative small businesses. We make investments on a co-venture basis with private investors in Massachusetts companies which are small technology based firms with high growth prospects but inadequate access to capital. Since June of 1979, we have packaged 13 investments and participated directly in 5.

To illustrate our role and how we participate directly in a situation, I would like to excerpt from a letter which was sent to me by C. Wayne Griffith, President, CEO of Xylogics Inc. while we were in the process of analyzing and putting together a financial package that was the basis for committing MTDC funds to this company.

" * * * In 1980, we will be adding fifty new jobs and $150,000 in capital equipment. This expansion and growth has put a serious strain on the financial resources of the company.

"Extensive efforts have been made over the last nine months to attract venture capital investment to Xylogics. These efforts have gone unrewarded. We have made presentations to a long list of venture capitalists from Boston to San Francisco and come up empty handed thus far. Over 20 have visited with us, some several times, but still no affirmative response. We need money, and soon to continue our growth. We are rapidly approaching the limit of our bank loan and our requirements to continue our innovative product developments are significant.

"I honestly do not understand the lack of positive response from the venture community. We have a good organization, an expanding family of innovative products incorporating our own 'micro-module' design, good financial controls, and an effective sales organization with some ambitious plans. Most venture capitalists seem to feel that the Intelligent Controller business has substantial risks and seem more prone to invest in areas where they feel risk is less or they understand it better."

Our commitment of $250,000 triggered or leveraged a $750,000 equity investment by American Research & Development of Boston and Innoven Capital Corporation of Saddlebrook, New Jersey. On the basis of our commitment and the private investment, the bank increased its credit line by $800,000 secured by trade receivables.

MTDC participation was a $250,000 unsecured note subordinated to present and future bank debt. It was at ten percent interest with a seven year term. The note has a two year moratorium on principal and will be amortized in equal payments monthly over five years. Given the risk and the need of MTDC to benefit directly from its successful investments to maintain its capital pool (we anticipate a failure rate of 20 to 50 percent), has an equity component i.e. warrants to purchase 2.7 percent of the company's common stock. In this situation MTDC's $250,000 has levered $1,550,000 in private capital. . .a leverage factor of 6.2 times. Xylogics is located in an EDA designated area thus its growth will provide jobs where they are most needed.

A few comments on Management Technical and Financial Assistance: Management and Technical Assistance although admittedly important are, in my view, usually given priority over the "real problem of innovative small businesses, namely the issue of accessing capital". Without access to the right mix of equity and debt capital even the best management and technical assistance program will be marginally effective. In the early stages of their development innovative small businesses often experience severe difficulty in securing capital. Most financial and technical assistance programs fail to recognize that different enterprises at different stages of development require different types and amounts of

capital. Without the right mix of capital, an innovative small business is doomed to failure with—or without—management and technical assistance.

Until recently, financial assistance has been a stepchild. Most programs have encompassed only debt or debt guarantees and are often tied to asset based financing. These types of programs are inconsistent with the process of technological innovation and the cash flow generating capability and needs of early stage rapidly growing technology based ventures. I think that it is idealistic to assume that private capital can by itself stimulate the process; I think that it is improper for public capital by itself to do it as well. A collaborative public-private effort seems to make sense and I think can make a difference.

Relative to the Recommendations and Conclusions in the Federal Laboratory section, I suggest they be looked at carefully. Technology transfer is a "buzz word" that has been with us for over ten years. In Federal Labs, technology is infrequently developed to address a market need . . . more often a government need. Although there is some possibility of "spin-off" of a given technology into the private market, often the adaptive engineering to make the technology consistent with the needs in the marketplace is more costly than would be the case if one started from scratch. The premise that Federal Labs are a source of technological innovation is faulty in that numerous studies have concluded that over 50 percent of innovation comes from small business or individual technological entrepreneurs. Technology is not the key . . . people are . . . particularly technical entrepreneurs who can make the relationship between the technology and the market and who can gain access to capital.

In closing I would like to make two points. Over the years I think the task of commercializing new technology has changed dramatically. After WWII commercial ideas often found a ready market waiting for them. The idea of the entrepreneur meant a small business. By working days to provide for family support and at nights typically in a cellar or garage, one could start a business. At that time, Federal funds were often available to technical entrepreneurs or embryonic ventures that started as "spin-offs" from Lincoln Labs at MIT and elsewhere. That process has become institutionalized. Capital is incentuous in that it flows to itself. Federal funding for technological innovation has in some respects also become incentuous in that it often flows to places where it has already been, namely the same large company or institution.

Successful development of an innovation now as many years ago requires experience and ability, but now more than then, substantial financial backing. We can look at the experience in other industrialized countries, we can stand by and watch as the Japanese, Germans, French and others commercialize and market technology in this country that ironically is often conceptualized here. We can do more studies or we can recognize that the "sensitive variable" is accessibility of capital and implement some of the recommendations and conclusions in the committee report, specifically:

Private initiatives to make capital more accessible i.e. tax policies such as the roll-over provision on capital gains and changes in ERISA to allow a certain amount of pension funds to be invested in innovative companies.

Public-private initiatives—given the risks associated with technological innovation, its importance in creating jobs, and the role of small business as a source of innovation, development finance mechanisms should be funded to provide risk capital on a collaborative basis with private capital.

Public initiatives—10 percent set-asde on Federal R. & D. for small business, NSF–SBIR program.

The Conclusions and Recommendations of your committee particularly those which have been noted above were supported by the Smaller Business Association of New England, Committee on Innovation (of which I was a member), and the White House Conference on Small Business (at which I participated). I think that it is important that they be implemented. I feel they can make a difference.

Mr. LLOYD. Thank you very much.

What we will do, as has already been indicated, is for each of you to respond without waiting until you are asked a specific question. If you have something that you wish to say, please do so after the other panelist finishes and we will recognize you.

That meets with everybody's approval?

Mr. BROWN. Yes.

Mr. LLOYD. One of the things in all of this keeps coming through to me is that we have an amorphous mass out there that is referred to as "government" that seems to be the perpetrator of the crime, as it were. You all have alluded to this.

In other words, you came up with the statement that money flows to itself, and Government is probably one of the major providers of money for innovative activities, and everybody looks to the Government.

Now, what can we do—and I recognize our own recommendations, but what can we do to change the attitude, or do we have to change the attitude? It is not only the people vis-a-vis the Government, but just people that we are trying to encourage.

Is that a fair question?

Mr. KING. My comment would be the fact that I think we are seeing a change in attitude.

Mr. LLOYD. Would you move closer to the microphone so we can hear you?

Mr. KING. This is as it relates to the small business sector. There is an increased awareness of the need to maintain this sector. As such, we are seeing encouraging——

Mr. LLOYD. Would you please move the mike in front of you so we can hear you?

Mr. KING. We are seeing encouraging emphasis on doing some tasks, such as our patent revision and the NSF program, and also the various small business legislative changes. This has occurred within the last 2 years, and it is very encouraging.

This is a sign of the recognition that we have a vital need to maintain the small business sector.

My own feelings, to a large extent, are that the responsibility of Government is one of maintaining an environment in which the opportunity to go into business is there; at the same time, the responsibility should not be one of saying that you shall succeed or that we guarantee the success. That is not the nature——

Mr. LLOYD. Let me interrupt you, and as I say anyone who wants to say anything may do so.

In whose judgment do we say this, that enough is enough and it is time to get out and go home? When does that judgment come in, particularly as the Government is concerned?

Let me give you a problem that goes along with what we are talking about.

Mr. KING. Yes.

Mr. LLOYD. This is not picking on any specific publication, but the National Inquirer is a perfect example. As soon as we try to aid somebody, they really show how we have wasted the dollars. And as you have outlined or as Mr. Pricer did in his chart, the National Inquirer is on us when we are at the low ebb and we are spending money in the development of a new and innovative energy system or a change in the basic four-cycle engine so that we can get greater efficiency. The new device will inject water instead of fuel.

We have done things like this in the past. Immediately some bright young reporter discovers that they are pumping $0.5 million into this, and how many people have they done this with? My goodness gracious,

we have just squandered $3 million. They have it right down to the penny and they print this in the National Inquirer.

As far as my constituents are concerned, in passing through the supermarket they pick it up and see it in the headlines, such as the Government wastes millions of dollars in trying to burn water. And that is the way it comes out.

Now, how do we handle that? Is that even worthy of consideration?

Go ahead, Mr. Kelley.

Mr. KELLEY. I think, Mr. Chairman, that for the first time in 20 years there is recognition of the role of small business in developing new technology and creating jobs. This is due in part to the efforts by Milt Stewart in the Office of Advocacy in the Small Business Administration—to the White House Conferencee on Small Business—and the fact that technical intrepreneurs and people investing in innovative small businesses are beginning to recognize that they can agree to disagree on some things, and they can agree to agree on other things and work together on them.

I think at the heart of this whole matter there is a strategy that perhaps——

Mr. LLOYD. Let me interrupt you.

Who provides this? If I give the money to General Motors for the very same study as I would give it to Joe or whoever it is in Oshkosh, Wis. General Motors is an accepted institution and it is perfectly all right to do that, but if I give it to my good friend, Joe, then he is in his backyard doing his thing and I do indeed have reporters who would question the wisdom of spending that money. They would show how we are wasting money.

That sells more newspapers or magazines or whatever it may be. It is easy to ridicule any effort. We constantly see this. NSF has been plagued with this kind of a situation.

I think that it is a real problem for me as a legislator. I have an ongoing honest interest in what we are trying to accomplish. I would get my ears beat off, and I want your help.

Mr. KELLY. Based on some of the statistical data that has come out, 50 percent of the innovations occur in small business, with 3 percent of the money. It is the question of the willingness to take risks in return for a very significant potential payoff.

I think that the alternative to looking at this process and begin putting public capital and other resources into this process is to do the kinds of things that have been done for many years; i.e. to put public kinds of things that have been done for many years; that is to put public money into the fixed assets. There are plenty of new industrial parks that are out there that are empty or half empty. Another alternative is to subsidize the investment and the hiring decisions of large firms. I think the issue is * * * the public policy question is * * * where are you going to put your money? Commonsense dictates that you put it where there is a payoff. The payoff is in small business, particularly in innovative small businesses.

Mr. LLOYD. I understand that.

Go ahead, Dr. Pricer.

Dr. PRICER. This is tied to your first point. It has to do with attitudes within Government and governmental agencies.

A statement was made earlier that I disagreed with——

Mr. LLOYD. Could I get you to move the mike in front of you?

Dr. PRICER. The statement was that there should not be assistance with requests for proposals to the smaller firms. I disagree with that. I think this issue is tied to your question and the answer is that there is a lack of understanding of the innovative process. We do need a strategy and that is often missing. If you look at one program, the DOE applied technology program, you will see there are many municipalities and frivolous projects that have been funded.

This was a program originally designed to encourage the development of new energy conservation and technology. I suspect that the reason the projects were funded was that the organizations had staffs that had a lot of time to put proposals together. The proposals probably were attractive and most likely met the requirements of the agencies. However, the new ideas were not necessarily marketable and there may have been little or no understanding of the invention to innovation process on the part of agency staff.

I agree very much with Mr. Kelley. We have to realize that without a market or a marketable product, we end up with nothing.

