# MEMORANDUM

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
OFFICE OF THE SECRETARY

TO : Mr. Matthias Lasker, Director
Division of Grants, Policy, and
Regulation Development, OGPM

DATE: January 24, 1974

FROM : Malcolm S. Mason
Office of the General Counsel

SUBJECT: Increments Above Cost in Grants to Non-profits

QUESTION: You have asked whether there is authority to pay to a non-profit grantee an increment above cost. The term "cost" includes, of course, both allowable direct costs and allowable indirect costs which relate to and are allocable to the objectives of the grant although not specifically identified with a single project. Your question relates to payments that go beyond both the allowable direct costs and the allowable indirect costs.

I have your memorandum of January 17, 1974, on this subject together with the attachments referred to therein. In your memorandum of January 11, 1974, to F. H. Hundemer, Jr., Chief of Contracts and Grants Division, PP Branch, you make clear that a definite answer must turn on the construction of the enabling legislation, stating that unless specifically authorized in the enabling legislation no increment above cost should be allowed. The word "specifically" may suggest a somewhat more literal requirement than is appropriate. It is clear, however, that since the rules applicable to any grant program must turn on the specifics of the program, only a general answer can be given without specifics to work from. Although we are agreed that this general answer is clear, I am, nevertheless, at your request, treating the matter more fully than it would otherwise deserve because some question has been raised as to the correctness of the conclusion and because the authorities in the field, even though they are clear in their intent, are slightly oblique in their statement.

be a proper grant cost and not an increment above cost. Allowable costs, of course, include indirect costs. If it is not so specified, a payment would be an increment above cost and, under the GAO definition which fairly represents prevailing understandings, it would be made only "as otherwise expressly authorized by law". Indeed, the Manual continues:

> "The acceptance of a grant from the United States creates a legal duty on the part of the grantee to use the funds or property made available in accordance with the conditions of the grant."

This principle is then strongly reinforced by stating:

> "The United States generally has a reversionary interest in the unused balances of advance payment grants, in any funds improperly applied whether received as an advance or reimbursable payment, and in property or facilities purchased or otherwise made available under the conditions of the grants, unless title thereto is specifically vested unconditionally in the grantee by the terms of the grant under authority of law."

The reversionary interest of the United States clearly means that funds not used by the grantee for specifically authorized expenses may not be retained by the grantee for its general purposes.

In several related passages the Manual emphasizes that grants must be applied solely in accordance with the conditions of the grant and that unused balances or grants must be returned to the United States.

The Manual further provides that payments to grantees in advance of work performed shall be accounted for as advances of the grantor agency until evidence of performance has been received from the grantees. Payments to grantees

authorizes grants-in-aid to non-profit universities and other institutions for the general support of their research and research training programs. Where such provisions exist, of course, the grant need not be limited to specified projects. Apart from such cases, statutes which contemplate grants not limited by costs are quite out of the ordinary and a clear showing of such an intent would properly be required.

AN ILLUSTRATIVE INSTANCE: To make this more concrete, we may take as an example the instance which I understand was in fact the one that gave rise to the question although it has now been resolved consistently with your advice. As I understand the case, Syracuse University Research Corporation, a New York educational corporation (not for profit), has received a grant under section 309 of the Adult Education Act as amended. Grants under this section are now governed by the OE General Provisions for Programs, Part 100 (§100a.10(8), 38 FR 30654, 30663, November 6, 1973) which explicitly limits the amount of award in §100a.50 to

> all or part of the allowable costs of projects which meet the requirements contained in the applicable Federal statutes and regulations.

The related section 100a.51 on limitation on costs similarly although this time more obliquely identifies the permissible maximum amount of the award with the "costs incurred" and with the "maximum total cost to the Federal Government of the performance of the grant or contract." Prior to the effective date of these General Provisions, §309 grants were governed in this respect by 45 CFR 167.10 and 167.12 (38 FR 16132, 16140, June 20, 1973) which make a similar implied identification.

Section 309(b) authorizes grants to local educational agencies and other public or private non-profit agencies for special projects and requires a non-Federal contribution of at least 10 percent of the costs of such projects,

facilities, general purpose equipment, and research equipment, these cost principles indicate with varying particular qualifications that costs may be allowed only as provided for by the terms of the research agreement or in certain cases where approved by the sponsoring agency. Clearly that approval may be given only in fairly specific terms and must be directed to the approved objectives of the grant itself. An approval could not properly be given for purchase of undefined capital equipment with no identified relation to the purposes of the grant. If a valid grant cost is involved then there is no question of increment above cost. If on the other hand a valid grant cost is not involved, then we would have an increment above cost; and it would clearly be improper to allow it.

An entirely similar analysis applies to lease-hold improvements. An essentially similar analysis applies to long-term debt reduction and to interest on indebtedness.

To move to other indicated purposes of the proposed increment above cost, we come to a number that are plainly not even plausible but which have varying incidental characters worth noting. Let us take the last as an example. On the face of it these costs "that are not properly chargeable to a project" clearly cannot be the specified purpose of the grant. Since that is the case, the statutory authority to conduct certain types of special projects does not include these costs.

With respect to cost-sharing grants, it is obvious that if the Federal Government supplied the funds to meet the required non-Federal contribution, this would hardly be a non-Federal contribution and would not meet the statutory purpose. It is not altogether impossible for Federal funds to be used to meet non-Federal contribution requirements. The Model Cities Act, for example, has such a provision, Demonstration Cities and Metropolitan Development Act of 1966 (P.L. 89-754) section 105(c), but when that is the case, it is explicit beyond question. Here again, we are

Representative BRECKINRIDGE. Let us go off the record for a moment.
[Discussion off the record.]
Representative BRECKINRIDGE. Back on the record.
I would like to emphasize what counsel has just said about the exchange that these hearings have made possible. I think the President's task force is going to become an action task force for us long before it reports. I think, more importantly, that the framework which exists there, which should be utilized for the exchange of expertise and experience, whether it is good or bad, might help us profit from the other fellow's ways in terms of either doing it or not doing it.
That is tremendously important because it will accelerate the goals that we all have in mind.
I am delighted by your initiatives. I look forward to your reports indicating the progress you are making.
Mr. Gray, do you have anything else to add at this time?
Mr. GRAY. No; I think my comments which you had previously indicated I could include in the record, would cover anything additional.
Representative BRECKINRIDGE. Gentlemen, we thank you very much.
At this point we will turn over the Chair to Mr. Baldus, chairman of the Subcommittee on Energy, Environment, Safety and Research.
Representative BALDUS. Mr. Tashjian, we will call you at this point.

## STATEMENT OF MICHAEL J. TASHJIAN, DIRECTOR OF PROCUREMENT AND CONTRACT MANAGEMENT, U.S. DEPARTMENT OF ENERGY, ACCOMPANIED BY FRANK BRDA, DIRECTOR OF SMALL BUSINESS DIVISION, U.S. DEPARTMENT OF ENERGY

Representative BALDUS. Do you have people that you would like to have join you at the table?
Mr. TASHJIAN. Yes; Mr. Brda.
Representative BALDUS. We welcome you, Mr. Tashjian.
Would you introduce your associate?
Mr. TASHJIAN. I am accompanied by Frank Brda. He is head of our Small Business Office within the Department.
Representative BALDUS. I understand you have prepared testimony. You may proceed with that, if you choose.
However, if you choose to summarize, that may be beneficial.
Mr. TASHJIAN. Mr. Baldus, I have discussed some of these initiatives with you and your staff. I think if it is all right with you, I would submit my statement for the record and proceed directly to questions if you like.
Representative BALDUS. Would you like to summarize?
Mr. TASHJIAN. Yes; I would like to say a few words.
Representative BALDUS. Very well.
Your written statement, in its entirety, will be made a part of the record.
Without objection, so ordered.
[The prepared statement of Mr. Tashjian follows:]

SECRETARY SCHLESINGER DECLARED HIS COMMITMENT TO SMALL AND MINORITY BUSINESS (SB/MB) INVOLVEMENT IN DOE PROGRAMS AND AUTHORIZED, BY MEMORANDUM, THE ESTABLISHMENT OF DOE-WIDE SB/MB PROCUREMENT GOALS AT PROGRAM OFFICES, PROCURING ACTIVITIES, AND DOE-OWNED, CONTRACTOR-OPERATED FACILITIES. OFFICES WHICH MEET OR EXCEED ASSIGNED GOALS SHALL RECEIVE ACHIEVEMENT AND AWARD CERTIFICATES IN RECOGNITION OF THEIR PERFORMANCE.

IN THE FIRST SIX MONTHS OF FY 1978, SMALL BUSINESS AWARDS, INCLUDING RESEARCH AND DEVELOPMENT, TOTALED $432.7 MILLION, OR 9.3 PERCENT OF DOE'S PROCUREMENT OBLIGATIONS, INCLUDING CONTRACT ACTIONS AT DOE-OWNED PLANTS AND LABORATORIES.

TO INSURE SMALL BUSINESS CONSIDERATION IN PROCUREMENT ACTIONS, DOE PUBLISHED INTERIM MANAGEMENT DIRECTIVE IMD-0705 TO INSTITUTIONALIZE PREFERENCE ACTIONS SUCH AS SMALL BUSINESS SET-ASIDES WITHIN THE DEPARTMENT.

THE FOLLOWING ARE INITIATIVES UNDERTAKEN OR PLANNED TO INCREASE THE SHARE OF RESEARCH AND DEVELOPMENT DOLLARS

SIMPLIFY CONTRACT TERMS AND CONDITIONS, WE HAVE COMPILED A DRAFT DIGEST WHICH REDUCES CONTRACTUAL LANGUAGE TO LAYMEN'S TERMS AND TRACKS PROCUREMENT REQUIREMENTS TO THEIR ORIGIN. BY LATE FALL, DIGESTS WILL BE AVAILABLE TO RESEARCH AND DEVELOPMENT COMPANIES AND OTHER INTERESTED PARTIES. SHORTLY THEREAFTER, WE WILL CONSIDER POSSIBLE DELETIONS AND MODIFICATIONS TO EXISTING PROCUREMENT REQUIREMENTS TO EASE THE BURDEN ON SMALL RESEARCH AND DEVELOPMENT COMPANIES. CONGRESSIONAL SUPPORT OF THIS ENDEAVOR WILL BE VITAL TO FUTURE PROCUREMENT REFORM.

4. SMALL BUSINESS SET-ASIDES IN DOE ASSISTANCE INSTRUMENTS. DOE'S PROPOSED ASSISTANCE REGULATIONS PROVIDE FOR RESTRICTION, IN WHOLE OR IN PART, OF GRANTS, COOPERATIVE AGREEMENTS, LOANS, AND LOAN GUARANTEES. FOR EXAMPLE, DOE'S RESERVE IN SMALL BUSINESS GEOTHERMAL GUARANTEES CONSISTS OF $30 MILLION. INASMUCH AS $9 MILLION HAD

TO SMALL COMPANIES AT DOE CAPTIVE INSTALLATIONS AS WELL AS FIELD OPERATIONS OFFICES.

7. SMALL BUSINESS CLASS SET-ASIDES. DOE IS ESTABLISHING CLASS SET-ASIDES AT DOE-OWNED, CONTRACTOR OPERATED FACILITIES AND AT HEADQUARTERS AND FIELD PROCURING ACTIVITIES. CLASS SET-ASIDES ARE SELECTED ITEMS OR SERVICES THAT SHALL BE AUTOMATICALLY RESTRICTED FOR SMALL BUSINESSES ON CURRENT AND FUTURE PROCUREMENTS.

8. UNSOLICITED PROPOSAL RESERVE. THE PROCUREMENT AND CONTRACTS MANAGEMENT DIRECTORATE IS ASKING EACH PROGRAM ASSISTANT SECRETARY TO RESTRICT PORTIONS OF UNSOLICITED PROPOSAL FUNDING TO SMALL BUSINESSES ON A FISCAL YEAR BASIS.

9. SMALL BUSINESS FILMS. DOE IS FUNDING TRAINING FILMS ON NEWLY ENACTED ASPECTS OF AMENDMENTS TO THE SMALL BUSINESS ACT, PUBLIC LAW 95-89, INCLUDING LABOR SURPLUS AREA PROVISIONS.

DOLLARS AND CENTS MEASURES TO REDUCE BOTH ENERGY COSTS AND CONSUMPTION. THE PRIMARY TECHNICAL ASSISTANCE IS IN THE FORM OF SPECIFIC GUIDEBOOKS.

NATIONAL BUREAU OF STANDARDS/DEPARTMENT OF ENERGY-RELATED INVENTION EVALUATION PROGRAM

THE CENTRAL PART OF THIS PROGRAM IS TO ENCOURAGE INNOVATION IN THE DEVELOPMENT OF NON-NUCLEAR ENERGY TECHNOLOGY. TO ASSIST THE DOE IN DISCHARGING ITS RESPONSIBILITY, PUBLIC LAW 93-577 (THE FEDERAL NON-NUCLEAR ENERGY RESEARCH AND DEVELOPMENT ACT OF 1974) DIRECTS THE NATIONAL BUREAU OF STANDARDS (NBS), DEPARTMENT OF COMMERCE, TO EVALUATE ALL PROMISING ENERGY-RELATED INVENTIONS, PARTICULARLY THOSE SUBMITTED BY INVENTORS AND SMALL BUSINESS CONCERNS FOR THE PURPOSE OF OBTAINING DIRECT GRANTS FOR THEIR DEVELOPMENT FROM DOE. AS OF MARCH 1978, THE NATIONAL BUREAU OF STANDARDS HAS RECOMMENDED 58 INVENTIONS TO DOE FOR ASSISTANCE. AT THIS TIME, DOE IS CONTEMPLATING TWELVE AWARDS OF GRANTS OR CONTRACTS FROM THIS GROUP OF NBS RECOMMENDED INVENTIONS. IN ADDITION, THREE INVENTORS HAVE RECEIVED BUSINESS OR TECHNICAL ASSISTANCE.

