INNOVATION

STARTUP, GROWTH, AND SURVIVAL OF SMALL, NEW TECHNOLOGY FIRMS

JOINT HEARING

BEFORE THE

COMMITTEE ON SCIENCE AND TECHNOLOGY

AND THE

COMMITTEE ON SMALL BUSINESS U.S. HOUSE OF REPRESENTATIVES

AND THE

SELECT COMMITTEE ON SMALL BUSINESS UNITED STATES SENATE

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INNOVATION

Startup, Growth, and Survival of Small, New Technology Firms

THURSDAY, NOVEMBER 1, 1979

U.S. HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE AND TECHNOLOGY,
COMMITTEE ON SMALL BUSINESS,
SENATE SELECT COMMITTEE ON SMALL BUSINESS,
Washington, D.C.

The joint committees met, pursuant to notice, at 9:45 a.m., in room 2318, Rayburn House Office Building, Hon. Don Fuqua (chairman of the Committee on Science and Technology) presiding.

Mr. FUQUA. The committees will come to order.

This morning, we have a continuation of the Joint Senate-House hearings on innovation.

The subject of today's hearings is the startup, growth and survival of small, new technology firms. This is a timely hearing as small firms have compiled an outstanding record of innovation. We must take forceful action to encourage the formation and survival of small, new technology firms; otherwise, our Nation will be relegated to a secondary position in the world's economic markets.

The Senate Select Committee on Small Business and Congressman Berkeley Bedell of the House Small Business Committee are joining us in these hearings today.

I also want to acknowledge the leadership role of Congressman George Brown, Chairman of the Subcommittee on Science, Research and Technology; and Jim Lloyd, Chairman of the Subcommittee on Investigations and Oversight, in setting up these important hearings.

We will be hearing from four panels of distinguished witnesses. The first panel will deal with national policies needed to encourage the startup and growth small, new technology firms.

The second panel will consist of five successful, small, new technology firms who will describe their experiences and offer suggestions on how to improve the business environment for innovation.

The third panel will consist of two renowned venture capitalists who will describe their experiences in promoting small, new technology firms.

The fourth panel will consist of representatives of NSF and NSA who will describe their successful programs with small, new technology firms.

I have tremendous concern over the direction that our society is going. Somebody just remarked when they saw the fish on my label, and I am not supposed to be talking—I attended a seminar in which they said, "one of the qualities of Christian people is the compassionate nature of sharing of accumulated wealth." If we agree with that, then I think we have to realize that people can do that, corporations cannot. Corporations are not in a position to be compassionate in what we build in our society. If we are going to move toward a society where corporations operate our entire economy, I think we are going to move toward a noncompassionate society.

Yesterday when Mr. Press from NSF gave his testimony, he indicated that practically all of the really revolutionary innovations come from small business. He went on, then, to testify that frequently when small business comes up with innovation, that small business is then acquired by large business, and through that acquisition it is beneficial to both the small business and the big business.

It might be. It is my contention that if what we are looking for in our society is increased innovation, among other things, then if we say that most of it comes from small business, and then if we say we are going to build a society in which that innovative small business, when it proves its innovativeness, is going to be acquired by big business, that innovation will be lost. I think we are causing another serious problem in our society.

So that one reason I am so thankful, Mr. Stewart, for the work that you have done is the fact that at least in my opinion, you have started to bring to the attention of our Nation a problem which most all of us have our eyes closed to as we look at all of the other problems of our society. I think it is a basic problem of what type of society we want to leave to our children and I hope we will look at that particular issue as these hearings proceed.

I thank you for your time, Mr. Chairman.

Mr. FUQUA. Thank you, Mr. Bedell, and we will now proceed. Mr. Richard Morse.

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

RICHARD S. MORSE, CORPORATE DIRECTOR

Received a S. B. in Engineering from the Massachusetts Institute of Technology, 1933; graduate work in Physics at the Technische Hochschule, Munich, Germany, 1933–1935. Honorary Degrees of D. Eng. and D. Sc., Distinguished Civilian Service Medal; Member, National Academy of Engineering.

After five years on the scientific staff of Eastman Kodak, he founded and for 20 years served as President of National Research Corporation, one of the first so-called "Route 128" companies. As one of the early pioneers in high vacuum technology, he holds some 25 patents and was associated with such industrial innovations as vacuum coating of optics, high vacuum melting of metals and alloys freeze-drying of penicillin and plasma, and the organization of Minute Maid, the first producer of citrus concentrate. During his entire professional career he has been involved with the organization, management and financing of new technical enterprises, and the role of technology in government and the university.

He served as Director of Research and Assistant Secretary of the Army (R. & D.) 1959–1961 and his many government responsibilities include: Chairman, Army Science Board; Chairman, Air Force Systems Command Advisory Board; member, Defense Science Board, Founded Research Analysis Corporation. As one of the initial members of the Technical Advisory Board of the Department of Commerce, he served on the Panel of Innovation and Invention and as Chairman of the 1967

Thirty-two corporate executives report that Government regulation and the question of adequate "return on investment" were the two most significant factors influencing their decisions to fund technical development programs.

A recent study showed that 54.5 percent of 125 research directors of major U.S. corporations felt they were much less able to commercialize innovative technology than Sony or Hitachi and 40.6 percent believed they had an equal ability to do so. This same group stated that their product development time cycle had increased 25 percent during the past decade.

A large mature company can often show stockholders a larger return on investment by modernizing a machine tool, or buying another company, than by embarking on high risk R. & D. program in a new technological field.

One merely needs to walk down the streets of America, view TV, or drive a car to realize that we have no monopoly in technical innovation and the influx of foreign products no longer results from cheap foreign labor. Our loss of position in some areas stems from better and more innovative foreign management capable of rapid exploitation of technology which may have originated in our country.

In many cases our inability to compete in world markets can be blamed directly on the U.S. Government and not on our corporate managers. In Japan the government and industry tend to work as partners to insure a viable competitive environment for the sale of Japanese products throughout the world. We have almost an adversary relationship between business and government and because of regulation, indecision and lack of financial support and understanding our own technology is now used by others to compete with America in the world—and at home.

A large percentage of our graduate students in science and Engineering in this country are non U.S. citizens. Some 25 percent of graduate degrees granted at M.I.T. last year were to foreign students. This is another way in which the technology transfer process will take place and not by the release of reports or shipment of computers abroad. The acquisition of new technology is an importatnt worldwide business.

The 1914 prediction of the dramatic "decline of the West" in Spengler's famous "Der Utergang des Abendlandes" has not fully materialized, but America no longer has a dominant position in many technological areas. We Americans do have a great ability to react to crises even if the solutions to our problems are more complex and require much greater time.

As we now look towards the East to our more recent enchantment it is interesting to observe the importance that the People's Republic of China has placed on technology. While we are still having hearings rather than taking action the PRC elected to mandate the role of innovation in their Constitution: Article 12 includes the following:

"The State devotes major efforts to developing science, expands scientific research, promotes technical innovation and technical revolution and adopts advanced techniques wherever possible in all departments of the national economy."

China has a long way to go but they have decided that technological innovation is the key to their position in the industrial society of nations.

In this country no one person, committee, Agency or Department of Government has assumed the responsibility to develop an optimum environment for technological innovation. The Office of Technological Assessment has conducted studies dealing with specific problems and legislative programs. NSF is primarily concerned with the important role of basic research and support of University programs. The Department of Commerce through it Technical Advisory Board has undertaken many useful studies dating back to the as yet unimplemented Charpie Report of 1967. Until recently the Small Business Administration has been concerned with small business loan activities rather than recognizing a need for changes in our business climate. Directives have periodically issued from OMB in an effort to emphasize the proper role of the private sector versus the funding of "in house" Government R. & D., but this policy has not been implemented by the Executive departments.

The position of Science Advisor to the President and the Federal Council Science and Technology was stimulated by Sputnik to insure our leadership in science and its applications.

While science now has a voice at the highest level of Government only recently has the question of improving the environment for technological innovation and the role of high technology companies have been considered.

In retrospect the Apollo program and the subsequent creation of an aerospace industry have probably had a net adverse effect on this country's ability to maintain its competitive position in the manufacture and sale of commercial products at home and abroad.

capital funds have been available in Boston alone within the past year. This money which previously came from wealthy individuals now includes such sources as Foundations, Universities, Foreign Capital, and large Corporations.

The Venture capital community has now become professionalized and the better organizations are in a position to appraise new opportunities and assist the new technical enterprises in which they invest their money. This new expertise should enhance the success ratio of new enterprises.

The academic community now conducts research relative to the innovation process, the role of venture capital and the formation of new companies. Both literature and courses are available for students, managers, inventors and entrepreneurs who wish to start their new firms.

As the process of new enterprise formation has matured the country now has a growing number of older successful entrepreneurs with capital, energy and experience who are now involved in helping a new generation of entrepreneurs develop a new series of high technology business.

Many of our more innovative major Corporations have begun to address the problem of finding new mechanisms to develop a spirit of entrepreneurship within the firm and to seek new technologies that can be profitably commercialized. The concept of "internal ventures" represents one organizational structure that has been introduced to retain the advantages of the individual entrepreneur within a highly structured large corporation.

Several of our major corporations now have established venture capital organizations for the sole purpose of going outside the company to seek new technology and the unique management talents of the entrepreneur who is seldom found in a large corporation and certainly not among our non-growth low technology industries.

The ingredients for a rejuvenation in our long history of inventions and entrepreneurship are still here. We have all the reports and studies we need. These hearings testify to the continued concern and interest in the problems. Congress and the Executive Departments and agencies should now take some actions—the educational period is over.

STATEMENT OF RICHARD MORSE

Mr. MORSE. Good morning, Mr. Chairman.

I would like to touch on the highlights of my written testimony, which I believe you have.

For more than a decade this country has had a longer series of reports, studies, congressional hearings, and the introduction of legislation, and yet I am afraid that the mechanism by which the innovation process works is still not fully understood.

Such action as has been taken in the United States, in general, has harmed rather than helped new enterprises.

For example, the elimination of employee qualified stock options was undertaken by Congress presumably because of its concern that executives of large companies were making too much money. Yet this action had a far more deleterious effect on the small company entrepreneur and its management. Which was not recognized at the time such action was taken.

In the area of patent rights, Congress still has a tremendous phobia regarding so-called rights of the Government.

I made a survey some years ago, and asked each department and agency in Washington to write me with respect to the total income received on royalties from Government-owned patents. Bear in mind, that more than half of all technical, professional people in this country work on the Federal payroll, directly or indirectly, which is a horrible situation. In spite of this, the total net royalty income of the Government from patents was almost zero and we still worry about this problem.

Our small companies are particularly vulnerable to the growing bureaucracy in Washington and increased complexity of rules and regulations.

enterprise system can operate and not create any new Government programs.

Unfortunately, I think Congress has been much more inclined to initiate grandiose, large, in many cases impractical, projects, such as a solar power satellite, for example, or a mammoth electric car program before we have a battery that operates, than to give even modest support for innovative technological ideas which may stimulate industrial production for the future.

The last thing that this country needs is a new department or agency charged with the responsibility for new technical programs or their administration. We have plenty of people here and we have more agencies than we need. Neither do I think we should increase R. & D. funding. As a matter of fact, there are a great many opportunities for eliminating costly technical programs and the commercially oriented research which we are now doing in "in-house" Government laboratories.

Let me make a couple of specific suggestions:

One, the Office of Science and Technology Policy should:

Report to the President and Congress on an annual basis regarding the national environment for technological innovation.

Recommend appropriate actions to the President to enhance the innovation process and make certain all agencies and departments effectively perform as required by legislative and executive action.

Create the position of Assistant Director for Technology with responsibility to expedite commercial applications of science and technology and enhance technological innovations.

Establish a Technology Advisory Board with a chairman and 10 members from small high technology firms, large companies, universities and labor to make recommendations to improve the business environment for technological innovation.

Two, our executive departments and agencies should:

Establish a policy of accepting unsolicited proposals for new innovative research programs without the current competitive bid system.

Develop a simplified uniform small business innovation contract. This would be used with companies qualifying as small business for contracts of less than $500,000 and based on ideas originating with the company. All rights except a royalty free right to the Government for Government use would remain with the contractor. Accounting and auditing and payment procedures would be simplified by the adoption of a cost reimbursement/fixed overhead contract without fee. A simplified proposal and reporting procedure would be established as employed in the days of OSRD and the Manhatten project.

I don't think you gentlemen have any conception of the red tape and problems that a small company has in doing R. &. D for the Government. I am involved as a director of a small company that is trying to get out of doing Government research. It has taken 2 years and they can't get their final payment as due.

Three, regulations:

Executive and legislative action should be taken to improve the climate for both the inventor, entrepreneur/founder and management of new enterprises.

STATEMENT OF MILTON D. STEWART, CHIEF COUNSEL FOR ADVOCACY

It is a privilege to take part in these joint hearings. Coming on the heels of the extended Domestic Policy Review of this issue by the President, these hearings underscore the importance which both policy making branches of the government assigned to this subject. It is my fervent hope that the Committees represented here, as well as several others in the Chamber, will work harmoniously and rapidly on the subject of national innovation policy.

My comments reflect my views as the Chief Counsel for Advocacy and not necessarily those of the SBA or the Administration.

Section 202 of Public Law 94-305 identifies the role of small business in the American economy and the contribution which small business can make in stimulating innovation. Section 9 of the Small Business Act gives the Agency as a whole additional responsibilities in this area.

Your crowded schedule of witnesses obviously put a premium on brevity. You may be assured that we stand ready to support with data from the literature, any or all of the general statements made here.

This is urgent national business. Those of us with long years of concern with the state of applied science and technology in America may disagree about many things; we are united on this. Our government is ten to fifteen years late in seeing the connection between the entrepreneurial climate for small high technology firms and a variety of national goals.

The Committees concerned with this subject need not speculate on what innovators themselves consider the highest priority elements for a national innovation policy. Attached as Appendices one through four are documents spelling out the views of more than forty specialists in the field beginning in January 1979 and working as three separate task forces. I must emphasize, however, that the conclusions of the task force do not necessarily represent the views of the SBA or the Administration.

Appendix 1 provides a summary introduction from a report dated July 1979 by the Office of Advocacy on innovation.

Appendix 2 provides the professional background of the innovators who comprised that task force.

Appendix 3 provides a comparative table showing areas of agreement of that task force and two others.

Appendix 4 shows some of the socio-economic studies of the subject which ought to be part of the arsenal of information of anyone making public policy in this area.

It cannot be said too strongly or too often that these innovators considered every subject dealt with essential to the creation of the entrepreneurial environment we need. While they were prepared to state priorities, they emphasized again and again that innovative entrepreneurial environment resulted from the cumulative impact of taxes, capital and credit policy, regulatory reform, research and development funding, procurement and patent matters.

All are necessary; none will be sufficient without the others.

The greatest service the Committees involved here could give the American people is responsible action on the priorities concerning the most underutilized sector of the national science base—small business. This must include an end to the ruthless relegation to the legislative ashcan of those traditional national fights and prejudices and turf-held rivalries which have blocked progress in this area for many years.

I appreciate the opportunity to appear before you today.

regulatory burdens to the relative size of the firms regulated."

Other specific legislative proposals by the S.B.A. task force are:

- Each Federal department or agency would target a 1% increase in R&D procurement set-asides of prime contracts. The increase would begin in fiscal year 1980 and would continue until small business receives a prime contract dollar volume equal to at least 10% of the department's total R&D budget.
- A similar 1% increase would be required of all agencies having budgets exceeding $100 million. These funds would be used to start a small business innovation research competitive solicitation program modeled after the present and highly successful National Science Foundation program.
- Small businesses would be allowed to retain, under certain provisions, patent rights on inventions made under Federally-supported research.
- The Office of Federal Procurement Policy (OFPP), in cooperation with the Small Business Administration would develop and issue simplified regulations for R&D procurement awards to small business designed from the users' point of view.

studies that indicate that small businesses have made a disproportionately large contribution to product innovation, to productivity increases, to job creation and to the production of tax revenues.

For example, a National Science Foundation study showed that small firms were found to produce 24 times more major innovation per R&D dollar expended than large firms.

Antibiotics, pesticides, helicopters, Polaroid cameras, automatic transmissions, oxygen steelmaking, and air conditioning are just a few of the innovations pioneered by independent inventors and small organizations.

Milton D. Stewart, Chief Counsel for Advocacy of the S.B.A. urged the quick consideration by government of the policy changes recommended by these panels, and the rapid enactment by Congress of the necessary legislation. Calling attention to the energy, environmental, and economic issues currently facing the United States and the world, and the major contributions innovative small firms have made to national problems in the past, Mr. Stewart stated:

> "It is rare that a single general prescription-enhancing the environment for small business technology innovation-appears to contribute to so many high priority Federal goals: stabilizing inflation through new products and new processes; speeding the replacement of non-renewable energy and material resources;

> "The small business sector no longer contributes as much to economic prosperity as it so brilliantly did in the fifties and sixties. The loss is not just for the few that might have had the satisfaction of technological entrepreneurship; more importantly it is a loss for all Americans who would have shared in the abundant economic benefits and would have held the myraid of skilled jobs that such pioneering would have made possible."

Despite the sad performance in the past as underlined by the citizen panels, all three groups held optimism for the potential of a reversal of the trends of decline. George S. Lockwood, President and founder of Monterey Abalone Farms and chairman of the panel, concludes:

> "With sufficient amendments to domestic policies to provide relief for small creative enterprises, a major renaissance in anti-inflationary innovation will emerge with concomitant social and economic growth."

He warns, however, that:

> "... such amendments will require a major departure from current policies affecting small businesses in capital acquisition, regulation, R&D funding, procurement, and patents."

A. Vernon Weaver, Administrator of the U.S. Small Business Administration has expressed appreciation for the work of the task force. "These recommendations reflect the growing realization that the small business community must be supported and encouraged at every level, if we are to continue to enjoy the benefits of innovation and new technology," Weaver said.

Exhibit 2

BACKGROUND MEMORANDUM

SBA, OFFICE OF ADVOCACY TASK FORCE ON SMALL BUSINESS AND INNOVATION

The business backgrounds of the members of the task force are described in the report of the task force (pages 35 - 47). The following quotations and current research activities have been furnished by those members of the task force who could be reached for comment.

Mr. Paul Bosted
Sun Systems
Sun Valley, Idaho 208/726-9336

"It is my hope that this report and the proper legislation will catalyze government agencies and their commercially dependent services to consider the capabilities of those small technological businesses located in America's heartland, outside the Boston-Washington corridor and the Silicon Valley."

Projects:

Developed an on-line stress analysis for shaft-mounted wind turbines. Also, a self-powered computer for solar collectors which continuously compiles the total amount of energy being produced.

Mr. William Chandler
Bay Venture Management
San Francisco, California 415/989-9679

"The most importmant thing this task force report proves is that small business is critical in our system -- the reason we've been able to enjoy our high standards of living is that we've enjoyed a viable, rich economic system. Now with the high cost of energy and other resources, maintanence of the high cost of living can only be achieved through the small innovators and entrepreneurs."

Projects: Company financed by Bay Venture Management.

BIOVATION - uses a corporate theme of innovation and clinical laboratories instrumentation

Dr. Orrie Friedman
Collaborative Research
Waltham, Massachusetts 617/899-1133

Projects:

Production of biologic products for human therapy and veterinary medicine and industrialization by recombinant DNA technology. Development of new, simple, inexpensive immunologically based technology for diagnosing human and animal diseases. Development of anti-leukemic drugs.

Dr. Clyde Goodheart
Biolabs, Inc.
Northbrook, Illinois 312/498-6020

"The cost to the American people of government policies that are hostile to innovation and to the creation of new companies is enormous but hidden. All too often when a creative, innovative person has an idea for a new product or service, that person dismisses the idea quickly as too costly, too difficult to get it through the regulatory process, and too difficult to get patent protection. Who can count the new jobs that could have been, the new and better products that could have been, the improved technology that could have been, the increased exports that could have been, indeed, even increased tax return to the government that could have been."

Projects:

Biolabs has developed carcinogenicity testing by using mammalian cells in vitro for determining whether a chemical is a potential carcinogen. Not only does Biolabs perform the test as a service, but is developing it in a kit form for sale.

Developing a new method for large scale culture of mammalian cells to be used for relatively inexpensive production of drugs, vaccines and antibodies.

Dr. Eugene Haddad

Projects:

Non-Destructive Chloride Analyzer for Highway Bridges - Columbia Scientific Industries Corp. is working on a Department of Transportation funded project to develop a new technique and mobile instrument for rapid, non-destructive detection of trace quantities of chloride deep within reinforced concrete bridge decks. As described in the November 1978 "Reader's Digest" bridge deck deterioration caused by chloride induced corrosion from deicing salt, is a cancer that affects at least 20 percent of the nation's half million highway bridges. High repair or replacement costs may be avoided by early detection of chloride at the depth of the reinforcing bars. Present methods, which involve drilling or coring the concrete then dissolving and analyzing the samples in a laboratory, are so time consuming as to be impracticle for wide spread use. The new "bridge deck analyzer" at present undergoing field trials, uses penetrating neutron gamma spectrometry to determine chloride content at the reenforcing bar depth without damaging the road surface. Several measurements per hour can be made and it is possible that a complete bridge can be checked out in one day.

Portable Elemental Survey Meter for Air Contaminants - Under contract to the Department of Energy with ancillary funding from NIOSH, Columbia Scientific Industries Corp. is developing a new kind of portable survey meter for monitoring air contaminants in marketplace atmospheres. The instrument will be capable of in-situ sampling and analysis for most "heavy metals" and many other elements. Samples are collected on respirable dust filters for periods of fifteen minutes to eight hours. The elemental composition of each filter deposit is analyzed using a new hand portable X-ray fluorescence spectrometer incorporating a micro-processor for providing direct print out of the micrograms of each element per cubit meter of air originally sampled.

The instrument is designed for use by employers for routine monitoring and for on-the-spot checking in the event of accidental releases of potentially toxic substances.

Mr. Charles James
Scientific Advances, Inc.
Columbus, Ohio 614/424-6161

"Over the last ten to fifteen years we have become a more enlightened and socially conscious society. And while this movement is commendable, it has been accompanied by a severe case of inflation, taxation, and regulation which threatens the survival of many small businesses. The conclusions of the task force reflect this condition and the recommendations if acted upon will help to reverse this dangerous trend."

Projects:

Partnership with Northwestern Mutual Life - Solar Irrigation systems; advanced thermal collectors; solar voltaic systems (sunlight to electricity).

Unique process for making aluminum flake which when combined with plastic compounds enhances electrical and thermal conductivity.

Unirad - second largest manufacturer of ultrasonic medical imaging equipment. (Sold in 1976 to Technicare).