Mr. LLOYD. Thank you.

Dr. EDWARDS. I understand, I believe at least to a degree, the dichotomy that the legislator must face because no matter what you do, you have problems. That was one of the reasons that I thought there could possibly be a buffer agency that would at least separate to some degree the national criticism that might come about through funds that are expended upon technological developments.

Mr. LLOYD. There is a gamble. We put money into a project or we aid a project that may or may not even make it. I do not know what the percentage would be on that. Maybe you know better than I. But the fact that it fails shows conclusively to some that we, as legislators, whether it is true or not, have once again failed or have refused to be realistic.

So there is a tendency to seek a stable thing.

Dr. EDWARDS. I guess I believe in the basic intelligence of most people. I suspect that while it is easy for me to say you need to develop a thick skin, you also need to be elected again as well. That is the reason for such an agency, because I believe some buffering can occur.

Mr. NELSON [presiding]. Go ahead, Mr. Brown.

Mr. BROWN. I think all of us in Congress are grappling with the question of how we can approach this problem and how we can stimulate innovation and productivity. I do not want to belabor it.

I think we all recognize that probably America's economic future in the world depends upon staying ahead of the rest of the world in terms of more efficient processes in a full range of things. But we do not know how to go about doing it.

Now, one thing I am learning, and I hope that we can all learn, is that this is a complex process. It is not a simple process. This requires the good idea, which meets a real need. It requires managerial talent and skill and entrepreneurial skills. This requires access to capital.

It requires all of these things which have been dwelt upon by one or the other of you. It probably requires some magic ingredient that we do not know about yet.

We have been talking a lot about the need to stimulate greater cooperation between sectors of the economy, the Government, business and universities and so on. Some of the answers seem to lie in either removing barriers to or creating incentives for this closer cooperation. But I still do not have it in my mind, a logical package that we could present as being a substantial aid to this need.

I am wondering if I have missed something here. I am afraid that most of the things that we can suggest are going to be sort of criticized as much as they are praised, such as the efforts to improve access to capital. We will be criticized because it is Government money.

There needs to be a complete program or a complete approach to this in some fashion. I am laying out my confusion to you or my frustrations in hope that perhaps collectively you can suggest what are the basic ingredients of this package we are going to have to put together.

Dr. Levin.

Dr. LEVIN. I think with respect to the Government sector support for R. & D., a very concise case can be made based on the statistics that we have been mouthing for about a year. It is about the high productivity and the innovativeness of small firms and their miniscule share of the Federal R. & D. budget.

If you are worried about what the National Enquirer will say—and I do read the National Enquirer on occasion when I do some shopping—from what I have seen, they are far more prone to attack General Motors and I.T. & T. than George's Invention Shop. The big scandal headlines like to show that somebody is in the pocket of some enormous executive.

I haven't seen too much criticism of small business. One kind of criticism that comes up frequently deals with an NIH grant to a university to study the cockroach's call for its mate. That is always good for a few lines in the paper. I have not seen much attack on small companies getting contract awards. What I have not seen enough of is small companies getting awards.

I would say the primary thing that the Government can do to help this innovative process, which stems largely from the small companies, is to grant parity to the small business scientist and engineer. He does not have it. The Government agency reviewing his proposal often looks down its nose at him. It does not grant him the respect or the credibility that it grants his counterpart in Government and universities or nonprofit agencies. As a result, fewer of his proposals get funded. Yet the suspicion that the Government review group reserves for the entrepreneur has been proven unfounded by the very fact that most of the innovation comes out of the small business environment.

I think if we could just make those facts—and they are facts—evident, that you then stand an excellent chance of defending yourself, even against the National Enquirer.

Mr. BROWN. Thank you.

This is a very poor time, frankly, to be talking about the need for an increased Government role, even for the most worthy objectives. I think most people would agree stimulating small business is high on the priority list, but what comes to my mind is the value of some of these suggestions that might circumvent this.

For example, the concept of a development bank and the concept of encouraging large business to invest in small business and to help get them off the ground, without controlling them, some of these kinds of things can be accomplished, it seems to me, without necessarily adding substantially to the role of Government, in the sense of creating a larger Government bureaucracy.

It involves creating some incentives or removing some disincentives. It would seem to me that it woudl be a way of creating the ongoing cooperation between institutions which would facilitate this process.

Dr. EDWARDS. I am sensitive to the Government's role and Government dollars going down the drain.

Mr. BROWN. Yes.

Dr. EDWARDS. None of us want that to happen, but it will happen. We will make mistakes. There are the great parts of our economy that are the producers of this Nation. They are very rich, in general. They are managed by people that through the growth and evolution of their company—well, they are professional managers, primarily. They are interested in the bottom line.

If there are ways—and I think I suggested one—that they can increase the bottom line, that means the Government will not get as much money either. It will go directly to perhaps the small company.

I guess my point is that small plus large equals very great, with the Government playing the role of the catalyst. Sometimes it may have to support this. It can support it not only in dollars, but it can support it—I do know that some corporations will listen to the Government. Some do not very well.

I think they are both important. We cannot deny the opportunity of large corporations to grow. I think they often deny themselves that growth because of other regulations. I do not think the Government has to spend all of this money. I think the private sector has it.

Mr. BROWN. Was it you that suggested, Dr. Edwards, that if the Government found itself in the establishment of a set of national priorities and development needs, that it——

Dr. EDWARDS. Excuse me. I think so. I think that would communicate——

Mr. BROWN. Excuse me. What occurred to me would be our effort to get the automobile industry to move toward a small, fuel-efficient car, in the last 6 or 8 years.

Dr. EDWARDS. That is one of your needs. It would increase the production that has fallen generically in that area.

Mr. BROWN. But the industry did not act very kindly.

Dr. EDWARDS. And I do not expect that they will, but you are tough also.

Mr. BROWN. Go ahead, Dr. Levin.

Dr. LEVIN. I think that kind of philosophy is responsive to the old saw about "necessity being the mother of invention." The kind of invention that this country needs today will not come from a direct necessity. We need the kind of innovation that produced the radio, the airplane and the TV. There was no necessity for any of those things. In those cases, invention was the mother of necessity.

Those are the kinds of inventions that the country needs to get way out ahead. If you set up a Federal agency that would prioritize what

the needs of the Nation are, then I do not think any radically new concept could be funded because it would not fall within those priorities out of lack of foresight by the prioritizers.

Mr. BROWN. I am not quite as negative about the idea as my remarks might have indicated. I really think there is a need for this kind of thinking. I doubt seriously that it would be readily accepted by the public as guiding them and their actions in the marketplace, unless it came out of the public, in other words, unless there was a large-scale public process involved in trying to identify what they felt were the needs that should be the mother of invention.

I think you have a very valuable thing that would give guidance to a lot of people who would want to try to meet those needs that are expressed broadly by the public. We do not have that. What we have now is a process in which large corporations seek to create public needs by advertising or some other process of that sort.

Then they meet the needs they have created, whether they are very important needs or not. A lot of this you see taking place in packaging innovations or in a number of model changes in all kinds of products, not just automobiles.

These are not what is necessary to maintain markets for American industry. They are almost counterproductive in that they divert the capital in ways which could be better used. But in our voluntary economy, it is going to be very difficult for the Government to seek to modify that process, that is, in any way except through widespread public involvement of some kind.

Mr. Kelley.

Mr. KELLEY. This question of national needs, I think it is very difficult for innovation to occur when it is put within the context of a script. The innovator often operates outside the script.

Innovation is a process that does not operate within the context of a script, it often has a long gestation period, and it is not too well understood. To complicate matters even more, it does not operate within the time frame of the political term of many elected officials.

It took 3 years for the State legislature to pass the Mass Technology Development Corp., and 18 months before this, the Japanese had already put it in place and funded 31 deals.

Traditionally, direct Government intervention in the process has only come in response to a crisis. Thirty years ago many of the companies on route 128 got their start through Government funds. At that time, it was a two-step process to get Government funds. In 1950, there was the Sputnik period. There was a crisis, and technical entrepreneurs, one of whom I knew personally, put together a 3-page proposal for $150,000 to Wright Patterson Air Force Base. He got a response back that they needed more information.

He gave them a response that he would be glad to give them more information when they gave him the money.

Now, that particular process involves 17 or so steps. I am not critical of all of the controls that have been put in. However, I think that many policymakers today fail to recognize that much of the true risk capital that went to the innovative firms in years past came from the public sector. That process has become institutionalized and Federal funds are not directed to the major source of innovation, viz small business and the technical entrepreneur.

Now the concept of development banks or public purpose venture companies which are in place in every other industrialized country, are getting growing acceptance.

When we first started in Massachusetts, there was a hostile relationship between us and the private sources of risk capital. Now they are delighted to have us come in, and the entrepreneurs are encouraged because MTDL can alter the risk-benefit relationship.

There are programs, as Congressman Lloyd mentioned, but here you are going to have to run somewhat against or challenge certain established interests and policymakers and Government officials are going to have to have the patience and the willingness to take the heat until the successes appear. I think the creativity and ingenuity is out here. It is just a question that the fuel, that is, the capital to drive and stimulate the process is not available.

Mr. BROWN. I want to pursue this for just a moment.

Mr. KELLEY. Yes.

Mr. BROWN. You indicated Massachusetts had set up the development bank, but the Federal Government has nothing similar to that, as far as you know.

Mr. KELLEY. They have one organization, well, I hear it is going to be cut back, and that is the national science small innovative research program. But Massachusetts is essentially the only State in the country that has taken the initiative.

There are several others—there is one in Kentucky and I think one out on the west coast.

Mr. BROWN. The nearest thing that I can think of to this at the Federal level is the—which was set up last year to provide a source of capital for cooperative forms of organization. There is not anything necessarily innovative about it, but they are operated, generally speaking, on behalf of a consumer group and not-for-profit basis. It is for a public purpose to provide a source of capital for them. Is that the model that would apply to a development bank, to a federally funded source of capital which could be used to provide certain capital under certain rules for the innovative small business we are talking about?

Mr. KELLEY. The National Consumer Cooperative Bank, which I think is headed up by a former banking commissioner in Massachusetts, Carol Greenwald, is slightly different than a development bank.

Mr. BROWN. Excuse me. I recognize the difference, but is the model appropriate? Is it a parallel kind of situation?

Mr. KELLEY. Yes; I would say there are certain parallel notions. However, the co-op bank provides debt capital.

Mr. BROWN. Thank you.

Mr. KELLEY. Yes, sir.

Mr. NELSON. Go ahead, Mr. Roth.

Mr. ROTH. Thank you very much.

I want to apologize for being late. Things were happening on the floor of the House.

I want to congratulate Chairman Lloyd and Chairman Brown for having this hearing. These are most beneficial and important.

Mr. BROWN. Thank you.

Mr. ROTH. I have one question. That is directed to Dr. Pricer from Wisconsin.

You were at our hearing in Appleton when we talked about innovation. On Thursday our Conference on Small Business—well, the crux of the issue really revolves around small business development centers. I was going to ask you how do development centers relate to the question of innovation. Can they help there, and how do they help? What is important to look for when you look at that legislation?

Dr. PRICER. Yes, it can help. If you could refer to my printed testimony, the red covered testimony, on page 4, we outline the process of assistance to innovative firms, small firms, as established at the University of Wisconsin.