APPROPRIATE TECHNOLOGY SMALL GRANTS PROGRAM

APPROPRIATE TECHNOLOGY HAS MANY MEANINGS AND APPLICATIONS. GENERALLY, IT CAN BE DESCRIBED AS THE TECHNOLOGY OR PROCESS WHICH IS MOST APPROPRIATE FOR LOCAL, CULTURAL,

On May 8, 1978, DOE announced the availability of planning grants to assist qualified small businesses in developing and submitting proposals. These grants will cover the costs normally incurred in developing, preparing and submitting a proposal to DOE.

Loan guarantees are also available for small businesses to assure that qualified small business concerns are not excluded from participation in the program due to lack of adequate capital. To provide specific information and create public awareness to prospective borrowers and lenders under the program, a series of orientation conferences is being held around the country. (Atlanta, August 10-11, New York, August 14-15 and Los Angeles, August 17-18, 1978.

The purpose of the orientation conferences is to bring together prospective private sector borrowers and lenders to learn more about the loan guarantee program and to discuss mutual interests in financing the Electric and Hybrid Vehicle Project. Loan guarantees will be available in early 1979.

Mr. TASHJIAN. You and I have talked before. We have talked primarily about small business in general and not zeroed specifically on R. & D. activties. We tried a little bit to examine our success, I might say, in identifying R. & D. firms. We have looked at a number of programs. We have to see where there may be applicability.

And, in particular, I am prepared to discuss, if you like, the Rabinow report. I was a member of an interagency committee that met with the Office of Management and Budget, OMB, when we looked at the Rabinow report to see what could be done.

There were seven or eight recommendations. In preparation we went through and ticked off some of the things we had done to develop recommendations coming out of that report.

So, perhaps in the question and answer period I can bring out some of the aspects of what we have done in that area.

Representative BALDUS. First of all, I want to compliment you on working with the committee in an informal manner. I think you ought to be complimented in a general direction. I think our efforts can be supportive of yours.

Mr. TASHJIAN. I think they can, yes.

Representative BALDUS. I am assuming we are going in the same direction.

I have some questions which I have prepared. I am sure you will be prepared to answer them.

One of them is in regard to the GAO investigation.

Your statement detailed the emphasis being made to increase small business participation on DOE procurement. However, in a preliminary response to my request for an investigation of DOE small business procurement practices, the GAO indicates that in 1977 ERDA awarded 10.3 percent of their procurement dollars to small businesses.

In your statement you indicate that for the first 6 months of 1978 small business's share was only 9.3 percent.

So, even though we are going in the right direction, hopefully we seem to be getting a different result. Can you explain that 1 percent drop in light of the efforts you have cited?

Mr. TASHJIAN. I do not think it is a drop. At midyear last year it was 7.5 percent. This year at midyear we were 9.3 percent. I think we are comparing the midyear figure to the yearend figure. I am optimistic that we are going to do better than we did last year because at midyear we were somewhere ahead of where we were last year.

Representative BALDUS. You can understand the concern of the small businessman?

Mr. TASHJIAN. Yes.

Representative BALDUS. The GAO report recommends that "the Secretary of Energy take steps to insure that the amount of small business subcontracts reported as prime contracts is clearly disclosed."

While I agree that the total contracting with small business is the significant figure. I share GAO's concern that "including subcontracting data in statistics representing prime contracts, such as the 10.3 percent reported by DOE, can be misleading * * *"

The footnoting which indicated that subcontracts had been included in the prime contracting figure did not indicate how much was prime contracting and how much was subcontracting.

In point of fact, only 2.6 percent of ERDA's money went for prime contracts with small business.

DOE purchasing offices for minority and small business. Like DOE purchasing offices, I track their performance.

So, in my mind I have treated them as an agent of the Government. We have reported their awards.

I think the bottom line is: Are the awards going to small business for the small businessman?

Whether he gets a prime or subcontract award really is not significant to him. He is concerned about getting an award.

Representative BALDUS. I sort of have another personal bias. I will explain it to you.

The definition of small business is still too high. In my district, it would be considered large.

I would ask for a further breakout as to the kinds of small businesses.

We will not go into that right now.

GAO tends to accept the Department of Energy's explanation that contracts with GO-CO's—Government owned, company operated research labs—are renewed noncompetitively unless performance under the existing contract has not been up to par.

On the other hand, if you look at the list of the top 23 contracts, which are with very large corporations, such as Union Carbide, Westinghouse, A.T. & T., DuPont, et cetera, and realize that we are talking about $4 billion in contracts with these top 23, one has to question to what degree the Government is facilitating the top position of these corporations and further how that stands up in terms of our national commitment to small businesses.

One also has to wonder about the labor-intensiveness and tendancy to innovatiou which are common to small business but which we are sacrificing. I think it is generally agreed that the large business is less innovative, but I wonder about that.

Can you comment on that?

Mr. TASHJIAN. Yes; these facilities are unique facilities. They are involved with nuclear weapons and nuclear research. It is a classified area. It is an area that historically we have a set number of facilities which involve either research or production of nuclear weapons. Those facilities have been a part of defense efforts for many years since the advent of the nuclear weapons.

The question is to what extent is it logical or feasible to think that a small business concern could perform.

If you look at the numbers and the hundreds of millions, I do not think it is feasible that a small business concern could take that prime contract and operate on it.

So, the next question is this: Can they operate under a subcontract basis? What is the opportunity for these facilities in spite of the classification and in spite of the large dollars and in spite of the special unique defense flavor of what they do? Can we increase their awards to small business?

I think we can and I think if you will look at those operating contracts, you will see that on balance somewhere between, I would guess, 35 and 40 percent of their purchases go to small business.

So, while it is true that they are labor-intensive, they perform, but while they perform a purchasing function on behalf of the Federal Government, as substantial amount goes to small business.

As to innovation, you are talking about technology there. I guess

Mr. TASHJIAN. Yes.

Representative BALDUS. The concentration of that in a few large companies, I am afraid, accelerates the trend toward the big fish eating the little fish.

Mr. TASHJIAN. I would agree with you. The thing is that big companies tend to have an organization that can seek out and gather that data.

We have tried to compensate for that by a Technical Information Center which makes it available to the world at large.

A small business firm does not have to hire someone. They can write to TIC and say they are interested in, let us say, solar collectors and ask for the reports. They can get a list and request copies of those reports.

Representative BALDUS. The large company, however, by moving a person from this corporation to that corporation, does not only have a written document, but is able to understand that. That is a subsidiary benefit.

Mr. TASHJIAN. I think that is true.

Representative BALDUS. I wonder how we avoid that?

Mr. TASHJIAN. I think the Center goes a little bit in that direction.

Where there is technology, NASA has a technology transfer program. In some cases, where there is applicability we can do this. There is a local university with which we are dealing—a minority university—that we try to give inventions to that we think might bear on commercialization.

It seems to me that these small business associations should be aware, if they are not, of the Technical Information Center and its availability to their members.

Representative BALDUS. Excuse me. I have to recess briefly.

[Recess taken.]

Representative BALDUS. The committees will resume their hearing.

In your statement, Mr. Tashjian, you referred to procurement set-asides, goals, and restrictions of portions of unsolicited proposal reserves for small businesses.

Can you give me exact percentages on how much of the procurement dollar is being allotted to small business in those categories in each case?

Mr. TASHJIAN. We are not in a final position on that. As far as the set-aside is concerned, I can tell you what our performance has been. I think of our small business awards, about 25 percent, about one-fourth of them, have been set-asides. That is, we have grabbed them off at the front-end and have kept them exclusively for small business.

What we are doing is that we are examining the feasibility of reserving an area of unsolicited proposals. For example, in the agency we have somewhere between 2,200 or 2,300 unsolicited proposals. They are submitted by inventors, companies, universities. We evaluate them for technical merit.

We are attempting to set-aside a portion of those exclusively for small business. We are still in discussions. That is one area.

The other area that we are examining has to do with the financial assistance area of loans and loan guarantees. In the geothermal loan

But it would have to be done on-site because all those contracts are not in Washington.

That is what that paragraph means, Mr. Chairman.

Representative BALDUS. I have one more remark and that is this.

Speaking for small business, when I think in terms of small business, I think in terms of my interpretation. That would be a great deal smaller than the Small Business Administration has for that definition.

Also, in the area of procurement the definitions would be different.

The outreach for getting contracts from very large companies is not very difficult. You tack something on the door and you probably have folks there. But for small business, to get the word to them that something is available, is a great deal difficult.

There is a responsibility for an outreach to those people. It is considerably different.

If you are going to significantly improve those figures—and I think it is beneficial if you do—then that is a responsibility that you have.

Mr. TASHJIAN. I agree with you.

In three of our programs we have had regional meetings. Our electric and hydrovehicle is one where we have a certain amount of money set aside for small business exclusively. We have had public meetings.

On the solar energy we have done that.

In the appropriate technology, this is a program which is diffused and localized and is an energy-saving device. We have done that across-the-board. We ran a prototype program in San Francisco covering the Western States and Hawaii with the seven States and territorial islands there.

In that program we used State and local program officials to help publicize it. We got over 1,100 proposals.

In the ten Federal regions we have two of them involved now of regions I and II in Boston and New York. In each case we had a regional meeting where we announced that we were giving grants to ideas which will be decentralized and will have local applicability and will save energy.

So, we are going to do that regionally all over the country. But we have had a number of meetings. On balance, the maximum awards are $50,000. We are really appealing to the small business concerns.

We gave, as I said, about 108 awards in San Francisco. We have asked for more money.

Mr. Chairman, you and I talked about that before. We are getting more money. It is for what we call diffused or appropriate technology.

I think you are quite right, Mr. Chairman. It is our responsibility to publicize. We have, in many cases. In many cases we have had regional meetings. This appropriate technology is very structured because it takes 10 Federal cities around the United States.

As a result of our first exercise, we are having a meeting next month on lessons learned. We went through this once. How can we simplify it? How can we reduce the paperwork?

We standardized our solicitation document and our grant instrument. We will have the regional representatives from the remaining seven regions who have not yet participated go over what I would say is a simplified message for running this program.

The booklet we have, for example, has an insert sheet. You fill it out, and send it to us. We try to look at what we can do to reduce the

neering development or preliminary design or full scale or what? Different people have different acronyms and different terminologies.

Representative BRECKINRIDGE. I would suggest, if I might, at that point that I have the same difficulty with the word "rural," which I happen to be involved in. I have come up with 23 pages of statutory definitions.

May I suggest that one of the first things that you address yourself to is reducing that to one page in the area of research and development to see if we cannot get a common definition?

Mr. TASHJIAN. I think the lead has to be taken by the Office of Federal Procurement Policy. They are the lead in establishing the Federal data procurement system, that is, the government-wide system that is supposed to come in this fall which will standardize the format for reporting all procurement data.

If we could have as a subset of that R. & D. data, then everyone in the Federal Government would use the same definitions and would have the same format. You could aggregate and have that data anyway you wanted to.

I would be willing to take a note to ourselves to approach them to see if this government-wide procurement data system will cover research and development. I would be happy to do that.

Representative BRECKINRIDGE. Let us undertake that jointly. You do that and so will the counsel of this committee. Then we will not go through the rest of lives arguing about apples and oranges.

Mr. TASHJIAN. Fine.

Representative BRECKINRIDGE. Until we do that, we will have to take your data, which I understand you confirmed to be only 2.6 percent under your present definition that goes to R. & D. small business.

Mr. TASHJIAN. Right.

Representative BRECKINRIDGE. That, of course, leads to the obvious question, inasmuch as that is a totally unacceptable figure on the basis of the testimony which we have had from Dr. Jordan Baruch, for example, who is in charge of the President's task force on this matter, and Dr. Frank Press, who is the President's Science Adviser, as confirmed by other reports that have come to us.

Regardless of the efforts which you have detailed and outlined in your regional breakdown, these seem to be totally nonproductive.

The question is: What do you intend to do that will prove productive and how and when?

Mr. TASHJIAN. May I just comment as to those numbers?

I feel they are somewhat misleading in the sense that they are perhaps not truly indicative.

One large program totally dwarfs a lot of smaller dollar productive programs. Let me give you an example.

I think in the fiscal year 1979 budget for DOE, which is still in the state of fluctuation was something like $500 million for the Clinch River project; magnetic fusion was $300 million. The fuel cycle and storage of radioactive nuclear waste and so on was $200 million.

When you start breaking out programs—and maybe only four programs account for over a billion dollars of the R. & D. budget—maybe half of it is there. You can see why the percentages are so low.

Representative BRECKINRIDGE. You have accounted for $1 billion of $7 billion. You are still leaving me with $6 billion. You are talking about 2.6 percent. I am still unimpressed.