Nortec - Manufacturer of non-destructive testing instruments using eddycurrent and ultrasonic technologies. (Nuclear and aerospace industries in detecting bolt holes without tearing apart equipment).

Mr. Eugene Lang
REFAC Technology Development Corp.
New York, New York 212/687-4741

"I am gratified for what seems to be the first concentrated and focused effort on the part of government to develop an understanding of the problems that small business faces in surviving, let alone growing, and the consequent effort to develop ideas and programs based on these ideas to solve some of these basic difficulties that are endemic to the small business community. I can only hope that there is sufficient follow through at both the Executive and Legislative levels of government so that all the good work that has been done will actually come to some significant fruition."

Working in laser technology and liquid crystal display technology.

Dr. Harold H. Lonsdale
Bend Research, Inc.
Bend, Oregon 503/382-4100

"There is justifiable concern in the country that we are losing our once enormous world lead in technological innovation. There are many reasons for this, principal among which is the fact that the genesis and growth of small, high technology companies have been largely stiffled. These companies have been inordinately successful at inventing and developing the important innovations of the 20th Century. The growth of the firms is now retarded because of excessive government regulation, inflation, and changes in tax laws, and SEC regulations that make investing in these new companies much less desirable than it once was. One viable solution to this problem -- a problem that threatens our whole economy -- is to reverse the long-standing government position on patent rights on government-sponsored inventions. These rights should be vested exclusively with the private inventors and developers, rather than with the government. Only with exclusivity can the capital be safely attracted with which to develop and commercialize these patent ideas. To maintain equity in the system, the firms granted exclusive patent rights should be required to repay the government investment out of the profits on the new product. The alternative is to risk continued stagnation of the economy and to permit the continued exodus of American technology and jobs to our foreign economic competition."

Projects:

1. A "coupled transport" process for removing metals from solution, useful in mining and pollution control.

2. Long acting specific insect traps.

3. Membranes for making oxygen enriched air.

4. Membranes for water desalination by reverse osmosis.

5. Long acting birth control devices.

Projects:

Developing a badge to be worn which will monitor the exposure by color change to toxic gases in the workplace.

Developing a liquid ion exchange membrane technique for recovering and concentrating minerals from mineral ores and waste water streams.

Dr. Harry D. Richardson
Nuclear Systems, Inc.
Baton Rouge, Louisiana 504/383-7791

Projects:

Nuclear Systems has developed a computer energy management system, called Smartstat 1000®. It is a solid state micro processor based programmable set-back thermostat for application in residential and light commercial buildings. It is designed to operate with all currently available multi-stage heat pump systems as well as converted gas fired, oil fired and electric powered heating and cooling systems.

Developed and manufactured a solid state electronic device to replace pilot lights in gas fired appliances. This will provide significant savings and consumption of natural bottled gas.

Dr. Robert Springborn
Springborn Laboratories, Inc.
Enfield, Connecticut 203/749-8371

"It is believed that the Task Force, composed of a number of leaders of U.S. technological change and innovation, has developed a concensus of what is needed in our country to re-activate and stimulate the innovation process. Speaking for a large segment of the small innovation company community, we ask not what can our government do for us but rather free us from governmental restrictions so we can innovate for our country. We hope our President hears this message and acts with boldness in re-establishing the U.S. as the world's leader in innovation."

Projects:

1. Solar Cell and Encapsulation Program.

2. Bio-Chemical and genetic toxicological studies on new drugs and chemicals.

Mr. Sidney J. Green
President
Terra Tek, Inc.
Salt Lake City, Utah
801/582-2220

"Terra Tek as a growing young high-technology company is aware that its growth is in the successful development of innovative ideas leading to expanded and new businesses. Action by the Federal government could substantially speed up the process whereby small high-technology companies are able to bring to commercial viability the industrial innovations that they are pursuing. These government actions are clearly stated in the Small Business Innovation Report, May 1979. Particularly significant to bring immediate results are the better targeting of Federal R&D procurements and special innovations development programs similar to the National Science Foundation Business Innovation Program."

Projects:

Terra Tek gained a beginning as a high technology company via government R&D contracts, and through the innovation of company leaders has diversified into many new technology areas. The growing of plants that contain hydrocarbon and rubber, to be used as chemical feed stock, for fertilizer production, as natural rubber, or as crude oil, has provided the Company an extremely attractive opportunity for expanded growth. Two new companies have already been formed as a result of this Terra Tek project.

Exhibit 3

COMPARISON TABLE

SBA ADVOCACY
TASK FORCE BILL

COMMERCE JOB CREATION
WORK GROUP (JC-WG)

COMMERCE INNOVATION
SMALL BUSINESS TASK FORCE (INN-SBTF)

TAX RECOMMENDATIONS

ADVOCACY TASK FORCE BILL SECTION	JC-WG AND/OR INN-SBTF RECOMMENDATIONS
Section 7(a)(3) (cont'd)	Allow small science and technology firms to carry forward losses for a period of ten years instead of five years. (INN-SBTF)
Section 7(a)(6)	We recommend restoration of the Qualified Stock Option Plan for Key Employees of small businesses. (JC-WG) Restore the Qualified Stock Option Plan for Key Employees in small science and technology firms, and establish the period for exercising stock options at ten years. (INN-SBTF)
Section 8	We recommend that the creation of Small Business Export Trade Corporations be encouraged by a double deduction for these corporations of up to $100,000 of annual expenses associated with the exporting activities of each client, with a loss carry-forward of ten years. In addition, we recommend that small businesses be allowed a double deduction of special expenses of serving export markets up to $100,000 annually. (JC-WG) Permit small businesses to take double deductions of expenses directly related to export market development. (INN-SBTF)
No parallel section in Advocacy Task Force Bill	We recommend that small businesses be allowed to deduct twice their payments for regulatory advisory services related to compliance with federal, state, and local regulation. (JC-WG)
No parallel section in Advocacy Task	Provide for a twenty-five percent tax credit for research and development related expenditures by small businesses (as currently allowed in Canada). (INN-SBTF)

TAX RECOMMENDATIONS

ADVOCACY TASK FORCE BILL SECTION	JC-WG AND/OR INN-SBTF RECOMMENDATIONS
No parallel section in Advocacy Task Force Bill	Treat license royalties as capital gains instead of ordinary income. (INN-SBTF)
No parallel section in Advocacy Task Force Bill	Eliminate the existing tax liabilities for overseas joint ventures in which the small business investment consists of a contribution of know how and technical information. (INN-SBTF)
No parallel section in Advocacy Task Force Bill	We recommend that private sector individual or corporate owners of technology be rewarded, through appropriate changes in the tax code, for selling, leasing, or licensing their technology to small business firms in the United States. In addition, we recommend the establishment of a voluntary national policy to encourage companies to make their technologies available for uses by others. (JC-WG)
COLUMN NOTE: These two sections of Task Force Bill have no direct paralles in JC-WG or INN-SBTF Reports.	For tax purposes, specialized equipment and instrumentation for research, development or testing may be written off at any time and specialized research, development or testing facilities may be depreciated over a minimum of five years by such small business firms. (ADVOCACY TASK FORCE BILL - Section 7b) The period of exercising stock options in small business science and technology based firms is extended from a maximum of five to a maximum of ten years. (ADVOCACY TASK FORCE BILL - Section 7(a)(5))

RESEARCH AND DEVELOPMENT RECOMMENDATIONS

ADVOCACY TASK FORCE BILL SECTION	JC-WG AND/OR INN-SBTF RECOMMENDATIONS
No parallel section in Advocacy Task Force Bill	The decline in R&D expenditures as a percentage of Gross National Product must be arrested and redirected upwards towards the goal of three precent by 1985. (INN-SBTF)
Section 4	Each year, starting in 1980, each agency with a budget of over $100 million for R&D should allocate at least one percent of its R&D budget to the small business program using the same format as that of the National Science Foundation but with their own research topics, and review and awards procedures. This program should be coordinated by an Inter-Agency Small Business R&D Committee chaired by the Small Business Administration. (INN-SBTF) We recommend that private sector individual or corporate owners of technology be rewarded, through appropriate changes in the tax code, for selling, leasing, or licensing their technology to small business firms in the United States. In addition, we recommend the establishment of a voluntary national policy to encourage companies to make their technologies available for noncompetitive uses by others. . . . . . The Work Group believes the National Science Foundation's program called "Small Business Innovation Applied to National Needs" has great potential for increasing technological innovation in the private sector and is worthy of emulation or even adoption by other federal agencies.. (JC-WG)

REGULATORY PROCEDURES

ADVOCACY TASK FORCE BILL SECTION	JC-WG AND/OR INN-SBTF RECOMMENDATIONS
No parallel section in Advocacy Task Force Bill	A thorough revision of the regulations and operating procedures of OSHA as they relate to small innovative business to include: -- A general exemption from OSHA, except where the accident history of a particular industry or firm is substantially greater than average, and in such cases, the burden should be upon OSHA to justify action; and -- The prohibition of first instance citations except in extreme cases. (INN-SBTF)
Section 6(b)1	In all regulatory activities, the burden should be placed upon each regulatory agency to establish a cause of concern before requiring regulatory compliance by a small business. Minimum levels of impact should be statutorily defined thereby exempting small businesses in all but extreme and justifiable cases. (INN-SBTF)
No parallel section in Advocacy Task Force Bill	Substantial strengthening of the Regulatory Council to include: -- participation by the Small Business Administration; -- requiring all regulatory agencies to balance the risks of a hazard against the economic costs, with thorough consideration of specific impacts of proposed regulations upon small business creative processes; -- the use of "performance standards" and not "method standards" in those cases where regulatory standards are clearly justified; (JC-WG)

CAPITAL AND INVESTMENT RECOMMENDATIONS

ADVOCACY TASK FORCE BILL SECTION	JC-WG AND/OR INN-SBTF RECOMMENDATIONS
Section 6(a)7	Modify ERISA to allow up to five percent of pension fund portfolios to be invested in small businesses. (INN-SBTF) We recommend (1) that ERISA's prudent man standard be restated so that it is clearly applicable to the total portfolio of pension fund investments rather than individual investments, and (2) that pension fund managers explicitly be permitted to invest up to five percent of pension fund assets in small firms. (JC-WG)
No parallel section in Advocacy Task Force Bill	Encourage state investment pools to invest a larger percentage of their holdings in small innovative businesses. (INN-SBTF)
Section 6(b)3	Exempt from SEC registration offerings of equity securities for innovative businesses outlined in Recommendation #1 of less than two million dollars. (INN-SBTF)
No parallel section in Advocacy Task Force Bill	Change the charter of the Securities and Exchange Commission to specify the encouragement of the flow of capital into small innovative enterprises as well as to protect the public investor. (INN-SBTF)

PROCUREMENT RECOMMENDATIONS

ADVOCACY TASK FORCE BILL SECTION	JC-WG AND/OR INN-SBTF RECOMMENDATIONS
Section 6 (a) 7	Every federal agency should study policies and procedures that discriminate against small businesses, and to institute changes that will equalize opportunity without harming the public interest. (INN - STBF)
COLUMN NOTE: These two sections of Task Force Bill have no direct parallels in JC - WG or INN - SBTF Reports.	The Departments of Defense and Energy and the National Aeronautics and Space Administration shall take additional steps to conduct regular break-out reviews of all proposed large scale systems contracts for research and development, and to seek means of making more of this effort available to small business. (ADVOCACY TASK FORCE BILL - Section 6 (a) (5)) All Federal agencies involved with research and development funding will develop, with the Small Business Administration, specific programs to inform their staffs and consultants of the need to provide a fair and equal opportunity to small women-owned and minority business firms to be considered for Federally funded research and development; and of the requirement to guide, counsel, and assist small firms to strengthen their capability to compete and insure that they receive a fair share of all Federal research and development contracts as described in the Small Business Act. Evaluations of procurement personnel performance shall include appraisals of achievement and attitude in expanding small and minority business participation. (ADVOCACY TASK FORCE BILL Section 6 (a) (6))

PATENT RECOMMENDATIONS

ADVOCACY TASK FORCE BILL SECTION	JC-WG AND/OR INN-SBTF RECOMMENDATIONS
Section 5(a)(1)-(9) (cont'd)	equal to the amount of the R&D award under which the invention occurred. Likewise, with inventions made in national laboratories, the government should preferentially license small business concerns. (INN-SBTF)
Section 5(d)	Small businesses should be able to obtain (with appropriate restrictions) compulsory licenses through suitable proceedings in cases where uncommercialized patents block entry into new markets. (INN-SBTF)
No parallel section in Advocacy Task Force Bill	The Justice Department should be required to undertake competitive impact studies for taking anti-trust action against small business when a small business is attempting to exploit the full property rights afforded by its patent. (INN-SBTF)
No parallel section in Advocacy Task Force Bill	Treat license royalties as capital gains instead of ordinary income. (INN-SBTF)

Exhibit 4

U.S. SMALL BUSINESS ADMINISTRATION
WASHINGTON, D.C. 20416

OFFICE OF CHIEF COUNSEL FOR ADVOCACY

August 10, 1979

SOME STUDIES SHOWING THE SOCIO-ECONOMIC IMPORTANCE OF SMALL BUSINESS INNOVATION AND SMALL SCIENCE AND TECHNOLOGY BASED FIRMS

1. MIT Study for Department of Commerce on "The Job Generating Process," David L. Birch, February 1979.

   Small concerns with 20 or fewer employees created 66% of all net new jobs in the private sector between 1969-1976. In addition 80% of new jobs came from businesses less than five years old. The same study showed that 87% of new jobs came from firms with 500 or less. The study is based upon a sample of 5.6 million businesses.

2. Canadian Federation of Independent Businesses Study:

   Small businesses with 20 or less employees created 72% of all new jobs in Canada between 1969-1977. During this same period these small firms created 317,000 jobs in manufacturing while those employees show a loss of 124,000 jobs.

3. MIT Development Foundation Study, "The Role of New Technical Enterprise in the U.S. Economy." John O. Flender and Richard S. Morse, 1975.

   Sixteen highly successful industry leaders were divided into three categories to compare growth in employment and tax revenues to that of sales over the five year 1969-1974 period. The categories and firms were:

   Mature Companies Dupont, General Electric, Bethlehem Steel, General Foods, International Paper, and Proctor and Gamble.

   Younger Innovative Companies Polarid, 3 M, IBM, Xerox, Texas Instruments

   Young Technology Companies Data General, National Semiconducter, Compugraphic, Digital Equipment, and Marion Laboratories.

   The findings of that study were as follows:

   Young technology companies with sales equaling only two percent of those of the mature industry leaders created 34,369 new jobs or 34 percent more than the 25,558 new jobs created by the mature companies.

   Total employment in the mature firms increased at only 3.2 percent over the five years compared to 23.7 percent for the innovative companies.

   The innovative companies provided nearly $2.3 billion of income tax revenues compared to $1.5 billion for the mature companies, or 34 percent more taxes.

The ratio of innovations to R&D employment is four times greater in firms with less than 1000 employees than in larger firms.

The total cost per R&D scientist or engineer is almost twice as great in firms of over 1000 employees than in smaller firms.

In spite of the above record in innovation and lower cost, small business receives only 3.5 percent of total Federal R&D.

6. U.S. Department of Commerce Study, Technology Innovation: Its' Environment and Management (Charpie Report), 1967.

The Secretary of Commerce convened a distinguished panel under Robert Charpie to consider the main factors affecting invention and innovation. Some conclusions were:

A handful of companies with 5000 or more employees perform almost all industrial R&D but this was not necessarily indicative of innovation performance.

In analyzing many studies they found that independent inventors and small technology based companies are responsible for a remarkable percentage of the important inventions and innovations of this century, a much larger percentage than their relative investment in R&D would suggest. These include:

The Jewkes study on 61 important inventions and innovations in this century, over one-half came from small firms and independent inventors.

The Hamberg study (U. of Maryland) of the 1946-1955 decade found that over two-thirds of the major inventions resulted from the work of independent inventors and small companies.

Professor Hamberg also studied 13 major innovations in the American steel industry. Four came from European companies, seven from independent inventors, none by American steel companies.

The Peck study (Harvard) of 149 inventions in the aluminum industry found that major producers accounted for only one of seven important inventions.

The Enos study (M.I.T.) considered seven major inventions in the refining and cracking of petroleum. All seven were made by independent inventors. The contributions of large firms were largely in the area of improvement inventions.

They emphasized the importance of the small company environment in innovation, of the large company in improving upon existing innovations, and that R&D expenditures do not necessarily correlate with obtaining innovation.

9. Fact Sheet, National Federation of Independent Businesses, February 1979.

Between 1970 and 1977 the Fortune 1000 largest industrial concerns increased their employment by only 3.9% or less than .8% per year. Total private sector employment, exclusive of the Fortune 1000 firms, increased 65.0% during the same period while government employment increased 31.1%.

Economic Concentration:

10. Economic Report of the President, January 1979.

In 1955, the top 500 industrials controlled 65% of all manufacturing and mining assets in this country. By 1965, the figure had climbed to 73%, and by 1977 it had reached 83%. Less than 3% of all industrial firms now control over 80% of all industrial assets as did the top 200 thirty years ago. The top 200 now control the same share as did the top 1000 in 1941.

11. Report on Federal Acquisitions Act of 1977.

-Only 8% of all award dollars were through competitive procurement;

-92% or 37.5 billion was from negotiated procurement;

-$23 billion was awarded without competition through sole-source awards;

-$14.5 billion was awarded without price competition.

12. Elmer B. Staats, Comptroller General of the U.S. "Improving the Climate for Innovation - What Government and Industry Can Do," Research Management, September 1976.

Our advanced technology is concentrated in a few high-technology and/or capital-intensive firms. It is not well diffused throughout medium and small sized companies. Our study shows that, without some added impetus, the advanced technology will not expand or diffuse widely to small or medium sized firms...

Some reorienting or rethinking of Federal policy toward funding the science and technology base may be appropriate... Federal financing of applied R&D in support of commercial technology should be considered in the context of potential economic and social benefits to the Nation and in relation to the private sector's ability and motivation to invest its own resources, as well as in relation to other government initiatives that can influence the climate for private sector innovation.

Senator STEWART. I make the same comments about Mr. Morse, too, I wouldn't want to leave him out.

STATEMENT OF GEORGE LOCKWOOD

Mr. LOCKWOOD. The small business community is very grateful that the Congress has made it possible for Milton Stewart to function.

Mr. Chairman, it is an honor and privilege to testify before your distinguished committees in these combined hearings today. I appear as national vice chairman of the Committee for Small Business Innovation, which has been formed around the nucleus of participants from small innovative businesses in President Carter's domestic policy review. We were amongst the 150 members of the Industrial Advisory Committee that was mostly composed of members from large businesses. I was chairman of the Small Business Subcommittee of this Industrial Advisory Committee that prepared a report which has been published by your Committee on Small Business, House of Representatives, entitled "Small Business and Innovation," August 1979, Number 49-414-0. Our subcommittee report begins on page 57 and contains a number of legislative recommendations based upon our domestic policy review experience.

As Milton Stewart pointed out, our report received significant contributions from 4 days of public hearings that were conducted by his SBA Office of Advocacy, and had participation of hundreds of small business entrepreneurs that helped us focus upon the constraints to small business innovation that occur today.

I also appear as president of Monterey Abalone Farms, a new technology firm I founded in 1972 now going through a major expansion and our final push to profitability. We have acquired some $5 million in high-risk equity capital from private sources over the years, to finance our initial investigations, conduct our research and development, test our concepts in pilot operations, and now expand to profitability. Our entire project has been without government support of any kind. In fact, government has been our major obstacle. We have 42 agencies of government involved in our decisionmaking, and I spend in excess of 50 percent of my time on government matters.

It was only this morning that we had a chance to review the President's domestic policy review message released yesterday. As a result, we cannot comment with any degree of sophistication upon it. My initial reaction, however, is one of disappointment. This message is more notable for its omissions than for its inclusions, particularly in the area of the impact of taxation policies upon small innovative businesses, and the omission of any real substantive approach to the enormous regulatory problems that disproportionately impact upon small innovative businesses. It appears to be a well laundered report; particularly by the Treasury Department and the regulatory agencies that our reports comment upon. It therefore seems to me that it will be the responsibility of Congress to assure that the recommendations of the Domestic Policy Review, particularly the Small Business Subcommittee, receive adequate consideration.

I understand that the Congress is in the process of forming a national policy concerning innovation. We would encourage you to include the following points in your national policy;

changes cannot be accomplished on a piecemeal basis. We strongly urge that the entire package of recommendations contained in our domestic policy review be enacted into appropriate legislation as soon as possible.

Thank you, Mr. Chairman.

Senator STEWART. Thank you, Mr. Lockwood. We appreciate your testimony. I have got some questions to ask and then, of course, I think some of the other members of the panel do also.

Mr. Morse, I want to ask of you a number of questions and thank you for coming to testify and for being here with us today. I want to ask you some questions with regard to the administration's policy review. It doesn't set specific goals for the increase of small business participation in Federal research and development.

Legislation has been proposed on the Senate side, I think there is some proposed on the House side, that would do that. Witnesses yesterday who testified on behalf of the administration indicated that this was a subtle area and they felt like specific and mandated goals would not achieve the purpose that we were seeking to achieve, that is, more research and development dollars from the Federal level going to small business. They say that the agencies are going to increase this on a voluntary basis.

What do you think of, first, the position that we are taking in the legislation by targeting certain mandated goals for participation by small business entities. And then I guess you can answer at the same time, what do you think of the administration position of letting OMB monitor the activities of the different agencies?

Mr. MORSE. Let me be sure I understand your question, sir. You are referring to the old scheme of set-aside contacts for small business?

Senator STEWART. Actually, what we are talking about is targeting 1 percent a year until it reaches the percent in the area of research and development moneys in each agency.

Mr. MORSE. This is mandating the percentage which would go to small companies?

Senator STEWART. Exactly right.

Mr. MORSE. Well, sir, I don't think that is the problem. If we wish to improve the environment for technological innovation, I think it is important that we change our contracting procedures. At the present time, many innovative high technology companies do not wish to have anything to do with the Federal Government. They won't take R. & D. contracts under the present conditions.

I think until you change the mode of procurement, get a simplified R. & D. contract, get rid of the accountants, the lawyers and bureaucracy, and the micromanagement structure which is now being used by inhouse laboratories who now run these contracts, you are not going to find any real innovative commercial company that is not reluctant to take a large amount of Government R. & D. work.

We have got to have a system whereby a small company that has a good innovative idea, can get it funded. If you mandate that DOE or DOD spend "x" percentage of their R. & D. funds you will be forced to spend the money but you are not going to get the real brains of the country involved. I don't think it will work. We

Senator STEWART. The testimony in previous hearings in 1978 by the people who were connected with it indicated if they hadn't had the mandated set-aside they wouldn't have spent the money with small business firms.