Now, I think that this outline answers some of the earlier questions of the committee. We start with the evaluation of new ideas using the University of Oregon in the invention evaluation process. That was established through a program funded by the National Science Foundation and it is being brought to Wisconsin.

Last year over 200 Wisconsin residents used the evaluation service. The idea is evaluated by a panel of experts using 34 variables, such as product liability, market potential, and competition.

If it is deemed to be commercially feasible, then we develop a plan for the development of the particular product or new idea. Research is done to determine if, in fact, there is a market for the product.

The one weak area is in the development of the idea or product, but with additional funding, we feel we have the capacity and the capability to fill this gap.

We help commercialize the idea. It may be to either help sell or license the new innovation or to establish manufacturing. We also provide indepth management assistance.

However, with the small business omnibus bill that is now in committee, we have the danger of the Schweiker amendment that will restrict the SBDC program.

If you look at the amended paragraph five, you will note that it indicates that wherever practical and feasible, private consultants shall be used. I think if we could change the "shall" to "may" that it would meet everybody's requirements.

There is a distinct difference between what the SBDC attempts to accomplish and what the private consultants attempt to do. The SBDC has an educational mission.

I think possibly an example applies to the kind of firm that we are talking about today. If a new firm is formed around a product, a highly technical product, and there is need for testing, and the owner of the firm realizes what the test is for and why there is a need, then we refer that individual to a private testing lab. However, if there is a research problem associated with the development of that product, then we feel that would be properly within the educational mission of the university system.

Mr. ROTH. Isn't that what we are talking about today? If we are going to change it from "shall" to "may," then we are going to have most of the discretion in the hands of the universities. Aren't we trying to get more innovation out of the private sector?

Dr. PRICER. Our mission is not to innovate.

Mr. ROTH. If you subcontract to get it out to the private sector, aren't you giving more incentive to work to the private sector with those products, rather than keeping it in the hands of the university?

I am not arguing with you. I was curious.

Dr. PRICER. The difference is the university would be operating in areas that would be at the cutting edge of new knowledge and doing research that the private consulting firms typically could not or would not provide.

If you look at consulting firms, by and large, they are busy with the implementation of procedures and processes. We think that is right and we refer many clients to private consultants. We have no conflict with private consultants.

Mr. ROTH. I wonder if I could follow up on this.

Mr. NELSON. Go ahead.

Mr. ROTH. I know you are very knowledgeable in this area. I appreciate the information that you have given us. I was wondering if I could ask any of the other people on our panel to offer their suggestions.

We are going into conference on Thursday, and I would like to get various viewpoints on how to handle the arguments. Do you have ideas on this?

Mr. KING. I would like to comment on it.

I am one of those at the table who has had experience on this type of assistance program. I could relate a couple of points.

One type of assistance that we normally are giving to companies, which is called management assistance, may also include as part of the structuring or restructuring of their financial position—well, many times it is necessary to fund the development process, which is necessary to get that company from the invention stage into a true development and into the marketing stage.

So all aspects of that business development or product development are part of the advisory types of services that are provided.

I believe what Dr. Pricer was referring to—and we also use outside consultants to function as specialists in particular areas. Now, those areas may not exist directly with the universities we are affiliated with, or they may exist in a more practical sense in the private sector. As such, it is the best use of, let us say, funds and services for any company.

I am not sure that answers your question.

I would like to make one other point.

Mr. ROTH. Yes.

Mr. KING. Now, what has come out constantly throughout the hearings and throughout the country is the area of the patent requirements and revision of the patents as it relates to exclusive licenses and licensing of federally owned patents and the access of the researchers to those patents.

It is very critical.

Second, the restructuring of our tax incentives is also very critical. The restructuring of some of the financial services to the firms is very necessary.

These actions themselves will create an increase in the amount of activity from the private sector that goes into the high technology

companies. That is going to occur. The management types of assistance programs for technical information, management and financial assistance, et cetera, will function as a catalyst in helping more of these companies succeed, and less of them will fail.

They will not necessarily be the type of thing that is going to create new inventions. That is not the function. There are thousands out there—that is half of the problem that we are involved with. You have to find one out of a thousand that is putting effort into it so that you are not wasting anything.

Even with the best knowledge that we possibly have in this area in providing these assistances, there is still a high degree of risk. The thing that happens would be this. If we look at the returns of the success, that return is so large in the form of all of the economic factors that we looked at, such as employment, taxes and the like, that it far exceeds some of the costs that go into the program.

I think we should become much more aware of it.

Mr. ROTH. Thank you.

Mr. KING. Thank you.

Mr. ROTH. You mentioned something about patent law. The patent law in this country today is a joke. If a guy has a patent, a big company can steal it. Then what can you do, sue him? What does he get out of it 10 or 15 years later?

I think the first thing we have to do if we want to do anything is to bring commonsense into innovation. You have to do something about the patent laws.

Mr. NELSON. Let us pick up on your statement.

Do the rest of you happen to think that either the Government procurement contracts or Federal financial assistance should have some requirement that there be management or technical assistance during the course of the contract?

Mr. KING. I would like to respond.

Mr. NELSON. Go ahead, please.

Mr. KING. I would qualify that by saying it should not be a mandatory function. You cannot mandate management assistance to somebody as an advisory function. To begin with, if the owner of the business is unwilling to accept the advice—and that is his choice—it cannot be mandatory. You cannot implement advisory types of services without the intent and interest of management being there to do it. They are the ones that have to do it. We cannot provide that type of service in most normal cases.

We consistently are also seeing poor decisions being made, such as lack of cash flow control and lack of planning. I think that we have to recognize that that type of assistance can be provided to a firm, and the result would be very good. You cannot mandate it.

Mr. NELSON. Do most of you agree with that?

Dr. LEVIN. I think you have to make a study to determine what you best do with the available capital. Obviously we are talking about capital in short supply. We are mainly addressing innovation here.

To achieve this requires research functions. Now, if those dollars are competing or if you are competing with dollars for research versus management, then I think you have to make a study to see where those dollars are best spent.

I would like to give Mr. Brown, if I could for a moment, some savings to take to his taxpayers. You were saying that you were finding it hard to know where to bite into this problem.

If, indeed, as I read in this report I picked up on the way in, the total cost per R. & D. scientist and engineer is approximately twice as great in firms having more than 1,000 employees than in smaller firms, I would urge the Federal agencies to give the small business firms the 10 percent of your allotted R. & D. dollars they are asking for. Then you can save the taxpayers 5 percent.

Mr. BROWN. Thank you.

Mr. NELSON. Any further questions?

Mr. ROTH. No.

Mr. KELLEY. On the question of management and technical assistance, I do not think it can be mandated. I think an issue in this area is the one of institutional capacity. I do not feel that management or technical assistance, as a general rule, competes with the private sector consultants. As a general rule, these kinds of early stage companies are characterized by being undercapitalized or with a mix of capital which is inconsistent with their cash flow needs.

Where you run into the institutional capacity is that it takes individuals that are very highly skilled to deal with entrepreneurs or managers who rarely attribute their problems to their own misperceptions of the market or their own personal kinds of inadequacies.

You need a very highly skilled staff in order to have an effective program. These kinds of things, that is, programs are ongoing initiatives within the Small Business Administration. They have an extensive management assistance program.

I think that this is perhaps another step beyond this. It is a different kind of strategy.

What I think is ironic here is that if you asked different people their perceptions of a particular problem, you get all sorts of different signals. If you ask the entrepreneur what the problem is, the entrepreneur will tell you that the problem is taxation or regulation of Government competition.

If you ask the creditor, he will tell you that the problem is incompetence and mismanagement because he is looking at the situation from a very different perspective.

I think some empirical studies that have been done—and I am not suggesting another study—but looking at the issue from the question of accessibility of capital, specifically the right mix of capital which will enable the situation, with everything else being equal, to get from point A to point B.

What I think is somewhat troublesome is that for an entrepreneur starting a small business, debt capital is much more accessible than equity or near-equity capital. If you are going to buy a house for $100,000, and you have $10,000 to put down, and you want a note for $90,000, and you are making $20,000 a year, then you say in 6 months I expect to have a cash flow of $50,000. If you went to get a mortgage from an S. & L., they would laugh you out of the bank.

Yet, in many situations, many small businesses are levered between 3 and 10 times as a matter of routine, whether it is done on the balance sheet or off the balance sheet.

If you have a house and you have $10,000 and a note for $90,000, and you are paying 3 points over, if you do not go into default, then you must be getting money from someplace else.

This is one of the problems many small businesses have, especially rapidly growing businesses.

Mr. NELSON. Thank you.

Mr. KING. I would like to comment on that further.

That company developing the function of innovative products that were not proven in the marketplace—where he is forced, and this is the environment that we have had in our 6 or 7 years, to use all of the debt capital available, but one of the problems that exists, he also is having to put everything he has at risk, including his home.

When we are trying to establish a policy to increase innovation and invention, we are going to have to look at the risk factor that does exist in that area. There is a greater degree of failure that will occur. I think we have to recognize that if we want to increase the innovation, then we may have to look at removing some of the risk to the individual.

Invariably, the innovating types of projects occur as a function of an individual within the firm. They are what we classify as the entrepreneur. We are making it very hard for them, especially since around 1970 or 1971.

We do not have a means where venture people can get their return on the take-outs on stock. We are going to have to look at different forms of financing and combinations of venture and debt-guaranteed programs. We have to look at those.

Mr. NELSON. Thank you.

Mr. KING. Yes.

Mr. NELSON. I think the points that have been brought out here today are excellent. We appreciate very much you gentlemen participating.

It is my understanding that some of you will be participating in our session on Thursday.

We will stand adjourned, to reconvene on Thursday, at 10 a.m., in this room.

[Whereupon, at 3 p.m., the subcommittee adjourned, to reconvene at 10 a.m., Thursday, June 12, 1980, in the same place.]

SMALL, HIGH TECHNOLOGY FIRMS AND INNOVATION

THURSDAY, JUNE 12, 1980

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE AND TECHNOLOGY,
SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT,
SUBCOMMITTEE ON SCIENCE, RESEARCH, AND TECHNOLOGY,
Washington, D.C.

The subcommittee met, pursuant to notice, at 10:10 a.m., in room 2318, Rayburn House Office Building, Hon. George E. Brown, Jr., presiding.

Mr. BROWN. This morning we are continuing with a series of hearings initiated primarily through the work of Hon. Jim Lloyd, chairman of the Subcommittee on Investigations and Oversight, which I found to be very fruitful in trying to understand some of the national problems of the economy which face us today.

I will invite Mr. Lloyd at this point to make any opening comments that he might wish to make.

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

Mr. Chairman, I want to thank you and my other colleagues on the Subcommittee on Science, Research, and Technology for this opportunity to cooperate on a very important subject—small, high technology firms and innovation. In particular, we are concerned with Federal procurement and R. & D. policies and involvement of small, high technology firms.

My subcommittee has held five field hearings on this topic and witnesses at each hearing kept telling us how difficult it is to do business with Federal agencies. Steps should be taken to make it easier to deal with Federal agencies' procurement regulations. Unsolicited proposals should be encouraged and expeditiously reviewed, and meritorious proposals should be adequately funded. These are some of the recommendations contained in the report recently released by my subcommittee, and I commend all the others to your attention for immediate action.