Department of Energy
Washington, D.C. 20545

OCT 3 0 1978

Mr. Steven J. Engelmyer
Subcommittee Counsel
Committee on Small Business
House of Representatives
2361 Rayburn House
Office Building
Washington, D.C. 20515

Dear Mr. Engelmyer:

During testimony on August 10, 1978, before the Committee on Small Business, the information below was requested by Congressmen Baldus and Breckenridge:

1. Number of contract actions with small business firms, nine months Fiscal Year 1978, (including goaled contractors operating DOE-owned facilities): 476,146

   Total number of actions: 701,718

   Small business percent of total actions: 67.85 percent

2. Research and development actions and dollars with large oil companies, nine months Fiscal Year 1978.

   Number: 21

   Dollars: $104,138,000, of which $64,600,000 represents DOE funding on a cost-shared project with Exxon on the Exxon Donor Solvent Coal Liquefaction Process.

Representative BRECKINRIDGE. Would you be able to say, offhand, whether you have a significant investment with them, or a major part of your investment?

Mr. TASHJIAN. With the oil companies?

Representative BRECKINRIDGE. Yes.

Mr. TASHJIAN. Yes, I would say we have a significant number of high dollar contracts with some oil companies, particularly in the coal gasification and coal liquifaction program where we are talking about 4 and 5 year and multimillions of dollars for prototypes and pilot plants. Then I would say yes, we do.

Representative BRECKINRIDGE. I would like for you to respond to this for the record for your benefit as well as for the committees' benefit.

I want to direct your attention to a study by Prof. John Enos of MIT to the effect that of seven major innovations in the area of petroleum refining over a period in recent history, there was not one of them that was developed by the seven majors in the United States of America.

That is not definitive. That is illustrative of the problem and the prejudices that exist and which are floating around.

There is a strong conviction throughout the country that the wrong people are in charge of the programs and that the people who do not do the innovation and who have not done it and who are not going to do it unless you pay for it should not now be brought in to do it.

The emphasis, therefore, is backwards, it is thought. The starting point should be the other way.

As all the other scientific advisers are suggesting, the answer to your problems are not within the major companies. It is with the small businessman, the innovator, and the developer who does twice as much for half as much and 2.6 times as effectively and efficiently and at much less cost to the taxpayer.

I would like you to address your problems to that frame of reference, not now, but when you have had a chance to flush out some data.

Mr. TASHJIAN. May I respond?

Representative BRECKINRIDGE. Yes.

Mr. TASHJIAN. I am not an engineer, but let me say this. I cannot argue with the facts if those are the facts. But the question is this.

Where in the development cycle are you? If you are in basic research, then large capital investments are not required.

But if you are going to build a pilot coal gasification plant to prove that you can convert coal to pipeline quality high BTU gas, then the experts say it will take $500 million or $600 million.

Representative BRECKINRIDGE. I would not argue that. You are talking about how many around the Nation? You are talking about two or three; right?

Mr. TASHJIAN. Yes.

Representative BRECKINRIDGE. Let us not load this record down with those numbers. That is unrelated to an annual program of $7 billion. That is virtually nothing 5 years from now. They are in place and they are going.

My point very simply is this. These large numbers, weighted in capital investment, are completely unrelated to the question we are discussing here.

The question is: Where is the talent in the Nation and where are you putting your money?

Your experience evidently is contrary to the experience that I have been reciting to you nationally. Evidently it costs more to do business here where you are talking about energy research than anywhere else in the United States of America in every other field.

The figure of 2.6 percent against a record of 50 percent, or 150 percent, quantified 2.6 times does not add up. It makes me wonder if you have any analysts over there. If so, what is their background? What is their area of qualification and expertise?

You are talking about the total range of energy potential. You are talking about something that every Tom, Dick, and Harry and every crossroads has a dream about and an idea on and a damn good one. You are not finding it.

My question is directed at the process that fails to find them and puts the investment in the people who have not innovated anything in the area.

I do not know what the size of your investment is in the major oil companies. I would like to have that information for the record. I would like to know what contracts you have outstanding and what amounts are directed and what type of research and developments there is so we can begin to get a feel for the total allocation in here.

I am not getting any answers to why you are not finding more people out there when they are doing it everywhere except in the area you have responsibility for.

Mr. TASHJIAN. I think we are finding some.

Representative BRECKINRIDGE. What is the number? You are finding some. Let us get to those numbers. Let us start talking about those numbers and let us not talk about the decentralization of the agency's responsibility.

Mr. TASHJIAN. We have a system—and you are asking how many people we have to examine and how qualified they are——

Representative BRECKINRIDGE. And they are producing so little. We are going in with a 2.6-percent figure. It is a 2.6-percent figure of a 10.3-percent figure. That is against a procurement figure of 23 percent or 25 percent.

Mr. TASHJIAN. I will say they will look at it. If there is a known source, they will try to set it aside. On some occasions if it is not a known source we will publish in the Commerce Business Daily to see if we can uncover it.

I do not know what you would have to do to find these sources. We attempt to do that to set it aside. Even if we do not set it aside, small business firms may still bid.

The question is: What other mechanism should we use? I am saying our first effort is to try to set it aside. If we cannot do that, then we ought to let it out for bids and perhaps there is a small business firm that we do not know about who will bid on it.

If it goes to a large business firm, then we attempt to have a portion of the subcontract awards set aside. We will put that in our solicitation and we put that in the prime contracts. We have targets for subcontracts to go to small business concerns.

You can look at the results and say: "Should you not have a higher number?" I really do not know. We have made great efforts to locate sources. The Small Business Administration has a mechanized computerized list of small business concerns. We are working on putting

Mr. TASHJIAN. I would certainly hope that we would have better statistics, better visability, but I would hope that we could back out of that base some of the programs I mentioned that really do not lend themselves. Then you would get a realistic statistic, one that was meaningful.

Representative BRECKINRIDGE. I do not think the major capital investment programs in a particular technology, like liquification or gasification or the Clinch River breeder reactor or anything else are what we are talking about here. They are the most expensive.

Mr. TASHJIAN. But they are the ones that make the 2.6 percent because they are in the base.

Representative BRECKINRIDGE. We cut it in half and made it $3.5 billion.

Mr. TASHJIAN. If you take out half the base, that will pay 5 or 6 percent. Then you will begin to get into the realm of comparability.

Representative BRECKINRIDGE. That would be 5.2 percent.

Mr. TASHJIAN. I am saying that I am trying to do whatever I can in the absolute sense. I would like to see it 10 percent or 20 percent. I want to see what those figures will look like.

I think we have a number of initiatives in the system to improve our small business awards. I think we are going to get results.

I do not think you can get them overnight. I think it is the forms and the systems and the people that will do it. We will get there.

Representative BRECKINRIDGE. Have you a goal which you have given yourself and your people or any sort of calendar or timetable that you are working on?

Mr. TASHJIAN. We have established a goal for ourselves this year. I think it is about 14 percent. Last year it was 10.6 percent.

I have given a goal to every DOE buying office, a subgoal, so that we are monitoring performance, not only departmentwide, but by office.

So this way I can see where we are having good performance.

We also have an incentive program. That is the stick. We also have a carrot.

Our Secretary has a secretarial award program for the activity that does the best in achieving and beating their goal. We have a secretarial award program.

So we have given them a goal to hold their feet to the fire, but we also hold out the specter of an award and recognition by our Secretary.

We have also given goals to our program people. I do not know any other department that is doing that.

I am the spokesman here. I turn out to be the advocate for small business within my Department because we have program people who are concerned with getting on with their project.

One of the things that you find for a procurement guy is that he runs headlong against the program man, who is anxious to get on with it.

In the Department of Energy we have assigned percentage goals for small business through the program people. It has motivated them a little bit. In the past they were fighting back. They are coming back to me and wanting me to help them get their pro rata share. I do not know of any other department that is doing that.

So I think it will help us. Another thing we have done is to have class set-asides for small business. For example, we have said in the

off the record previously and the line of questioning that Congressman Baldus was following when he was questioning you.

The difference is one of focus in terms of approaching the problem. You are looking at the Department of Energy's procurement policies and procurement dollars, and you are looking at the pressure from the Congress and the national commitment generally to small business. You are saying to yourself that it makes sense and that we should be helping small business.

But then you are going back to the Department of Energy high on procurement and saying: "How can we slash a bigger piece of this pie for small businesses?"

This also has to do with the question of the importance of accounting and breaking down contracts and subcontracts. Part of the problem on the accounting issue and the reason it comes up mostly in terms of subcontracting is again because you are looking at the big pie and you are watching it filter down to small businesses. You are concluding that 10 percent is getting to small businesses. It is improving, you say, and so you think it is working.

We are concerned about the subcontracting because of the need in the country for funding, which is not being met. Specifically what I am talking about is this. I am talking about the innovation of small business again and the fact that the procurement which you do give to small business is mostly subcontracts out of other prime contracts.

What that means is that the studies which are funded from that funding are the result of ongoing large projects which have been committed by the Department of Energy and which are long-term, very expensive things—like the Clinch River breeder reactor and nuclear studies and things like that.

The point of focus that we are looking at this problem from is a different one. We are looking at the large number of small research companies in the country which have this innovation ongoing and which have ongoing ideas and have things they want to pursue. They are looking for a place where they can find Federal funding to do that.

They are not finding it at the Department of Energy, even when their particular project is an energy project.

I think both Chairman Breckinridge and Chairman Baldus have a concern.

The subcommittee, yourself, and the Small Business Administration have had a series of meetings and hearings and discussions concerning solar energy and the ability of small firms in solar energy to get Federal funds to develop their product.

As a result of that series of meetings and hearings, we passed into law the SBA solar loan program, which will be going into effect October 1.

However, we uncovered several hundred companies around the country who were coming up with innovations and solar energy, and who were just not able to find the Federal dollar. That is a problem that goes to the Department of Energy's image as a whole in the country.

There are the accusations of the Department that are heavy laden with people from the industry, from the gasoline industry, and that the Department of Energy is too nuclear oriented. There are suspicions such as those that circulate around the country.

Category 2 was that the solar systems would be supplied by small business.

Category 3 was that a minimum of 20 percent of the hardware which they procured would be supplied by small business.

We made 82 awards in that solar program. Seventy-eight of them fell within categories 1, 2, or 3; that is, there was mandated small business involved.

So, there are ways in which the Department of Energy can encourage either the use of small business hardware or systems or encourage teaming. We have done it.

Mr. ZEPP. There are two specific examples I will cite, one of which is a firm located in California called Solar-Hydrogen Development Co., Inc., which has developed a solar hydrogen system, of which they are quite proudly trying to prevent themselves from being reliant upon Government money for the development of their product.

Basically, it is a system which utilizes solar energy to split hydrogen out of water. The hydrogen is then used as a fuel source.

They have been trying, through the Department of Energy and other departments, simply to get a contract to provide automobiles equipped to use this hydrogen fuel for an agency auto fleet. They have been unable to do so, and have been turned down by the Department of Energy. They have had trouble getting a response.

The other one is the one I originally intended to bring up. It is a company located in New York called Bio-Energy Systems and a particular division of that company called Solaroll.

I have talked with these people at length. I am not an engineer or particularly expert either. But it is apparent to me that this company is really on to something. They are manufacturing and selling. In fact, their company has been operating profitably, but at a very minimum level of profit because of the newness and the problems in purchasing solar equipment right now.

They are manufacturing a solar product which is based on what they call "solaroll." What it is, is a specially formulated synthetic elastomer known as EPDM.

It has several advantages over current solar technology. It does not have the cumbersomeness and the weight and the problems of installing that your typical copper, glass, aluminum, solar reflectors have. Basically it is a roll of this plastic type material which just gets rolled out, put into place, and is more efficient. It does not have problems with expansion of water within the system during freezing because the system itself has a greater ration of expansion than does water.

It is about one-third the expense and has so many advantages over anything that is currently being developed commercially.

There problem is not with the Department of Energy. They have not been seeking Department of Energy funding for this. They have been seeking Small Business Administration loans to capitalize and go into production in a bigger way.

The reason I am bringing this into the hearing now is because the National Bureau of Standards is not appearing before this hearing. It is not possible to bring in every agency.

They have all their clearances to get a Small Business Administration loan. However, there was one last hurdle and that was to get NBS

I guess in that sense I would say this. We do not have a structured policy. I learned something myself hearing that testimony as to the extent to which they identified specific needs and tried to match them up with basic research or application.

I have described some areas, of course. We go out with a formal solicitation. We issue what we call program opportunity notices and program research and development announcements. They say: "Here is a department trying to solve a problem. What is your solution?"

Conventionally, an agency would issue a request for a proposal which would have a statement of work and a complete description of what it is they wanted to buy.

In that sense, we try to use the program opportunity notice and the program research and development announcement to bring forth innovative ideas focusing on a specific problem that we are trying to solve.

That is one area which I believe is similar to their approach.

As to the incentive feature, I am not sure. Of course, there is the Government funding as an incentive.

Mr. GLOVER. We did not go into all aspects with the NSF, but one of those that was particularly interesting was the fact that they used peer evaluation as opposed to internal evaluation.

Mr. TASHJIAN. We do that in some of our unsolicited proposals. We use a peer evaluation system. In fact, I think sometimes we ask NSF to look at some of our proposals.

But the point is that is the second area.

Mr. GLOVER. My real point is this. You are the second agency which has testified today that says: "Hey, I did not even know about that program today. It sounds like a pretty good idea to me."

It is unusual that we have such an emphasis on innovation, but we do not have the exchange between the various departments and agencies about programs that are working.