Mr. STEWART. I think that is a fair conclusion based on experience as I know it. You get into an area of quasireligiousity between Congress and executive branch about who is on first and who is on second and who has the prerogative for doing what. That is emphatically not my business. As far as I am concerned, the complement for entrepreneurship is created substantially by both. If the Congress says unequivocally and makes it stick through its oversight process, that it wants innovative small businesses accommodated in the procurement process, it has got to decide for itself what is the best way to make it happen.

Senator STEWART. Mr. Lockwood, do you care to comment about that?

Mr. LOCKWOOD. There are several issues that emerge, sir, in your question. First of all, there is no question that we are dealing here with the issue of how government spends its money as well as how individual entrepreneurs and decisionmakers make up their minds in our society, and I think both have to be addressed.

You are addressing particularly the one on how the Government spends its money. Our committee and our report very clearly believe that the Government will not substantially increase the value that it will receive from technological innovation if it is not mandated that a certain amount of Federal expenditures go to small business. You are going to get a much better buy for your dollar. But in no way are the Department of Defense and other large agencies going to accommodate small business innovative processes unless it is mandated. They simply don't have the patience, it is not administratively convenient, which is an expression we heard over and over again in our study.

So we strongly believe that in terms of how the Government spends its money, there has got to be a mandated amount and we have recommended the 1 percent a year up to a level of 10 percent.

But second, we think it would be a serious mistake if the Congress does not look at how it can take steps to release the entrepreneurial inventiveness in the private sector outside of government programs. This is in the area of taxation, regulation and patent policy.

Mr. MORSE. May I add to that. I want to be sure I didn't leave you with the wrong impression.

I support what George has said completely. My concern with the set-aside question which you posed to me earlier was predicated on the basis we keep our current contracting mechanism. In my view, if we continue to have the present system of buying R. & D. activities, the bid proposal system, cost sharing problems and everything else associated with the letting of R. & D. contracts, set-aside will not be useful. If we can change contract procedures and policies Government R. & D. will appeal to the more innovative high technology companies who at the present time are reluctant to participate in any such work.

Senator STEWART. Thank you very much. I have got some other questions.

would allow and encourage small business to enter into this market again. There are very specific recommendations here concerning Federal policies and procedures and legislation that we would urge you to consider.

Mr. LLOYD. You feel that following these recommendations will indeed encourage small business. Without some changes small business obviously cannot compete in any way with large business nor with the Federal Government itself.

Mr. LOCKWOOD. We believe not only would it allow many more small businesses to enter into this market and to provide services to the Government, but we sincerely believe that the U.S. Government will get a substantially better buy for the expenditures that you are making.

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

Mr. MORSE. I think we have to show a differential between procurement of standard products and R. & D. I think George and I are talking R. & D. procurement. That is quite a different situation. If small corporations want to go out and bid on fixed price take or leave it, fine. When you get into the problem of conducting research and development, an innovative company is then faced with patent rights, the bureaucracy, the overhead.

If we could adopt the kind of contract mechanism where the innovative firm felt that they could afford the risk, the time and the overhead, and have a reasonable patent position, you would get innovative companies working for the Government again.

Mr. LLOYD. Thank you very much.

Mr. STEWART. I want to make a general comment, if I may, that I think every Member of Congress really doesn't need made to him. In the last 14 months I probably have talked to somewhere between 15,000 and 20,000 small business people in preparation for the White House Conference on Small Business. The attitude you describe is very general. The thing that makes it especially tough on public policy is that the people who feel this most strongly are the creative innovative small firms. As a taxpayer I would like to see these creative firms work hardest for the Government, but these are the ones least willing to do it because they can make out in the private sector. They don't need government contracts. Again and again you hear the litany: "It's the last government contract I will ever take or ever try to get."

Now, the model for how to go about it is in the NSF program, a simplified select process that fits neatly into the private sector and gives the simplicity and ease of treatment that I think small business has to have. I would look at the mechanics of that very hard. That is why I think the President has done a great thing in directing that it be expanded to other agencies.

Mr. LLOYD. Thank you, Mr. Chairman.

Senator STEWART. Congressman Roth.

Mr. ROTH. Thank you, Mr. Chairman.

I want to compliment the members this morning for their testimony. I didn't have the chance because of a vote, to hear Mr. Lockwood, unfortunately, but did have a chance to go through your testimony. I think it is very well done and all of you did a real good job.

The tremendous increase in interest rates, inflation, it takes about $3 for every $1 of depreciation to keep the plant up to date. Our managers of our large corporations think more in terms of return on investment, return on investment for shareholders. There are many ways today where you can improve your plant and show 20 or 30 percent return on investment. They compare that with a high risk R. & D. program. They say, let's not do the R. & D., this is another factor influencing our not being innovative in large companies.

Mr. ROTH. Thank you.

Mr. LOCKWOOD. I would like to comment on one of Mr. Roth's questions pertaining to the technology drain overseas. It is very clear that in our company's business plan that after our present expansion is completed next year, all future expansion will be overseas. We find it very, very difficult to operate within the regulatory environment that our particular company—indeed our whole industry—has to operate in the United States.

We have 42 different Government agencies we have to deal with and yet we can go to Australia or New Zealand or to a number of other countries that have approached us and with whom we have had serious conversations and overcome much of this regulatory problem. So this is clearly a factor in the technology drain that we are talking about.

Mr. ROTH. Thank you.

Mr. WYDLER. I want to follow up a little bit. We hear that expression so much today, and I am trying to figure out in my own mind what we really mean when we say it. I want to find out what you mean by cutting out the bureaucracy, getting rid of the red-tape. These are code words. I don't understand really sometimes what they mean to you when you say cut out the bureaucracy? What would you like us to do specifically about something we could cut out that would help small business?

I can never understand what people mean by this.

Mr. MORSE. You want some specific cases to illustrate the point?

Mr. WYDLER. Yes.

Mr. MORSE. I think George has given a fine general description of his problems of regulation. If, today, a small company has an innovative high technology idea—that is what these hearings are all about—it is very difficult to get any funding on reasonable terms.

Mr. WYDLER. I want to limit it to that example.

Mr. MORSE. The Department of Energy has a lot of money for R. & D. I have had specific experiences with this organization with several small companies.

Before a new idea is in fact acted upon you often find that a DOE inhouse laboratory wants to check it and spend in-house funds. Our system of Government permits the transfer of funds from one agency to another, and funding of in-house laboratory programs much easier and more promptly than the support of a small company project.

If the bid and proposal system is used, the small company spends inordinate amounts of time and money. An approved overhead rate would be established. Lengthy arguments would revolve regarding patent clauses in the contract and use of background rights. This

Mr. WYDLER. The Government spending, more risk being taken with the Government money.

Mr. MORSE. I appreciate your comments. I have been on both sides of this question of R. & D. funding. I also have been in Washington and there is no doubt it is a problem and there are a limited number of companies that take advantage of the Government. I just hope you realize that the present complexity is infinitely worse than it ever was and the Government is the loser.

I think on net basis, if the Government made a few mistakes but was willing to give somebody authority and responsibility to make a decision we all would be ahead of the game and save money. I was a director of the company that had the prime contract on a steam automobile sometime ago. We spent about $13 million of Government money. Technically it was very well spent. DOE decided they didn't care about steam cars anymore. The contract was canceled as they were more concerned about fuel economy than pollution.

I would say from my own experience if that work had been done in the private sector it would have cost one-half as much and probably would have saved 25 percent of the time. I think we can afford to take some risk in making decisions, which again I repeat, is precluding many competent, innovative technical firms from doing government R. & D.

We are ending up with other types of contractors who are not as innovative and whose technology is probably not at good. So we as taxpayers lose.

Mr. LOCKWOOD. Mr. Chairman, might I just comment on the question that Mr. Wydler has raised here, that basically is what can the Government do to cut out bureaucracy. Let me point out very clearly that oftentimes the regulations that you pass here in Congress have a disproportionately heavy impact on the small independent business. There clearly has got to be consideration of exemptions for certain sized firms.

In other words, before a particular regulation applies there should be some level of impact before OSHA or EPA or whatever, come into small business. In our particular report, sir, we have a number of recommendations in this area. OSHA is one terrible example of what you can do to small business. I, for instance, operate in California. The California OSHA program picks up on the Federal OSHA program which you passed. We have 28,000 OSHA regulations to comply with in the State of California. I spent over a 1,000 hours of my time litigating through the OSHA appeals process to get out from underneath some citations that were going to cost me thousands and thousands of dollars, that were unnecessary, and finally, the appeals process upheld me after 1,000 hours that we spent.

It is on position that there has got to be a provision of prevention against first instance citations, except the extreme cases. There has got to be exemptions for innovative firms from much of what OSHA is trying to do, unless it can be clearly shown that there is justification for them to impact on small concerns.

This goes throughout the regulatory maze, whether it be EPA or FDA or whatever, there has to be some special consideration to nondiscriminatory treatment of small independent innovators.

Mr. FUQUA. Thank you very much.
Mr. Brown.
Mr. BROWN. No questions.
Mr. FUQUA. Mr. Hance.
Mr. Ambro.
Mr. Evans.
Mr. Ritter.
Mr. RITTER. I would just like to welcome the gentlemen from the panel, and particulary the gentleman from the Sloan School. I happened to spend a few years of my life up there in Cambridge, Mass. Delighted you could make it.
Thank you.
Mr. FUQUA. Thank you very much. We thank you so much for being here. I wish we had more time. This is a very stimulating discussion. I think we have gained some very valuable information.
The next panel will be Dr. Imrich Klein, from Scientific Process & Research, Inc.; John Kariotis, Kariotis, Kesler and Allys; Sidney Green, TerraTek, Inc.; E. Sanlorenzo from General Applied Science Laboratories; and Dr. Gilbert V. Levin, of Biospherics, Inc.
[The biographical sketch and the prepared statement of Dr. Klein follow:]

STATEMENT BY IMRICH KLEIN, SCIENTIFIC PROCESS & RESEARCH, INC., HIGHLAND PARK, N.J.

In my company's eleven years if operation as consultants to the plastics processing industry we have many times been faced with the need to develop innovative approaches to manufacturing problems. During that time my associates and I have developed dozens of new manufacturing techniques, devices and tools. Some of our techniques are in widespread use today within the plastics industry and four devices of our invention have been granted patents. Yet most of our inventions and ideas lanquish undeveloped and untested. Does this simply prove that many of these inventions are without intrinsic value? We don't believe this is so. Our experience simply reflects the hostile business climate that existed in our country for the last eleven years and which in my humble opinion already caused irreparable damage to our industrial leadership, material well being, financial strength and as a result also to the security of the western world. What then are the problems that we have faced?

Innovation is a natural process engendered by a technological society's needs to increase productivity and to expand the marketplace of manufactured products. But the manufacturer of a product has another need - one that is contradictory to the goals of technical innovation. The manufacturers strive at all times to reach a high level of

of the large plastic material manufacturers. During this time none of the machinery manufacturers showed any interest in evaluating the merits of the invention.

When the first test was finally completed, one machinery manufacturer was willing to negotiate an exclusive license to build and market the device. In fact over a three year contract period the machinery manufacturer never built, tested, marketed or sold a single unit. Clearly the policy of established machinery manufacturers, our licensee and others that we have dealt with since, has been to withhold new development until market pressures force them to introduce the innovation. Yet, because the manufacture of heavy machinery is capital intensive there is very little incentive for new competitors to enter the field and so these market pressures mount very slowly. So slowly, in fact, that the term of a patent right becomes an insignificant period of time. Why then should a manufacturer pay royalties on a product when it can simply be withheld from sale until the patent expires.

When the term of our contract with the manufacturer came to an end it was evident to us that we would have to develop our invention on our own. By this time our patent was already two years old and it seemed imperative that we bring the product to market within a short time.

simulations on the operation of the new device under a wide variety of conditions. For the first time we were able to quantitatively asses the value of the device in operation. When the results of the study were published the response of the industry was astounding. We received at least 100 inquiries from plastics processing companies all over the world wishing to see a prototype of the device in operation. This response was quite surprising as it resulted from a technical paper and not from a marketing campaign. Naturally, we still had no prototype to experiment with and no plant facilities with which to operate such a prototype. We applied to the NSF for a Phase II contract to build the device and study it in operation. However, we had never before prepared a full scale contract proposal to the Federal Government and were unsure as to how to go about it. Fortunately, the Small Business Program of the NSF was extremely helpful in explaining the method of filing and the proposal formats. They also directed us to references which outlined the requirements of doing business with the Government. Without this assistance it is doubtful that we ever would have been able to submit a successful proposal the first time through.

As we hold several other patents we also applied for grants under other government programs for studies on these devices as well. However, our experience with other

and noted that this other device was not used to save energy. This review process continued for many months or rather years and there was never a technical analysis made of the merit of the device. The correspondence with the reviewers which we saw, was strictly at a layman's level and consisted entirely of sophistry and untutored "horse sense" and not at all of technical discussions. One aspect which irked me considerably was the reliance on large companies as sources of review. Although no reviewer's identity was ever directly revealed, the reviews all had healthy measures of corporate policy statements from the large companies in the field. These statements sounded more like the work of lawyers and public relations representatives than of scientists interested in the progress of manufacturing technology.

How much investment has the federal government actually made in my company's inventions and ideas? Let me first point out that those ideas which have been accepted for government subsidy have been shown to meet an important national objective. Second, because it is impossible to maintain trade secrets while working on an NSF contract I have never come to the government with an invention without exhausting every means that I know of to capitalize on the idea without government support. The two inventions of ours which are currently being studied under government

several venture capital firms as well that were attracted by the government participation in the project.

How many small companies just starting out in business could hope to pay one third of that bill out of pocket and attract another third in venture capital? The requirements for government funding as they now stand are so stringent and so difficult to determine that it is questionable whether any company capable of securing, funding and managing such a project really needs the government's help. On the other hand, the majority of companies with ideas which are worthy of development and which can greatly contribute to the advancement of technology may not be able to successfully tread this thorny path. It should be the aim of the government to provide not only funding but guidance and support to small high technology firms to assure that the new products the nation and the society in general requires reach the market in a timely and orderly manner.

Within a few months we got contributions totaling about $90,000, with more promised to at least equal the $200,000 followup capital. This means that these companies gave us products and in some cases machinery worth as much money as the contract from the National Science Foundation provided in itself, without requiring any participation in the product.

I just want to illustrate that Government sponsorship of a high technology item in itself can make a great deal of difference. Of course, we also found out that the machinery industry in particular is not interested in funding the development of new products because it is so costly to bring them out. Money is not available these days, and hasn't been in the past 10 years or so.

Instead, they stick with their old product line, without rocking the boat. As a result, of course, we can see how this leads to the problems of balance of payments deficits and other trade and security problems which you gentlemen in the Congress are confronted with day after day. Without a proper environment for the development of new equipment it is difficult to maintain technological leadership for very long.

I think that supporting high technology companies with new ideas is a very worthwhile project. Whether it is being done one way or the other, by set aside or other means, I don't think that I am qualified to elaborate on that.

I think that this is the most important agenda this nation has because with the troubled balance of payments and with all the other problems that we have, I think even our security is going to be jeopardized in the next few years if we cannot find a means to stimulate our most important national resource—the innovative talent of our people.

Thank you.

Mr. FUQUA. Thank you very much.

Mr. Kariotis?

[The prepared statement of Mr. Kariotis follows:]

Cost control developed by years of design of new construction and knowledge of construction techniques used in the present and past by the building industry will be a foundation to build a methodology that can be used by the practicing engineers throughout the United States to reconstruct and rehabilitate the extensive inventory of presently under-utilized masonry buildings and also mitigate the life safety hazard of these buildings when they occur in the geographic areas of the United States that are subjected to earthquake hazard.

This research program has beneficial effects for the rehabilitation of urban areas and development of a larger market for the construction industry involved in building reconstruction. The immediate benefits to members of the joint venture are employment growth both due to the research effort as well as new engineering projects that utilize the special expertise acquired by this research. While reconstruction and rehabilitation of buildings had been a specialty of Kariotis, Kesler & Allys prior to obtaining this research contract, the demand for our engineering services in this field has increased.

This research has developed innovative analysis and redesign techniques that are at variance with design techniques and building codes now used for new construction in earthquake prone areas. To gain understanding, acceptance and general use by the design professions and the governing agencies, a program of nationwide dissemination of the methodology is needed. This task of information distribution is nearly the equal of developing the methodology by research and material testing.

This communication problem we are confronted with is not unique to our research program. We are in close collaboration with other funded researchers in the earthquake engineering field and gain information from them that extends our information base. But we see a large quantity of associated research outside our task that need be tranlated into current design and construction. Specialized research done by very qualified investigators needs to be coordinated by an intermediary between the researcher and the industry that is the user of the research product. Small business involved in the technology side of the related industry is the logical provider of this translation of research to practice.

Since this field, earthquake engineering, does not manufacture a product for sale but instead provides a service for incorporation into myriad construction and rehabilitation projects, funding of this translation is not a clearly defined carry-on of research. The recovery of these translation costs from a single source is not feasible since, in our instance, the users are an engineering profession

STATEMENT OF JOHN KARIOTIS

Mr. KARIOTIS. I represent a small business firm. We provide civil and structural engineering services. This firm and its predecessors represent 24 years of experience.

In 1977 we responded to the proposal solicitation by the National Science Foundation for their small business innovation to national needs. Our proposal was in our field of expertise, earthquake engineering, related to a disaster and natural hazards program.

On completion of phase one, we formed a joint venture of three small business that had coordinated studies on the same earthquake engineering topic. Our carry-on proposal was entitled "Methodology for Mitigation of Seismic Hazards in Existing Unreinforced Masonry Buildings."

This program is just beginning its second year of funding. The formation of a joint venture enabled us to pool very specialized abilities of three separate firms, to propose extensive research analysis in materials testing.

Our materials testing is of full-sized elements that exist in buildings, that have existed in the United States from current days to as old as 150 years ago.

The methodology that we are working on for mitigation of seismic hazards will be developed from this research analysis and materials testing, and will enable the design profession and the construction industry throughout the United States to reconstruct and rehabilitate the very extensive inventory of underutilized masonry buildings, and further to mitigate seismic hazard, life safety hazards that may exist in these buildings when they exist in geographic areas of the United States that are subject to seismic hazards.

This research program we believe has very beneficial effects for the rehabilitation of urban areas, and develop a larger market for the construction industry that is now involved in building reconstruction.

We believe it is necessary for the building official to have access to this methodology to enable him to protect the public interest.

It further aids in our belief the general public in that innovation and cost effective reconstruction and rehabilitation, furnishes housing and space at less than present construction cost, and will further stimulate retention of the cores of urban cities.

But after this methodology is developed, our problem is how do we disseminate the information. This task of information distribution throughout the United States is nearly equal to the task of development of the methodology.

Problems of information distribution are not unique to our research program. We do not produce a product. We produce a service. This service should be available to all of the design profession.

Further, we see many research projects that have developed very valuable information, that needs to be moved into the general use.

Funding of information distribution is a difficult task. Since we do not produce a product for sale but rather our service, which is incorporated into many construction rehabilitation projects, we do not see a single beneficiary that can fund this information distribution.

STATEMENT BY SIDNEY J. GREEN, PRESIDENT, TERRA TEK, INC., SALT LAKE CITY, UTAH

I am President of Terra Tek, a Utah-based, high-technology Company. Our Company and its subsidiaries and affiliates employ about 150 people and provide services and products to industry and government clients involved in energy and resource recovery and development, civil construction, and defense problems. We began in 1970, and last year our Company created about 30 new jobs. We expect to add 30 to 50 new jobs in the next 12 months, and are currently developing about a dozen innovative, new products and services, many of which we expect to eventually bring to the marketplace.

When I speak of industrial innovation--and I mean the development and commercialization of high-technology, innovative products, services, and processes--universities, national laboratories and not-for-profit institutes, big businesses, and small businesses all contribute inventors and entrepreneurs to the process. Numerous studies have shown, however, that the small, high-technology firm--frequently a firm with a few to a few tens of people--offers the best environment for the entrepreneur to be innovative. Innovation is clearly a process where big is not better; and, in fact, well-documented investigations clearly show the fact that small, high-technology firms produce a very, very disproportionately large share of technical innovations. Yet at the same time, small businesses have access to relatively little capital, relatively small amounts of equipment and facilities assets, and relatively little in the way of management and know-how skills required to compete with the big institutions and the big institutional bureaucracies. Small businesses are simply frequently

yet been demonstrated. In general, this early stage is before venture capital groups will become involved, and of course before a public offering to raise capital is feasible. The entrepreneur invariably spends much of his time obtaining resources to pursue his idea at this stage--as opposed to actually pursuing the idea. I feel that government R&D procurements play a very significant role, as these funds will frequently provide the entrepreneur with the resources to literally keep bread on the table and pay the bills. Therefore, any methods that would productively allow small businesses to play a larger role in Federal Government mission agency R&D procurements--greater than the three or four percent of the R&D funding which currently goes to small businesses--would be very helpful. I also believe that more programs such as the National Science Foundation Innovation Research Awards program would be extremely helpful. Obviously not every high-technology entrepreneur will find that government R&D procurements are programs like the National Science Foundation has, will be in their game plan. But for many ventures, such federal programs will play a significant role, and even a small percentage change in Federal Government R&D procurements would have a very, very profound effect in terms of support available for new entrepreneurs.

I am very pleased that the Senate and House have placed priority on actions that may assist high-technology innovation. And, that by the very nature of these hearings, that is the Senate and House Small Business Committees--an appreciation that small businesses play a significant role is shown. The small business community is a fragmented

We find today when funding even for Government labs is difficult to obtain in R. & D., they have developed a technique for funding each other. One agency will contract out to another agency in return for a contract from that agency and thereby support each other's personnel.

Now we find that these Government laboratories are even invading our turf. Much as I am a supporter of NASA, I have had a fine relationship with it for many years, I find that its prime contractor, supported supposedly solely by it, can no longer keep its people.

So, it is competing with us in the field of, would you believe, wastewater treatment. When that competition is leveled against us, those Government laboratories have an enormous advantage. Their overhead is nonexistent. The traditional statement is, "It doesn't cost us any money to do this work because we have the people and the facility anyway."

We find also that more and more research today is being programed. That means that a group or panel of experts in a particular area is convened and asked by a department what it should spend its money on.

Lo and behold, if you are an innovator and you want to do something not within the prescribed area, you are through, there is no way to get funded.

The sole source unsolicited proposal route is essentially dead today. Mr. Marconi would have had a terrible time trying to get his radio funded, when all the procurement documents would have been asking for new methods to make smoke signals more effective, to promote the telephone, to promote heliostats, et cetera.