The National Science Foundation's small business innovation research program is an example of what can be done by Federal agencies to stimulate the creative talents of small, high technology firms. NSF should expand this program and I encourage the agencies here today to implement similar type programs.

In closing, I welcome all witnesses who will testify today. In particular I want to acknowledge Roland Tibbets who should be given credit for creating NSF's small business innovation research program.

I think that the most important thing is that we have a great group of people that have been willing to come to testify. I want to thank them

personally. I think that we have a long way to go, Mr. Chairman. I think we have our work cut out for us. I think we have tapped a vein of strength for the American public, which is not only small business, but the involvements that they have. I think, in all honesty and fairness, as to the ideals of our country, it is imperative, not just important, but imperative, that we go forward with the thrust of these hearings and turn the hearings into real action so that we can incorporate what it is that we are learning here, incorporate the recommendations and suggestions of these very fine people into solutions of making our whole country a better place.

Thank you very much.

Mr. BROWN. Thank you very much, Mr. Lloyd.

Mr. LLOYD. Yes

Mr. BROWN. Obviously, one ingredient in this very complex mix of trying to determine how to keep a healthy U.S. economy is creating a sense of understanding in the Congress. I have found among my colleagues in Congress that we seem to have a very limited view. I think that we all have a high sense of importance of priority on this subject, but we tend to look at it from a point of view which reflects our own previous experience on service in Congress. We rarely are able to grasp the problem as a whole and a comprehensive policy. I will say this again. I have found that these hearings have contributed a great deal to my understanding of the totality of the problem, for which I am very grateful.

This morning we are going to have the distinguished panel which is seated before us, who will present their views on this subject.

We have Mr. Michael J. Tashjian, director of procurement at the Department of Energy.

We have Mr. Roland T. Tibbetts, program manager for innovation and small business, National Science Foundation.

Then, in a repeat performance, we have Dr. Gilbert V. Levin, president and chairman of the board of Biospherics, Inc., who had testified here earlier in the week.

We have Dr. Thomas C. Edwards, president and chairman of the board of ROVAC Corp., Rockledge, Fla., who, likewise, testified earlier. Both have made substantial contributions to our understanding of this problem.

So, would you then proceed in that order?

Mr. TASHJIAN. Thank you.

STATEMENT OF MICHAEL J. TASHJIAN

Mr. TASHJIAN. I would like to introduce the people that I have with me today.

Mr. BROWN. Yes.

Mr. TASHJIAN. I have Mr. Carl Guidice, Deputy Assistant Secretary for Management for Fossil Energy. I have Mr. Robert San Martin, Deputy Assistant Secretary for Field Operations and International Programs for Conservation and Solar Energy.

Mr. BROWN. May I make a point right here that both of these gentlemen are very welcome.

Mr. TASHJIAN. Thank you.

Mr. BROWN. If you need to call on them for testimony, and if they can answer questions, I hope that they will feel free to do so. At that time, please give their full names to the clerk.

Mr. TASHJIAN. I also have Mr. Stephen Mournighan, Acting Director of the Office of Small and Disadvantaged Business Utilization at the Department of Energy.

Now, rather than read my statement, Mr. Chairman, I could summarize it.

Mr. BROWN. Yes.

Mr. TASHJIAN. I can submit the entire statement for the record.

Mr. BROWN. Yes; without objection, the whole statement will be included in the record.

Mr. TASHJIAN. Thank you.

Mr. BROWN. You may proceed.

[The complete statement of Mr. Michael J. Tashjian follows:]

TESTIMONY OF MICHAEL J. TASHJIAN, DIRECTOR, PROCUREMENT AND CONTRACTS MANAGEMENT DIRECTORATE, U.S. DEPARTMENT OF ENERGY

My name is Michael J. Tashjian, and I am the Director of Procurement and Contracts Management at the Department of Energy.

The Department of Energy (DOE) has actively supported the mandate of the Congress to expand opportunities for small businesses in its procurement activity. In the first two years of its existence, DOE has successfully expanded its contracting with small businesses, increasing its contracting percentage to small business from 14 percent in fiscal year 1978 to 16 percent in fiscal year 1979. Our goal this year is 18.9 percent. To give you an idea of what this is in dollars, in fiscal year 1979, $1.3 billion went to small businesses.

Beyond goals, we have taken many innovative steps to enhance the potential DOE business opportunities for small businesses. I am not just talking about purchases of supplies or routine services. Rather, we have developed projects aimed directly at the high technology, research and development (R. & D.) area. Specifically, we established the first Federal unsolicited proposal reserve for small R. & D. businesses. That is, money is set aside to fund unsolicited proposals submitted only by small businesses, thus removing competition with large businesses for funds. We have paid bid and proposal costs, on a test basis, to minimize the barrier of writing a large proposal, and the expense of that effort, which may discourage small businesses.

Each procurement initiated by a program office is screened by a small business specialist to see whether a set-aside is appropriate. Finally, to help small businesses in their marketing activities, DOE has funded the newsletter of the American Association of Small Research Companies and has often participated in their activities.

In the area of financial assistance, $30 million has been set aside in the geothermal loan guarantee program. Selection factors are included in many of our R&D procurements and assistance activities which give preference to small business firms. A recent example is the program solicitation for the alternative fuels commercialization program. DOE also has its appropriate technology small grant program, under which grants are awarded to small businesses and other organizations (excluding large business) in a wide variety of energy related areas. Finally, we have the energy related inventions program under which inventors can submit their concepts to DOE and the National Bureau of Standards for evaluation and possible support.

As a great deal of the DOE budget is obligated through its government-owned, contractor operated (GOCO) laboratories, we have also taken the initiative to insure that small businesses get preferential treatment in this area as well. Goals are set for each contractor. In many cases, the award fee evaluation criteria, which is used to determine the fee a contractor earns, includes criteria to measure their utilization of small businesses. Set aside procedures, common in Federal contracts, have been extended to these operating contractors.

So, we have done quite a bit in the promotion of opportunities for small businesses. But, we plan to expand our efforts. As I stated, our goal in fiscal year 1980 is 18.9 percent of the procurement budget, which equates to $1.5 billion. We are starting early in the fiscal year 1981 procurement cycle (i.e., the planning stage) to identify, with program offices and field offices, those projects which can be given preferential treatment. We are going to expand the unsolicited proposal reserve to make more funds available for innovative and unique proposal concepts. We plan also to hold regular public sessions to discuss business opportunities in DOE and to provide assistance to small firms in marketing to DOE.

We have the Procurement Automated Source System (PASS) in place at headquarters and our major field offices, including major GOCOs. This system has over 6,800 R&D firms on computer files which we access to develop source lists and make determinations on set-asides. We plan to continue to expand and update this system. This system, when utilized by our network of DOE/GOCO's small business/disadvantaged business specialists, will enhance our capability to bring the small business community into our procurement activities.

The key words for a successful R&D small business program are planning, monitoring, and aggressiveness. Goal setting is not enough. A well rounded, multiphased, institutionalized program is required to make it happen. The office of small and disadvantaged business utilization will be working with all of the program offices to increase the funds to be awarded to small firms, especially those specializing in R&D. DOE is committed to insuring a place for small businesses in its search for solutions to this Nation's energy problems, and, as you can see, this has been done well in the past, and we will diligently continue our efforts in the future. Your staff has asked for information concerning the past record of DOE's programs. At this time, I submit this information to you. (At this point, Mr. Tashjian presents statistical data showing how much money each DOE program and GOCO awarded to small businesses.)

Mr. TASHJIAN. In the period of time since DOE has been formed, our awards to small business firms in terms of percentage and dollars have both increased. We have gone from 14 percent in 1978 to 16 percent in 1979. We have a goal of approximately 19 percent for fiscal year 1980. We have over $1 billion going to small business concerns with the Department of Energy. We have taken a large number of initiatives in the Department of Energy in setting aside reserves, that is, money is set aside to fund unsolicited proposals submitted only by small businesses. We have worked very actively with the Small Business Administration to establish an inventory of small business concerns who perform R. & D. I think DOE is the only Federal agency that has funded the automated listing of potential contractors with the Small Business Administration. We have, on a trial basis, given grants to small business concerns to pay for their bid and proposal costs.

We have in the financial assistance area, the area of other than contracts—loan guarantees, cooperative agreements, and grants—set aside a program where we reserve exclusively for small business loan guarantees in areas such as geothermal, electric and hybrid vehicle and other programs. We have also worked diligently in the subcontract area, recognizing that many small business concerns do not have the resources to bid directly to the Government. We have a number of Government-owned, contractor-operated facilities, both laboratories and manufacturing facilities. We have, in the past, had percentage goals. We have an awards program. We do have a program that we have designated as class set asides. This means that they can only be bought from small businesses. For example, in the area of construction, we have a $2 million threshold, which means any construction award of $2 million or under must be set aside for small business. I think that we have a well-rounded, multiphased institutionalized program that has done very well.

Mr. Chairman, I am prepared at this time to answer any questions that you might have.

Mr. BROWN. Thank you.

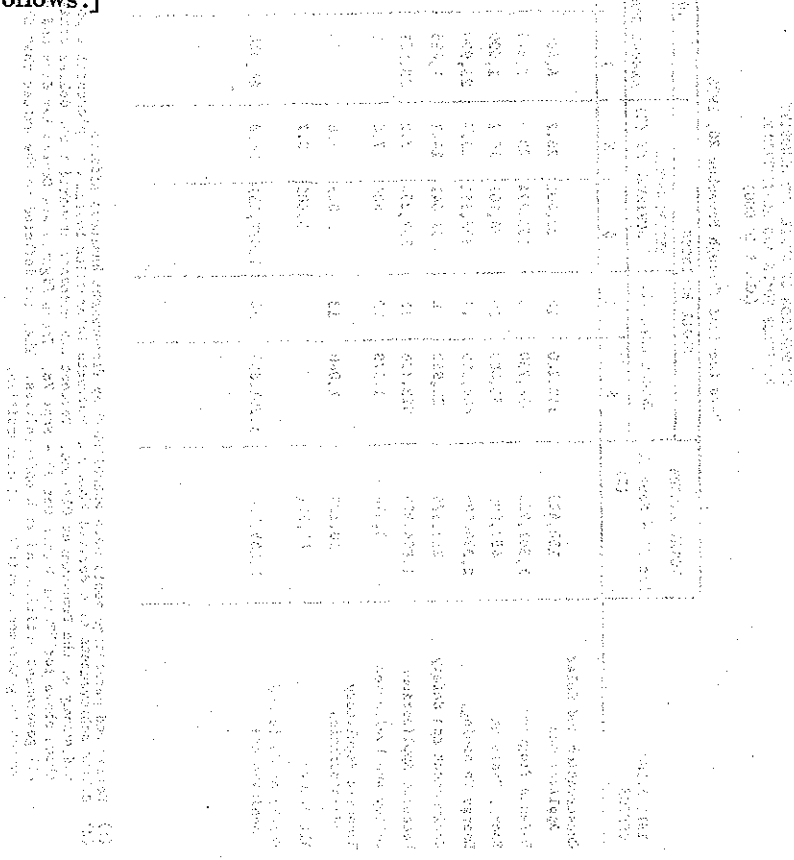
Mr. TASHJIAN. I do have some statistical data which the staff requested we submit for the record.