Hopefully, as we go through this exercise with the President, and maybe even before that, a policy will evolve. Maybe OMB would coordinate these activities so you could pick up a good idea. If the DOE develops it in the future, then they can come forward with it. There will be an exchange.

Mr. TASHJIAN. I think there is a place for an interagency group. The OFPP held a meeting when the Rabinow report came out. I was there. It was held about 1½ years ago. In my judgment, I do not think that group has ever met again. I do not want to be critical of OFPP, but I agree with you.

I think there is a need for a form of interagency meeting and examining research and development with small business companies. There probably is a need for a more structured forum to bring forth what different agencies are doing and to examine reports like this Rabinow report or the Charpie report to see whether there are institutional barriers for small research companies getting contracts.

We were happy to participate. As I said, we took the Rabinow report and went to see what we could do to implement those recommendations.

I think there is a need for some sort of interagency cooperation. I do not know who should chair it. Maybe the Small Business Administration should, or maybe the Office of Federal Procurement Policy should.

so they can better grow, employ more people, and in general contribute to the innovative process of our Nation.

Represent BRECKINRIDGE. I want to thank Representative Patten for being with us today and for his interest.

Dr. Garber, we are delighted to have you with us. You have been here throughout the day, I believe, have you not?

## STATEMENT OF DR. CHARLES A. GARBER, PRESIDENT, STRUCTURE PROBE, INC., WEST CHESTER, PA.

Dr. GARBER. Yes; I have.

Representative BRECKINRIDGE. You have endured all the testimony of your associates.

I appreciate your patience and your interest in taking this day off to be with us.

You may proceed in any manner that suits your convenience. We will consider your statement as read and entered into the record in its entirety, but you may proceed with your statement or you may summarize it, whatever suits your convenience.

Dr. GARBER. Thank you very much.

I would like to go through my prepared statement because it does cover a number of items that really are germane to all of the ideas that have been discussed for the last 2 days.

Some of the items have been addressed by other people, but I believe you will find it interesting that the way I approach them, is from a different perspective. I think it could be extremely useful to you to have the benefit of some of these other perspectives.

There are indeed certain items that, in view of some of the previous testimony for the last 2 days, you might want me to be more expansive about because there are some very, very serious problems facing businesses in the science technology, particularly the small science technology businesses today. And, they are having a very, very serious effect on the ability of our country to be innovative, not only in the near term, but even worse, I think, in the longer term.

Representative BRECKINRIDGE. I appreciate your willingness to take that time. I will assure you that the committee welcomes that. The committee wants you to proceed that way.

Dr. GARBER. Thank you.

My name is Charles A. Garber and I serve as president of Structure Probe, Inc., a small science/technology-based business located in West Chester, Pa.

I hold personal or corporate membership in a number of scientific and professional organizations, including the American Association of Small Research Companies—AASRC—the American Council of Independent Laboratories, Inc.—ACIL—and the Association of Consulting Chemists and Chemical Engineers—ACC&CE.

I serve in a leadership capacity as a director of a consulting chemist group, and as a member of the Tax-Favored Competition Committee and of the Government Relations Committee of the ACIL.

Structure Probe, Inc., is an independent for-profit laboratory and analytical professional services firm, specializing in the use of our own—and very costly—electron microscopy and related facilities for

iad of other small businesses that conduct their activities today not much differently than 10 years ago.

Instead, we are dealing with a class of firms deeply involved with changes in technology. Technology, by its very nature, is very dynamic, never static. Its practitioners must run hard to keep up and not fall behind. A field that is no longer changing but has become mature and static can no longer be thought of as a science/technology field.

I describe this phenomenon as the "inflation" of science. It is this inflation that renders obsolete not only equipment and plants, but also people, if they do not run fast enough to keep technically current.

This inflation of science renders obsolete the way products or services are marketed. And it can render obsolete the way products are conceived, developed, or manufactured.

The ability to understand and predict the dynamics of this inflation is a prerequisite for a successful science/technology-based business.

We are dealing, therefore, gentlemen, with a class of firms that routinely makes multithousand dollar decisions regarding some piece of plant or equipment but which could, in the short span of a year or less, drop to a fraction of their original purchase price.

One need look only at digital watch prices over the last few years, or the hand held calculator prices. Firms no less in stature than Texas Instruments took substantial write downs on inventories of these products, as the marching inflation of technological change reduced their then present value. Even they misjudged the dynamics of technological change.

Can these disastrous drops in price be accurately predicted? Perhaps, but to no greater a degree of accuracy than one can predict future interest rates at a bank. Here we are talking about a devastating form of scientific inflation which has as much potential for restructuring science/technology institutions as monetary inflation has on our social institutions.

Hence, small science/technology-based firms, because of the unpredictable dynamics of scientific "inflation," have associated with them inordinately high risk.

For the small firm, the risk factor becomes even more of a dilemma, because one mistake and it is out of business. Larger firms generally can afford a battery of experts and consultants to lessen the chances of misjudgement.

This intrinsic high risk is also responsible, to a large degree, for the virtual disappearance of venture capital sources for the science/technology-based small firm.

Science/technology firms can be found at virtually all corners of the economy: One, pure R. & D.; two, product development; three, manufacturing; four, marketing; five, sales, and, of course, firms like ours who would fall into the category of vendors of services supporting the above.

But no matter in which part of the economy they are found, their single biggest problem is scientific inflation and the risks associated with it.

Understanding small science/technology-based firms is important because innovation flourishes in such entities. OMB's 1977 memorandum establishes this fact and documents that Federal policies are failing to utilize small science/technology firms properly, and innovation has suffered as a result.

Without objection, so ordered.

Dr. GARBER. I hope I will be able to do that. I cannot think of anything that is in my statement that will not be able to be documented in some way.

Representative BRECKINRIDGE. Thank you very much.

Please proceed.

Dr. GARBER. Many of our largest corporations, in recent years, have pumped millions of dollars into research facilities and projects, but their managements are now asking what has been accomplished with these funds.

Not many feel they have gotten their money's worth, and, in fact, some have concluded future earnings would benefit the shareholders more if invested in more television commercials instead of research.

I think Professor Morse made that point yesterday when he referred to just putting the moneys somewhere else in the company other than basic research.

Let us look at this point a little closer. Remember, it is not so much a question of whether these large corporate labs have or have not developed new products. We all know that they have. It is a question of: "At what cost?"

Too much money is required to be pumped in relative to what actually comes out. The return on investment for doing their own R. & D. just is not there. They are right; they would do better by investing their funds in more television commercials. There is even a trend among large organizations to stop all in-house research; it is cheaper to buy out a company than it is to develop the technology in-house.

In view of what you just said, sir, perhaps I should modify this a little bit and point out that I probably am exaggerating a little bit. I do not think anyone is really summarily discontinuing research. But there is a serious trend to cut back your in-house development work and have it done on the outside.

When Du Pont, and this is an actual example, wanted to get into the pharmaceutical industry they bought Endo Laboratories. When they wanted to get into the electronics industry, they bought Berg Electronics.

In both cases, for the same money, they bought more innovation by buying out small firms than developing it themselves.

Certainly there are a number of factors responsible for the drop in industrial research productivity. One factor I would like to stress is the lower than expected productivity of the technical staff of such organizations.

These large organizations are staffed with individuals with advanced degress, many of whom have virtually no concept of how to get a job done for the least amount of money.

As graduate students, many of us saw first-hand, faculty members writing proposals to NSF or other agencies for increasingly larger and more expensive facilities, frequently more for the sake of "having them" and "building empires" than using them to actually solve problems and do innovative research.

The concept of sharing an expensive capability with another instiution was an unthinkable one. And, of course, the prestige of buying a "Cadillac" rather than a "Chevrolet," even though the "Chevrolet" would have been more than adequate for the intended use, resulted in the "Cadillac" being the instrument frequently purchased.

But you are absolutely correct, Mr. Chairman. I think very shortly we can come back to this if we do not hit it right on the head in a few moments.

Representative BRECKINRIDGE. Excuse me.

Go right ahead.

Dr. GARBER. There is some accountability, but still missing is the concept that the research staff should aggressively approach all projects from the standpoint of accomplishing them with the least cost.

At Du Pont, I personally saw some Ph.D.'s spending more time writing equipment justification proposals than they spent solving problems for Du Pont. So we are talking about a matter of pumping in a certain amount of money. But what comes out is not as much as it ought to be.

The small firm is 100 percent accountable. If a 5-year-old used electron microscope will do the job, fine. It is purchased for 10 percent of the cost of a new one. Small firms just cannot afford to buy instrumentation with bells and whistles which will either never or only rarely be used. They know that in the rare event they do require one of the bells or whistles, they can purchase time on someone else's instrument.

In summary, innovation must be understood and defined in the sense of accomplishing technological development for the least cost. Remember, we are not speaking of innovation in basic science, but innovation in an economic sense. U.S. innovators discovered the basic science of color television; however, it has been economic innovators in Japan who have found cheaper ways to do it.

What I have tried to explain then is the direct relationship between innovation and accountability. The greater the accountability, the greater the innovation. Small is beautiful.

The third area that I would like to touch upon will be a few comments on the recently released OMB document prepared by the Rabinow panel, dated March 10, 1977.

I was not at all surprised at any of the findings of the report. What I cannot understand is why so many studies have been done, all of which demonstrate that the United States gets far more innovation per dollar spent at small science/technology firms but still nothing ever happens.

If the Government wants an instant increase in innovation, without spending one penny more, divert much more funding to tax-paying small businesses. Not-for-profits, substantially engaged in commercial research activity, which have grown fat and slow under the protective umbrella of their tax favored status, should be made to go for profit, and, thereby, be forced to be more accountable and thereby innovative.

The fourth area I would like to touch upon is a little bit of the history in the founding of our own company, Structure Probe, Inc. I will tell you something of our growth and some of the problems we face.

Let me now describe in more detail my company's formation and growth so that you can better understand specific problems we face which require new governmental policies if firms like ours are to grow and prosper and contribute more to the innovation process.

From graduate school I joined the Du Pont Co. at their experimental station research facilities in Wilmington, Del., as a research physicist. My Ph. D. specilization was polymer physics and materials science, with a strong orientation toward electron microscopy.

I would like to interject a comment here. There has been a little bit of talk about the individual inventor. Well, I have an organization employing 25 people, roughly. They certainly are not individual inventors, but this comes awfully close to the framework for an individual person to go into and tinker around and try to do something. There is a lot of that kind of doing.

When we talk about the private laboratory community across the United States, that comes awfully close of talking about the private inventor, the single person.

Representative BRECKINRIDGE. In your last paragraph you have described exactly my experience here in the last 6 years. You say: "* * * the Government has created a legal and policy environment which has seriously stunted my growth, diverted my energy, limited my ability to innovate, and eroded my future potential."

I do not know that you know me that well, but evidently you do know me.

Dr. GARBER. I will have to say that was an independent statement.

Representative BRECKINRIDGE. Please proceed.

Dr. GARBER. The first of several examples that I would like to give is unfair competition from a not-for-profit organization, namely, the Franklin Institute in Philadelphia.

What came as a complete shock to me, after going in business, was to learn that our major competition was not another firm such as our own—as such had sprung up in other major metropolitan areas—but a not-for-profit, the Franklin Institute located only a few miles away from my facility.

This competitor:

1. Paid no Federal or State income tax;
2. Imported equipment duty free;
3. Sent out advertising on a nonprofit mailing permit;
4. Received substantial subsidies from the Federal, State, and local governments, and;
5. Was free from the burden of a number of other taxes, such as the State sales and use tax.

As a consequence, Franklin's SEM services were priced substantially lower—30 percent to 40 percent—than our prices or those charged for comparable services in other parts of the United States.

As a result of these unfair advantages, Franklin Institute monopolized SEM services in my geographic region, the Delaware Valley around Philadelphia.

My experience in seeking governmental assistance in eliminating these unfair advantages has been an exercise in futility.

Let me summarize:

1. The Internal Revenue Service.

In the period 1971–72, I began to contact the IRS in Philadelphia, tax-exempt branch, to find out how it was that Franklin, a not-for-profit, could be running business in direct competition with private sector commercial firms.

Despite repeated calls and several meetings, I have received no indication that IRS is prepared to take remedial action.

2. The Bureau of Customs.

Inquiry was made as to why the Bureau of Customs permits duty-

By this type of arrangement, it is possible that the commercial firms benefit by:

1. Making an apparent contribution to the local university;
2. Obtaining research services at a cost far cheaper than they could obtain it either themselves in-house or by going to a firm such as ours; and
3. Expensing everything in that year rather than capitalizing it as a long-term R. & D. expense.

Lehigh, but primarily its faculty, similarly benefit because the program:

1. Becomes a showcase example of the university helping its local industry;
2. Brings in money to the university; and
3. Provides numerous consulting opportunities for its faculty.

Of course, one must not confuse true consulting, on the one hand, with the provision of a commercial service—what Lehigh is doing—on the other.

From my own personal phone conversations with officials at Lehigh University, I have concluded that Lehigh: One, knows exactly what it is doing; and two, will continue to do it until forced to stop.

Programs of the type described at Lehigh are being introduced at other universities, perhaps under different names and slightly differing frameworks.

But the end result is always the same: The university is either in direct competition with commercial firms, or—and this is an important point—in the case of new emerging technologies, they preclude the founding of firms in their local region that would perform such services in the private sector in the future.

That is an important point here because the universities say: "Hey, look at this wonderful service we are providing. There are none around right now." But then they go into business. Once they are in business, no one could ever compete against them.