None of these experts would have thought of suggesting communication via a wireless.

In the recommendations that I have made in my statement, primarily I would like to see the Federal Government recognize innovative small business as a key ingredient in regaining the technical leadership that the United States has lost.

I would like to see Government incentives for investment by private and public agencies in small businesses. I would like to have the competition, the unfair competition, by Federal agencies and laboratories with innovative small businesses eliminated.

Contracts from Federal agencies should be made more supportive of innovative small businesses. I would even suggest an affirmative action program for small businesses so that all innovative small businesses would be treated as minority businesses are now treated.

Finally, I would suggest in the interest of not only small business but of the major crisis confronting our country, that a large program, Apollo-like, be enacted to solve our energy problem.

The energy problem cannot be solved by the type of hole-plugging research that is being advocated today. Whole new technologies must be invented, and the small business innovator can play a very large role in that.

But just not to leave you with the impression that I think the small business innovator is omniscient, I want to turn to my favorite philosopher, Fred Allen, and recall a little skit from one of his radio shows.

from a Fred Allen radio show. Fred was deploring the unkind fate of the inventor and lamented: "Take Robert Fulton - everyone thought he was crazy. And take Eli Whitney - everyone thought he was crazy. And take Albert Einstein - everyone thought he was crazy. And take Heathbert Thornton..." "Who was Heathbert Thornton?" interrupted his straight man. "Oh," snapped Fred, "he was crazy."

Thank you very much. I will be glad to try to answer any questions.

STATEMENT OF DR. GILBERT V. LEVIN

Dr. LEVIN. Thank you, Mr. Chairman, committee members.

I am president and chairman of the board and founder of Biospherics Inc., a small company dedicated to innovative products, processes, and services in environmental science and public health.

By training I am an environmental engineer, with bachelor, master and Ph. D. degrees from the Johns Hopkins University.

I founded Biospherics in 1967 on a loan that I secured from the bank personally. From that time, starting as one person, we have grown to our present size of 200 people. This year we project receipts of $5.5 million.

We went public in 1969, and are now listed in the Over-The-Counter market as one of the NASDAQ corporations.

We think we have lived up to the small business innovation reputation. Among our innovations are a method for removal of phosphorus from municipal waste water, which we have licensed the Union Carbide Corp. to distribute worldwide, and which has already been sold to some 20 municipalities.

Waste water monitoring instruments.

A rapid method to identify infectious microorganisms for clinical use.

An instrument to measure oil pollution in water discharges.

A patient education kit for heart attack victims.

A Mars life detection experiment which was selected by NASA in a national competition and was sent to Mars on the NASA Viking mission.

It is really kind of thrilling to think that something made in our laboratories is resting on Mars as of this moment.

There have been, like that one, some glorious experiences in running and growing a small business. But please remember, you asked me to speak on the problems. So I would like to summarize some of the problems I have alluded to in my prepared statement.

During our 12½ years, I think we have encountered all the problems a small business is supposed to encounter, and I think a few which are invented especially for us.

In the category of cash, which obviously always come first, I find, just as Sid Green said—and we did not collude on this—I spend more time chasing money than I do innovating, and some of my finest innovation has been devoted to how to get the money to go ahead and do the job.

at some future date. Generally, at worst, they are required to purchase a retroactive license or pay a penalty while keeping the lead position in the field and the profits accumulated.

In describing the foregoing incidents, I am aware some of you may simply ask "But isn't that the way innovative small business is supposed to work - succeeding over the deaf ears of bankers, the opposition of Government agencies, and the indifference of the public?" My answer is "No! not if we truly believe that innovation in technology is vital to our country's future." While Biospherics may have been mildly successful in overcoming these odds, we spend an enormous amount of time treading water instead of working on other innovative ideas.

RECOMMENDATIONS The recommendations I would make to improve the climate for small business innovation are largely contained in the Small Business Administration Advocacy Bill which I helped draft and which is published in the August 1979 Committee print entitled: "Small Business and Innovation" by the Committee on Small Business, House of Representatives, Ninty-Sixth Congress, First Session. However, I would like to make a general summary of those and perhaps one or two others which I believe to be particularly important:

1. The Federal Government should recognize the need and importance of small business innovation as a key ingredient in returning technological leadership to the United States.

2. A variety of incentives should be developed to induce private and public funding sources to invest more heavily in innovative research and development by small businesses.

3. The Federal Government should make a clear delineation of funds to be expended on contract research as opposed to

any competitive process. Daily operating costs are reduced approximately 90% compared to costs for other phosphorus removal processes. Solid waste production is approximately 50% less than other processes. The resistance of the wastewater plant to shock loading and to toxic substances is greatly improved by the process.

Over the past 5 years, Biospherics has been profitable with annual growth exceeding 30%. Some people suggest that our best course of action is stand pat and await natural growth. However, we still have the desire to create and innovate - and still find barriers thereto. Not all of the barriers are posed by banks, or the public marketplace for small business stocks, or the difficulties of Government procurement, or even the SBA. A new and, in my view, major problem to innovative small companies was introduced in 1974 by the Financial Accounting Standards Board which controls "generally acceptable" accounting principals applied by public accounting firms. Until 1974, it had been possible for a firm to capitalize its investment in research and development just as it would capitalize its investment in hardware for future sale. The FASB decided, however, that there is a difference between intellectual and real property. It apparently believed that more R&D companies were dishonest in capitalizing white elephant research projects than were hardware companies in capitalizing inventories of, say, whale bone. Accordingly, the FASB declared that all research and development must be fully expended in the year in which it occurred. In addition to causing Biospherics and other small business research and development firms to take a substantial "bath" that year by expensing accumulated capitalized R&D,

the road is very frustrating. For a decade now, almost every agency has yielded to the fashionable "systems management" approach to funding research and development. A committee of experts in a given field is convened to determine objectives and priorities. The systems manager for the program then distributes the money to be spent in the coming year among the various subjects according to the determined priorities. Requests for proposals (RFPs) are prepared and advertised by the agency. When the proposals are received, they are reviewed by a panel of "peers." To a large extent, this is a good, democratic process to set goals and priorities and to make awards. Unfortunately, science is not a democratic process. Significant innovation seldom comes along directed pathways. Indeed, such carefully specified research programs can lead to "hole-plugging" research in which large efforts are given over to achieving marginal increments of progress. The committees, prestigious as they may be, may not even foresee the primary need in an area of technology and, hence, may simply not provide an appropriate area of funding. For example, what pre-Marconi committee of communications experts would have earmarked funds for research into radio? By its very nature, an expert committee could not merely recommend "research into new methods of communication." Rather, because they were experts, they would feel compelled to define the types of communication they felt needed development: smoke signals, mail, telephone, and the like--and the more expert the group of individuals, the more specific would be the items distilled into the research shopping list. Reading the subsequent RFPs, Mr. Marconi would have sought in vain for some area in which he might be eligible for support.

to imagined undue personal gain. Furthermore, in the event the enterprise fails, he is less likely to be criticized. For example, several years ago, the director of research of a large agency to whom I was suggesting a new line of research said "Dr. Levin, you are wasting your time. You don't understand that the era of the small research firm is over. Research and development has gotten so complex that only large aerospace type companies have the necessary resources, facilities, and personnel to carry out our programs." In another incident, I went to visit an agency research head with a NASA official. I had suggested a particular use of satellites for the agency, and NASA had felt that this was a good idea and was offering to fund the agency to the use of the satellite. We were proposing to perform the necessary research. The research bureaucrat listened politely and then matter-of-factly stated that he had no sympathy for the idea and "could never envision the day when (the agency) could have any need for the use of a satellite." Today that agency is deeply involved in satellite applications of the nature suggested.

In the late 1960's, the environment was very favorable for research and development firms to submit "unsolicited" proposals to Government agencies for "sole source" funding. Thus, a company which had an original idea would send a proposal to an appropriate agency which, if it liked the idea, could directly fund the company. With the turn of the decade, this attitude was changed and agency administrators announced that funding for long-term research projects would be curtailed or even eliminated. For example, the EPA announced that it would not fund any research projects that would take longer than three years to re-

bank rates, interest can eat up approximately 50% of the "profit" allowed under the contract. And this is before introduction of the "stretch-out." The stretch-out may be deliberately applied or may occur because Government contracting officers cannot make timely renewals of contracts. The small business, caught in the dilemma of continuing to pay its people out of its own funds or of laying them off, generally opts for the former in order to have the capability to continue performance. If the stretch-out lasts even one month, its impact, added to that of the non-allowable interest, generally means that the company will lose money on the entire contract.

In our second year, we were fortunate enough to win two contracts almost simultaneously. This time, the SBA called us. The call, alas, was not an offer of help. Instead, we were told that the SBA had learned of the dual award and felt that we could not muster the financial capacity to manage both contracts. We were summarily given 10 days to develop a 5-year cash flow and to fill in blanks on a one inch thick sheath of forms. The SBA official advised us to give up one of the contracts and avoid the "futile exercise." Anyone who would advise a small R&D firm to give up a contract simply doesn't understand the game. Trying to conduct our business during the day and to meet the SBA demands during the night, we had little sleep and plenty to worry about. However, we completed the exercise and managed to demonstrate that our company was viable. Ten years later, the very same official called to challenge an award made to us on the basis that, by application of the small business size in that particular line of activity, we were 5% over the size standard. The SBA then recommended that the awarding agency

JOINT CONGRESSIONAL HEARINGS ON INNOVATION AND PRODUCTIVITY

Statement of Gilbert V. Levin, President, Biospherics Incorporated, Rockville, Maryland, November 1, 1979, Rayburn House Office Building.

Chairman Nelson, Chairman Smith, Chairman Fuqua, and respective committee members, I much appreciate the opportunity to speak on the creativity and innovation of small business, a matter which I have long believed to be essential to the Nation's well-being. I am President, Chairman of the Board and founder of Biospherics Incorporated, a small company dedicated to innovative products, processes, and services in environmental science and public health. Financed by my personally guaranteed and secured bank loan, Biospherics opened for business in March 1967. In twelve and a half years, the company has grown from one person with no contracts to approximately 200 full-time and part-time employees with revenues for 1979 estimated at $5.5 million. The company has developed in the multi-disciplinary fashion originally planned and it has lived up to the reputation of high-technology small businesses by inventing a number of new products and processes and bringing them to market. Our innovations include a major method for the treatment of municipal wastewater which, under our license, is being widely installed by the Union Carbide Corporation; instruments for monitoring wastewater; a rapid method for the identification of infectious microorganisms; an instrument to measure oil pollution; a patient education kit for the recovering heart attack victim; and a life detection experiment selected by NASA in a national competition for the 1976 Viking Mission to Mars.

The available inventory of surplus instruments, computing tools, test equipment, machine tools, could be effectively factored into the productive small business. In this way the burden of borrowing is reduced, and assistance is provided in capitalizing small businesses and the small business becomes more effective.

We would like to see a greater distribution of these assets into the small business community even if they were to be made available on a cost sharing basis.

One final observation which again relates specifically to small businesses engaged in R. & D. activities.

It is our opinion that some procuring activities consistently take the attitude that there is an inadequate number of potential sources within the small business community and substantially limit the number of research and development type contracts which are set aside for small businesses.

We believe that there is most assuredly an adequate R. & D. base within the small business community.

In summary, our goal is to continue to pursue research and development contracts since this activity spawns ideas and technology that can be transferred to other fields. At the same time, we will seek commercial contracts in the areas of high technology services, design and fabrication and our own product development.

It is very likely we can continue at our present level by continued sales efforts to capture the shortrun procurement type contracts. However, in our view this approach provides little opportunity for expansion.

To provide the elements needed for growth, our search will concentrate on obtaining task agreement type contracts in the above areas. Only in this way can we see a small business such as ours derive and transform innovative ideas into positive and real national productivity.

Thank you, sir.

Mr. FUQUA. Thank you, sir.

Dr. Levin.

[The biographical sketch and prepared statement of Dr. Levin follow:]

STATEMENT OF ERNEST A. SANLORENZO

Mr. SANLORENZO. Thank you, Mr. Chairman. My comments will be unique to our sort of business.

General Applied Science Laboratories was founded in 1956 by a group of university professors. Its purpose was to perform applied research in a number of fields, including structural dynamics, electronics, aerodynamics and propulsion.

This corporate venture prospered as a result of the expansion of the U.S. space program, and within a few years we had approximately 400 employees doing research for a number of Government agencies, as well as for some private companies. At its peak our sales volume was $6 million a year.

During this period of growth, GASL designed and built various aerodynamic and propulsion tests facilities at our Westbury, N.Y. site. With the support of the Air Force Aero Propulsion Laboratory, these facilities were assembled to aid in the development of various propulsion systems and operated by our company at no cost to the Government under a facilities contract.

In 1972, administration of this equipment was transferred from the Air Force to the National Aeronautics and Space Administration, Langley Research Center.

These test facilities and their supporting equipment are currently being utilized in a number of research programs and represent a unique capability which forms a substantive basis for our business.

During the course of this growth, we became a wholly owned subsidiary of the Marquardt Corp. With the deemphasis of hypersonic air breathing propulsion by the Air Force in 1967 our company began to contract with loss of key personnel, and finally resulted in a disengagement on the part of the Marquardt group.

With this loss of support, the company was acquired by a group of employees who attempted to rebuild the company with little success other than survival for a period of 2 years.

In 1972 we merged with a company called Advanced Technology Laboratories, which brought back to GASL a number of former key employees. Finally, in 1978 the company was purchased by a group of senior employees.

In a chronological and corporate sense, GASL is an old business. In reality is it a 2-year-old small business.

Our current activities include applied research in aircraft design, experiments to develop low emission gas turbine combustors, and performance testing of the NASA-Langley hydrogen scram-jet engine.

The majority of the efforts are being performed under cost plus fixed fee contracts with various Government agencies. Uniquely, one effort is under a task agreement contract, which is currently entering its third year.

We now have 35 employees. Our volume of business is $1.2 million a year, and our backlog is $500,000, representing about 5 months' work. As the backlog to volume ratio indicates, there is very little room for complacency.

Let me make some suggestions. The ratio of backlog to volume rarely changes in our line of business because the typical Government contract duration is 1 year. At the same time, the typical Government procurement cycle is 6 to 9 months.

fabrication services. A $500,000 level of effort was indicated for a period of one year to provide fabrication of test components that would be defined during the term of agreement. In our view, this procurement had one major flaw. It contained no provision for progress payments on task items that could easily amount to over $100,000. Thus, while set aside for small business, this procurement was beyond our fiscal reach because of the payment - on - completion clause. Clearly, making available the provision for the progress payments would materially aid small businesses. This particular procurement was of great interest to our company as it would have provided a complementary addition to current work and would have provided a basis for the commitment of capital funds for the expansion of these activities. Nevertheless, we were discouraged from competing by the very substantial capital outlay requirements.

The prime virtue of the task - type agreement lies in its longer duration than the usual procurement contract. Aside from the mutual benefits it provides to both the buyer and seller, it also provides a time frame which is consistent with the effective use of surplus government equipment. Regardless of the type of effort, whether it be research, testing, or fabrication, the available inventory of surplus instruments, computing tools, test equipment or machine tools could be effectively factored into the productive small business. In this way, the burden of borrowing is reduced, assistance is provided in capitalizing small businesses and the small business becomes more effective. We would like to see a greater distribution of these assets into the small business community, even if they were to be made available on a cost - sharing basis.

We offer our final observation which again relates specifically to small business engaged in high technology research and development. It is our opinion that some procuring activities consistently take the attitude that there is an inadequate number of potential sources of research and development work within the small business community and substantially limit the number of research and development type contracts which are set aside for small business. We believe that there is most assuredly an adequate R&D base within the small business category and would like to see more R&D type contracts set aside for small business.

In summary, our goal is to continue to pursue research and development contracts, since this activity spawns ideas and technology

finally resulted in the disengagement on the part of the Marquardt Group. With this loss of support, the company was acquired by a group of employees who attempted to rebuild the company with little success other than survival for a period of two years. In 1972, GASL merged with Advanced Technology Laboratories (ATL) reexpanding its financial and technical operating base. The ATL group was headed by Dr. Ferri and brought back to GASL a number of former key employees. With Dr. Ferri's death in December 1975, GASL entered another crisis phase which culminated in an agreement for the purchase of GASL by a group of senior employees in 1978. At the present time, 80% of the stock of GASL is held by four principals who are full time employees actively running the business.

In a chronological and corporate sense, GASL is an old business. In reality, it is a two year old small business.

Our current areas of activity include applied research in high performance aircraft design using analytical methods and wind tunnel evaluation; experiments to develop low emission gas turbine combustion systems; performance testing of the NASA Langley hydrogen - fueled hypersonic scramjet engine module, and design and fabrication services for test articles and aero - test facility components. The majority of the above efforts are being performed under CPFF contracts with various government agencies. Uniquely, the latter effort is under a task agreement contract arrangement which is currently beginning its third year.

GASL currently has 35 full time employees. Our current volume of business is $1.2 million/year and our backlog is approximately $500,000, representing about five months work. As the backlog - to - volume ratio indicates, we have little room for complacency.

SUGGESTIONS

We mentioned the current ratio of backlog to volume. This ratio rarely changes in our line of business because the typical contract duration is one year. At the same time, the typical government procurement cycle (the time between the issue of an RFP and the signing of a subsequent contract) is 6-9 months. Coupling these two facts, it is easy to see that a research project is as little as one-third complete

BIOGRAPHY

Ernest A. Sanlorenzo

Currently Senior Vice President of General Applied Science Laboratories, Inc. Mr. Sanlorenzo has been with GASL since 1957. His area of research is in applied aerodynamics and air breathing propulsion. His current activities are concerned with combustion of hydrogen fuel in a supersonic combustion ramjet system designed by NASA's Langley Research Center. Mr. Sanlorenzo designed the propulsion test facilities at GASL, and is responsible for their operation in current research programs.

Prior to joining General Applied Science Laboratories, Mr. Sanlorenzo was associated with Nuclear Development Associates, White Plains, N.Y., served in the Air Force as a project officer at the Arnold Engineering Development Center, Tullahoma, Tennessee, and was a research assistant at Princeton University, Gas Dynamics Laboratory.

Mr. Sanlorenzo received an S.B. degree in Aeronautical Engineering from Massachusetts Institute of Technology in 1951 and an M.S. degree in Astronautics and Aeronautics from Polytechnic Institute of Brooklyn in 1963.

STATEMENT OF SIDNEY J. GREEN

Mr. GREEN. Mr. Chairman, I have presented a written presentation which may be used in the records as appropriate. I would like to make a few comments, summarizing this presentation.

I am president of a small high technology company. However, prior to becoming president of this company, I worked for a very large corporation. In fact, at the time I believe it was the world's largest corporation.

My experience there was very pleasant. It was a good company. I left because the big system environment did not allow me to pursue new ideas, new methods, new things as rapidly as I desired.

The big system that I was part of even with all its comforts, and with all its resources, was restricting my innovative desires.

The company I am president of now has done well, I believe, in its own right. But also even as a small company we have spun over or have become involved with five subsidiary ventures, each working in different high technology areas.

We have other ventures in the making. Therefore, I believe it is correct for me to indicate that my personal experiences involving high technology innovation have been more involved with new startups, particularly in the very, very early stage when even commercial feasibility of a new invention or a new idea has not yet been demonstrated.

In general, this early stage is before venture capital groups become involved, and of course before a public offering to raise capital is feasible. The entrepreneur invariably spends much of his time obtaining resources to pursue his ideas at this stage, as opposed to actually pursuing the development of the idea.

I feel that Government R. & D. procurements play a very significant role in this very, very early stage. These funds will frequently provide the entrepreneur with the resources to literally keep bread on the table and pay the bills.

Therefore, any methods that would productively allow small businesses to play a larger role in Federal agency R. & D. procurements would be very helpful, I believe.

I also believe that more programs, such as the National Science Foundation small business innovation research program, would be extremely helpful.

Obviously not every high technology entrepreneur will find that Government R. & D. procurements or programs like the National Science Foundation has will be in their game plan. But for many ventures, such Federal programs will play a significant role.

Even if a small percentage change in Federal Government R. & D. procurements were made, this would be a very profound effect in terms of support available for new entrepreneurs.

In closing, my personal experience has been involved with the very, very early stage of innovation processes, the startup phase, and I argue that government R. & D. procurements does play a very significant role in this very, very early stage.

I do not mean to underrate the requirements of the complete innovation process, however, where certainly tax incentives, patents, capital formation, regulations all play an important role, too. I have simply spoken primarily about an area of considerable personal experience.

PROVISIONS

1. The employee will have the freedom to conduct the program with a minimum of restrictions. The funds of the Grant may be used for material purchases, travel, consulting services, etc., at the sole discretion of the employee except for the conditions on expenditures listed in Provisions 5 and 6.

2. Two or more employees may propose a joint effort for a single project.

3. Upon completion of the program, a report will be submitted to the Innovation Grant Coordinator. This report will detail the results, and will present a plan as appropriate for the complete development and commercialization of the product, service or research capability.

4. If the results of the program show sufficient promise to justify expansion of a service, production of a product, further prototype development, or additional research, the employee will be encouraged to spearhead this new effort. Terra Tek would prefer to have the employee become a partner in the new venture in order to encourage the employee to fully develop the idea into a commercially viable endeavor. Additionally, the employee may receive a royalty or bonus based on the sales and profits of a new or improved service or product.

5. There is, in general, no restriction prohibiting the purchase of capital equipment, however, capital equipment purchases will be delineated by the employee at the time of the award in order to allow Terra Tek to properly plan for such expenditures. All capital equipment purchased should use the usual Terra Tek purchasing methods, and the equipment will become the property of Terra Tek.

6. The following restrictions will apply to this program:

   (1) Any partners outside of Terra Tek's full-time employees must be approved by an Executive Board before any interaction is initiated.

   (2) Funds cannot be used for foreign travel or for any kind of payments to spouse or relatives without prior approval of an Executive Board.

   (3) No expenditures or committments of any kind can be made in excess of the amount of the Grant.

   (4) In the event the employee terminates from Terra Tek, all rights to products, services, improvements, etc., developed under the Innovation Grant remain the sole property of Terra Tek.

DESCRIPTION OF PROGRAM

The Terra Tek Innovation Grant Program provides a mechanism for encouraging employees to initiate research and development into new areas of their own choosing. Topics are not limited to the employee's present area of expertise and may range over the spectrum of theoretical studies, experimental research, prototype development, new testing techniques, market analysis, etc.

Terra Tek expects to award from two to five Innovation Grants each year. The awards will normally be made in June and December to be conducted over the following six-month period. The amount of each award will be based on the merits and the requirements of the project, but are not expected to exceed $10,000.