Mr. BROWN. Yes.

Mr. TASHJIAN. Thank you. We would like to have that in the record.

Mr. BROWN. Without objection, that will be included in the record.

[The above-referred material to be furnished the committee follows:]



Fiscal Year 1978

COMPARISON OF SMALL AND MINORITY
BUSINESS GOALS AND ACHIEVEMENTS
(ALL $ IN 000)

Data Received Through November 20, 1978

INITIATING OFFICE	TOTAL AWARDS Oct 77 - Sept 78 (2)	SMALL BUSINESS				MINORITY BUSINESS			
		ANNUAL GOAL (1)		TWELVE-MONTH ACHIEVEMENT (2)		ANNUAL GOAL (1)		TWELVE-MONTH ACHIEVEMENT (2)	
		$	%	$	%	$	%	$	%
Conservation and Solar Applications	150,405	112,280	14	39,401	26.2	6,400	0.8	1,252	0.8
Defense Programs	1,561,222	78,750	5	368,874	23.6	7,875	0.5	23,043	1.5
Energy Research	457,995	53,000	10	74,102	16.2	1,600	0.3	2,907	0.6
Energy Technology	2,896,986	409,320	12	398,551	13.8	23,900	0.7	14,056	0.5
Environment and Safety	213,374	22,960	8	51,641	24.2	1,435	0.5	8,341	3.9
Resource Applications	1,894,324	523,126	12	137,254	7.2	23,551	0.8	4,746	0.3
Policy and Evaluation	8,824	1,378	13	684	7.8	85	0.8	0	0
Economic Regulatory Administration	18,123	1,040	13	1,015	5.6	64	0.8	0	0
All Others	64,301			5,609	8.7			313	0.5
Totals of Goals and Achievements	7,265,554	1,201,854	14	1,077,131	14.8	64,910	0.77	54,658	0.8

(1) Dollar and percentage goals were established by Procurement Business Affairs.
(2) Dollar achievements were derived from the Contracts Information System, supplemental reporting to the 330 Systems, and survey of the Procurement Offices. Percent achievements compared these dollar achievements with the figures shown above for "Total Awards Oct 77 - Sept 78. These figures are Controller data and exclude contracts with all government entities and with universities. They are inflated to the extent that CIS is not up-to-date for awards to government entities and universities.

COMPARISON OF SMALL AND MINORITY
BUSINESS GOALS AND ACHIEVEMENTS
(ALL $ IN 000)

Data Received Through November 20, 1978

AWARDING OFFICE	TOTAL AWARDS, Oct 77 - Sept 78 OTHER THAN DEDICATED (2)	SMALL BUSINESS				MINORITY BUSINESS			
		ANNUAL GOAL (1)		TWELVE-MONTH (2) ACHIEVEMENT		ANNUAL GOAL (1)		TWELVE-MONTH (2) ACHIEVEMENT	
		$	%	$	%	$	%	$	%
Albuquerque	98,257	49,475	25	26,000	26.5	2,375	1.2	1,200	1.2
Chicago	199,993	14,930	25	28,531	14.3	716	1.2	902	0.5
Headquarters Proc. Ops.	1,111,880	155,750	40	120,642	10.9	4,672	1.2	6,040	0.5
Idaho	30,191	24,057	25	11,104	36.8	1,155	1.2	377	1.2
Nevada	63,503	8,750	25	12,908	20.3	418	1.2	390	0.6
Oak Ridge	186,242	9,000	25	24,014	12.9	432	1.2	4,605	2.5
Richland	16,295	4,650	25	9,000	55.2	223	1.2	594	3.6
San Francisco	229,153	41,250	25	33,000	14.4	1,980	1.2	1,578	0.7
Savannah River	15,181	11,275	25	138	0.9	541	1.2	0	0
Grand Junction	5,519	1,820	40	44	0.8	1,820	40	2,287	41.4
Pittsburgh N. R.	11,374	0	21	2	0.0	- 960	1.2	0	0
Schenectady N. R.	0	0	22	0	0	560	1.2	0	0

(1) Dollar and percentage goals were established by Procurement Business Affairs.

(2) Dollar achievements were derived from the Contract Information System, the supplemental reporting to the 330 Systems, and survey of the Procurement Offices. Percent achievements compared these dollar achievements with the figures shown above for "Total Awards, Oct 77 - Sept 78, Other Than Dedicated." These figures are Controller data and exclude contracts with all government entities and with universities. They are inflated to the extent that CIS is not up-to-date for awards to government entities and universities. Survey data was used for those offices not recorded by the Financial Information System.

COMPARISON OF SMALL AND MINORITY
BUSINESS GOALS AND ACHIEVEMENTS
(ALL $ IN 000)

Data Received Through November 20, 1978

AWARDING OFFICE	TOTAL AWARDS, Oct 77 - Sept 78 OTHER THAN DEDICATED (2)	SMALL BUSINESS				MINORITY BUSINESS			
		ANNUAL GOAL		TWELVE-MONTH ACHIEVEMENT		ANNUAL GOAL		TWELVE-MONTH ACHIEVEMENT	
		$	%	$	%	$	%	$	%
Bonneville Power	54,385	23,000	33	28,614	52.6	1,216	1.75	2,212	4.1
Alaska Power	330	180	90	182	55.3	15	7.5	1	0.3
Southeastern Power	32	4.4	12	4	12.5	1.1	2.8	0	0
Southwestern Power	2,091	800	20	316	15.1	40	1.0	49	2.3
Western Area Power	7,893	2,000	35	2,564	32.5	100	1.75	393	5.0
Morgantown ETC	11,617	4,519	58.7	5,511	47.4	39	.5	43	0.4
Laramie ETC	4,984	2,244	47.6	1,749	35.1	24	.5	59	1.2
Grand Forks ETC	1,069	322	49.8	292	27.3	3	.5	1	0.1
Bartlesville ETC	3,805	929	35.2	1,070	28.1	18	.7	194	5.1
Pittsburgh ETC	4,713	3,868	60.0	2,664	56.5	64	1.0	465	9.9
Region I Office	59			37	62.7			21	35.6
Region II Office	99			6	6.1			1	1.0
Region III Office	135			16	11.9			1	0.7
Region IV Office	50			36	72.0			0	0
Region V Office	117			0	0			0	0
Region VI Office	266			88	33.1			0	0
Region VII Office	171			12	7.1			1	0.6
Region VIII Office	136			80	58.8			0	0
Region IX Office	75			49	65.3			26	34.7
Region X Office	220			44	20.0			0	0
Clinch River	150,628			73	0.0			38	0.0
Awarding Office Totals	2,208,372	385,963		308,790	14.0	15,607		21,478	1.0

(1), (2) See previous page.

COMPARISON OF SMALL AND MINORITY
BUSINESS GOALS AND ACHIEVEMENTS
(ALL $ IN 000)
Data Received Through November 20, 1978

AWARDING CONTRACTOR BY OFFICE	SMALL BUSINESS				MINORITY BUSINESS			
	ANNUAL GOAL (1)		TWELVE MONTH (2) ACHIEVEMENT		ANNUAL GOAL (1)		TWELVE MONTH (2) ACHIEVEMENT	
	$	%	$	%	$	%	$	%
ALBUQUERQUE								
Mason-Hanger	4,610	35.8	4,672	39.1	451	3.5	439	3.7
Bendix (22817)	30,761	44.5	22,817	34.0	830	1.2	253	0.4
Sandia	73,022	33.8	85,370	49.6	7,561	3.5	7,502	4.4
Rockwell	11,830	43.6	14,835	56.2	1,085	4.0	1,040	3.9
General Electric	4,632	30.9	6,113	36.0	300	2.0	205	1.2
Monsanto	10,338	53.1	12,420	51.4	389	2.0	320	1.3
Zia (3)	4,471	59.2	5,649	70.0	378	5.0	262	3.2
Univ. of Cal (LASL)	44,216	40.8	37,921	46.5	2,167	2.0	1,680	2.1
Lovelace	1,960	60	1,691	60.3	222	6.8	603	21.5
Ross Aviation	283	26.4	302	38.6	13	1.2	108	13.8
Wallace-Brown (3)	1,034	60	236	80.3	21	1.2	0	0
CHICAGO								
Univ. Res. Assoc.	20,770	60	25,165	47.7	692	2.0	859	1.6
AUA and U. Chic.	21,980	36.8	29,008	25.4	1,493	2.5	671	0.6
Ames, Iowa	1,334	52	1,545	44.8	31	1.2	5	0.1
Princeton PPL	7,358	46.2	7,679	12.2	191	1.2	254	0.6
Lummus Co.	1,451	25.8	1,019	33.0	197	3.5	48	1.6
MATS	117	8.3	637	70.5	35	2.5	2	0.2
Assoc. Univ. (BNL)	18,967	52.4	19,314	56.0	724	1.2	434	1.3
HQ PROC. OPS.								
No goaled contractors								
IDAHO								
EG&G	28,822	48.6	39,768	56.7	2,076	3.5	2,410	3.4
NEVADA								
REECO	19,911	48.7	31,281	51.4	2,044	5.0	3,254	5.3
EG&G	8,176	44.2	12,722	53.7	740	4.0	1,231	5.2
Fenix & Scisson	1,031	29.6	1,135	12.5	105	3.0	70	0.8
Holmes & Narver	4,373	46.2	4,340	34.1	757	8.0	396	3.1

(1) Dollar and percentage goals were established by Procurement Business Affairs.
(2) Dollar achievements were derived from corresponding data as reported to the 330 Sys Percent achievements for the contractors are based on their total obligations as reported to the 330 System.
(3) Wallace-Brown started reporting under Zia in third quarter. The data shown for Wallace-Brown is six month data.