So, the private sector is forever shut out.

Representative BRECKINRIDGE. Could you provide later a list of any other universities that are going into this? Are there any associations or universities that could lead us to this? How could we get at this?

Dr. GARBER. Nothing would delight me more than to be able to give you such a list. The American Council of Independent Laboratories, which is an association, which is really more a professional association of private-owned laboratories like our own, representing about 225 to 250 laboratories, has gathered a lot of information on this subject.

We would be delighted to provide you with this information.[1]

Representative BRECKINRIDGE. Thank you.

Without objection, so ordered.

You are raising an interesting and difficult problem.

Dr. GARBER. I understand.

Representative BRECKINRIDGE. That is an important difference between a bona fide 501(3)(c), educational and charitable, not-for-profit organization which renders a service of some sort that is not a commercial service, as such, and is for the public good, and on the

[1] Dr. Garber supplied the following: "On pages 266–267 of my testimony, I referred to documentation that exists as to the seriousness of the threat to laboratory services firms from not-for-profit and nonprofit organizations. This information has already been forwarded to the committee by Dr. Earl Hess who appeared on Aug. 9."

The NSF was not even aware that there was a private sector laboratory analytical community. To my knowledge, not one private laboratory was sent a program announcement when the program was originally announced.

Opportunities have been afforded by NSF for interested representatives of the private laboratory community to discuss the problems of this new initiative and how it could impair future instrumentation capability which should be developed in the private technology sector if innovation is to flourish.

The availability of a concerned small business representative at NSF, Mr. Ted Wirths, has made it possible for meaningful exchanges on these issues to begin.

The final chapter of this NSF program is not written at any point, but firms such as ours are viewing the outcome of this initiative very closely before making major financial commitments for new analytical instrumentation.

This morning we heard testimony from Dr. Jack Sanderson of NSF. There seems to be a loss of understanding between work done at universities of a type that is instantly published or instantly made available to the public, versus that that becomes the private property of a commercial sponsor.

I am not at all against the kind of work, let us say, that it done at the Polymer Research Center at MIT, because as long as such research could be published and made immediately available to everyone, then the public at large benefits.

However, I do not see why taxpayers of this Nation should be subsidizing the private interests of commercial firms like General Motors, which I believe he mentioned specifically, and for which the public at large does not benefit.

The implication that such centers are actually going to be helpful to small business should be closely examined. We all know the meaning of the word "ivory tower" approach.

If NSF really wants to help small business, then such centers should be established in the private sector—the place where you have the full accountability and a place where you get your greatest money's worth,

Mr. GLOVER. I would like to thank the witness for your views, but in an effort to have a balanced record, we always do encourage differing opinions, and especially when we have made some laudatory comments about our friends at the National Science Foundation and the good things they are doing.

It is important that the record be balanced with the analysis of things that perhaps they are doing that are not quite as beneficial.

I want to thank you for that particular comment in this regard.

Dr. GARBER. Thank you.

The last area that I would like to touch upon is what I call the policy of doing nothing.

I have spent numerous hours trying to explain my situation before various Government agencies, enlisting the help of my Congressmen—over a period of years—as well as my U.S. Senators.

For example, in 1973, I was privileged to testify before the U.S. House Committee on Ways and Means. The commitee was then considering tightening up on some of the loopholes through which certain not-for-profits operate, and I was invited to tell the committee what it

do not really know them to be true myself—but just because he has had to innovate to survive, that then gets applied to the development of science and technology.

I think that might be one of the main reasons why, although it has all these other problems to deal with, when it comes to innovation, the small firm is still there.

I think the serious problem, however, is that someone like myself, has to have time to innovate on technical matters also. I find that I spend so much of my time on nontechnical matters that I do not have time to innovate technically. That might be one reason why the otherwise optimistic future of small science and technology firms like ours could change.

Mr. GLOVER. What would be the effect of a major program designed to aid small business in the area of research and development? What effect would that have on the economy and specifically such problems of unemployment, trade deficit, and inflation?

Dr. GARBER. If all the reports that have been before us are correct, the conclusion is that money invested in small business results in much more of an output and it is much more efficient.

To the degree that this increased efficiency and increased productivity affects the inflation rate, and to the degree that it enables us to create new technology, which means more jobs and enables us to compete with our foreign trading partners on a more favorable basis, I would think that any kind of a program that aids and encourages small business would be most beneficial for our Nation.

Mr. GLOVER. What effect does industry concentration have on innovation?

Our friend, Arthur Obermayer has provided us with two studies which showed that neither the big oil companies nor the big steel companies have been responsible for innovation in their respective industries.

I was wondering whether you know if this pattern holds true in other areas.

Dr. GARBER. I really cannot say. I would have to think about that a little bit.

I gave you several examples of decisions made by Du Pont. I know there are other companies like that. What I perhaps did not mention, for example, is that a company like Du Pont actually spent substantial sums in-house before they realized they were not going to do it themselves. Then they bought Endo. They spent substantial sums of money in-house trying to get into electronics. Then they bought Berg. They realized they could not do it themselves.

So, concentration may, in fact, inhibit innovation, but these companies then will get it on the outside. In other words, it may not be getting done inside, but it is being done somewhere else and it still will get done.

That is a complicated question. I would have to think more about that.

Mr. GLOVER. I am sure that you are familiar with the National Science Foundation's small business program which was discussed today.

I would like you to address yourself to the small business innovation program and whether this program could be applied on a larger scale to other Federal agencies.

cause harm to the really fine educational system we have in this country.

The educational systems' primary mission is to educate students.

If it is necessary and if it is for the good of the country that we deliver instrumental capability in more locations so there is much greater industrial access, then the best way to do this is to set up these regional centers within the private sector instead of setting them up in universities.

After all, universities have very difficult problems signing secrecy agreements. If such centers were set up within the private sector, then there would be no injury to existing private sector firms. Industry would have no problems dealing with them because they could sign secrecy agreements and everything else.

In fact, firms like mine philosophically do not want handouts. Universities are very happy to have handouts, but we really do not want that. We do not want things given to us.

If such a need exists, then the only reason why we do not have these facilities is because we cannot raise the private capital. All we really need are loan guarantees or some kind of help to minimize the downside risk.

But a handout is not one of the things that we would really want.

Mr. GLOVER. We have heard a number of references to small business specialists employed at various levels in the procurement process in a number of various agencies.

Would you comment on your experience, if you have had any, in dealing with small business specialists?

Dr. GARBER. Yes.

There have been a number of different agencies where we may write a letter about why a particular contract was sole-sourced. I would always copy the small business specialist. More often than not, we do get some kind of response.

But I never really had a good feeling for what a small business specialist really did and how he really worked.

There was a very interesting program which was an all day conference at the Meadowlands in New Jersey a few months ago. It was called the Business Opportunities Conference.

I am not sure that I know exactly who sponsored that but some agency of the Government sponsored it. I think it is in conjunction with the SBA.

Procurement people from all Federal agencies in the area were brought together in one place. Businessmen, particularly small businessmen, were invited to meet them at this one place.

So, within a period of about 4 hours, I was able to meet maybe 15 different small business specialists.

One of them had time on his hands. I started to ask him questions about how it was that he determined whether something qualifies for a small business set-aside.

This was interesting. He told me that virtually every procurement that goes out has to be "signed off by him." In other words, it needs his signature saying that there are no two small businesses which could bid on this particular procurement.

So I then questioned him about several procurements that were going out to either universities or nonprofit sole sources since we could

Right now the people there are not tuned in to understand that.

Mr. GLOVER. Do you have any other comments you would like to make at this time?

Dr. GARBER. I think that is it.

Mr. GLOVER. I want to thank you very much.

I would like to mention that there are several potential witnesses who have asked to submit statements to the committee. There are several other studies also by various other witnesses who could not appear. They will be included in the record at this point.

Without objection, so ordered.

The committees will now adjourn.

[Whereupon, at 5:50 p.m., the committees adjourned.]

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# APPENDIXES

## APPENDIX I

"SMALL FIRMS AND FEDERAL RESEARCH AND DEVELOPMENT," A REPORT TO THE OFFICE OF FEDERAL PROCUREMENT POLICY, OFFICE OF MANAGEMENT AND BUDGET, EXECUTIVE OFFICE OF THE PRESIDENT, MARCH 10, 1977

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF MANAGEMENT AND BUDGET
WASHINGTON, D.C. 20503

OFFICE OF FEDERAL PROCUREMENT POLICY

MAR 10 1977

MEMORANDUM FOR CERTAIN OFPP AGENCY CONTACT POINTS

SUBJECT: Increased Use of Small Technology Based Firms

The importance of small business firms in our American private enterprise system has been accepted for many years within the Federal Government. Passage of the Small Business Act of 1953, coverage in the Armed Services Procurement Act of 1947 and the Federal Property and Administrative Services Act of 1949, and advocacy by the Commission on Government Procurement in its Report of 1972 are some of the many ways the importance of small business has been recognized. Special legislation and programs of emphasis have attempted to improve the capabilities of small firms to operate effectively in the marketplace. Although the success - or lack of success - of these actions frequently cannot be measured, there are strong indications that more attention needs to be given to the support of small firms.

Federal Government contracting for research and development is one area in which small firms are inadequately used -- less than four percent of research and development expenditures are with small firms. Recognizing this, the Office of Federal Procurement Policy established an interagency panel in early 1976 to consider ways of increasing the utilization of small technology based firms. The panel was chaired by Jacob Rabinow of the National Bureau of Standards. Other members were from the National Science Foundation, the Department of Defense, the National Aeronautics and Space Administration, the Energy Research and Development Administration, and the Office of Federal Procurement Policy.

Attachment

Mr. Edmund Alvarez
Director, Office of Operations
Department of Agriculture
Washington, D.C. 20250

Mr. Dale R. Babione
Deputy Assistant Secretary
of Defense (Procurement)
OASD (I&L), The Pentagon
Room 3E760
Washington, D.C. 20301

Mr. William E. Mathis
Director, Contracts Management
Division (PM 214)
Environmental Protection Agency
401 M Street, S.W. Rm 2003
Washington, D.C. 20460

Mr. Michael J. Tashjian
Director of Procurement
Energy Research and Development
Administration
Washington, D.C. 20545

Mr. Paul A. Stone
Deputy Assistant Secretary for Grants
and Procurement Management
Department of Health, Education,
and Welfare, Room 513-D
South Portal Bldg.
Washington, D.C. 20201

Mr. James E. Johnson
Assistant Director for Procurement
Office of Management Services
Department of the Interior
Washington, D.C. 20240

Mr. Stuart J. Evans
Assistant Administrator for
Procurement
NASA
Washington, D.C. 20546

Mr. Eldon Taylor
Assistant Director for
Administration
National Science Foundation
1800 G Street, N.W. Rm 525
Washington, D.C. 20550

Mr. Harold K. Fletcher
Associate Administrator for
Procurement
Small Business Administration
1441 L Street, N.W.
Washington, D.C. 20416

Mr. Barnett M. Ancelertz
Director, Installations &
Logistics
Department of Transportation
Washington, D.C. 20590

# SMALL FIRMS AND FEDERAL RESEARCH & DEVELOPMENT

## INTRODUCTION

There is increasing concern that the capability of the United States to continue its historic successes in technology is in a serious decline. While astonishing achievements have occurred since World War II, there is now considerable evidence that product innovation has either leveled off or declined in many industries. Predictions of a weakened military posture and a less favorable economic position in world trade are associated with analyses showing that the U.S. is losing a significant part of its capability to invent new products essential for the country's defense and for its international sales market.

Analysis of technological capability is an exceptionally complex matter affected by many diverse factors involving individual and organizational motiviations, economics, and governmental actions. Since the Federal Government is the biggest source of research and development (R&D) ($26.3 billion proposed for expenditure in 1978), Government acquisition procedures have a large impact on the country's utilization of its best technical and management talents.* One part of this problem - the role and difficulties of the small firm in selling R&D to the Government - was given particular attention by an ad hoc interagency panel under Mr. Jacob Rabinow, nationally known inventor, lecturer and writer, in 1976. The Panel was composed of representatives from the National Science Foundation, Department of Defense, National Space and Aeronautics Administration, Energy Research and Development Administration, Small Business Administration, and the Office of Federal Procurement Policy.

To assist the Rabinow Panel in its inquiry, the services of Mr. William K. Scheirer, an economist, were obtained to perform a literature search and analysis of the role of small firms in fulfilling Government contractual requirements for research and development. Significant findings of Mr. Scheirer are summarized below. His report, with an extensive bibliography, is available for inspection at the National Technical Information Service, Department of Commerce, as Report Number OMB/OFPP/CA-77/1, and in the Office of Federal Procurement Policy.

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* "A Government Takeover of R. and D.?", Richard Morse, Pres., MIT Development Foundation, N.Y. Times, Dec. 19, 1976.

Government R&D obligations to industrial firms vary from less than one-half of one percent for the Department of Agriculture to 62 percent for the Department of Defense; and that reliance on industry for Federal R&D has declined from 59.6% in 1966 to 50.7% in 1976 in current dollars.

The overwhelming percentage of the dollars in Federal R&D goes to development as opposed to research (basic and applied). Although the industry share of development is substantial, most of this goes to large businesses capable of performing very large development contracts. On the other hand, in the research area where its capability is high, small firms lose awards to colleges and universities, federally funded research and development centers (FFRDCs), as well as to large firms.