In order to be considered for an award, an employee must submit a proposal--not to exceed three pages--to the Terra Tek Innovation Grant Coordinator, at least thirty days prior to the award date. This proposal should contain the following information.

1. A statement of the proposed project, including the expected end result.
2. A brief description of the potential benefits.
3. An itemized cost estimate and a time schedule.

The statement of the project should define the program to be undertaken and the feasibility of completing a meaningful effort consistent with the resources in the cost estimate. The potential benefits of the proposal should be defined under all or part of the following three categories:

- Development of new products or services.
- Expansion of present business activities, and
- Enhancement of Terra Tek's basic research capabilities.

The cost estimate should include computer time, materials, travel, outside labor and any time the employee may charge to the project. The employee may buy his own time to be used on the project (at full burdened rate); however, the employee will not be paid any extra income above his normal salary. The schedule should contain simple milestones and should be geared toward completion of the project within a six month period if possible, but no more than a twelve month period.

1974 - Present	Adjunct Professor, Mechanical Engineering Department, University of Utah, Salt Lake City, Utah
1977 - Present	Director, Native Plants, Inc., Utah
1978 - Present	Director, Plant Resources Institute, Inc., Utah
1977 - 1978	Alternate and Delegate, International Society of Rock Mechanics, Stockholm, Sweden, and Rio de Janeiro, Brazil
1978 - Present	Director, Drilling Research Laboratory, Inc., Utah
1976	Alumni Achievement Award, University of Missouri/Rolla
1976	Chairman, Gordon Research Conference, "Deformation Mechanisms and Failure of Polymers and Composites"
1976 - present	Director and Secretary, Salt Lake Boys' Clubs, Inc.
1976	Chairman, Panel on Limitations Imposed by Rock Mechanics on Energy Resource Recovery and Development, National Academy of Science Committee
1975	Consultant to Committee of Technology of Drilling for Energy Resources, National Academy of Engineering
1974 - 1975	Chairman, Rock Mechanics Subcommittee, Petroleum Division of ASME; and Director, Utah Section of ASME
1975 - 1977	Executive Committee, Civil Explosion Application Division, American Nuclear Society
1974 - 1976	Vice Chairman, Papers Committee - Experimental Mechanics; and Chairman, Great Salt Lake Section of SESA
1974 - 1975	Chairman, Thermal-Mechanical Fragmentation of Rock, National Science Foundation, Program Review Committee
1975	Outstanding Professional Engineer Award, Utah Engineers Council
1972 - 1974	Department of Defense, Defense Nuclear Agency, Geologic Material Property Committee
1970 - Present	Director, Central Products Corporation, Missouri
1962 - 1963	Stanford University Engineering Mechanics Graduate-Student Scholarship
1960 - 1961	Westinghouse Advanced Mechanics Program, Pittsburgh, Penn.
1959	Graduated Fourth in Class University of Missouri/Rolla.
PUBLICATIONS AND PATENTS:	Author or Coauthor of over 40 papers and numerous reports, and several patents.

SIDNEY J. GREEN

EDUCATION:	B. S.	University of Missouri at Rolla (Mechanical Engineering)	1959
	M. S.	University of Pittsburgh (Mechanical Engineering)	1960
		University of Pennsylvania (Engineering Mechanics)	1961
	Engineer	Stanford Univeristy (Engineering Mechanics)	1964

TECHNICAL MEMBERSHIPS:
American Society of Mechanical Engineers
American Underground Space Association
Geothermal Resources Council
Society of Experimental Stress Analysis
Tau Beta Pi, Phi Kappa Phi, Pi Tau Sigma, Sigma Pi Sigma
Utah Engineers Council

EXPERIENCE:

Current	President and Chief Executive Officer, Terra Tek, Inc., Salt Lake City, Utah
1970 - Present	Terra Tek, Inc.
1967 - 1970	Head of Materials and Structures Laboratory, Manufacturing Development Staff, General Motors Technical Center, Warren, Michigan
1964 - 1967	General Motors Defense Research Laboratories, Santa Barbara, California
1959 - 1962	Westinghouse Research Laboratories, Pittsburgh, Penn.; and Westinghouse Steam Division, Philadelphia, Penn.
1958 - 1959	Instructor, University of Missouri/Rolla, Rolla, Missouri

SPECIAL POSITIONS:

1978	Member, Small Business and Industrial Innovation: Federal Policy Priorities, Committee
1978	Department of Energy Workshop on Program Planning for Industrial Research Related to Energy Conservation
1978	Guest Lecturer, Oxford University and Imperial College, London, England
1978	Chairman, U.S. National Committee for Rock Mechanics, National Academy of Science
1977 - Present	Director, Resource Enterprises, Inc., Utah

INNOVATION GRANTS

IN-HOUSE EMPLOYEE PROGRAM

TerraTek

CRITERIA FOR SELECTION OF INNOVATION GRANTS

Each proposal will be given a technical rating based on the following criteria:

- Development of new products or services
  - (a) What is the size of the potential market for the product or service?
  - (b) What is the estimated time it would take for commercialization of the product or service?
  - (c) What are the capital requirements for development to commercialization?
  - (d) What is the estimated profitability of the product or service?
- Expansion of present business activities
  - (a) What improvements will be made in present products and/or contract Research and Development?
  - (b) How significant is the improvement toward expansion of Terra Tek's present activities?
- Enhancement of Terra Tek's basic research capabilities
  - (a) What increase in body of technical knowledge is expected, and will this be in the form of an individual's knowledge or a new test technique, etc.?
  - (b) What development, enhancement or improvement of Terra Tek's research equipment and/or techniques will be made?

The final decisions for awards will be made by an Executive Board with assistance from the Innovation Grant Coordinator. Prior to awards, interviews will be conducted with proposers in order to assure comprehensive understanding of their proposals. During the interview, the Terra Tek Research Review Board may be asked to help with technical ratings; and, if appropriate, outside expertise will be obtained to assist with specific questions. Terra Tek reserves the right to make as many awards, or no awards, as it deems best for the Company.

Terra Tek is a company of dedicated and talented people, and is recognized by government and industry as a leader in research and development involving rock mechanics, the geosciences and associated technologies, and practical applications of material sciences. Terra Tek, however, is continually aware of the need to improve the climate of innovation and experimentation which is the backbone of our growth. The Terra Tek Innovation Grant Program is one result of our recognition of this need to develop new ideas.

Terra Tek Innovation Grants are designed to provide an opportunity for an employee to pursue with great freedom his own initiated program, consistent with Terra Tek's corporate goals. The objectives of the plan are to:

- Provide a mechanism for employees to pursue ideas in areas not presently being pursued by the Company.
- Provide additional personal growth for employees by giving them the opportunity to initiate and implement a project of their own choosing and totally under their control.
- Improve and enhance Terra Tek's basic research capabilities.

All employees are encouraged to seriously consider this program; however, the program is purely voluntary and no employee will be required in any way to participate unless they choose to do so.

Sidney J. Green
President

Mr. Chairman, I would like to make one last comment. I, too, agree, just as Mr. Lockwood stated earlier in this hearing, that the announced administration feelings on innovation do not seem to be complete in meeting needed national requirements.

I have not had the opportunity to fully comprehend the presentations given yesterday, but from my knowledge of what was presented there seems to be much lacking. I am pleased to hear, though, that the administration labels this as a first step.

Thank you.

Mr. FUQUA. Thank you very much.

Mr. Sanlorenzo.

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

Remarks Before the Joint Senate/House Hearings - November 1, 1979

INNOVATION AND PRODUCTIVITY

HISTORY - General Applied Science Laboratories, Inc.

General Applied Science Laboratories, Inc., (GASL), was founded in 1956 by the late Dr. Theordore Von Karman and a group of university professors including the late Dr. Antonio Ferri. Its purpose was to perform applied research in the fields of high speed aerodynamics, propulsion, structural dynamics and electronics. The corporate venture prospered as a result of the expansion of the United States space program and within a few years, GASL had expanded to approximately 400 employees and was deeply involved in research programs for the Air Force, Army, Navy, NASA, and DARPA, as well as private companies such as General Electric, AVCO, Convair, and Republic Aviation. At its peak, GASL's sales volume was in excess of 6 million dollars per year.

During this period of growth, GASL designed and built a group of high speed aerodynamic and propulsion test facilities at its Westbury, N.Y. site with the support of the Air Force Aero Propulsion Laboratory. These facilities were assembled primarily to aid in the development of high speed aeropropulsion devices such as ramjet and scramjet systems and were operated by GASL at no cost to the government under a facilities contract. In 1972, administration of the equipment under this contract was transferred from the Air Force to the National Aeronautics and Space Administration, Langley Research Center. The test facilities and their supporting equipment are currently being utilized in a number of research programs, and represent a unique capability which forms a substantive basis for GASL's business.

During the course of its growth, GASL became a wholly owned subsidiary of the CCI - Marquardt Corporation; the aeropropulsion research group of GASL serving in support of Marquardt's efforts in ramjet/scramjet development, and the electronics group becoming a separate entity functioning as part of an industrial products division of Marquardt.

With the deemphasis of hypersonic air breathing propulsion by the Air Force in the late 1960's, GASL's size and capability contracted with the loss of key managerial and technical personnel, and

before the researcher must begin planning next year's work to insure continuity of his effort without interruption.

Clearly the typical contract duration and the procurement cycle time do not provide the compatible matching to allow continuity of effort or cost effective assignment of personnel. The manager of an R&D small business such as ours is constantly trying to keep his people gainfully occupied. He finds it hard to borrow carryover funds because he can rarely demonstrate a backlog which extends beyond six months. Because the base of effective steady business is a small percentage of total sales, he finds himself limiting capital budgets for company expansion. What is the solution? We have seen the elements of the solution in task type contract agreements - one of which has already been mentioned in the context of one of our activities. To elaborate, this form of contract provides the framework for services over an extended period of time, two or three years, for example, renewable annually at the option of the government. It allows the procuring agency to signal its general intent without necessarily committing itself to the actual procurement until it knows specifically what it wants. It allows for redirection of effort without voluminous procurement documentation, formal proposals, internal justification, and the loss of time and continuity which accompanies the present procurement process. It allows the buyer to easily terminate the business relationship in the event that he is not satisfied with progress or results. The supplier of services, on the other hand, now has a longer period over which he can plan growth. He is motivated to perform well since he values the longer term relationship and he is relieved of the burden of detailed and often exhaustive proposal preparation which raises his overhead cost and removes productive personnel from his labor force. His operation can proceed with a greater continuity of effort and higher productivity.

In our view, we have seen such an arrangement work both to the advantage of the government and to our stability. I would urge that this type of procurement be encouraged in the small business community. Its validity and application obtains over a wide range of procurements. We plan to pursue this type of arrangement whenever possible.

Under task - type contracts, one needs to include a reasonable form of payment schedule. This is often not the case. Our company was recently involved in a "small business set aside" procurement for

that can be transferred to other fields. At the same time, we will be seeking commercial contracts in the areas of high technology services, design and fabrication services, and our own product development. It is very likely that we can continue at our present level by continued sales efforts to capture the short run procurement type contracts. However, in our view, this approach provides little opportunity for expansion. To provide the elements needed for growth, our search will concentrate on obtaining task agreement type contracts in the areas of design and fabrication, testing services, software development, and general engineering services. Only in this way, can a small business such as ours derive and transform innovative ideas into positive and real national productivity.

I thank the members of each committee for the opportunity to present these views and I hope the remarks will be of assistance in your work.

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Remarks prepared by Ernest Sanlorenzo, Sr. Vice President, of General Applied Science Laboratories, Inc., Westbury, New York

Ernest Sanlorenzo

ERNEST SANLORENZO

Couple these two facts and it is easy to see that the research program can be as little as one-third complete before the researcher must begin planning next year's work to insure continuity.

The typical contract duration and the procurement cycle time do not provide the compatible matching to allow continuity of efforts or cost effective assignment of personnel. The manager of a small R. & D. business such as ours is constantly trying to keep his people gainfully occupied.

He finds it hard to borrow carryover funds because he can rarely demonstrate a backlog which extends beyond 6 months, and because the base of effective steady business is a small percentage of total sales, he finds himself limiting capital budgets for company expansion.

What is the solution? We have seen the elements of the solution to this problem in a task type contract agreement. To elaborate, this form of contract provides the framework for services over an extended period of time, 2 or 3 years, for example, renewable annually at the option of the Government.

It allows the procuring agency to signal its general intent without necessarily committing itself to the actual procurement until it knows specifically what it wants to do.

It allows for redirection of effort without voluminous procurement documentation, formal proposal evaluation, and the loss of time and continuity which accompanies the present procurement process.

It allows the buyer to easily terminate the business relationship in the event he is not satisfied with progress or results. The supplier of services, on the other hand, now has a longer period over which he can plan growth.

He is motivated to perform well, since he values the longer term relationship and can avoid the often exhaustive proposal preparations which raise his overhead costs and remove productive personnel from his labor force. His operation can proceed with a greater continuity of effort and higher productivity.

In our view, we have seen this arrangement work to the advantage of the Government and to our own stability. I would urge this type of procurement be considered with the small business community. Its validity and application obtains over a wide range of procurements.

Under task type agreements, one needs to include a reasonable form of payment schedule. This is often not the case. We were recently involved in a procurement that involved $500,000 for a period of 1 year.

In our view, this procurement had one major flaw. It contained no provision for progress payments on task items, that could easily have amounted to over $100,000. Thus, while set aside for small business, this procurement was clearly beyond our fiscal reach, because of the payment on completion clause.

Clearly making available the provisions for progress payments would materially aid small businesses.

The virtue of the task type agreement lies in its longer duration than the usual procurement contract. It also provides a time frame which is consistent with the effective use of surplus Government equipment.

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GILBERT V. LEVIN

Biographical Sketch

EDUCATION: The Johns Hopkins University, B.E., 1947, M.S., 1948, Ph.D., 1963 (Environmental Engineering). Stanford University Graduate School of Business, Summer 1979.

EXPERIENCE: Eight years as Public Health Engineer in the State Health Departments of Maryland, California and the District of Columbia: experience in water supply, sewage disposal, epidemiology, industrial wastes, and medical and public health aspects of civil defense, 1948-1956. Research Assistant and Clinical Assistant Professor of Preventive Medicine at Georgetown University Schools of Medicine and Dentistry, 1953-1960. Vice President, Director of Washington Laboratory, Resources Research, Incorporated, 1956-1963. Biochemist, District of Columbia Department of Sanitary Engineering, 1962-1963. Director of Life Systems Division, Hazelton Laboratories, 1963-1967. President, Biospherics Incorporated, 1967-present. Research experience has been in fields of biological process development for water pollution control, inventor of PhoStrip® process for removal of phosphorus from wastewater and of method for rapid detection of microorganisms, and detection of extraterrestrial life. NASA Experimenter on Mars '71 Orbiter and NASA Experimenter for the Labeled Release life detection experiment on Viking '76 mission to Mars. Member of Small Business Administration Task Force on Small Business Innovation; Chairman, Region 3, Committee for Small Business Innovation.

MEMBERSHIPS: American Association for the Advancement of Science, American Water Works Association, New York Academy of Science, American Society of Civil Engineers, Water Pollution Control Federation; Fellow, American Public Health Association, Cosmos Club.

PUBLICATIONS: Approximately 100 publications in environmental science and engineering.

PATENTS: Approximately 25 U.S. and foreign patents in applied biology and environmental engineering.

HONORS: NASA Public Service Medal, 1977
AAAS Newcomb Cleveland Prize, 1977
I·R 100 Award, 1975

However, during our 12 years, we have had to surmount almost every problem known to beset small businesses - and a few that we think may have been invented solely for us. It is my hope that the recitation of some of these may warrant your attention to the recommendations I will make.

During the first year of operations, cash ebbed away faster than had been projected on my pro forma. Anxiously, I sought help from the Small Business Administration, and was disappointed when an official told me that the SBA could be of no assistance. Several months later, we won a significant Government contract but were told that the award depended on our financial capacity. I went back to our bank with the details of the contract. I tried to borrow money or establish a line of credit based on the contract much as a merchant would borrow money based on a large order in hand. The bank, however, did not see the similarity and had grave reservations about what it might do should it fall heir to a Government contract for research services. I obtained the line of credit for my company by pledging my home and personal property. As I left the bank, I viewed the row upon row of desks occupied by experts in the mortgage department and wondered aloud to the bank vice president "Where are the desks for your experts in technology?"

I soon learned that the negotiated fee, or "profit," in a Government cost-plus contract with a small business was, to a great extent, illusory. Frequently, agency payments are 60 to 90 days late. Employees must be paid on time and meeting the payroll stressed our new line of credit. However, the interest which we paid the bank was not a reimbursable cost under the contract. At current fees paid to small businesses and current

negate the contract! However, the arithmetic proved arbitrary and our sponsor did not. Shortly therafter, when Milton Stewart, the then newly appointed Counsel for Advocacy of the SBA asked me to serve on a task force for small business innovation, you might easily understand that I was less than enthusiastic. However, Milton persuaded me and, I must say that, to my knowledge his effort has been the most potentialy productive yet undertaken to solve the problems you are reviewing.

Money problems certainly lie at the heart of the high technology small business. However, problems involving intellectual property are even more frustrating to the innovator trying to thread his way through the shoals to support. We have had ideas boldly stolen by agencies and, in one incident, classified in an attempt to divorce us from the resulting project carried out within the agency. We have submitted ideas clearly marked as proprietary and seen contracts to develop those ideas then awarded to large corporations. In one of our areas of development, we have seen our research results, given in confidence to an agency research head, usurped and announced as a major development in a press release by a Cabinet member who omitted all mention of our role.

To some extent, I believe that the negative attitude of some Government officials toward innovative small businesses may be caused by sibling rivalry. A technical official may believe that he is the logical, vested authority in the particular field and that any new concepts should come from him or his group. In letting contracts, this type of individual would rather fund a large corporation knowing that his technical counterpart is a salaried employee rather than fund his small business counterpart

duce to practice in the field. The objective was to harness the Nation's research and development capabilities to achieve national goals in an efficient manner. The results were quite the opposite and, I believe, that this approach is largely responsible for the decline of Yankee ingenuity, which decline I believe in large measure led to the Nation's current economic ills: inflation, low productivity, unemployment, and negative balance of payment in foreign trade.

As R&D funding in the civil areas has declined, a new form of competition has risen to confront high technology small businesses. Agency laboratories are using funds intended for contracts to maintain their own personnel and activities. Funding incest has broken out among agencies which fund each others' laboratories. Now, the unfair competition has developed to the point where some Federal and State agencies offer services to private industry in direct competition with firms organized to do this - and winning contracts with an artificially low overhead because "our people and facilities are there anyway."

Large industry, frequently as overly organized as government, has followed the Federal lead with respect to research and development. Many of the major corporations have announced significant reductions in R&D efforts. Rather than undertake in-house efforts, some major companies now acquire new developments through the purchase of small firms. The promising young companies then fall victim to the "immediate pay-off" philosophy of their acquirers. Thereafter, their efforts are restricted to near-sighted hole-plugging advances.

For a company interested in innovation rather than the provision of technical services for an agency's announced program,

In its twelve year history, Biospherics had to swim upstream to develop basic new ideas. Perhaps its most significant development is the PhoStrip® process for the removal of wastewater phosphorus to protect our waterways. We took our laboratory concept through pilot plant development and full-scale demonstration at a municipal wastewater treatment plant. The process took seven years to bring to market. Repeatedly rejected for support by appropriate Government agencies, Biospherics raised money for the PhoStrip® development through the sale of a public issue of stock in August 1969, just squeaking through as the new issue means for raising capital for small firms collapsed. As is classically the case, the funds raised proved inadequate to the task. Our drive toward technical success almost resulted in bankrupting the company. A fellow entrepreneur used to chide me that "Biospherics is technically bankrupt but doesn't know it." At various stages of success in the development program, we called in the Federal agencies for support or, at least, encouragment. Instead, we met with solid scepticism and were told that our data were incomplete. From third party sources, we learned that the very integrity of our research was impugned by agency officials. The problem was that our research was not of the hole-plugging variety. Nonetheless, we did persevere at the expense, I have reason to believe, of several government contracts.

Upon completion of a highly successful full-scale demonstration, we licensed the process and are now receiving substantial royalties from rapidly growing sales to municipalities across the country. The process has all the advantages the Government should be looking for. It is far less energy intensive than

the ruling has had a depressing effect on innovation. This can readily be explained by illustrating the path Biospherics has been forced to tread through the Scylla and Charybdis of innovation and profit over the past several years. Our absolute dollar profits are relatively small compared to the costs of a significant R&D effort. Thus, were we to invest in such an effort, our financial "track record" would suffer in that the profitability shown in our annual financial statement would be seriously impacted. This would have dire consequences for the small company aspiring to raise capital from a sale of corporate stock. Underwriters and investment bankers will not look at small companies that do not have a consistent, preferably increasing, record of profitability over a period of 3 to 5 years. On the other hand, elimination of research and development to maximize profitability will stunt technological growth. We have tried to walk that narrow path by carefully tuning our research and development effort to maintain our profitability. This is an extremely frustrating posture for the innovator.

Much has been said about liberalization of patent rights with respect to inventions made by small businesses under Government contracts. A small company simply cannot afford the risk of developing a product based on a nonexclusive license from the Government. The company knows that, as soon as the product begins selling, companies with far greater capacities will obtain similar licenses from the Government agency and push the small company out of the marketplace. Even with an exclusive license, the small company is constantly in jeopardy of willful infringement from a large corporation. A sizable market may lead companies to infringe even at the risk of being called to account

research in its own laboratories and should eliminate unfair or unwarranted competition with the private sector. Progressively larger amounts of funding should be set aside for research and development by small businesses.

4. An in-depth review should be undertaken to make Federal contracting practice more supportive of small business high technology firms. Among the objectives should be an end to the "stretch-out" practice, shortened proposal review periods, allowance for interest, allowance for small business in-house research and development on at least an equal footing with the allowance given large corporation, a liberalized patent policy, and a receptive attitude to unsolicited proposals even when the obejctive of such a proposal may not be within prescribed funding priorities.

5. The SBA should advocate an innovative small business affirmative action program along the lines of the very effective program it has developed for minority firms.

6. I would like to conclude with a personal recommendation. Our country should undertake an Apollo-like program, but of even greater magnitude, to solve our impending energy crisis. This crisis cannot be solved by conservation of hole-plugging improvement of inadequate, old methods. New technologies must be born and small research firms can play a role in inventing them, including developments needed to harness fusion. And when this program is mounted, I urge that no bureaucrat be allowed to say "This matter is too large and complex for the participation of innovative small business".