COMPARISON OF SMALL AND MINORITY
BUSINESS GOALS AND ACHIEVEMENTS
(ALL $ IN 000)
Data Received Through November 20, 1978

AWARDING CONTRACTOR BY OFFICE	SMALL BUSINESS				MINORITY BUSINESS			
	(1) ANNUAL GOAL		TWELVE-MONTH (2) ACHIEVEMENT		(1) ANNUAL GOAL		TWELVE-MONTH (2) ACHIEVEMENT	
	$	%	$	%	$	%	$	%
OAK RIDGE								
Union Carbide	129,619	41	105,627	31.4	7,904	2.5	1,760	0.5
Goodyear	22,829	41.8	12,228	18.4	655	1.2	45	0.1
National Lead	2,508	47.4	2,908	58.1	79	1.5	89	1.8
Rust Construction	5,365	60	6,095	66.3	107	1.2	200	2.2
OR Assoc. Univ.	1,480	60	1,438	57.4	30	1.2	0	0
RMI, Inc.	109	60	298	82.1	2	1.2	1	0.3
Rust Maintenance	386	60	339	54.6	8	1.2	24	3.9
RICHLAND								
Battelle Northwest	8,683	50.6	8,825	44.1	206	1.2	265	1.3
United Nuclear	2,904	60	2,695	39.2	121	2.5	74	1.1
Westinghouse	12,314	44.6	21,836	55.0	552	2.0	647	1.6
J. A. Jones	10,019	49.5	31,079	92.3	243	1.2	431	1.3
Rockwell	18,142	51.7	21,455	51.4	526	1.5	2,183	5.2
SAN FRANCISCO								
Univ. of Cal. (LLL)	53,189	60	65,681	36.5	3,989	4.5	1,891	1.1
Univ. of Cal. (LBL)	14,629	53.3	20,105	52.3	549	2.0	1,289	3.4
LMEC Rockwell	5,797	50.4	5,626	68.3	173	1.5	166	2.0
UCLA*	451	60.0	128	34.4	9	1.2	3	0.8
Stanford	9,535	35.2	16,447	34.9	948	3.5	1,010	2.1
SAVANNAH RIVER								
Dupont	41,802	42.4	56,808	47.5	1,183	1.2	186	0.2
GRAND JUNCTION								
Bendix	4,279	34.2	10,774	49.2	350	2.8	783	3.6
PITTSBURGH N. R.								
Westinghouse	16,800	21	6,840	22.3	960	1.2	58	0.2
SCHENECTADY N. R.								
General Electric	10,340	22	5,600	6.8	560	1.2	27	0.0
Awarding Contractor Totals	692,622	None	768,343	39.7	41,656	None	33,178	1.7

(1) & (2) See previous page
(3) Based on total awards of the goaled contractors which are reported as 1,934,511 for the twelve-month period.
* Nine-month data

SMALL AND MINORITY BUSINESS ACHIEVEMENTS
BY REPORTING, BUT UNGOALED, CONTRACTORS
(ALL $ IN 000)

Data Received Through November 20, 1978

CONTRACTORS BY AWARDING OFFICE	SMALL BUSINESS TWELVE-MONTH ACHIEVEMENT (2)		MINORITY BUSINESS TWELVE-MONTH ACHIEVEMENT (2)	
	$	%	$	%
ALBUQUERQUE				
Swinerton and Walberg (3876)**	2,643	63.8	29	0.7
Swinerton and Walberg (3877)	305	69.0	0	0
NEVADA				
Eberline Instrument Corp. (1509)	36	56.3	0	0
KMS Fusion Inc. (1598)***				
SAN FRANCISCO				
Rockwell At. Int. Div. (0701)	1,114	64.5	35	2.0
General Atomic Co. (0167)	7,436	45.8	106	0.7
Rockwell At. Int. Div. (0824)	405	53.7	7	0.9
General Electric (0893)	478	34.4	2	0.1
General Electric (1464)	3	1.6	0	0
IDAHO				
Kaiser Engineers (1600)	5,438	78.3	22	0.3
Morrison Knudson Co. (1465)	3,251	84.6	0	0
Jones Boecon (1565)	13,516	55.5	478	2.0
Allied Chemical (1540)	4,866	50.3	249	2.6
CHICAGO				
MIT (3069)	1,142	60.6	0	0
Ford Motor (4396)	191	80.3	1	0.4
Energy Develop. Assoc. (2966)	83	52.9	19	12.1
MIT (4094)	456	42.7	0	0
Consumers Power Co. (4066)	0	0	0	0
Midwest Reserve Inst. (4042)	2,091	44.9	310	6.7
Westinghouse (3045)	490	49.0	4	0.4
Public Serv. Elec. & Gas (2857)	2,025	42.6	0	0
Ford Motor (2566)	832	77.1	4	0.4
Consolidated Nat. Gas (2883)	16	15.7	0	0
Sundstrand Energy Systems (4299)	104	43.2	6	2.5
Illinois Univ. (1195)	169	38.9	1	0.2
Illinois Univ. (1198)	199	23.7	0	0
Sterns Roger Eng. (4085)*	0	0	0	0

* Nine-month data
** The four-digit serial number portion of the contract number is noted in the parentheses.
*** Formerly (4149) under Chicago

SMALL AND MINORITY BUSINESS ACHIEVEMENTS
BY REPORTING, BUT UNGOALED, CONTRACTORS
(ALL $ IN 000)

Data Received Through November 20, 1978

CONTRACTORS BY AWARDING OFFICE	SMALL BUSINESS TWELVE-MONTH ACHIEVEMENT (2)		MINORITY BUSINESS TWELVE-MONTH ACHIEVEMENT (2)	
	$	%	$	%
CHICAGO (Con't)				
Waste Management Inc. (2770)*	193	89.8	0	0
Foster Wheeler (0008)	0	0	0	0
Avco Everett Res. (4507)	346	52.7	1	0.2
Rochester Univ. (2812)	1,113	44.4	13	0.5
General Electric Co. (2911)	61	92.4	0	0
Value Engineering	39	92.9	0	0
CLINCH RIVER				
Westinghouse (0003)	719	7.5	0	0
Burns & Roe (0004)	34	1.3	0	0
Westinghouse (2395)	1,109	53.4	22	1.1
Stone & Webster (0012)	976	90.5	0	0
PITTSBURGH NAVAL REACTORS				
Duquesne Light Co. (0292)	168	24.5	0	0
HQ PROCUREMENT OPERATIONS				
Pittsburgh & Midway (0496)*	1,112	21.4	0	0
Bituminous Coal Res. (1207)*	21	31.8	0	0
Pope, Evans & Robbins (1237)	38	3.2	0	0
Westinghouse Elec. (1514)*	373	65.6	0	0
Fluor Engrs. & Const. Inc. (1517)*	152	19.6	7	0.9
Bituminous Coal Res. (1527)**	5	29.4	0	0
Continental Oil Co. (1743)*	221	66.2	0	0
GTE Sylvania (2162)	25	53.2	0	0
Ashland Synthetic Fuels, Inc. (2260)*	94	47.2	1	0.5
Mobil Res. & Develop. (2276)	0	0	0	0
Inst. of Gas Tech. (2286)	9	20.0	0	0
Enco Tech. Inc. (2304)	88	100	0	0
Inst. of Gas Tech. (2336)	14	21.5	0	0
Dow Chemical Co. (2346)*	666	38.1	0	0
Inst. of Gas Tech. (2434)	933	30.8	120	4.0
Inst. of Gas Tech. (2435)	674	28.8	150	6.4
Minnesota Gas Co. (2469)	7	31.8	0	0
Combustion Eng. (2473)*	68	52.3	0	0
Inst. of Gas Tech. (2489)	6	8.7	0	0
Combustion Eng. (2514)*	83	64.3	0	0

* Nine-month data
** Contract work completed, six-month data

SMALL AND MINORITY BUSINESS ACHIEVEMENTS
BY REPORTING, BUT UNGOALED, CONTRACTORS
(ALL $ IN 000)

Data Received Through November 20, 1978

CONTRACTORS BY AWARDING OFFICE	SMALL BUSINESS TWELVE-MONTH ACHIEVEMENT (2)		MINORITY BUSINESS TWELVE-MONTH ACHIEVEMENT (2)	
	$	%	$	%
HQ PROCUREMENT OPERATIONS (Con't)				
AVCO-Everett Res. Lab. (2519)*	1,042	89.2	2	0.2
PRC Energy Analysis Co. (2522)	283	61.8	98	21.4
Montana Energy (2524)*	392	81.0	0	0
Internat'l Nuc. Energy (4068)	97	77.6	0	0
General Electric (5059)*	184	36.0	0	0
Illinois Coal Gasification Group (2012)*	152	25.6	0	0
Procon (2618)*	160	100	0	0
Gulf Res. & Develop. (2305)	1	100	1	100
Foster Wheeler Corp. (1521)	6	17.6	0	0
Curtiss-Wright Corp. (1726)*	256	88.9	0	0
Bituminous Coal Res. (2798)*	10	33.3	0	0
Gulf Res. & Develop. Co. (1800)	352	100	0	0
Rockwell Internat'l (2711)	27	77.1	8	22.9
General Electric (2065)*	2	100	0	0
General Electric (2084)	1	100	1	100
General Electric (2134)*	0	0	0	0
Rockwell Internat'l (2518)	4	28.6	0	0
Accurex Aerotherm (2563)	90	32.6	30	30.9
TRW Energy Systems (2623)	107	84.3	0	0
Westinghouse Electric (2786)*	13	8.4	0	0
PRC Energy Analysis Co. (4024)	81	85.3	0	0
Burns & Roe (5066)	60	90.9	0	0
Rockwell Internat'l (2044)*	270	82.1	0	0
Stone and Webster (2583)	0	0	0	0
Continental Oil Co. (2542)	0	0	0	0
Middle South Services (5048)	0	0	0	0
United Technologies (4015)*	21	100	0	0
American Science & Eng. (2120)*	106	12.6	0	0
Memphis Gas Light (2582)*	75	23.4	5	1.6
Combustion Eng. (1545)*	154	46.8	0	0
Foster Miller Assoc. (1793)*	10	26.3	10	26.3
Inst. of Gas Tech. (2806)	179	89.1	168	83.6
Chem. Systems Inc. (2036)	16	100	16	100
Westinghouse Elec. (2061)*	64	100	0	0
Occidental Research (2244)	19	32.8	0	0
Hydrocarbon Res. Inc. (2361)*	162	49.1	8	2.4
Olympic Eng. Corp. (2424)	1	11.1	0	0
Inst. of Gas Tech. (2307)	1	5.6	0	0

* Nine-month data

SMALL AND MINORITY BUSINESS ACHIEVEMENTS
BY REPORTING, BUT UNGOALED, CONTRACTORS
(ALL $ IN 000)

Data Received Through November 20, 1978

CONTRACTORS BY AWARDING OFFICE	SMALL BUSINESS TWELVE-MONTH ACHIEVEMENT (2)		MINORITY BUSINESS TWELVE-MONTH ACHIEVEMENT (2)	
	$	%	$	%
HQ PROCUREMENT OPERATIONS (con't)				
Hydrocarbon Res. Inc. (2547)*	141	76.6	0	0
Burns Roe Inc. (2455)	322	100	0	0
Westinghouse Elec. (2617)*	578	99.7	0	0
Westinghouse Elec. (2870)*	11	7.0	0	0
Rockwell Internat'l (2044)	290	82.2	0	0
Ion (3001)*	0	0	0	0
Hydrocarbon Res. Inc. (1544)	174	34.7	0	0
Fluidyne Inc. (3005)*	19	70.4	0	0
Commonwealth Research (2352)*	224	28.2	0	0
Exxon Res. & Eng. (2422)	0	0	0	0
Exxon Res. & Eng. (2452)*	2	100	0	0
Fluidyne Inc. (2463)*	5	55.6	0	0
Exxon Research & Eng. (2471)*	8	88.9	0	0
Exxon Research & Dev. (2650)*	6	100	0	0
Mitre Corp. (2776)	17	100	16	94.1
Mitre Corp. (2783)	3	100	0	0
Dow Chemical Co. (2801)*	81	100	0	0
General Electric (5112)*	0	0	0	0
Auerbach (6116)	156	100	156	100
Mitre Corp. (6119)*	1	100	0	0
Mitre Corp. (6203)	2	100	0	0
PETROLEUM RESERVES OFFICE				
Williams Brothers (7001)	17,932	27.0	3,108	4.7
PETROLEUM AND OIL SHALE RESERVES OFFICE				
Fenix & Scisson*	562	69.9	0	0
TOTALS	81,568	39.3***	5,214	2.5***