Summary conclusions reached are that (i) Federal agencies tend to use sources other than industrial firms for basic and applied research; (ii) a significant portion (64%) of Government R&D is for development normally involving large industrial firms; and (iii) the percentages of both total expenditures for R&D and R&D contract awards to small firms are very low.

Small Firm Impediments

As indicated above, large firms are favored in the award of development contracts on the basis that they are essential for the production phase of the program. However, this is not the only restriction to a greater use of small firms. Mr. Scheirer found that policies and procedures followed by Federal buying activities also restrict the use of small technology based firms. Following are some of the more significant impediments encountered by small companies:

- It is difficult to identify and respond to Government R&D requirements. On a competitive basis, large firms have a greater capability to determine what the Government is interested in researching and to unravel the complexities of "Requests for Proposals" for R&D work.
- Preparation of proposals is expensive and time-consuming to a point frequently exceeding the capabilities of small firms.
- A bias in favor of large firms can exist when awarding R&D contracts. The tendency is to consider awards to large well-established firms "safer" than to small firms.

4. Intensive efforts should be made by Federal agencies to reduce or compensate for impediments experienced by small technology based firms. These efforts may include but not be limited to the following:

a. Early identification and publication of agency R&D requirements.

b. Coordination of R&D requirements with Small Business representatives early in the acquisition process.

c. Use of the Commerce Business Daily to provide advance information on anticipated contractual requirements for R&D.

d. Providing methods for small technology based firms to obtain an understanding of requirements which may not be possible through the written solicitation. For example, some buying activities currently provide research and technology libraries, catalogs for technical requirements, and special briefings to explain their research and technology needs.

e. Providing sufficient time for firms to prepare and submit proposals.

f. Reducing to the extent feasible the time and supplemental data required between receipt of proposals and award of contracts.

g. Providing agency R&D points of contact for small firms.

5. Agency policies and procedures should encourage unsolicited proposals. Contracts should be awarded for research and technology efforts based upon the merit of such proposals without converting the requirements to competitive solicitations.

6. The agencies, including the Small Business Administration, should use more technically trained personnel to serve as advocates for and advisors to small technology based firms. Special emphasis should be given by such persons to the advance procurement planning process for R&D requirements.

Table I

## FEDERAL R&D AWARDS TO BUSINESS, FY 1975

(millions of dollars)

| | Awards to Business | | | | Obligations to Industrial Firms | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 Small Business | | 3 Total | 4 | 5 Total | 6 Research | | 7 Development | 8 | 9 | 10 | 11 | 12 | 13 |
| Agency | | Amount | % | Business | | R&D | Basic | Applied | | | | | | | |
| Defense | | 316.4 | 5.6 % | 5601.5 | | 5606.837 | 1% | 14 % | 85 % | | | | Sources: awards from agencies; obligations from National Science Foundation (forthcoming). | | |
| NASA | | 216 | 9.6 % | 2255 | | 1791.797 | 2 % | 9 % | 90 % | | | | | | |
| ERDA | | 16.773 | 6.5 % | 258.166 | | 561.588 | * | 12 % | 88 % | | | | | | |
| Transportation | | 25.304 | 31.9 % | 79.224 | | 161.911 | — | 16 % | 84 % | | | | | | |
| NSF | | 25.198 | 25.9 % | 97.873 | | 97.873 | — | 54 % | 46 % | | | | | | |
| Interior | | 12.904 | 21.6 % | 61.497 | | 63.766 | 2 % | 53 % | 45 % | | | | | | |
| EPA | | 411.350 | 37.2 % | 119.264 | | 51.878 | — | 55 % | 45 % | | | | | | |
| USDA | | 8 | 44.4 % | 18 | | 17.744 | 37 % | 50 % | 13 % | | | | | | |
| Agriculture | | .5 | 100.0 % | .5 | | 1.635 | 22 % | 57 % | 16 % | | | | | | |
| Total Above | | 665 | 7.8 % | 8490 | | 8294.229 | 1 % | 14 % | 85 % | | | | | | |
| All Agencies | | | | | | 8385.317 | 1 % | 14 % | 85 % | | | | | | |
| Coverage: Total Above as % of All Agencies | | | | | | 99 % | 91 % | 99 % | 99 % | | | | | | |

The amounts going to small business range from $\frac{1}{2}$ million for the Department of Agriculture to over $300 million for the Department of Defense. The percentages of total business awards going to small business range from 5.6 % for Defense to 100% of the small Agriculture amount. For the nine agencies as a whole, small business received $665 million, or 7.8% of total business awards.

Agencies with a high proportion of development in their R&D obligations to industrial firms have a relatively low rate of small business participation. Defense, NASA, and ERDA have the highest proportions of development in their R&D industrial obligations and the lowest proportions of small business awards to total business awards. Transportation is a notable exception with a large element of development but a high rate of small business participation. NSF, Interior, and EPA all have approximately 45% development in their R&D obligations to industrial firms; their small business "participation" rates range from 21 % for Interior to 37% for EPA. NSF and Agriculture have the smallest "emphasis on development and the highest small business participation rates.

# APPENDIX II

"SMALL FIRMS AND FEDERAL R. & D.," BY WILLIAM K. SCHEIRER, CONSULTANT, OFFICE OF FEDERAL PROCUREMENT POLICY, OFFICE OF MANAGEMENT AND BUDGET, EXECUTIVE OFFICE OF THE PREIDENT, FEBRUARY 24, 1977 (BACKGROUND TO OFFICE OF MANAGEMENT AND BUDGET REPORT OF MARCH 10, 1977)

## SMALL FIRMS AND FEDERAL R&D

William K. Scheirer, Consultant
Office of Federal Procurement Policy
Office of Management and Budget
Executive Office of the President

For at least the past decade, there have been growing and general concerns that the United States has failed to maintain its record of innovation, especially as compared to the rest of the world. The Federal Government has been increasingly concerned that its policies may, in certain instances, adversely affect innovation in the private sector. In particular, there has been an intensifying uneasiness, frequently concomitant with the overall concerns, that Federal research and development (R&D) procurement policies may not be taking appropriate advantage of the innovative capacities of small firms. This report considers the question of whether small firms have an appropriate share of Federal R&D procurements.

The report first addresses small firm performance in terms of Federal interests regarding R&D contracts, concluding that small firms have compiled a striking record of innovation in the private sector, especially given their share of the economy and the resources expended by them on R&D. Data collected by the Office of Federal Procurement Policy on the current small firm share of Federal R&D awards are then described, with the conclusion that small firms should probably be receiving more than their present 8% share of Federal R&D awards to industry, even allowing for contracts that cannot feasibly be broken into parts sufficiently small and allowing for subcontracts. This conclusion is then both verified and explained by identifying a number of impediments to small business participation in the Federal R&D process which are not found in the private sector. The identification of impediments produces a number of recommendations concerning stability and efficiency of R&D funding, administrative requirements, nature and timing of Requests for Proposals, treatment of proposals, and contact between small firms and technical personnel.

This report is based upon a synthesis of approximately 75 documents; the bibliography has about 200 items. Citations are in the form of author and, where appropriate, page number; the volume number or date is also given if necessary for identification in the bibliography.

The third aspect of what can be accomplished by Federal R&D contracts with industrial firms is that the recipients of the contracts, particularly if they are small firms, are financially strengthened by the contracts in that certain costs can be spread over more work. Note that this aspect does not necessarily contradict the arguments that will be cited below that small firms are more efficient in conducting R&D; it only indicates that there are economies of scale in some aspects of performing R&D.

First, a caveat. There is no necessary connection between strengthening a firm by a Government contract and enhancing that firm's innovative capacity in the private sector. As Arthur D. Little (p.1) put it, "many U.S. companies with proven records of developing and marketing new products often shun federal R&D funds...." As for the firms which do not shun Federal funds, "a firm doing contract R&D will find that its knowledge and skills will in time become increasingly specialized to government interests and more and more removed from the commercial area" (Danhof, p.248).

With this in mind, what are the differences between small and large firms in innovative capacity vs. size and resources expended? Note the stress on innovation rather than invention. The difference is aptly illustrated by the following story told by Brown (p.713): "In January 1971 the New York Times published an announcement about a most important U.S. invention; in February, the London Times noted the importance of the U.S. invention but clarified the record by stating that British scientists had made the invention 15 years earlier as published in a British patent (the number was cited); in March, Izvestia agreed with the importance of the invention but claimed Russian credit for it based on a publication by two Russians 25 years earlier in a Russian journal; and in April, Japan announced the export to the U.S. of the new product, based on the U.S. invention" (emphasis deleted).

There are many differences between small and large firms relevant to a discussion of innovative capacity. These differences can be grouped, somewhat arbitrarily, in terms of incentives and capabilities, and in terms of individuals vs. the firms as a whole. The differences are discussed below in the following order: firm incentives, firm capabilities, and individual incentives and capabilities.

firms can handle in terms of manpower, facilities, or other resources. The greater resources of the large firm also means that it can reduce R&D risk by undertaking a number of projects, either alternative approaches to the same goal or entirely different undertakings. Further, the large firm will tend to produce more products, making it somewhat more likely that it will be able to use any serendipitous results of its R&D. However, according to Kamien and Schwartz (1975, p.27), "the role of diversification of products in fostering or retarding innovation has been examined statistically, but without a clear conclusion."

The lesser resources of the small firm may mean that it can perform research but not the later stages of innovation (development, production, marketing, and distribution). According to the National Science Foundation (Hogan and Chirichiello, p.322), companies with less than 1,000 employees spent 61% of their R&D funds in 1971 on development, as opposed to 79% for all companies. The U.S. Panel on Invention and Innovation estimated (p.9) that research and development represents only 5-10% of the costs of a successful product innovation. One way of obtaining the necessary capital is for the entrepreneur to have the ability to make a convincing presentation to a venture captialist with, at best, some general technical knowledge. An alternative is that "Some larger companies or groups with holdings in a smaller enterprise have been valuable sources of capital and management skill without destroying the entrepreneurial qualities of the small concern" (Layton, Harlow, and De Hoghton; p.7). Failing this, the entrepreneur can try to license his invention. But this not infrequently runs into the "not invented here" syndrome cited by a number of authors.

Even to the extent the small firm feels it has the necessary resources, it may suffer from a lack of depth in certain areas, particularly in the later stages of innovation. Charpie (p.7) comments on the innovator: "Ordinarily, he has a stronger technical background than he does an administrative or management backgound." Litvak and Maule (1972, p.10-11) add: "A general deficiency in the area of marketing has been a recurring theme in our studies of entrepreneurship in small firms... Lack of a management orientation is frequently the reason for the failure of entrepreneurs to commercialize their product ideas." But the U.S. Panel on Invention and Innovation (p.27) referred to "the problem that a new market represents to the large company's established marketing staff. Indeed, there is no question that good innovative opportunities often are not exploited because the company lacks the requisite market familiarity" (emphasis added). Mansfield and Wagner studied 20 major firms and concluded (p.197) that "Apparently, the rate of technological change could be increased significantly - without substantial increases in R and D expenditures - if firms could make fuller use of the R&D results that they are already turning out."

adequate commitment to a new idea in the face of internal obstacles to change. There is an understandable reluctance to depart from what has been a successful pattern of business" (U.S. Panel on Invention and Innovation, p.28).

The lack of specialization in the small firm may have a positive effect on the creative process. Citing Shockley's hypothesis that superior inventors are able to relate a greater number of previously unrelated concepts, Rabinow (1968, p.92) says: "When one narrows his specialization, he probably comes up with fewer ideas. If one loads the dice in favor of a certain art, one cuts off analogous arts, which I think are important. The more an inventor can pull out of related and unrelated arts, the more original his ideas are likely to be."

On the question of firm capabilities, then, the large firm has the advantage of greater resources, particularly in the later stages of innovation, while the small firm has the advantage of easier communications with its implications for acceptance and attainment of change.

Individual Incentives and Capabilities

The third group of differences between small and large firms are the incentives and capabilities of the individuals comprising the firms. Large firms offer greater salaries, fringe benefits, security, support in facilities and staff, and contact with colleagues having related professional interests. "Another supposed advantage of the large firm in innovation is that it attracts and retains the best entrepreneurial talents by offering the greatest challenges and opportunities" (Kamien and Schwartz, 1975, p.27).

The larger the firm, however, the more likely there is a divergence between the interests of the individual and the firm. Rotondi's empirical work leads him to conclude that "organizational climates may effectively emphasize either creativity or organizational identification, but not both" (1974, p.54). Rabinow points out that "Many of our corporations are no longer managed by their founders. The present day 'professional manager' is often motivated by short-term interest only. He does not have any emotional involvement in his company's product, nor is he going to leave his business to his children" (1976, p.4).

employees. Another 24% were produced by companies with 100 to 999 employees. Manufacturing companies contributed 277 of the 319 U.S. innovations. The number of manufacturing innovations per $10 billion in sales were (p.222):

Manufacturing Innovations per $10 Billion in Sales

| | Less than 100 employees | 100-999 employees | 1,000 or more employees |
|---|---|---|---|
| 1953-59 | 3.1 | 3.2 | 2.4 |
| 1960-66 | 3.0 | 2.6 | 1.9 |
| 1967-73 | 2.0 | 2.0 | 1.5 |

These ratios use manufacturing sales and receipts during 1958, 1963, and 1967, respectively. The average lag between invention and innovation was 7.4 years for all U.S. innovations. The innovations can be related to NSF data (May 1975, p.41) on R&D scientists and engineers seven years earlier for firms with less than and more than 1,000 employees. The corresponding years in the available data are 1964-65 and 1970-73 for innovations and 1957-58 and 1963-66 for R&D employment. The results per 10 thousand R&D scientists and engineers are 1.7 innovations for firms with less than 1,000 employees and 0.4 innovations for firms with more than 1,000 employees. This comparison may overstate the differences in that it credits the R&D scientists and engineers with any major innovations stemming from inventions made by operating men, but it also understates the differences in that it overlooks the disparities in costs per R&D scientist or engineer which in 1973 were $32 thousand for a company with less than 1,000 employees and $61 thousand for a company with 1,000 employees or more (p.46).