Lest I leave you with the impression that I think the innovator is omniscient, let me recall, as best I can, a skit

Soon after beginning the company I saw the small amount of money I had borrowed ebb away much faster than the pro forma which I had created to guide the new firm. I immediately appealed to the SBA, Small Business Administration, and learned to my dismay that, at least at that time, the function of the Small Business Administration was to defeat small businesses—not help.

We got our first substantial Government contract, but it had a condition that we had to demonstrate "financial capability". The only way we could do this was to secure a line of credit, from our bank which I could do only upon personally guaranteeing that line by mortgaging my house to the bank.

We then found, as the contract progressed, that the Government pays late, and, further, that it does not allow the interest on the money we must borrow to pay our employees, who like to be paid on time.

We found that between this characteristic and another one that was invented some years ago by Government agencies called the "stretch-out", we could actually perform very effectively on a project and lose money.

The stretch-out occurs when you have completed the first year's work on a project that is to be renewed for the following year. The agency says, either deliberately or because it cannot act in time, that: "We are sorry, we cannot fund the new contract coincidentally with the expiration date of the old one, and a little time will elapse."

A small company is faced with a dilemma. Should it let its employees go and lose the capability of carrying out that contract, or should it pay its own money to maintain those employees until the contract is reenacted?

In the latter event, which the small company is really forced to choose, it finds that even upon successful completion it has lost money on the contract if the stretch-out has lasted even 1 month.

The area, however, that I find particularly frustrating in the small business innovation game is that related to intellectual property. Much as Rodney Dangerfield expresses it, I don't believe that the small business entrepreneur gets the respect that he deserves from Government agencies for his innovation.

We have had ideas boldly stolen from us by Government agencies. We have seen ideas we have submitted as proprietary been developed in-house by the Government agencies. We have seen those ideas given away to large corporations under contract to develop.

We have seen one of our ideas submitted to a Government agency classified and performed in-house so that we might not even follow the progress on it.

In one instance, we have seen an idea we had submitted at the urging and in the confidence of a Government agency announced by a cabinet officer as a major breakthrough of his department, omitting any reference to us.

We have encountered unfair Government competition. Government laboratories will do in-house work which we are fully capable of doing, in some instances which we initiated and then they took in-house.

community of individualists, as almost all entrepreneurs are to some extent individualists. The small business community is difficult to poll, and as Mr. Milton Stewart of the SBA Office of Advocacy has so eloquently said numerous times in the past, it is even more difficult to get small, high-technology business people to reach agreement on business matters. There is, however, strong agreement that the legislative priorities that are well documented in a number of studies including the one I previously mentioned, could make a very significant improvement in the acceleration of the development of innovative products, services, and processes. As we all know, this has a direct positive effect on the creation of new jobs, on the reduction of inflation by increased productivity at reduced cost, and on an improvement in our unfavorable balance of trade payments by the export of new products and services.

not in the same league as the big institutions and the big institutional bureaucracies when it comes to dealing with tax and legal problems, federal and local government regulations, and competing in a marketplace dominated primarily by big competitors. It is particularly worthy of note that even with these extreme handicaps--lack of financial resources, lack of equipment and facilities assets, lack of ability to handle big institutional problems--yet the small, high-technology company still produces a very, very disproportionately large amount of innovations.

Many groups, big and small, including this current government hearing, are trying to determine and to put into actions things that will assist the acceleration of innovative products, services and processes. It is most appropriate that the Senate and House Small Business Committees should address this problem, as the small business--particularly the small, high-technology firm--plays such a significant role. Experts from all parts of the U.S. free-enterprise system have met on numerous occasions to provide the background information in the form of solid facts, as to what will assist innovation. For example, the recent Small Business Administration Office of Advocacy Task Force Report on Small Business and Innovation is just one of such well-documented investigations. The federal government can do things that will significantly affect small, high-technology firms, and therefore allow the small, high-technology firm to accelerate innovative processes.

My personal experience involving high-technology innovation have been more involved with new start-ups--particularly the very, very early stage when even commercial feasibility of a new invention or idea has not

This methodology technique should not be our special expertise, which was developed with Government funds, but should be shared with the nationwide design profession.

Recovery of information distribution costs from a single source, again, is not feasible, since the benefits are widely distributed through the design profession, construction industry, the urban cities, and the general public.

We see a solution to this problem of funding information distribution which is our special problem, as well as the original research, is to encourage a public agency that best represents the benefited public, to contract with small business to move technology into general use.

This is our special topic. Thank you for your interest.

Mr. FUQUA. Thank you very much.

Mr. Green.

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

scattered throughout the United States, a construction industry equally distributed, urban cities that recover use of their under-utilited city cores, building officials that receive the knowledge to protect the public interest, and the general public that profits from innovation and cost effective rehabilitation and construction.

The task of communication of research to potential users, translation of research to product development and preparation of design manuals and information distribution seminars must be undertaken to maintain progress through research. The task can be effectively performed by small business which is involved in the specific field. But costs of performing this task cannot be recovered by the small business involved in the technology since the benefits accrue mainly to others.

The solution of this problem, research, information refinement, translation and dissemination is straight forward. Hand the problem to innovative, technology oriented small business. Fund the problem solution by determining the most benifitted public interest and the associated public agency. Prepare program solicitations to small business by the public agencies. Program control may be vested in an agency such as the National Science Foundation that has a successful track record for small business programs.

We wish to express our appreciation for an opportunity to voice our opinions to this select legislative body. We welcome an opportunity to respond to your questions relating to your concern for the public interest.

JOHN KARIOTIS

STATEMENT TO THE JOINT HOUSE & SENATE HEARINGS

STARTUP, GROWTH AND SURVIVAL OF SMALL NEW TECHNOLOGY FIRMS

Kariotis, Kesler & Allys is a small business firm furnishing civil and structural engineering services. The engineering services are provided to architects, builders, governmental agencies and other engineering firms as well as the general public. The firm is a successor to previous partnerships. The prior small businesses and this firm have accumulated 24 years of experience in offering engineering services.

In 1977, we responded to a proposal solicitation by the National Science Foundation for a program entitled "Small Business Innovation Applied to National Needs" Our proposal for a program was in the field of our expertise - Disaster and Natural Hazards: Earthquake Engineering.

A preliminary research contract completed in 1978 on a project titled "Mitigation of Seismic Hazards in Existing Unreinforced Masonry Wall Buildings" led to the formation of a joint venture with two other small business firms. These engineering firms, Agbabian Associates and S. B. Barnes and Associates, had completed similar preliminary research contracts on other facets of the same earthquake engineering topic. This joint venture made a carry-on proposal entitled "Methodology for Mitigation of Seismic Hazards in Existing Unreinforced Masonry Buildings - Phase II". The combined specialized skills of the three small business firms enabled the joint venture to propose an extensive research, analysis, and material testing program that is a first in full size element dynamic testing. The purpose of the dynamic testing is to determine the performance of building materials incorporated in the construction of masonry wall buildings from the present day to nearly 150 years ago.

These firms of practicing engineers will utilize the extensive data gathered from their material testing, supplemented with data developed by two academic programs at the University of California, Berkeley and San Diego campuses. The design and analysis backgrounds of the members of the joint venture facilitates the development of a methodology that will utilize innovative and cost effective building modifications and retrofits that will mitigate the recognized seismic hazards that especially exist in this type of building, the unreinforced masonry building.

STATEMENT OF DR. IMRICH KLEIN

Dr. KLEIN. Mr. Chairman, I really want to throw away my prepared notes and I would rather like to point out——

Mr. FUQUA. Let me interrupt. If you were not here—we will make them part of the record, your prepared remarks. If you want to summarize in the interest of time, that will be fine, but your full remarks will be made part of the record.

Dr. KLEIN. Thank you, sir. I think our company and my background serves as a case history for the comments we heard from the first panel. Since we have been the recipients of one of the NSF grants—I think I can illustrate what this has done to bringing new products to the marketplace.

In our 11 years of existence as consultants to the plastics processing industry, we have been recognized authorities in the field, and many of our inventions and contributions have been adopted by the industry.

Our work led to four patents, and several other patents are pending at this time. Of course, in order to bring any of these inventions to the marketplace, we had to go out and secure capital which we didn't have and still don't have.

We discovered that our good reputation and our extensive dealings with large corporations all over the country, and even abroad, did not lend any credibility to our inventions.

For years all these inventions laid undeveloped. Some of them were so important that we spent our own money to patent them worldwide even though there were no takers for the rights. We went to various companies to help us run some prototypes, tests, et cetera, but it took quite a number of years between the time we contacted these companies until one of the leading chemical companies agreed to conduct some tests on our behalf.

Venture capital was not available at all. Nobody wanted to give any money, especially to high technology firms, because there was no prior experience with which to judge the potential benefits of these devices, and therefore we were rejected on that basis alone.

Accidentally we stumbled on the NSF RANN solicitation at that time and received a very small $25,000 contract for the study of one of our new inventions. We ran a lot of computer simulations and could show what the potential benefit of one of these devices would be.

As a result, we got over 100 inquiries, from all over this country, and from overseas as well, but everybody wanted to see the process and the product in operation.

Of course, we had no prototype because that was quite costly. So everybody chilled off. Nobody was interested any further. So we went to the National Science Foundation and we requested a $200,000 contract, phase 2. We got that.

Based on that, we went out and looked for venture capital. Three different venture capital firms offered to invest money in our device at various levels of participation, better or worse is unimportant.

The most important thing, though, is that after we got the contract from the National Science Foundation, we contacted chemical companies in this country and asked for contributions in the form of plastic materials with which to perform the study.

grants have been broughtto their present levels of development by an average investment of $75,000 each supplied by my company and other companies. On one project the government has supplied a total of $68,000 of research funds. However, as a direct result of the NSF interest in and sponsorship of the project, industry has so far already donated an additional $90,000 in materials and equipment. The NSF expects to invest a total of $225,000 in the project by the time it is complete. Industry pledges for donations and what has already been donated is expected to add up to approximately another $200,000. My company's contributions to the Phase II research project are estimated at a further $128,000. So, the U.S. government has so far invested $68,000 out of a total cost of $233,000. By completion they will have invested $225,000 out of a total cost of at least $628,000 strictly devoted for Research & Development or a mere one third of the cost.

It must be pointed out that these donations are being given by the industry without getting any interest in the product itself. The industrial firms making the contributions are essentially the same ones that rejected any cooperation before a government agency became involved. One can, therefore clearly say that at least in our case the question of follow-up capital was easily solved by a relatively minor government participation. There were offers for follow-up capital by

government agencies did not parallel our dealings with the NSF. Our most disappointing contacts were with the Department of Energy and the National Bureau of Standards. We found the review process within these agencies to be unusually antagonistic and in some cases biased. The primary problem we discovered was a double barreled prejudice related to energy saving devices. Number one: anyone proposing such a device was treated as a crackpot unless proven otherwise. Number two: any energy saving device had to make a major dent in oil imports. A device which may only reduce the nation's oil consumption by one half of one percent even if it only required $40,000 to $50,000 to develop is small potatoes to the Department of Energy.

Furthermore, the process of successive reviews accomplished very little. In several levels of review we found the same ground being covered at no additional depth. In the first round of review I received a rejection letter which quoted at length a theory which I personally had developed fifteen years before but which had no bearing on the device under investigation. When I pointed this out the proposal was passed on to a second level. The next review was made by someone who apparently had very little grasp of the physics of the mechanical process in question who simply pointed to a device which had no similarity with our patented device

Klein

In order to test the product ourselves we needed a source of capital and we began a search which lasted over 8 months. When we approached the lending officials at our bank we learned that commercial banks are prohibited from funding new ventures. Venture capital firms, on the other hand were looking for operations which could yield extremely high rates of return on a safe investment. As we were dealing with a high technology product, we were told that there was no way to determine the probable rate of return. One holding company that looked us over told us that because we were not loosing money there was no tax incentive for them to buy us and our projected development costs were too small to make an investment worthwhile for them. Frankly, we were told, we were doing too well to get money, but obviously not well enough to complete development on the invention. We also looked into public offerings but the preparation of a prospectus and offering alone, as it turned out, would have cost us almost as much as the capital we needed with no guarantee that the stock offering would succeed.

Purely by chance we learned from a colleague of the RANN program, later renamed ASRA, sponsored by the National Science Foundation. We applied for a contract under this solicitation to begin a preliminary study of the device in October 1977. With the $25,000 award we were able to run extensive computer

standardization and stability in order to minimize capital investments. They seek to eliminate the need to retrain personnel to the use of new equipment. They attempt to extend the life of obsolete equipment and products to capture a maximum return on investments already made. As a result, the built-in conservatism of industry constantly fights with the need to expand present production capabilities, reach new markets and respond to the forces of a changing society.

In our experience the result of these opposing considerations has been to limit technical advances to the minimum absolutely required to maintain marketability of a product. This tendency aggraveted by tight money policies was practiced with unusual rigor over the past 10 years by the U.S. industry.

My company is currently engaged in research on a device which I first conceived over nine years ago. My company's assets then, as now, were insufficient to afford the luxury of even building a prototype. We applied for a patent on the device and attempted to interest some of the larger companies in the plastics processing field, in building a prototype and trying out our idea on a pilot scale. Although many of these companies are my clients and I personally have a reputation as an innovator in this field, it took nearly three years to arrange a single trial in the research department of one

Received his Ph.D. in Chemical Engineering in 1959 from Case Institute of Technology. Prior to establishing Scientific Process & Research, Inc. a research company specializing in plastics processing in 1968, of which he is president he worked as a researcher for Western Electric, Exxon and Du Pont. He is a consultant on plastics processing to many of the Nation's leading corporations.

He has presented and published close to 300 technical papers, two books: "Engineering Principles of Plasticating Extrusion" and "Computer Programs for Plastics Engineers" both published in the Polymer Science & Engineering Series of the Society of Plastics Engineers. He is a corresponding editor of Plastics World Magazine where he publishes a monthly column entitled Processor's Corner. He is also on the editorial advisory board of the International Journal of Polymeric Materials and conducts courses on Plastics Extrusion for Modern Plastics Magazine, a McGraw Hill publication. He has 4 patents with several others pending.

His society memberships include: Society of Plastics Engineers, Society of Plastics Industry, American Institute of Chemical Engineers, Wire Association, American Chemical Society and is a Fellow of the American Institute of Chemists.

The Security and Exchange Commission is another agency upon which we commented in our study. We have proposed in our study that there should be some realistic level of public investment before imposing massive registration requirements and their great expense when going into the public markets for raising money for innovative ventures. We have a number of explicit recommendations in our report that I would commend to you, sir, in this area of regulatory relief.

Mr. WYDLER. Thank you.

Mr. FUQUA. I want to recognize the chairman of the Small Business Committee, but before I do, I would like to appeal to the members, to forego some of the questions so we can get to the next panel which should be starting right now. Now I would like to recognize the distinguished chairman of the House Small Business Committee, Neal Smith, whose committee is participating in the joint hearings. We appreciate very much your cooperation and you being here today, Neal.

Mr. SMITH. Thank you very much.

I will take a minute to say I want to congratulate you for going ahead with these hearings. I think it is terribly important not just for the purpose of helping small business, but the fact of the matter is, as has been pointed out in your reports, the quality of the research increases when we get small business involved. So it is not just to benefit small business, it is to benefit the Government, it is to benefit everybody.

I remember about 18 years ago I was handling the reorganization plan that resulted in the Office of Science and Technology. Since that time, we have had a number of ups and downs, but we have never really accomplished what we ought to have accomplished through this method, so I just want to say I am glad to see all of you here and it certainly is an important issue.

Mr. FUQUA. Thank you, Mr. Chairman.

I would like to conduct one piece of housekeeping business that we have, and this affects the committee on Science and Technology.

I ask unanimous consent that Dr. Ian Marceau be appointed to the standing committee professional staff pursuant to rule XI, clause 6(a)(1), and that Miss Nancy Smith be appointed to the standing committee clerical staff pursuant to rule XI, clause 6(b)(1) effective November 1, 1979.

Mr. BEDELL. Thank you, Mr. Chairman.

We are so short on time, I don't want to take time. I would be interested at some time in learning more about the cost share program, which apparently you panelists believe is a problem to small business and which I don't understand.

Mr. Stewart, could you drop me a letter to explain it rather than take the time of the committee?

Mr. STEWART. Be glad to.

Mr. BEDELL. I would appreciate that. I want to commend the panel for their testimony. I think it has been most helpful.

Mr. FUQUA. Thank you very much.

Mr. Carney.

Mr. CARNEY. Mr. Chairman, in the interest of time I will not ask any questions at this point. Thank you.

process at the present time can take from 5 months to 1½ years before any funds would be forthcoming to the small company.

In the case of DOE, they in many cases—I have had some direct experience with this in the last 2 years—require matching funds from the company. In principle this is a good idea. I think matching funds from a contractor shows he really means it, and is not trying to get government money to keep his company going without any corporate commitment.

A small company doesn't have matching funds. A small company doesn't have the after-tax earnings that a General Electric or DuPont has, where you can balance income and expense accounts back and forth.

Once the new enterprise has the contract, you would be appalled at the micromanagement techniques, as I call them, that then are often applied by the Department to tell the company how to do the research, monthly reporting, risk analysis, and all these new buzz words which people use who have never run an industrial business experience. If you are going to spend $15,000 on a risk analysis for a research program you probably never should have started in the first place. Those are the kinds of bureaucratic problems that a small company faces.

Having completed the work, you may not be fully paid for a year after the work is completed. You are doing this while you are borrowing money from the bank in your home town at 20 percent. This is tough. Then you get into the patent rights problem and their costs. You used to be able to get a patent for $200. It is nearer $2,000 now—beyond the reach of a small company this very inventive.

The impact of this kind of environment upon the small business community is infinitely worse than on the large corporation.

Mr. WYDLER. Of course, but you can see the trouble if we eliminate most of the things you are talking about, when you really get down to it, because these are the protections that we have for the spending of government money or taxpayer money, as we like to describe it. These are the things we put in place to protect the public from some bureaucrats sitting there and saying that is my friend, Jones, let's give him the money, and there is my friend Bill, let's give him the money. That is why we did it. I think we don't do it——

Mr. MORSE. I am sure that is true.

Mr. WYDLER. That is why we did all these things, and we are being driven, it is really amazing what is happening because every answer we have to bureaucracy today seems to be more of the same. I am for it, as a matter of fact. I don't want my statement to be misunderstood. But we are passing a bill on the floor, probably today, to set up a bureaucracy to cut through the bureaucracy, and maybe we are going to end up with a point we will have a small business mobilization board to help small business cut through the bureaucracy of the other. We may come to this.

I don't know where we are going on the whole business. But the problems that you are raising are very fundamental as to what we can really do to balance this more in the sense of taking more risk, I suppose that is what it amounts to.

I think, in going back to Congressman Lloyd's question, I think Japan has a very good arrangement with their business and government contracts. Maybe we could learn something from their experiences.

I was most impressed by the testimony of Mr. Morse—Dr. Morse, I believe—and it seems to me less than a decade ago the Europeans had a crisis of what they called the brain drain, everybody was coming to this country. Now, as you said in your testimony, technology equals people and we seem to be exploiting that. I see that some 25 percent of recent graduates from MIT are people from outside the country. What has happened in these 10 years to cause this complete shift?

Mr. MORSE. Well, I think the brain drain which primarily affected the English was an interest of British scientists to come to the United States for better jobs and more money. I gave the illustration of the number of non-US citizens who were getting graduate degrees, 25 percent last year at MIT, to illustrate other changes in the competitive environment. We don't have any monopoly on science and technology anymore and world competition will be worse.

Everybody wants to come over here and study. They will go back with our technology and turn around, as Sony and Hitachi and others have done, and we get our R. & D. back in our own laps.

This is a dynamic situation. Technology transfer is not done by reports, but is a people transfer process. Yesterday someone suggested interviewing tourists abroad to bring back technology so industry can use it. I can't believe anybody thought of this. By the time any such data gets back here it has already been in production, and is too late. It is a catchup operation. Things move very fast in the world now, not just in the United States.

Some years ago when I was involved in high vacuum technology, I actually traced some technology transfer from Cambridge, Mass., to Palo Alto, to Peking in 4 days—new technology of evaporating quartz on silicon.

The game has changed. I am trying to emphasize that we have to take some action. We are worse off today than we were 10 years ago. We have a lot of bright guys in this country—let's put them to work. We have to change the business environment, and get the Government out—it kills us.

Mr. ROTH. Well, I think that most people would agree with you—I can't speak for the others—but I certainly agree with that. But aren't you somewhat concerned about United States Steel building their huge steel plants overseas rather than in this country? That adds, of course, to our brain drain and our technological drain and so on.

Mr. MORSE. United States Steel is building a plant overseas?

Mr. ROTH. Yes. The Japanese and their government work together as partners. We have one of the most productive plants in the world. United States Steel is not a high technology company nor an innovative one. It is pretty hard to innovate with the capital investment they have. That is a mature high capital cost industry. It is very hard to be innovative. I feel for them, the cost of capital, and that is the other thing that is happening today.

Mr. Lloyd.

Mr. LLOYD. Mr. Chairman, I thank you very much.

Mr. Chairman, following up on some of the conversations which have been presented this morning, without getting into the technical aspects but more into the philosophy, I am intrigued by the the statement made by Mr. Morse that small business stays out of doing business with the Government. I believe that is true since I have been a small businessman and I know when I say small you can define it many ways. It was my wife and myself and a couple of other employees. We were doing our very best to stay alive.

We did have some government contracts and I had an automatic rule, if you do business with the Government, add 10 percent. That was automatic. That was on a short-term situation. We would not touch any kind of long-term situation. Anything that went more than a year, forget it, we wanted no part of it, because we could not sustain nor could we meet the competition of government lawyers, et cetera. That was my experience.

Is my experience normal, or was I really a unique situation? Anyone can answer.

Mr. LOCKWOOD. Mr. Lloyd, let me say when we founded our company, we made a clear determination not to seek Government help, we did not want Government financing, we did not want Government contracts, it would have burdened us even more greatly than we have already been burdened by the involvement of government in many areas of regulation.

Mr. LLOYD. Are you indeed agreeing with me?

Mr. LOCKWOOD. I am indeed agreeing with you and if the Government were to come to us today and want to buy our products, I would look very long and hard before we would enter into a government contract.

Mr. LLOYD. Well, if indeed that is the attitude which pervades the business world, or small business world, then these hearings can help determine how we can get small business back in the fold so that you can do business with the Government. We can talk about different methodology but we have to deal with the philosophy, because I don't think your attitude is any different from many small businessmen.

If the Government wants to come out and has a purchase order in hand and they want "x" number of units in a certain amount of time, fine, they put their money down, and you do business with them. The minute it enters into a contractual relationship where you have to deal with some purchasing agent, or even dealing with OMB, who makes a decision as to where the dollars should go, then the little man is out. How do we get the little businessman, like myself, from years ago, to seek Government contracts yet have some security if there are Government delays. Is there some sort of bonding process the Government can put up which says if some contracting officer hangs you out for 90 days, you then have recourse in this matter and the Government will not only recompense you for the time you put in but pay a penalty for delays caused by some bureaucrat.