* Nine-month data

*** Based on total reported obligations of 207,434,000

Fiscal Year 1979
Small and Disadvantaged Business

(in $000)

	Final Obligations	Small Business Goals	Small Business Actual	Disadvantaged Business Goals	Disadvantaged Business Actual
Department of Energy					
Grand Total	$8,269,819		$1,321,200	$100,000	$131,430

Fiscal Year 1979
Small and Disadvantaged Business
Goals and Awards
(in $000)

		Small Business Goals		Small Business Actual		Disadvantaged Business Goals		Disadvantaged Business Actual	
Headquarters									
Procurement Office	992,688	$123,529	7.8%	$117,579	12.9%	$ 23,629	1.5%	$ 18,789	1.9%
Wms. Bros.	128,583	61,254	35.9%	43,746	33.9%	12,970	7.6%	2,151	1.7%
Fennix & Sisson	21,476	839	.6%	10,048	46.8%	13	.00%	561	2.6%
Total	$1,143,187	$185,622	9.5%	$171,373	16.0%	$ 36,612	2.3%	$ 21,501	1.6%

Fiscal Year 1979
Small and Disadvantaged Business
Goals and Awards
(in $000)

		Small Business Goals		Small Business Actual		Disadvantaged Business Goals		Disadvantaged Business Actual	
Chicago									
Operations Office	$ 381,258	$ 31,965	11.7%	$ 50,014	13.1%	$ 1,135	.4%	446	.1%
University Research	40,966	25,945	51.6%	28,590	9.8%	1,311	2.6%	1,244	3.0%
Argonne	78,022	37,262	30.8%	36,938	47.3%	895	.74%	2,249	2.9%
Ames	5,032	1,632	64.1%	1,666	33.1%	4	.16%	25	.5%

Fiscal Year 1979
Small and Disadvantaged Business

(in $000)

	Total Purchases	Small Business Goals		Small Business Actual		Disadvantaged Business Goals		Disadvantaged Business Actual	
Albuquerque									
Operations	$ 64,635	$ 29,130	16.0%	$ 58,019	89.8%	$ 2,372	1.3%	$ 6,029	9.3%
Mason-Hanger	12,638	6,660	55.5%	6,332	50.1%	636	5.3%	501	3.96%
Bendix	99,014	41,135	43.5%	42,092	46.6%	2,850	3.0%	776	.8%
Sandia	204,500	102,960	55.0%	108,766	53.3%	9,430	5.0%	11,893	5.8%
Rockwell	32,788	14,850	55.0%	19,108	58.3%	1,290	4.8%	1,361	4.2%
GE	20,930	6,830	40.5%	6,853	32.7%	720	4.3%	282	1.4%
Monsanto	18,108	9,500	55.0%	9,061	50.0%	690	4.0%	420	2.3%
Zia	6,938	1,750	75.0%	5,610	80.9%	360	15.4%	549	7.9%
Univ. of Calif.	128,043	58,499	55.0%	57,350	44.8%	4,000	3.8%	2,513	1.3%
Lovelace	3,706	1,601	66.7%	2,442	65.9%	115	4.8%	50	1.3%
Ross Aviation	1,500	337	48.1%	1,500	100.0%	110	N/A	9	N/A
Total				$317,133				$ 24,383	
Oak Ridge									
Operations	$ 232,385	8,945	22.0%	$ 14,745	6.8%	$ 2,000	.27%	$ 3,035	1.3%
Piketon	31,316	11,321	35.5%	13.505	43.1%	4.579	14.4%	3,280	10.5%
Union Carbide	237,426	121,125	38.6%	102,598	40.8%	3,155	1.0%	5,263	2.2%
Goodyear	17,472	13,670	21.3%	9,535	54.6%	187	.29%	63	.36%
National Lead	4,498	3,148	83.1%	3,111	69.1%	112	3.0%	53	1.2%
Rust Construct.	16,291	6,401	69.8%	4,695	28.8%	250	2.7%	443	2.7%
Assoc. Univ.	2,784	1,601	66.5%	1,691	60.7%	32	1.3%	-0-	-0-
RMI	425	332	91.7%	345	81.2%	20	5.5%	6	1.4%
Rust Maint.	729	362	60.1%	175	24.0%	30	5.0%	25	3.4%
Total				$150,400				12,170	

Fiscal Year 1979
Small and Disadvantaged Business

(in $000)

	Total Purchases	Small Business Goals		Small Business Actual		Disadvantaged Business Goals		Disadvantaged Business Actual	
Chicago (Cont'd)									
Princeton	$ 20,308	$ 7,937	17.6	$ 9,276	45.7%	$ 369	.82%	$ 69	.34%
Lummus	1,020	1,431	41.3%	293	28.7%	77	2.2%	63	6.2%
Brookhaven	50,563	21,473	67.6%	22,958	45.4%	919	2.9%	890	1.8%
MATSCO	846	659	77.0%	287	33.9%	20	2.2%	5	.59%
SERI	23,835	1,958	53.9%	5,242	22.0%	49	1.3%	103	.4%
Total	$ 60,1844	$130,298	24.5%	$155,264	26.7%	$ 4,730	.89%	$ 5,094	.87%

Fiscal Year 1979
Small and Disadvantaged Business
Goals and Awards
(in $000)

	Total Purchases	Small Business Goals		Small Business Actual		Disadvantaged Business Goals		Disadvantaged Business Actual	
San Fransisco Operations	$ 279,289	$ 36,972	16.1%	$ 16,128	5.8%	$ 1,986	.86%	$ 3,142	1.1%
UCLA	679	489	96.0%	386	75.8%	5	.98%	4	.59%
LLL	139,927	69,039	40.1%	70,829	50.7%	3,730	2.2%	4,710	3.4%
LBL	62,032	21,027	58.7%	23,567	38.0%	1,626	4.5%	2,395	3.9%
Stanford	32,187	15,954	52.0%	18,922	58.8%	1,948	6.4%	2,349	7.3%
Rockwell	9,500	7,840	21.7%	6,109	64.3%	261	.85%	126	1.3%
Total				$135,941				$ 12,726	

Fiscal Year 1979
Small and Disadvantaged Business

(in $000)

		Small Business				Disadvantaged Business			
		Goals		Actual		Goals		Actual	
Richland									
Operations	$24,647	$10,083	29.2	$ 3,034	12.3	$ 747	2.2	$ 779	3.2
J. A. Jones	39,560	32,059	95.0	27,262	63.9	547	1.6	1,703	4.3
United Nuclear	6,391	3,015	43.8	3,851	60.3	90	1.3	101	1.6
Rockwell	44,055	22,329	57.4	23,285	52.9	3,270	7.4	2,013	4.5
Battelle	22,280	10,188	51.4	11,655	52.3	337	1.7	549	2.4
Total				$69,087				$ 5,145	

Fiscal Year 1979
Small and Disadvantaged Business
Goals and Awards
(in $000)

		Small Business				Disadvantaged Business			
		Goals		Actual		Goals		Actual	
Idaho									
Operations	$69,211	$12,440	17.9	$ 4,128	5.1	$ 474	.7	$ 1,920	2.8
EG&G	58,319	40,964	70.2	33,335	49.2	2,521	4.6	2,754	4.1
Total				$37,463				$ 4,674	

Fiscal Year 1979
Small and Disadvantaged Business

(in $000)

		Small Business				Disadvantaged Business			
		Goals		Actual		Goals		Actual	
Nevada									
Operations	$88,443	$14,025	30.8	$30,336	6.5	$ 490	1.0	$2,024	2.3
REECO	47,452	34,933	65.9	27,573	58.1	3,940	7.4	4,012	8.5
EG&G	16,538	14,025	61.4	9,943	60.1	1,583	6.9	1,101	6.6
Holmes-Narver	7,517	5,811	67.7	5,173	68.8	1,332	15.5	923	12.2
Fennix-Scisson	9,319	1,494	16.4	1,897	20.3	86	.9	52	.6
Total		$70,288	50.6	$74,922	44.2			$8,112	

Fiscal Year 1979
Small and Disadvantaged Business
Goals and Awards
(in $000)

		Small Business				Disadvantaged Business			
		Goals		Actual		Goals		Actual	
Savannah River									
Operations	$ 29,615	$ 155	.7	$ 766		$ 16	.07	-0-	-0-
DuPont	130,544	53,429	49.7	50,841	38.9	226	.2	$ 894	.7
Total				$51,607		$ 242		$ 894	

Fiscal Year 1979
Small and Disadvantaged Business

(in $000)

		Small Business				Disadvantaged Business			
		Goals		Actual		Goals		Actual	
Grand Junction									
Operations	$ 4,974	$ 2,400	11.5	$ 2,434	48.9	$2,400	11.5	$ 2,434	48.9
Bendix	31,154	12,525	42.5	16,534	53.1	800	3.4	915	2.9
Total				$18,968				$ 3,349	

Fiscal Year 1979
Small and Disadvantaged Business
Goals and Awards
(in $000)

		Small Business				Disadvantaged Business			
		Goals		Actual		Goals		Actual	
Pittsburgh Naval Reactor	N/A	N/A		N/A		N/A		N/A	
Bettis	$84,751	$24,720	60.4	$18,258	21.5	$ 194	.52	$ 465	.55

Fiscal Year 1979
Small and Disadvantaged Business

(in $000)

		Small Business				Disadvantaged Business			
		Goals		Actual		Goals		Actual	
Schenectady Naval Reactor Knolls	N/A	N/A		N/A		N/A		N/A	
	$ 8,048	$12,030	14.5	$ 3,077	38.2	$ 741	.9	$ .3	

Fiscal Year 1979
Small and Disadvantaged Business
Goals and Awards
(in $000)

		Small Business				Disadvantaged Business			
		Goals		Actual		Goals		Actual	
Richland Fast Flux Test Facility	$25,774	$ 1,000	6.7	$ 1,471	5.7	$ 150	1.0	-0-	-0-
Westinghouse	28,343	24,375	62.2	15,146	53.4	832	2.2	$ 957	3.4
Total (FFTF)				$16,617					

Fiscal Year 1979
Small and Disadvantaged Business

(in $000)

		Small Business				Disadvantaged Business			
		Goals		Actual		Goals		Actual	
SPRO									
Project Office	$190,163	$ 35	22.0	$13,674	7.2	$ 10	6.2	$ 5,783	3.1
Parsons-Gilbane	50,397	11,636	27.1	39,458	79.5	3,971	9.2	23,573	46.8
Total				$53,132				$29,356	

Fiscal Year 1979
Small and Disadvantaged Business
Goals and Awards
(in $000)

		Small Business				Disadvantaged Business			
		Goals		Actual		Goals		Actual	
Clinch River	$ 276	$ 76	35.0	$ 132	47.8	$ 48	22.1	$ 2	.9

Fiscal Year 1979
Small and Disadvantaged Business

(in $000)

		Small Business				Disadvantaged Business			
		Goals		Actual		Goals		Actual	
Energy Technology Centers									
Morgantown	$44,005	$ 6,174	53.0	$13,207	30.0	$ 54	.5	$ 21	
Laramie	5,725	1,959	39.3	1,840	32.1	74	1.5	337	5.9
Grand Forks	754	327	30.6	501	66.4	2	.2	-0-	-0-
Bartlesville	2,146	1,199	31.5	1,485	69.2	244	6.4	4	.2
Pittsburgh	8,816	2,985	61.0	3,205	36.3	572	11.7	310	3.5
Total ETC's				$20,238				$ 672	