The evidence is that small firms have compiled a striking record of innovation in the private sector, especially given their share of the economy and the resources expended by them on R&D.

## THE PRESENT SMALL FIRM SHARE

In March 1976, the Office of Federal Procurement Policy (OFPP) requested data on small firm participation in Federal R&D from a number of agencies significant in this process. The Small Business Administration definition of a small business is basically a firm of less than 500 employees, with the addition of larger firms in certain industries. Very few of the awards included in the data received were made to firms with more than 500 employees.

The R&D business awards reported to OFPP are not always consistent with the R&D industrial obligations reported to the National Science Foundation (NSF). There are four possible sources of the numerous differences: the NSF data may be more recent; there may be intra-agency differences in the definitions of research and development, awards vs. obligations, and/or business vs. industry. Based upon extensive discussions with a number of agencies, the most important explanation of the differences seems to be that the offices with data on small business participation do not generally use the same definitions of research and development as the offices which supply data on R&D industrial obligations to NSF. This leads to the following recommendation.

RECOMMENDATION ONE. Data on small firm participation in Federal R&D should be reported annually to the Small Business Administration. Each reporting activity should use the same definitions of basic research, applied research, and development. These definitions should be a reconciliation of the definitions of the National Science Foundation and the Securities and Exchange Commission.

The agencies which responded to the OFPP request for data represent 99% of fiscal 1975 Federal R&D obligations to industrial firms and 94% of obligations to all R&D performers, including in-house performers of research and development. These agencies awarded $665 million in contracts to small business, or 7.8% of approximately $8.5 billion in awards to all business. Industrial obligations were about 45% of obligations to all performers. Thus, small business received about 8% of obligations to industry and about 3 1/2% of obligations to all performers.

Even allowing for contracts that cannot feasibly be broken into parts sufficiently small and allowing for subcontracts, the small firm share seems low in view of the striking record of innovation that small firms have compiled in the private sector. In addition, other NSF data (May 1975, Tables B-6 and B-9) indicate that the 1973 share of companies with less than 1,000 employees in total company R&D funds, including subcontracts, was one-third greater than their share of Federal R&D funds. On the other hand, Mansfield, Rapoport, Schnee, Wagner and Hamburger surveyed 22 small R&D firms in the Philadelphia area and found only six firms that "think that they are getting less than they should... With regard to age of firm and percent of sales accounted for by the federal government, there is little difference between these firms and the others" (p.59).

The suggestion that small firms should be receiving a greater share of Federal R&D can be both verified and explained by identifying impediments to small business participation in the Federal R&D process which are not found in the private sector.

## IMPEDIMENTS TO SMALL FIRM PARTICIPATION

The preceding discussion suggests that small firms face impediments in the Federal R&D procurement process, above and beyond the impediments they face in the private sector. A general indication of such impediments is the lack of influence of small firms: "the track record during the recent 4-year leveling of R&D has demonstrated clearly that in-house government laboratories have succeeded best in protecting their budgets, followed in order by universities, non-profit organizations, big business, and small business" (Research and Development Study Group of the U.S. Commission on Government Procurement, v.2, p.89). Waterman adds: "The procurement practices of the government are not well designed to facilitate small business participation" (p.49).

For purposes of identifying specific impediments to small firms in the Federal R&D process, it is convenient to divide the process into six parts in a somewhat arbitrary order: identification of needs, administrative requirements, treatment of unsolicited proposals, proposal evaluation, contract size, and stability of overall funding.

### Identification of Needs

The first step for the small firm is to not only identify Government needs but when they will be needed. This is more difficult than in the private sector for two reasons: the Government need stems from a decision to have R&D performed or, more generally, an interest in a certain kind of R&D. Such a decision or interest is more difficult to indentify than a need for an improved product (for example), because the Government need is for R&D rather than a product. It could be argued that the Government interest in R&D itself stems from another more basic need which could be identified as private sector needs are identified. But the Government interest in R&D also involves the decision that it is worth doing R&D on that basic need; the small firm is thus in the position of identifying not only the basic need as it does in the private sector, but also someone else's interest in R&D on that need, a determination it makes for itself in the private sector. Further, the involvement of other decision makers in establishing an R&D need introduces the question of when that need will be established. This is at least as difficult to determine as the R&D need itself.

RECOMMENDATION FOUR. "... indications of the problems for which an agency proposes to seek contract resources should be widely disseminated as soon as possible. Everything should be done to try to let potential performers know what kinds of work the government expects to be contracting for and when RFPs for this work will be issued. In this way, research organizations can plan the allocation of their proposal preparation resources and plan as well for optimal use of the research resources that will be committed by the proposals...." (Biderman and Sharp, p.40).

RECOMMENDATION FIVE. RFPs should be written to provide for broad areas in which proposals would be entertained and which would amount to publicizing some of the interests in unsolicited proposals.

RECOMMENDATION SIX. Contact between technical personnel and small firms should be promoted by:

A. Regular open workshops where technical personnel describe agency needs and

B. Announcements in the Commerce Business Daily of lists which give the names of technical liaison personnel.

## Administrative Requirements

The second step for the small firm in the Federal R&D process is to prepare a proposal. A necessary part of any full proposal is the compilation and presentation of a substantial amount of non-technical information concerning overhead rates, etc. These requirements and other administrative requirements such as periodic reporting do not have a counterpart in the private sector. Because familiarization with these requirements is in part a fixed cost of doing business with the Government, large firms again have an advantage of scale. It is ironic that many of these requirements were instituted in an effort to compensate for the lack of market competition, but their unwitting effect has been to discourage small firms from participating, with the result of reducing competition in this manner.

Waterman (p.113) asked his sample of 568 procurement and technical personnel to what extent the administrative requirements impaired the ability of small firms to compete for R&D contracts. Of the 485 with an opinion, 75% felt that small firms were impaired; half of those felt that small firms were

RECOMMENDATION EIGHT. "Eliminate restraints which discourage the generation and acceptance of innovative ideas through unsolicited proposals" (v.2, p.25).

## Proposal Evaluation

After a proposal is submitted, it is evaluated by technical and procurement personnel. The evaluation will include a judgment on the capability of the firm. Waterman found "a number of observations that small firms... frequently lose key people in the course of contract performance and are compelled to rely on less competent ones" (p.140). Such an evaluation is more important than in the private sector because the product is less well-defined and there is consequently a greater possibility of effective default without legal recourse due to ambiguities in the definition of the work product. Part of this impediment can be met by more precise specification of the product as in Recommendation Three. Another approach would be the following recommendation.

RECOMMENDATION NINE. Greater use should be made of contract provisions requiring the participation of key personnel.

Another impediment faced by small firms is that many small firms are not known to technical personnel; this impediment is addressed in Recommendation Six. The importance of this impediment is underlined by Waterman's finding (p.127) that when the technical agency recommends a source, the contract is awarded to that source more than 75% of the time according to 56% of the 507 respondents with an opinion, and 25% to 75% of the time according to 37% of the respondents with an opinion.

## Contract Size

Large contracts preclude small firms from competing as prime contractors. A large firm is paid in such cases to break a contract down. However, there may be instances where a contract could be broken down more efficiently by Government technical personnel.

RECOMMENDATION TEN. Greater attention should be paid to overall expenditures (including in-house expenses) in determining the size of contracts.

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It would also be most helpful to us at this time if OMB could respond in detail as to the advantages and disadvantages of implementing each of the other recommendations of your 1977 study.

You may be assured of our desire to work with the Administration and encourage industrial innovation in every way possible.

Sincerely,

Gaylord Nelson

Thomas McIntyre

NM/hsl

John B. Breckinridge
Member of Congress

While many people view research and development as the province of large, national and multinational companies, smaller businesses have demonstrated a particular effectiveness in the development of technological innovations.

Small businesses and individual inventors have been responsible for more than half of all major inventions in this century: the xerox copier; the vacuum tube; penicillin; shrink-proof knitwear; dacron; the zipper; the helicopter; air conditioning; and the ball point pen, among many others. Small business has led the world and the American economy in technological advancement.

High growth rate in employment is another hallmark of small technology-oriented businesses. A study conducted by the Massachusetts Institute of Technology Foundation revealed that five young technology companies, when compared with five mature companies in similar industries, increased their employment, sales and taxes paid 40 percent more than the mature companies. These increases occurred in the period 1969 to 1974.

Moreover, a report prepared by the Office of Management and Budget in March 1977 demonstrated that small businesses were more cost efficient in generating technological innovations. This report stated that "the ratio of innovations to sales is approximately 30 percent greater for small firms ... the cost for research and development per scientist or engineer is twice as great in firms that employ over 1,000 employees than it is in firms that employ less than 1,000 employees."

In addition to its inventiveness, high growth rate and cost efficiency, small business has carved out a special niche for itself because of its efficiency and flexibility in performing research for larger companies.

As a result, many small technological research companies and laboratories have been formed for the purpose of providing research capabilities and services to companies lacking facilities needed for the development of specific scientific projects.

Impediments to Small Business

During the past quarter century, many economic problems have arisen to stymie the progress of small business. A typical small business owner may devote long hours to creative projects, only to face obstacles such as limited access to securities markets, venture capital shortages, onerous taxes and an overabundance of paperwork and regulations.

New ventures and new technological innovations made by small firms require access to venture capital and long-term permanent financing. In most instances entrepreneurs and small business owners do not have ready access to enough of this capital to invest in industrial innovation.

We would appreciate your considering our views, and we request that this letter be included in the hearings record.

Cordially,

Hilton Davis
Vice President
Legislative Action

cc: Committee Members
Herbert L. Spira
Robert J. Dotchin

We have a good start at such a mission-oriented display already developed in our functional analysis, Part 5 of the Budget. At the National needs level, the aggregates for the most part tie into end-purposes, e.g.: defense; health; energy; and income security. The enclosed R&D mission display deals with the next level — the agency mission; it is intended to spotlight relatively small but immensely leveraged "front end" program investments. Frequently R&D can lead to large scale procurement or operating programs, so it is particularly crucial that we be able to see toward which end-purposes the Federal Government's R&D funds are being applied.

We recognize, of course, that some R&D is not and should not be mission oriented but rather should nurture a base of science, technology and fundamental knowledge. Such science and technology base R&D is shown as a separate category. We have attempted to match the rest against missions (e.g. water transportation) and further split it in two to show funds being used in the (1) early stage of concept and demonstration and (2) final development of new programs to be put into use. These data, then, give us a feel for the balance between basic and applied-type R&D which for fiscal year 1979, is at a roughly 1 to 1 ratio.

Within the mission-related categories, major system acquisitions as defined in OMB Circular No. A-109 are displayed by the agency mission they support. The display does not contain all major system acquisitions, since it is limited to research and development budget authority (i.e., production and procurement of major system acquisitions with other than research and development funds are not included).

The summary of key data is as follows:

| | (in millions of dollars) | |
|---|---|---|
| Science and Technology Base | | $12,052.2 |
| Mission Oriented | | |
| Concept and Demonstration Development | $5,363.8 | |
| Full-Scale Development | $9,029.5 | |
| | | $14,393.3 |
| R&D Management | | $ 2,464.6 |
| | | $28,910.1 |

The mission oriented R&D work ranges from highes of $1,827.7 million for the NASA mission of Space Transporatation and $1,466.5 million for the Department of Defense mission of Strategic Offense to lows of $2.9 million for the Department of Commerce missions of Maritime Technological Development and Applications and $4.6 million for Maritime Business Environment.