Mr. LOCKWOOD. It is our considered opinion as expressed on page 84 of our report where there are some 9 or 10 specific recommendations concerning changes in Federal procurement policies, that

should have a simple contract the way we did during OSRD days in World War II.

The fee on a Government contract is a joke with the small company. You don't make any real money on the fee. By the time you get through with the redtape you are losing money. In a field where a new technological idea needs support to prove feasibility, funding of unsolicited proposals can be very useful for the small company.

I don't think setaside would work, and it never has. DOD, for example, in general prefers dealing with a large system contactor. The very potent aerospace industry is not going to be interested in giving its funds away to a small company and this industry has a poor record of developing commercial products.

Senator STEWART. What do you think about the idea suggested by the administration, do you think that will work?

Mr. MORSE. I am not sure which idea you are referring to.

Senator STEWART. They are talking about using OMB to monitor the activities of the agencies to see that more of the innovative or research and development funds get to small business companies.

Mr. MORSE. Well, I don't care whether the funds go to small business companies, I want them to support innovative technology. In my testimony I suggested that we create a position in OSTP, maybe you could do it in OMB—whereby there would be someone responsible for, and knowledgeable, with respect to the innovation role, to make sure that policy and regulations are in fact implemented.

OMB historically has issued several directives. I remember one distinctly to the effect commercially oriented R. & D. would not be done in inhouse laboratories. Nobody is paying any attention to that. Absolutely disregarded. That is the bureaucracy with which I am concerned.

Science has had a fine voice at the President's science adviser level. Science is doing quite well in this country. Most of the funding is in the universities, where it should be. No one is worrying about the kind of R. & D. and technology which leads to commercial products and makes jobs and makes us competitive in the world markets.

Senator STEWART. Do you buy the argument at all that small business concerns are the most innovative and produce a large percentage of our innovations in this country and that as a result—I think that is the theory behind it, isn't it, Mr. Stewart, behind the mandated target? The amount of money for research and development?

Mr. STEWART. I think so, Senator. Let me put it this way. Maybe George would have some useful contribution here.

I think the three of us and everybody who is in the private sector and has lived with the problem of innovation, wants to see a combination of Federal policies which add up to a favorable climate for small firms which will let people take risks. Now, I have no trouble at all, myself, with percentage targets for small business set-asides. In my own experience with programs like the NSF small business innovation research, which I have watched very closely for the last 4 years, I think they help.

One, innovation is an essential ingredient for creating jobs, controlling inflation, and for economic and social growth.

Two, small businesses make a disproportionately large contribution to innovation. There is something fundamental about the ability of small firms to innovate that must be preserved for the sake of healthy economic and social growth.

Three, if the Congress desires to bring inflation under control, to create new and better jobs, and to continue to enjoy the economic and social benefits of innovation, then individual entrepreneurs and their small companies must be free to innovate. Unfortunately, the governmental controlled environment for small business innovation has greatly deteriorated during the pase decade.

Four, there must be recognition in government that the creative processes in small business are profoundly different than in large corporations and in governmental and academic institutions. There is an acute lack of awareness within government of how small independent innovators create and how Federal policies determine the climate for small business innovation.

Five, a wide array of Federal policies adversely impact upon small innovative businesses, including Federal tax, pension fund and security policies, that have virtually eliminated all forms of capital from innovative small business ventures.

Six, Government regulations that treat large and small firms equally that are in fact usually discriminatory against small firms.

Seven, Federal policies for funding research and development are such that the most innovative sector of the American economy, small science and technology based enterprises, are virtually excluded from effective participation. Federal procurement policies similarly exclude small innovative firms.

Eight, recent changes in patent policies have resulted in the diminution of the value of patent protection for inventors and small business.

Mr. Chairman, we believe that there will be a major renaissance in innovation with concommitant social and economic growth with sufficient amendments to domestic policies to provide relief for small creative entrepreneurs. However, such amendments will require a major departure from current policies affecting small businesses in areas of capital acquisition, regulation, research and development funding, procurement, and patents.

There is an underlying tension at work in government policymaking today, at least amongst those who are concerned with small business innovation: There are those who would like more Government programs to help small firms, in contrast to those of us with the Committee for Small Business Innovation who believe that it is necessary to have a reduction of government involvement in the small business innovation processes so that individual innovators can again be free to be creative.

Our Committee for Small Business Innovation is not asking for more from government, sir, we want less from government. We believe the result of the removal of governmentally imposed discentives—particularly in the area of taxation and regulation—will be that the amazing resourcefulness of American innovators will again emerge to provide material, social, and economic growth for our country, particularly in combating inflation. Such necessary

STATEMENT OF MILTON D. STEWART

Mr. STEWART. Mr. Chairman, I have submitted for the record a brief statement with four appendices which relate to a study of innovation conducted by the Office of Advocacy. We were really little more than ministerial agents in this carrying out of a statutory obligation the law imposes on us to:

> Examine the role of small business in increasing productivity, stimulating innovation and entrepreneurship and providing an avenue through which new and untested products and services can be brought to the marketplace.

I am going to content myself at the moment with expressing the satisfaction that comes to someone who has worked in the vineyard a long time, not as long as Dick Morse, but a long time. The action of the President yesterday put the country unequivocably on a policy road which leads toward the acknowledgement that innovation, including specifically of small business' role with respect to innovation, is a matter of major national concern.

The President specifically characterized his own message as an important first step in that direction. I think implementing policies begins clearly with having them, and I think the President has articulated, particularly with respect to small business innovation, research as carried on by the National Science Foundation, patent policy, enough specific forward moving systems, to make it unequivocably clear that the executive branch is now committed to innovation as a national goal.

I will be happy to answer any questions about this or anything else.

Let me conclude only by saying that my own confidence in the judgment of innovators themselves as to their ability to produce for society the mangificent results that they have in our country, for 200 years, was, if anything, increased by the experience of spending 4 days with people like George Lockwood, and the rest of our task force and hearing them talk about what they want the Government to do and what they want the Government not to do.

Thank you very much, Mr. Chairman.

Mr. FUQUA. Thank you very much, Mr. Stewart.

We have a rollcall vote going on the floor and we are going to have to take a short recess we will be right back to hear from you, Mr. Lockwood, and then we will have some very stimulating questions.

Mr. LOCKWOOD. Thank you, sir.

Mr. FUQUA. We will stand in recess for 5 minutes.

[A 5-minute recess was taken.]

Senator STEWART. If I could have your attention, we will get the hearing underway. I apologize for being late, we started on a vote and I was informed we have a 5-minute break. If we were not to break, we were to recognize our next witness, who is George Lockwood, national vice chairman of the Committee for Small Business Innovation.

Mr. Lockwood, it is good to see you in such good company this morning. The fellow next to you has a very good reputation and has a good last name, too.

Mr. LOCKWOOD. Thank you, Senator Stewart, I share your warm feelings toward Milton Stewart.

7. National Science Foundation, Science Indicators 1976, National Science Board, 1977.

On the basis of sample of major innovations introduced to the market between 1953-1973, small firms (with up to 1000 employees) were found to produce about 24 times as many major innovations per R&D dollar as large firms (over 10,000 employees) and 4 times as many as medium-sized firms.

Six industries accounted for over 85 percent of total U.S. industrial R&D spending in 1974. Just 20 companies conduct 53% of all U.S. industrial R&D; 309 companies conduct 84% of the total (Ed. note - Most of these firms, unlike small businesses, are multi-nationals.)

The most frequently cited source of the technology underlying major inventions was applied research, most of which was performed within the innovating company. Second in frequency was basic research, most of which, however, was internal.

Public funds assisted in the development of 24 percent of the sample innovations from the most R&D intensive industries; 36 percent of those innovations were from non-manufacturing industries.

Sixty percent of the inventions underlying major innovations occured in the profit center that produced the innovation, and an additional 25 percent was initiated elsewhere within the same enterprise. Independent inventors and universities contributed less frequently.

8. Date Resources, Study for General Electric, The Role of High Technology Industries in Economic Growth, 1977.

The Data Resources study compared the performance of high technology versus low technology industries in the U.S. over the 25 year period 1950-1974. The study came to the following conclusions:

Employment in high technology industries grew almost nine times as fast as in low technology industries during this period.

Output grew almost three times as fast.

Productivity increased twofold over low technology.

Prices increased at only one-sixth the rate.

Our balance of trade high technology products rose to a surplus of $25 billion a year while in low technology products it declined from breakdown in 1950 to a $16 billion deficit in 1974.

The same study expresses concern over the sharp reduction in new small company public underwriting offerings of equity securities of less than $5 million for companies with a prior net worth of less than $5 million.

($ in millions)	Small Technical Firms Total Dollar Amount ($ Million)	Number of Offerings
1969	$1367	698
1970	375	198
1971	551	248
1972	896	409
1973	158	69
1974	16	9
1975	16	4
1976	145	29
1977	118	30

4. American Electronics Association Study, Testimony before U.S. Senate Select Committee on Small Business by Dr. Edwin Zschau, February 1978.

Companies responding to this extensive industry survey were divided by age into four categories:

Mature - more than 20 years old
"Teenage" - 10-20 years old
Developing - 5-10 years old
Start-up - less than 5 years old

The survey showed that:

The employment growth in Start-up companies was 115 times greater than for Mature companies in 1976.

It was 55 times higher in Developing companies.

And 20-40 times higher in Teenage companies that in Mature companies.

Although the Mature companies had on the average 27 times more employees than the average of all firms founded since 1955, in 1976 the newer companies created an average of 89 new jobs per company; during this time Mature companies created an average of only 69 new jobs per company.

5. U.S. Office of Federal Procurement Policy, Office of Management and Budget, Small Firms and Federal R&D, 1977.

The report concluded that :

Small firms have compiled a striking record of innovation in the private sector. Firms with less than 1000 employees accounted for almost one-half of major U.S. innovations during the period 1953-1973.

EXPORT AND TRADE RECOMMENDATIONS

ADVOCACY TASK FORCE BILL SECTION	JC-WG AND/OR INN-SBTF RECOMMENDATIONS
No parallel section in Advocacy Task Force Bill	Eliminate the existing tax liabilities for overseas joint ventures in which the small business investment consists of a contribution of know how and technical information. (INN-SBTF)
Section 8	We recommend that the creation of Small Business Export Trade Corporations be encouraged by a double deduction for these corporations of up to $100,000 of annual expenses associated with the exporting activities of each client, with a loss carry-forward of ten years. In addition, we recommend that small businesses be allowed a double deduction of special expenses of serving export markets up to $100,000 annually. (JC-WG) Permit small businesses to take double deductions of expenses directly related to export market development. (INN-SBTF)

PATENT RECOMMENDATIONS

ADVOCACY TASK FORCE BILL SECTION	JC-WG AND/OR INN-SBTF RECOMMENDATIONS
Section 5 (b)	The Patent and Trademark Office should develop a practical and effective computer based search and retrieval system for its own use and public access, with particular concern for its usefulness for small business firms. (INN - SBTF)
Section 5 (c)	A new mandatory re-examination procedure should be instituted in the Patent and Trademark Office whereby a litigant who raises a defense of invalidity of a patent based on new found heretofore unconsidered art should first test the assertion of invalidity in the patent office where the most expert opinions exist at a much reduced costs. (INN - SBTF)
No parallel section in Advocacy Task Force Bill	The budget of the patent office should be increased sufficiently to allow for more thorough searching of prior art using the most modern search technology. (INN - SBTF)
Section 5 (c)	The patent laws should be amended to recognize that the reliability of patents is a keystone in the commitment of funds to carry out commercialization of patented inventions, and incontestibility should be mandated after a period of time so as to result in absolute reliability, except in cases of fraud.(INN - SBTF)
Section 5 (a)(1)(9)	Legislation should be passed to give small businesses title to inventions made under government contracts, with the provision that commercialization be undertaken in a reasonable time. If such commercialization is not undertaken title should revert to the government and the government should license small businesses. As an alternative, small business should be able to obtain title to inventions developed under government awards if they invest an amount of capital at least

PROCUREMENT RECOMMENDATIONS

ADVOCACY TASK FORCE BILL SECTION	JC-WG AND/OR INN-SBTF RECOMMENDATIONS
Section 6 (a) 1	Cost sharing requirements for research and development awards for small business shall be eliminated and negotiated fees shall be allowed on all contracts. (INN - SBTF)
Section 6 (a) (2)	No federal agency shall exclude small business from a fair and equitable opportunity to compete on a merit basis on the same terms as other participants. (INN - SBTF)
Section 6 (a) 4	No agency shall restrict opportunities for small businesses to submit unsolicited proposals and shall give such proposals a fair review based upon their merit. Each agency shall provide small firms opportunities to receive sole source awards. (INN - SBTF)
No parallel section in Advocacy Task Force Bill	A separate set of simplified Federal Acquisition Regulations should be developed to apply to small business firms. (INN - SBTF)
No parallel section in Advocacy Task Force Bill	All proposals submitted by small business must be awarded or declined within four months of submission. (INN - SBTF)
No parallel section in Advocacy Task Force Bill	Proposal evaluations shall consider total costs relative to the work proposed, and not consider overhead or indirect cost rates due to variations in institutional and company accounting practices. (INN - SBTF)
No parallel section in Advocacy Task Force Bill	Fee negotiations shall take into consideration the level of interest rates and shall be higher in times of high interest rates than in times of low interest rates. All debt service costs shall be allowable costs for small business and procedures should be instituted for prompt payments to small businesses, with late payment penalties. (INN - SBTF)

REGULATORY PROCEDURES

ADVOCACY TASK FORCE BILL SECTION	JC-WG AND/OR INN-SBTF RECOMMENDATIONS
No parallel section in Advocacy Task Force Bill (cont'd)	-- wherever possible, return to reliance upon standards associations with federally mandated standards being the last resort, and -- improved congressional oversight of the regulatory process as it relates to small innovative businesses. (INN-SBTF)
No parallel section in Advocacy Task Force Bill	Provide product liability and recall insurance at reasonable costs for small businesses, with exemptions from recalls except in the most extreme cases; and the establishment of statutory limits of liability for product failures similar to Workman's Compensation Insurance. (INN-SBTF)
No parallel section in Advocacy Task Force Bill	We recommend that small businesses be allowed to deduct twice their payments for regulatory advisory services related to compliance with federal, state, and local regulation. (INN-SBTF)
COLUMN NOTE: These two sections of Task Force Bill have no direct paralles in JC-WG or INN-SBTF Reports.	All federal agencies which issue regulations affecting small business shall, insofar as practicable, issue them so as to relate regulatory burdens to the relative size of the firms regulated. (ADVOCACY TASK FORCE BILL - Section 6(b)) In cases where government regulations provide for an agency to make a decision involving a matter initiated by a small business within a certain time period and that decision is not forthcoming by said deadline, it shall be assumed with legal force that the decision is affirmative i.e., that permission, if not denied within a specified period, is granted and an extension, if not denied within a specified period, is approved. (ADVOCACY TASK FORCE BILL - Section 6(b)(2))

RESEARCH AND DEVELOPMENT RECOMMENDATIONS

ADVOCACY TASK FORCE BILL SECTION	JC-WG AND/OR INN-SBTF RECOMMENDATIONS
Section 9	A clear federal policy should be established and enforced to prohibit federal funds from being used to finance projects that are competitive with or duplicatory of private sector technological developments, or in any other ways might prevent the establishment by small business of exclusive technological or intellectual properties in new areas of non-defense technological advancement. (INN-SBTF)
No parallel section in Advocacy Task Force Bill	There should be decreased emphasis on applied research in universities, federal laboratories and non-profit institutions, particularly where such applied work might pre-empt private initiative or is duplicatory or competitive with private sector activities. (INN-SBTF)
No parallel section in Advocacy Task Force Bill	We recommend that private sector individual or corporate owners of technology be rewarded, through appropriate changes in the tax code, for selling, leasing or licensing their technology to small business firms in the United States. In addition, we recommend the establishment of a voluntary national policy to encourage companies to make their technologies available for uses by others. (JC-WG)
No parallel section in Advocacy Task Force Bill	We recommend that there be some re-direction of federally-supported agricultural research to the development of technology for improving the efficiency of small family farms and food processors and for making food production, transportation, and preservation less capital and fossil-fuel intensive. (JC-WG)
Section 7(a)(5) Depreciation Allowance	Provide for a twenty-five percent tax credit for research and development related expenditures by small businesses (as currently allowed in Canada). (INN-SBTF)

RESEARCH AND DEVELOPMENT RECOMMENDATIONS

ADVOCACY TASK FORCE BILL SECTION	JC-WG AND/OR INN-SBTF RECOMMENDATIONS
Section 3	We recommend that each federal agency receiving R&D funds by appropriation from the Congress be required to allocate at least 10 percent of all such funds (excluding those for basic research) to small businesses and that this objective be achieved in annual one percent increments beginning in FY 1980. (JC-WG) Each federal agency should be directed to allocate at least ten percent of its R&D budgets to small business and increase current levels by one percent of its budget each year until the ten percent minimum is established, starting in 1980. (INN-SBTF) This increase should be heavily directed towards basic research at universities and applied research and development in the private sector, with strong incentives for commercialization. (INN-SBTF)
Section 7(c)	We recommend that small business firms be allowed to establish and maintain a reserve for R&D for use in times of financial stress. (JC-WG) Allow small business concerns to establish and retain a "reserve for research and development in profitable years to be used in periods of business stress, with the maximum level of this reserve being ten percent of gross revenues. (INN-SBTF)
No parallel section in Advocacy Task Force Bill	We recommend that each federal agency allocate five percent of its R&D funds for technology transfer. These funds should be used to establish well defined and organized programs of technology transfer in which there are incentives to individual researchers to contribute their time and skills to the identification of commercial applications. Such incentives should be related to the benefits realized from technology transfer. (JC-WG)

TAX RECOMMENDATIONS

ADVOCACY TASK FORCE BILL SECTION	JC-WG AND/OR INN-SBTF RECOMMENDATIONS
No parallel section in Advocacy Task Force Bill	Revise the corporate income tax rate to provide greater retention of earnings during the initial start-up and growth phases for small science and technology firms. (INN-SBTF)
Section 7(d), Section 7(a)(5), and Section 7(b)	A new class of equity security be created for start-up innovative businesses that would couple the benefits of limited partnerships with the benefits of Sub-chapter "S" Corporations. This new equity class would possess the following features: -- limited liability protection, -- include up to one hundred investors, -- allow incorporated investors, -- allow the use of cash basis accounting for tax determinations, -- allow operating losses and investment tax credits to flow through to individual funding investors in the year occurred, -- allow specialized equipment and instrumentation for research, development or testing to be expensed in the year purchased. This new class of stock and its benefits should be available to small businesses that spend in excess of five percent of their gross sales revenues and development as determined by Generally Accepted Accounting Principals (GAAP). (INN-SBTF) (Note: As referred to hereinafter INN-SBTF Recommendation 1)

TAX RECOMMENDATIONS

ADVOCACY TASK FORCE BILL SECTION	JC-WG AND/OR INN-SBTF RECOMMENDATIONS
Section 7(a)(2)	We recommend that the capital gains tax rate be reduced to 25 percent (the pre-1969 rate) on the capital gains realized from the sales of stock of small businesses (less than 500 employees at date of purchase) whenever such stocks have been held for more than three years, with a rate of 10 percent for the capital gains of investors in the smallest businesses (less than 100 employees at date of purchase). The reduced rates would not apply to capital gains realized from the sale of real estate. (JC-WG) Reduce the federal tax on gains from capital investments in small science and technology firms to a level of fifty percent of the otherwise applicable capital gains rate, if the investment is held for a minimum of five years. (INN-SBTF)
Section 7(a)(2)	We recommend deferral of capital gains taxes on the sales of stock if the proceeds are reinvested within one year in small businesses, except those whose principal activities are real estate transactions. (JC-WG) Allow investors in small science and technology based firms to defer paying capital gains taxes on equity investments, provided the gains are reinvested in other small science and technology based firms within two years. (INN-SBTF)
Section 7(a)(3)	We recommend that the threshold for application of the full corporate tax rate of 46% be raised for small businesses from $100,000 to $200,000 of annual net income; and for annual net income below $200,000 a progressive rate schedule beginning at 10% on the first $50,000, and increasing in 10% increments to $200,000 on each additional $50,000. In addition we recommend that the carry-forward provisions for start-up losses of small businesses be extended from five to ten years. (JC-WG)

SBA OFFICE OF ADVOCACY TASK FORCE MEMBERS NOT AVAILABLE FOR COMMENT:

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404/352-2050

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San Francisco, CA
415/421-3110

Mr. Robert F. Zicarelli
President
Northwest Growth Fund, Inc.
Minneapolis, MI
612/372-8770

3. Long-range forecasting on "The impact of energy costs, technological change in capital equipment costs upon new materials competition."

Dr. Bruno O. Weinschel
Weinschel Engineering
Gaithersburg, Maryland 301/948-3434

"Because this small business with approximately 300 employees is founder-owner-engineer operated, we can adopt to new technologies such as the use of microprocessors very readily. We are performing self-funded focused basic research, applied research and development. Some major projects have required extensive effort lasting through as much as a five year period. The resulting instrumentation has contributed to exports to Japan, Germany and even the Peoples Republic of China. Our export rate is approximately 35% without any credit losses. A small company offers employees more rapid opportunity for advancement, because their capabilities can be recognized more readily. A small company can embark on innovations more readily since it need not worry about the obsolescence of major investments in old technologies. While we hold over 50 patents, they are used by some of our large business competitors and are benefiting, therefore, not just our business but the whole industry."

Projects:

1. Improving deposition technology of thin films used for microwave applications in satellites in order to improve microwave properties and reduce production expense.

2. Develop improved solid state oscillators up to 26.5 GHs having a broadband high power output and reduced post tuning drift.

3. Develop semi-automatic instrumentation for use by low skilled operators to perform calibrations of attenuators under local or remote program control to an accuracy and range which was formerly only capable in very advanced laboratories using highly skilled operators such as, for instance, the National Bureau of Standards.

Drs. Arthur and Judy Obermayer
Moleculon Research
Cambridge, Massachusetts 617/547-2353

Dr. Judy Obermayer:

"The normal government approach to a problem is to throw lots of money at it and expect the solution to appear. Government bureaucrats spend with ease and safety in mind. Big companies can spend big money fast with little risk with the bureacrats giving it out. But the best ideas do not come from them; big, lethargic institutions. What we care proposing does not require more money, but rather, more effective use of what we have. The challenge is to force the bureaucrats to take some of the same money and divide it among many qualified, innovative small companies and inventors with new and creative ideas. Exploring the technical and economic feasibility of untried technology means taking on the risk of failure! We must recommend that it is a necessary risk to ensure that development of original and innovative technology for our future economic survival."