Fiscal Year 1979
Small and Disadvantaged Business
Goals and Awards
(in $000)

		Small Business				Disadvantaged Business			
		Goals		Actual		Goals		Actual	
Power Administrations									
Bonneville	$63,790	$32,058	58.0	$16,298	25.5	$2,784	5.0	$ 1,316	2.1
Alaska	804	203	61.5	350	43.5	2	.6	19	2.4
Southeastern	37	-0-	-0-	3	8.1	-0-	-0-	-0-	-0-
Southwestern	307	354	16.9	161	52.4	62	2.0	73	23.7
Western	24,327	2,873	36.4	9,593	39.4	495	6.3	258	1.1
Total Power				$26,405				$ 1,666	

Fiscal Year 1979
Small and Disadvantaged Business

(in $000)

Regions		Small Business Goals		Small Business Actual		Disadvantaged Business Goals		Disadvantaged Business Actual	
I	$ 311	$ 41	69.9	$ 225	57.7	$ 26	44.1	$ 86	11.0
II	3,679	7	7.1	-0-	-0-	2	2.0	-0-	-0-
III	235	100	50.0	78	33.2	2	1.5	4	1.7
IV	64	40	80.0	9	14.1	4	8.0	-0-	-0-
V	(295)	6	5.0	-0-	-0-	1	.8	-0-	-0-
VI	394	99	37.2	125	31.5	10	3.7	13	3.3
VII	221	13	7.6	124	56.6	1	.6	5	2.3
VIII	151	90	66.2	79	52.3	9	6.6	2	1.3
IX	495	55	73.3	-0-	-0-	32	42.7	-0-	-0-
X	96	49	22.3	30	31.2	5	2.3	6	6.2
Total Regions				$ 670				$ 116	

Fiscal Year 1979
Small and Disadvantaged Business
Goals and Awards
(in $000)

		Small Business Goals		Small Business Actual		Disadvantaged Business Goals		Disadvantaged Business Actual	
FERC	$ 1,134	$ 666	17.6	$ 513	45.2	$ 81	2.1	$ 148	13.1

Mr. TASHJIAN. Thank you, sir.

Mr. BROWN. You have concluded.

Mr. TASHJIAN. Yes, sir.

Mr. BROWN. The procedure that we are going to follow is to ask you, Mr. Tibbetts, to go ahead.

Mr. TIBBETTS. Yes, sir.

Mr. BROWN. Then we will have comments from the other gentlemen based on their own experience.

Mr. TIBBETTS. Yes.

Dr. LEVIN. Yes.

Mr. BROWN. This will be based on their own experience and their familiarity with the small business area.

Proceed, Mr. Tibbetts, please.

STATEMENT OF ROLAND T. TIBBETTS

Mr. TIBBETTS. Thank you.

I am Roland Tibbetts, program manager for innovation and small business at the National Science Foundation.

I am here today with Dr. Henry Bourne, Deputy Assistant Director for Engineering and Applied Science at NSF.

Mr. BROWN. We welcome you, Dr. Bourne.

Dr. BOURNE. Thank you.

Mr. BROWN. Go ahead.

Mr. TIBBETTS. I wish to thank you for the opportunity to participate in this hearing on the subject of small, high technology firms and innovation.

I would like at this time to discuss the National Science Foundation's small business innovation research program, which is a program specifically directed at this subject.

Mr. BROWN. Yes.

Mr. TIBBETTS. I will leave out parts of the testimony due to time, Mr. Chairman, and request the entire statement be included in the full record.

Mr. BROWN. Without objection, Mr. Tibbetts, your complete statement will be included in the record.

Mr. TIBBETTS. The program that is known as SBIR is unique in its approach to Federal R. & D.

Basically it is designed to encourage and support small high-technology firms in particular that are qualified to submit research proposals on regular NSF applied research activities. The program has several special characteristics.

For example, it asks the question, "Does the research submitted on NSF program objectives also have potential commercial application?" If it does, we offer an extra point of merit in the evaluation process. The program is directed at high-risk research and innovation.

Possibly more important, it provides an approach which involves the use of private venture capital to pursue technological innovation and commercial applications as an extension of the NSF-funded research.

The program involves three phases. Phase I provides small awards of approximately $25,000 for 6 months principally to determine two things: Can the small firm do high quality research, and does the research approach appear technically feasible?

Those projects which appear most promising after the first phase receive phase II awards. This is the principal research project and these awards have averaged $200,000 for up to 22 years. Phase III is the development phase. It is privately funded to pursue commercial applications from the NSF research funded in phases I and II.

With this opportunity to pursue commercial applications from research in normal NSF program areas, we are finding that in almost all proposals, more attention is paid to the proposed research to see that it has potential commercial use. In order to adequately evaluate this aspect, we request that the small business obtain a commitment from a third party, such as a venture capital firm or a large business.

Government funds are spent solely on research meeting NSF support criteria. Private venture capital or other funding is spent on pursuing new products, processes, and services from the Federal research base.

The program is directed at increasing the private sector return on investment from Federal R. & D. It also provides an opportunity for the small firm not to participate in NSF research, but to fund high-risk ideas that have great difficulty in obtaining financial support. The program also has the objective to continue the employment of those persons supported by NSF research through private investment and new products and processes following the end of the Government funding.

The SBIR program is highly competitive. Only one of eight proposals received has been funded to date. These have been very good indeed. The number of proposals received has been rapidly increasing and the quality of the proposals has improved with each solicitation.

In our most recent solicitation, some 530 proposals were received in 13 topic areas last January. These proposals are currently being reviewed, and we anticipate making between 50 and 60 phase I awards next month. These proposals came from 43 States and the District of Columbia.

We have had three solicitations to date. The first was initiated in 1977 following congressional earmarking of NSF applied science funds for small business. This resulted in 329 proposals, 42 phase I and 21 phase II awards.

We are approximately three-quarters of the way through phase II on most of these projects. Two have already resulted in approximately $7 million being invested in two different companies, one investment by a venture capital firm, the other from a major U.S. industrial firm. We would like to emphasize, however, that the large firm did not acquire the small firm for its multimillion-dollar investment. It simply licensed research developed by the small firm identified by the NSF program for certain applications.

Another winner had six venture capital possibilities and three $200,000 offers after previously having had no success attracting venture capital investment; and the venture capital was on favorable terms for the small high-technology firm.

Surprisingly, this firm also received $70,000 of materials free and equipment from large firms at half price. We have found considerable interest from both the venture capital industry and large business in this program.

As another example, a one-man firm with a laboratory in the person's basement at the time of his application now has eight employees and a new laboratory. Although a product firm, it now has won five of six R. & D. proposals submitted to ONR, NIH and NSF, and a possible breakthrough of national importance in the semiconductor industry as a result of the SBIR project. It also has a $250,000 commitment for phase III support, and it is being contacted by IBM, TRW, Univac, GCA, Varian and others.

In another case, a firm has a possible breakthrough in genetics and another is placing a single isotope on the cutting edge of machine tools where a sensor can determine tool wear or breakage. This project has the interest of Ford, Chrysler, General Electric, Raytheon and a number of foreign countries. There are problems, however, in this last project because our regulatory agencies say it will take 2 years to clear this idea because of the isotope in spite of the fact that it has radioactivity at one-third the level of those products that have not required NRC licensing.

In the meantime, Japan, Sweden and Holland are most interested in the approach, and Japan has already had the president of one of the SBIR winners visit that country.

Since phase I proposals were submitted in the first solicitation, those firms receiving phase II awards, taken as a group, have doubled their employment.

The second solicitation received 408 phase I proposals, and made 54 phase I awards. We are just now receiving phase II proposals. In the third solicitation, the number of proposals increased by more than 100, and the quality also improved again. These proposals are now in review with awards anticipated next month.

The program is designed to provide many incentives for small firms, and to simplify the Federal R. & D. process for small business. It provides the incentives of many topics and awards in one solicitation, the chance for a follow-on award in phases II and III, patent rights to the small firm contingent upon phase III funding, taking place, that is, full reimbursement of costs, and a negotiated fee. It does not substitute on regular NSF engineering and applied science program objectives. The proposal has to meet NSF evaluation requirements, and goes through our regular review process in phase II.

The program also simplifies the Federal process in dealing with small firms. It combines 13 topics in one solicitation. The workload associated with these proposals is divided among a number of program managers large enough to provide expertise in the program areas represented.

In the next solicitation this fall, we plan to broaden coverage by adding additional EAS program topics into a single solicitation. Phase I also limits proposals to 20 pages. It is a quick screening process to get a large number of proposals down to a manageable number quickly since only phase I winners can submit phase II proposals. Grants also are used to simplify the awards mechanism. This is particularly useful for small-scale research projects.

The program opens the opportunity door wide to many new and previously unknown but creative small firms.

Fifteen thousand copies of the program solicitation were distributed. From an estimated 5,000 small high-technology firms, only 530 proposals were received, in part due to the challenging nature of the topics. We know that at least six new firms have been started as a result of the NSF awards. To date, 52 percent of all awards have gone to firms with 10 or less employees in competition with firms up to 500 employees. These very small firms obviously compete very well in research. They are also highly innovative in many of their ideas, and we have been impressed with the amount of research carried out, particularly for $25,000 or less under phase I.

The program has wide support among small business, venture capital, and many large business firms that see small business as a source of technological innovation for larger industry.

COSIBA, the Council of Small and Independent Business Associations, awarded NSF its first award for Federal small business program excellence. As a result of the Domestic Policy Review on Industrial Innovation, the program also was cited as one of the President's initiatives for expansion to the $150 million level in other agencies as well as NSF. Foreign countries have also shown great interest, particularly Japan, West Germany, Britain, France, Holland, and Sweden.

At NSF, we are continuing to refine the program and are considering some options such as using more topics to respond to major U.S. industrial problems.

The program also encourages the small firms to increase their research capabilities by working with university scientists and engineers. About one-half of the winners, to date, have done so.

In cooperation with SBA, we are also working on the related management, financing, and market research needs of these small technology-based firms. States are also showing much more interest since the Birch report on the Job Generation Process, and we work closely with such organizations as the Massachusetts Technology Development Corp. MTDC assists many small firms prior to submitting proposals, and also in obtaining follow-on venture capital commitments.

Finally, NSF, since its fairly recent interest in small technology-based firms, has conducted interagency conferences throughout the country on Federal R. & D. for small business firms.

Through our Office of Small Business R. & D., headed by Ted Wirths, we also publish the highly useful Small Business Guide to Federal R. & D. Also small business can and does submit unsolicited proposals to NSF in tbe applied research area. These proposals are reviewed and awarded using normal NSF procedures.

Our innovation centers assist small firms not only in technical but also in managerial areas as well as stimulate start-ups and teach courses in entrepreneurship.

A summary of NSF applied science funding to small business and a list of all awards made under the 1979 solicitation are attached to this statement.

Dr. Bourne and I would be glad to answer any questions you may have.

[The prepared statement of Mr. Tibbetts follows:]