Dr. Arthur Obermayer:

"It took five years from the Wright Brother's first flight to convince the U.S. government to buy an airplane from them. Even then, the government was afraid to take a chance on a little guy with a big idea. As a result, all the U.S. airplanes flown in World War I were made in Europe. So far we have not learned from our mistakes. We have not gotten the government to take a chance on the small inventor/entrepreneur. Even when the need is recognized, the government has not had the capacity to overcome its own inertia and prejudices. A typical example is the Energy Related Inventions Program at the Department of Energy which initially received over 5000 proposals from individual inventors and small companies. Unfortunately, no money was provided for proposal evaluation so good ideas sat for years with no action. Finally, the Small Business Administration is becoming our advocate and giving voice to the critical role played by small business in our economy."

Dr. Gilbert V. Levin
Biospherics Incorporated
Rockville, Maryland 301/770-7700

"If the recommendations in this report were followed, the result could be a turning point in correcting the national malaise cited by President Carter. Innovation thrives in small businesses as do pride and productivity. Jobs are created at rates far exceeding the national business norm. Management and employees work hard and are willing to sacrifice for the opportunity to develop new ideas. I believe Yankee ingenuity has its roots in small technology firms. Given a choice, they can solve some of our national problems and, in the process, restore much of the drive that has gone out of the American way of life."

Projects:

*1. Oil Sentry - an instrument to measure oil contamination in water.

*2. Phostrip Process - a waste water phosphorus removal process.

**3. MRM - Microbialradiometabolism - rapid identification of pathogenic micro-organisms, and antibiotic testing instrument.

*4. Suspended Solids Meter - for use in monitoring waste water.

**5. Biocatalytic Waste Water Treatment Process - an improved biological process for treatment of municipal waste water.

**6. Dissolved Oxygen Meter - for use in monitoring waste water.

* These have been developed and brought to market.
** In active development.

Mr. Robert Hillas
E.M. Warburg, Pincus & Co.
New York, New York 212/593-0300

"There is a tremendous reservoir of technological and innovative minds within the U.S. A free operating market system is the most efficient means of coupling the innovative minds with capital, and small business is both a primary source and the result of this process. Furthermore, the greatly increased activity of the venture capital industry during the last 6-12 months, which directly parallels the time frame of the reduction of the capital gains tax rate, clearly indicates that one way to foster innovation in this country is to allure the innovators and the inventors with substantial capital rewards for successful ventures."

Projects:

E.M. Warburg, Pincus & Co. through its venture capital affiliate, recently completed one technologically intensive investment and is in the process of closing another. Nuclear Pharmacy, the first investment, is a pioneer in the energy field of nuclear medicine which it serves with its nation-wide chain of nuclear pharmacies.

Litesom is a start-up venture intimately involved in the development of lightwave communications systems.

Mr. Patrick J. Iannotta
Ecolotrol, Inc.
Bethpage, New York 516/938-6622

"The life blood of the American economic system rests on small technology firms and individual investors. To the extent that the government fosters their well being this nation can solve many of its problems. To the extent that it hinders their development and growth, you fundamentally weaken the viability of our economy."

Projects:

Anaerobic fluidized bed - high strength industrial waste treatment system which in addition to treating waste water gives off a by-product of methane gas which is an energy source. Initial results have been good.

Combustion efficiency computer - allows for simple real time analysis of industrial boiler efficiency.

Mr. Harold Guller
Essex Cryogenics Industries
St. Louis, Missouri 314/832-4500

"As we commemorate the 10th anniversary of man's small step to the moon, it is significant to note that President Carter has challenged American ingenuity to find new answers to our energy problems. As we were galvanized into innovative, technological advances by President Kennedy's ambition to send man to the moon, we may now have another awesome technological challenge to overcome the growing demands for new sources of energy. This endeavor now adds direction to the recommendations of the task force whose studied opinions are contained in this report, SMALL BUSINESS & INNOVATION, and perhaps in the near future Americans can again take that giant leap for mankind."

Projects:

Working on an on-board oxygen enrichment system; molecular sieve used for pilots on planes; liquid propane dual fuel systems for vehicles.

Dr. Eugene Haddad
Columbia Science Industries
Austin, Texas 512/258-5191

"Technological innovation is the creation of a new product to solve a complex technological problem. Fallout from a product of this type may have enormous consequences upon our society. An example is the computer and associated computer industry.

Technological innovation is an outgrowth of small and large companies alike, and in particular with most innovation coming from small companies. Government practices over the past ten years have lead to the decline of the number of small high technology companies through higher taxes on profits, increased regulations, less incentives for private investors and a lack of recognition that government seed money was required for helping and starting up new companies.

Our government must revise our present policies if we are to change the disasterous decline in technological innovation that the country is presently experiencing."

Mr. Dan Cronin
Ampersand Associates
Boston, Massachusetts 617/423-8203

"During the period from 1969 to 1976, 9,583,000 new jobs were created in the private sector, of these, only 75,000 were generated by Fortune 1000 companies. Think of it -- 99.3 percent of all new private jobs were created by small business, companies with sales of less than $100M.

Congress with some constructive nudging from small business has lately come to recognize the significant contribution that small innovative companies can make towards solving critical national economic problems -- innovation, job creation and productivity improvement. Last year, for example, in the 1978 Tax Reform Bill, Congress reduced the capital gains rate to roughly the 25 percent rate that prevailed during the 1960's. In response, over $1 billion in venture capital has been raised and has been invested in innovative small businesses. This task force report recommends a number of other important regulatory tax and patent reforms that will further stimulate the establishment and expansion of young innovative companies. It deserves close attention and study by the Congress and the Administration."

Projects:

In 1974 Ampersand financed Data Terminal Systems, then a 30 employee company doing $1,500,000 in sales. Data Terminal developed the first stand-alone, upgradeable micro-process driven electronic cash register. Now five years later the company is the world's second largest manufacturer or electronic cash registers. It employs about 1000, has sales approaching $100 million -- one third of which is exported -- and is listed on the New York Stock Exchange. Data Terminals exemplifies the benefits of support for the nation's young, innovative companies. The company directly created 1000 new jobs. Extraordinarily sophisticated business systems at reasonable costs and simple to operate are now available for both small and large retailers. The productivity of retail personnel using this system is markedly improved.

"This report, along with other recommendations and findings that are being developed now, will be considered by the President," Weaver said. He pointed out, however, that the recommendations in this report do not necessarily reflect the position of the Administration at this time.

# # # #

> strengthening domestic producers' competitive ability and the balance of payments; enlarging the most job productive part of our economy; and enhancing our ability to control undesirable consequences of our industry..."
>
> "Unfortunately, it is a fact well known to students of innovation that over the past twenty-five years numerous blue ribbon panels, commissions and task forces have documented the importance of innovative small business, described the problems it faces and made recommendations for the remediation of these problems. What is tragic is that despite all these reviews, government has failed to respond by enacting their recommendations."
>
> "Unlike these previous studies however, these new reports are primarily the work of innovators themselves -- the chief executive officers, of innovative small businesses and the venture capital managers who must make decisions on which innovations to fund."
>
> "There is no longer any excuse for anyone not to know the highest priority steps that innovators themselves need. They have told us in their own report."

A work group report prepared under the direction of William Norris, founder and chairman of the board of Control Data Corporation, and included in the SBA report, documents the government actions which have brought about the decline of innovation. These include policies and laws which have made it increasingly difficult for small firms to raise money, to retain key employees, to compete with larger firms, and to comply with the government's many regulatory requirements.

- Tax incentives would be offered in recognition of the risks of small-scale R&D. Any small business which maintains an average R&D investment over three years of three percent (3%) or, in a single year spends six percent (6%) of gross revenue in R&D, could get tax deferment if reinvested; gains would be taxed at half rates; losses could be carried forward for 10 years rather than 7; the period of exercising stock options would increase from 5 to 10 years and faster write-offs could be made for specialized R&D equipment.
- To improve small business export performance, increased tax deductions would be allowed for specially-created Small Business Export Trade Corporations, and for special expenses to serve export markets.
- Federal agencies would be prohibited from engaging in and supporting R&D projects that are competitive with or duplicate private sector technological developments.

Supporting small business, the report says, is particularly important because small business is the principal source of major innovations in the nation when compared with large business, universities and government laboratories. The reports cite evidence from numerous

Exhibit 1

SMALL BUSINESS & INNOVATION

A Report of the
Small Business Administration
Office of Advocacy Task Force

July 31, 1979

********** SUMMARY OF FINDINGS **********

Major changes in Federal laws, and government practices will be required to reverse a 15-year decline in the ability of small business to come forth with innovative new products and processes from scientific research and technology efforts.

These conclusions and a layman's draft of model legislation to accomplish this are contained in three previously unpublished reports released by the Office of Advocacy of the Small Business Administration. The reports are the results of three citizen panels on job creation and domestic innovation set up by the S.B.A. and the Commerce Department over the past year.

The recommendations deal with improving the climate for science and technology based innovation through changes in such areas as taxation, patent procedures, and regulations. Thus, for example, the reports recommend an official policy of "regulatory flexibility": "all Federal agencies which issue regulations affecting small business shall insofar as practicable, issue them so as to relate

The former qualified stock option plan should be reinstated for small companies.

Tax incentives such as the proposed roll over provision for investments on a tax free basis should be provided for venture capital investors in new enterprises.

A large company can keep people because of salary, pensions, "perks" and job security. The principal incentive for an entrepreneur or manager and, more important, the second round of managers, has essentially vanished now that we have removed the qualified stock option plan. That was a great blow to small business.

On the positive side, this country has tremendous resources, if we can get them going again. American students are mostly back at work now after our earlier period of campus unrest.

Over $100 million of new venture capital funds have recently, been made available in Boston alone through organized professional venture capital sources. The venture capital community has now become professionalized and better organized. It is in a position to appraise new opportunities and assist new technical enterprises in which they invest their money. This new expertise should enhance the success ratio of new high technology companys.

The academic community now conducts research relative to the innovation process, the role of venture capital and the formation of new companies. Both literature and courses are available for students, managers, inventors and entrepreneurs who wish to start their own new firms.

As the process of new enterprise formation has matured the country now has a growing number of older successful entrepreneurs with capital, energy and experience who are now involved in helping a new generation of entrepreneurs develop a new series of high technology business entities.

Many of our more innovative major corporations have begun to address the problem of finding new mechanisms to develop a spirit of entrepreneurship within the firm and to seek new technologies that can be profitably commercialized. The concept of "internal ventures" represents one organizational method that has been introduced to retain the advantages of the individual entrepreneur within the highly structured large corporation.

Several of our major corporations now have established venture capital organizations for the sole purpose of going outside the company to seek new technology and the unique management talents of the entrepreneur who is seldom found in a large corporation and certainly not among our nongrowth low technology industries.

The ingredients for a rejuvenation in our long history of inventions and entrepreneurship are still here. We have all the reports and studies we need. These hearings testify to the continued concern and interest in the problems. Congress and the executive departments and agencies should now take some actions—the educational period is over.

Thank you.

Mr. FUQUA. Thank you very much, Mr. Morse.

Mr. Stewart.

[The prepared statement of Mr. Stewart follows:]

They have far more effect on the small company than the larger one, who has the ability to absorb the overhead and other problems associated with dealing with the Government.

Originally—I am going back now to the genesis of the so-called Boston Route 128, the California bay area centers of high technology—small companies could look to Government support for so-called unsolicited proposals. If someone had a good technological innovative idea it was possible to get some funds. That situation has essentially vanished. Although there is some excellent work being initiated now in NSF in this direction.

Our "in-house" Government laboratories are conducting an ever increasing amount of commercially oriented research and even the manufacture of equipment, in direct competition with the small business community. Because of such factors including the concept of cost sharing, most high technology companies will now no longer even bid on a Government R. & D. contract. The country is a loser in this regard, because it is from these very small high technology companies that more innovative ideas tend to come.

Thirty-two corporate excutives—I am speaking now of large companies—reported in a study that I did a while back that Government regulation and the question of adequate return on investment, are the two most significant factors which influence their decision to fund technical development programs.

Some 54 percent of 125 research directors of large U.S. companies now feel they are less able to commercialize innovative technology than Sony or Hitachi. Four percent believe they had an equal ability to do so. The same group also indicated that the product development time cycle has increased more than 25 percent in the last decade.

The Japanese Government and industry tend to work as partners to insure a viable, competitive environment for the sale of Japanese goods. We have almost an adversary relationship between business and government. Because of regulation, indecision and lack of financial support and understanding, our own technology is now used by others to compete with America in the world and at home.

A large percentage of our graduate students in science and engineering are now non-U.S. citizens. Without taking a position whether this is good or bad, it is certainly a way in which our technology will be taken abroad.

Technology transfer is a people transfer process. I think people forget that. You don't transfer technology by printing reports or having data banks or all that sort of thing, it is the intrepreneur who takes a piece of technology and goes and does something with it.

Everyone is excited about the Peoples Republic of China these days. It is interesting to read the Constitution of China, where article 12 states, "The state devotes major efforts to developing science, expands scientific research, promotes technical innovation."

In this country, no one person, committee, agency or department of the Government has assumed responsibility for technological innovation. I want to emphasize that. We should strive to create an environment for innovation in this country, in which the free

Unfortunately, this country and the Congress are much more inclined to initiate some grandiose highly publicized impractical projects such as the solar power satellite or mammoth electric car program (before a battery has been developed) than to give modest support to innovate technological ideas which may stimulate industrial products and processes for the future. This comment does not minimize the value of our important military space activities and such useful commercial applications as our reconnaissance, communication, navigation, and weather satellite programs. The time has come to employ logic, sound engineering and economic consideration in our decision makeup procedures other than the influence of the media, local politics and emotion as we develop national R. & D. programs.

Recently we have had recognition in Congress that our industrial society in a highly competitive world requires something more than a healthy science program. More research funds do not necessarily make jobs or create viable processes and products. This requires the total innovation process and a relatively high number of our more promising new technological ideas will come from small high technology companies.

The last thing this country needs is a new department of agency charged with responsibility for new technical programs or their administration. We, also, have no need for any increase in R. & D. funds. There are many opportunities for eliminating current costly technical programs and "in house" Government research administrative expenses.

I. The Office of Science and Technology Policy should:

(a) Report to the President and Congress on an annual basis regarding the National Environment for Technological innovation.

(b) Recommend appropriate actions to the President to enhance the innovation process and make certain all agencies and departments effectively perform as required by legislative and executive action.

(c) Create the position of Assistant Director for Technology with responsibility to expedite commercial applications of Science and Technology and enhance technological innovations.

(d) Establish a Technology Advisory Board with a Chairman and members unpaid (10) from small high technology firms, large companies, Universities and labor to make recommendations regarding our national environment for technological innovation.

II. Our Executive Departments and Agencies Should:

(a) Establish a policy of accepting insolicited proposals for new innovative research programs without the current competitive bid system.

(b) Develop a simplified uniform "Small Business Innovation Contract". This would be used with companies qualifying as Small Business for contracts of less than $500,000 and be based on ideas originating with the company. All rights except a royalty free right to the Government for Government use would remain with the contractor. Accounting and auditing and payments would be simplified by the adoption of a cost reimbursement/fixed overhead accounting procedure without a fee. A simplified proposal and reporting procedure would be established as employed in the days of O.S.R.D. and the Manhattan project.

III. Regulations: Rules and regulations of the SEC, EPA, OSHA, FTC, FDA, etc. should be continuously reviewed to determine their adverse impact upon small business and action taken as indicated.

IV. Financial Incentives:

(a) Executive and legislative action should be taken to improve the climate for both the inventor, entrepreneur/founder and management of new enterprises.

(b) The former qualified stock option plan should be reinstated for small companies.

(c) Tax incentives such as the proposed "roll over" provision for investments on a tax free basis should be provided for venture capital investors in new enterprises.

This country has tremendous resources and all aspects of our technological society are not deteriorating. American students are mostly now back at work after our earlier period of campus unrest. For the entrepreneur our present energy problems represent opportunities for new ideas and the launching of new technical enterprises. Graduates today, more than ever, are interested in jobs with innovative Companies, they are not anti-big-business, although they certainly look for the opportunities of the small growth companies rather than the large mature organization with its non-innovative management and lack of excitement.

Perhaps because of the recent reduction in capital gains tax, or disillusionment with the stock market and impact of inflation, there has recently been a great increase in the availability of venture capital. Over $100,000,000 of new venture

study, "The Automobile and Air Pollution." Member of the General Advisory Committee of The Energy Research and Development Administration (ERDA).

In 1978 he retired after 15 years as Senior Lecturer at the Sloan School of Management at M.I.T. In 1972, he was responsible for the organization of the M.I.T. Development Foundation, Inc. an affiliate of M.I.T., established in collaboration with industry to expedite the public use of research at M.I.T. and other institutions.

He currently serves as Director or Trustee of Dresser Industries, Inc.; Compugraphic Corp., Eco Incorporated, PMC/BETA Corporation, Woods Hole Oceanographic Institute, Boston Museum of Science, Museum of Transportation, Boston Five Cent Savings Bank.

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Statement by Richard S. Morse—The Changing Environment for Technological Innovation

For more than a decade this country has been engaged in a long series of reports, studies, congressional hearings and the introduction of legislature to enhance the role of technological innovation and improve the climate for the small business community. There has been little concrete effective action. In spite of a few recent steps in the right direction the U.S. environment for the entrepreneur has deteriorated. The mechanism whereby the innovation process operates is still not fully understood by the public, the media or Congress.

Legislature actions such as the elimination of employee qualifed stock options have had a severe adverse impact on small technical enterprises which require financial incentives for the entrepreneur, investors and key employees to counterbalance the high risks inherent in a new enterprise and compete with the larger companies for talent.

The apparent innate concern of Congress regarding patent rights is appalling. In spite of the fact that more than half of all the technical professional people in the United States are directly or indirectly being paid by Federal R. & D. funds, the total royalties ever received by the Government for its so called patent rights are relatively speaking zero. Patents require an entrepreneur, an inventor or corporation to undertake their commercialization. This is not an easy task and certainly not a role for Government unless we propose to abandon our free enterprise system.

Our small companies are now particularly vulnerable to the growing bureaucracy in Washington and the increased complexity of rules and regulation. Rising interest rates and inflation render it more difficult to move faster than the large corporations and find a profitable market for new products.

A small high technology enterprise can no longer look to the Government for support of an innovative idea as was the case a decade ago. The current proposal system is very costly and time consuming. Nine months to a year can ensue before funding begins. Patent rights are particularly important to a small innovative organization and the burden of current accounting, auditing and reporting procedures are unbelievable. A small company, for example, may spend one or two years in an effort to terminate a Government R. & D. contract and collect the money owed by the Government.

The elimination of the unsolicited R. & D. proposal concept of some years ago has placed a great burden on innovative companies with new ideas and the Government no longer has access to some of our best high technology. Our "in house" government laboratories are now conducting commercially oriented research in direct competition with the small business community. The concept of "cost sharing" as employed by D.O.E. makes it very difficult for a high technology company to compete with a large industrial corporation, or the aerospace industry which has heavy R. & D. support from the government but usually little expertise in bringing commercial products to the market.

Large mature low growth rate companies are in many instances unable to attract first class technical people and their highly regimented disciplined organizations do not usually lend themselves to high technological "risk taking." New innovative ideas often succeed because of the "courage of ignorance" found in small enterprises and tend to be suppressed in the large non-innovative firms where decisions are made the basis of careful analysis and comparisons with other more immediate opportunities for investment.

In addition to the mere magnitude of our large companies, which militates against innovation, inflation, regulation and cost of capital and labor influence technological innovation.

I am pleased to welcome our first panel which consists of Richard Morse, George Lockwood, and Milton Stewart. Richard Morse served 15 years as senior lecturer at the Sloan School of Management, MIT, and founded and served as president of National Research Corp.

George Lockwood is president and founder of Monterey Abalone Farms and is now serving as national vice chairman of the Committee for Small Business Innovation.

Milton Stewart is Chief Counsel for Advocacy for the Small Business Administration.

All three have participated in numerous innovation studies and have distinguished themselves wth meaningful contributions in the area of small business and innovation. I request each of you give a brief opening statement. Your written statements will b included in full in the record. This allows the bulk of the allotted time to be spent in discussion of the important issues.

[Mr. Hollenbeck's opening statement follows:]

OPENING REMARKS OF HON. HAROLD C. HOLLENBECK BEFORE JOINT HEARING OF SENATE COMMERCE AND SELECT COMMITTEE ON SMALL BUSINESS AND HOUSE SCIENCE AND TECHNOLOGY AND SMALL BUSINESS

Mr. Chairman, the subject that we are discussing today is of enormous importance and reflects issues which will occupy this nation over the next generation.

I wish to make just three quick observations. First, the very multiplicity of committees involved in this hearing indicates the broad scope of the problem we address which will, of course, affect the livelihood of all Americans. We must rise above narrow territorial considerations in devising new congressional mechanisms to deal with this problem. It may be that increasingly over the future Congress will have to resort to mechanisms similar to the ad hoc Energy Committee to deal with these multidisciplinary multi-subject issues, such as energy and industrial innovation.

My second observation is as follows. The issue of industrial innovation and retooling our economy to be more innovative is a generation long process, indeed it is a process that never ends, as times and conditions in the world change. We cannot, and must not expect immediate solutions to these problems. As a matter of fact, there is good evidence to indicate that current investment practices by. U.S. business brought upon partly by foreign competition, high interest rates and inflation are contributing to the short term thinking which itself has contributed to declining investment in innovative new concepts and products. Thus, my second observation is that the solutions to these problems must be long-term. They will not come overnight.

My third observation is simply that we must never consider innovation good per se. The real question is why do we innovate? Why is innovation necessary? The answer is that we do so to meet human needs under changing conditions. Changing conditions in terms of availability of resources, and the world economic environment in which this nation lives. Thus, we must always ask ourselves: Why innovate? The answer is that we innovate to satisfy real human needs and solve national problems, such as the shortage of energy and materials of the degredation of environmental quality. Public policies should only promote innovation that also meets the criterion of bettering the quality of our lives here and the lives of men throughout the world.

Mr. Chairman, I thank you.

Mr. FUQUA. I would first like to ask Congressman Bedell if he has any opening remarks.

Mr. BEDELL. Thank you, Mr. Chairman.

I would like first to welcome Milton Stewart. In our hearings we have had in the Small Business Committee he has stood out as one of those people with the courage to advocate some of the things that I think we need to see in our society if we are going to build the type of society we need.

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