CHART 1:

# FY 1979 R&D BUDGET AUTHORITY

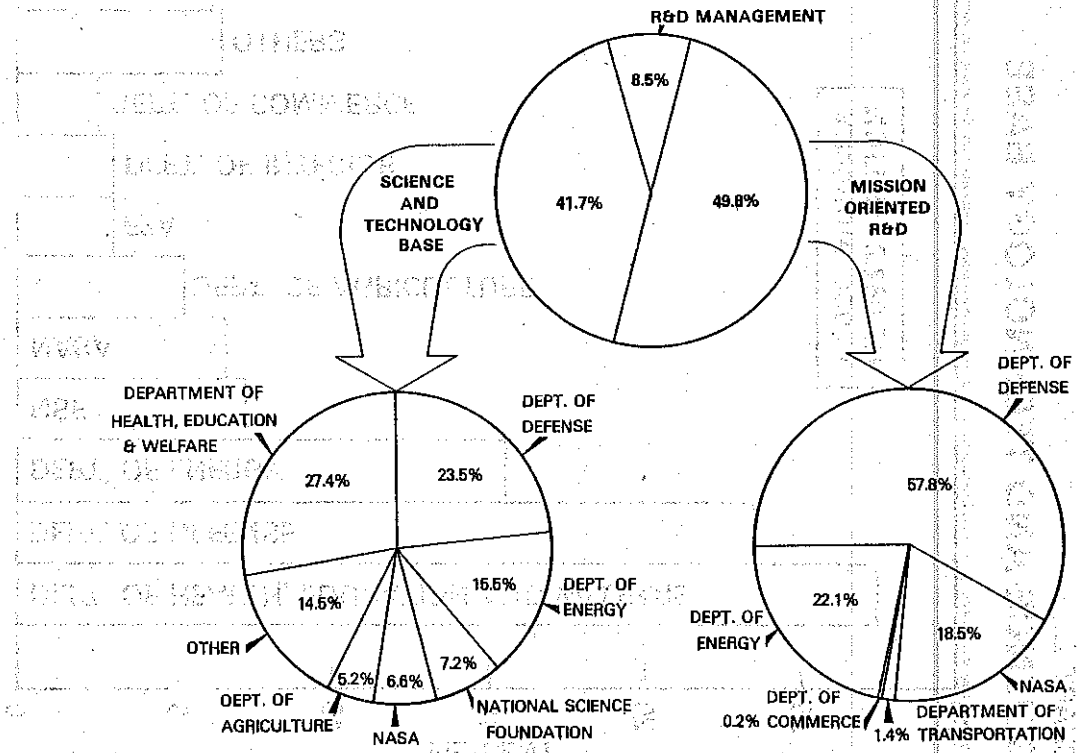


CHART 3.

## MISSION ORIENTED R&D

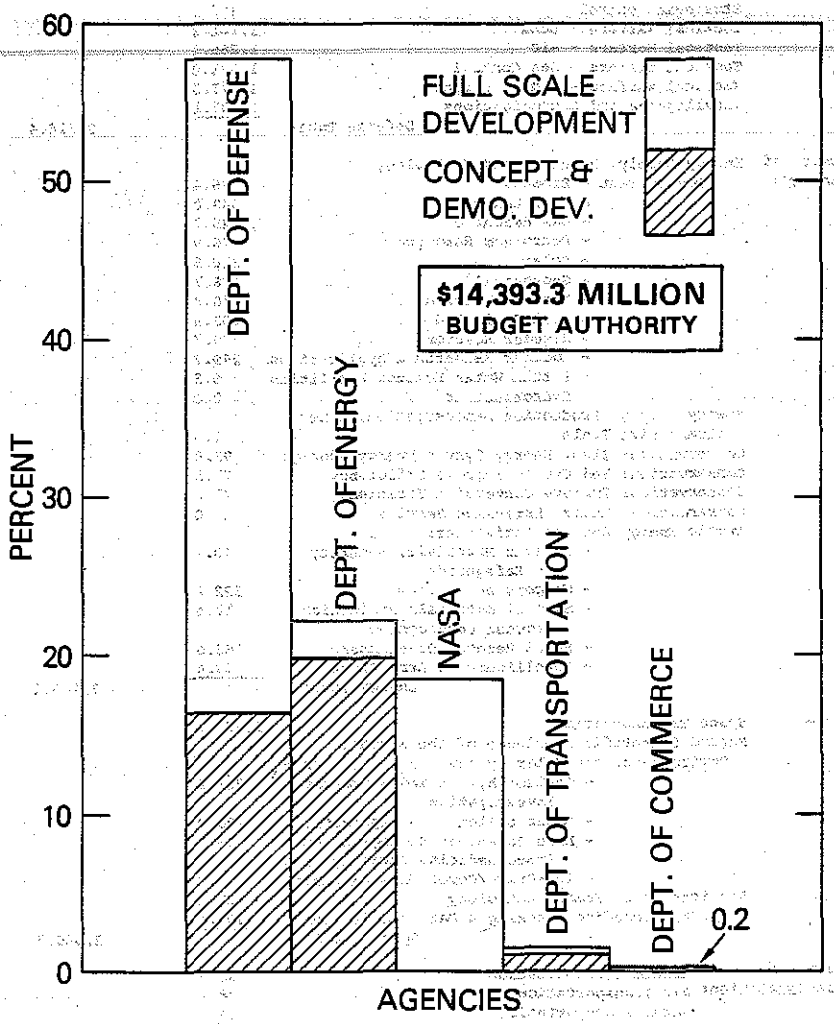


CHART 5.

## MISSION ORIENTED DEPT. OF DEFENSE R&D

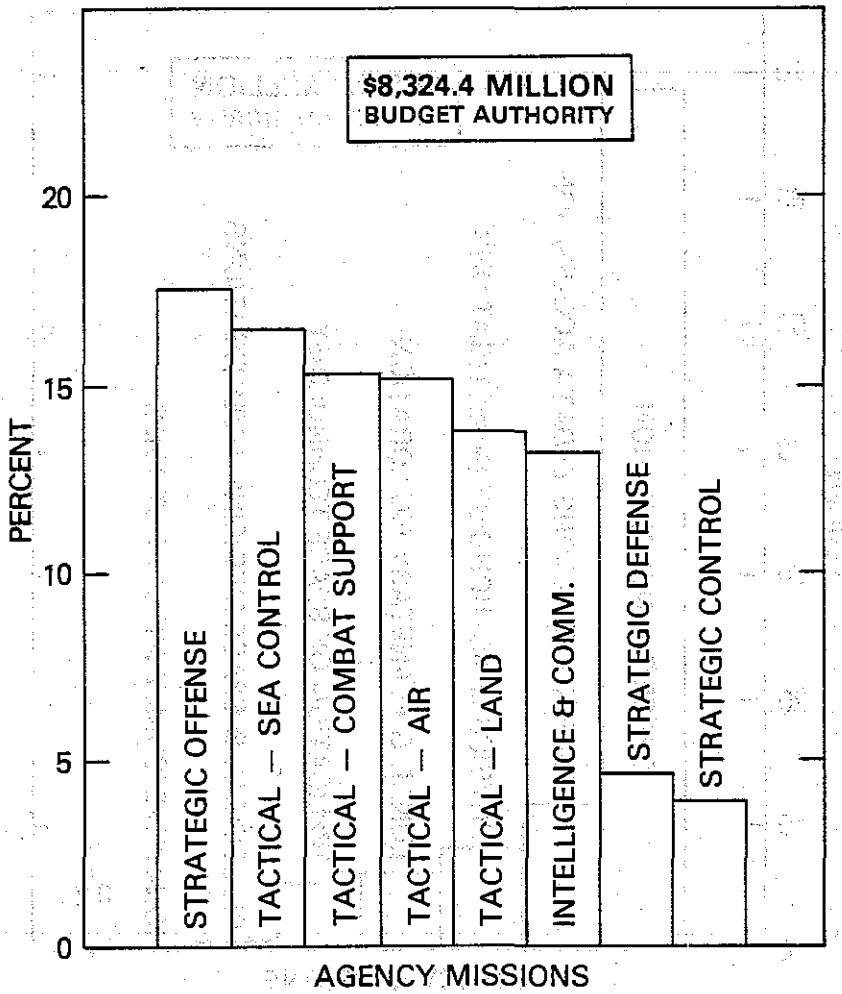
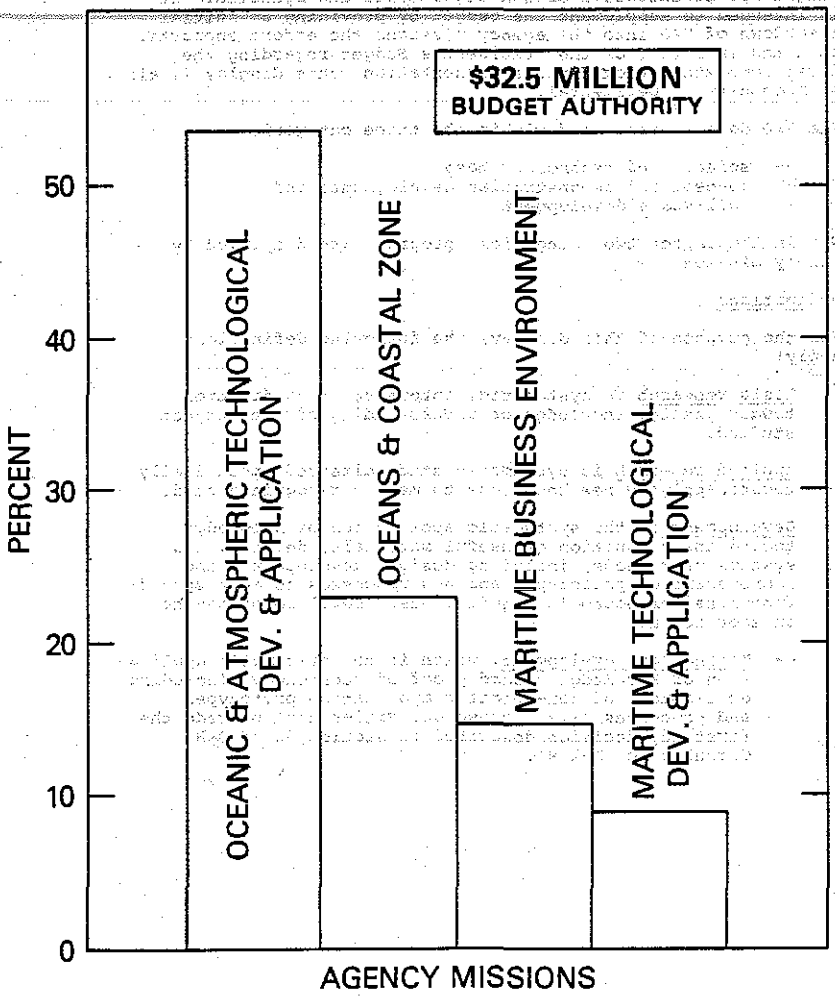


CHART 7.

# MISSION ORIENTED DEPT. OF ENERGY R&D

CHART 9.

## MISSION ORIENTED
## DEPT. OF COMMERCE R&D



-- Concept and demonstration development, which is the systematic application of knowledge toward identification of solutions to meet specific functional or economic requirements, including development of specific application prototypes and process (i.e., the development of activities that follow the first key decision described in section 9a and precede the the third key decision described in section 9c of Circular No. A-109).

-- Full-scale development, which is the systematic application of knowledge toward production of useful materials, devices, systems or methods; including design, development, and improvement of equipment and processes to meet specific functional or economic requirements (i.e., activities that follow the third key decision described in section 9c of Circular No. A-109).

Science and technology base is the total of basic research, applied research, and technology development.

Agency missions are those responsibilities for meeting national needs assigned to an agency. Agency missions are expressed in terms of the end purpose capabilities to be ultimately provided by the programs.

Programs represent an organized set of activities directed toward a common purpose, objective, or goal undertaken or proposed by an agency in order to carry out the responsibilities assigned to it (i.e., major system acquisitions as described by Circular A-109 and implemented by the agencies).

Science and Technology Base

The science and technology base as shown in Table RD-1, includes basic and applied research and technology development. These activities are directed toward an increase in knowledge and in the understanding the applicability of the knowledge and as such support all agency missions.

Concept and Demonstration Development

Table RD-2 includes five agencies which have programs (major system acquisitions) which are directed to specific agency mission needs. These program efforts are in the concept formulation or proof of concept demonstration phase of development. The data entries labled "Other" are aggregates of all non-major system programs in this stage of development for the agency missions shown.

Table RD-2 CONCEPT AND DEMONSTRATION DEVELOPMENT
(in millions of dollars)

| Agency | Agency Mission | Program | 1979 Budget Authority Estimate |
|---|---|---|---|
| Dept. of Defense (cont'd) | Tactical Warfare - Land | Surface-to-Surface Missile Rocket System | 70.8 |
| | | XM-1 Tank Gun Cooperative Development | 8.1 |
| | | Advanced Multi-Purpose Missile | 8.1 |
| | | DIVAD Gun | 75.7 |
| | | Advanced Amphibious Assault Craft | 18.3 |
| | | Landing Vehicle Assault | 12.0 |
| | | Other | 59.8 |
| | Tactical Warfare - Air | Beyond Visual Range Air-to-Air Missile | 18.4 |
| | | Advanced Medium Range Air-to-Air Missile | 18.3 |
| | | Conventional Airfield Attack Missile | 5.0 |
| | | Air-to-Ground Stand-Off Missile | 5.5 |
| | | Combat Aircraft Technology | 6.0 |
| | | AV-8B Aircraft | 50.1 |
| | | Night Attack Aircraft | 10.0 |
| | | Other | 172.6 |
| | Tactical Warfare - Sea Control | Land Based Support Aircraft | 4.0 |
| | | Advanced Air Anti-Submarine Warfare | 2.9 |
| | | V/STOL Aircraft Development | 40.8 |
| | | Surface-to-Surface Missile Development | 1.1 |
| | | New Ship Design | 14.5 |
| | | Long Range Dual Mission Missile | 8.1 |
| | | Advanced Submarine Design | 34.8 |
| | | OTH Targeting | 6.4 |
| | | Moored Surveillance System | 13.8 |

Table RD-2 CONCEPT AND DEMONSTRATION DEVELOPMENT
(in millions of dollars)

| Agency | Agency Mission | Program | 1979 Budget Authority Estimate |
|---|---|---|---|
| Dept. of Energy (cont'd) | | High BTU Synthetic Pipeline Gas Demonstration Plant | 40.0 |
| | | "H" Coal Pilot Plant | 21.0 |
| | | Other | 358.0 |
| | Energy Supply Research and Technology Development: Gas Resource | Other | 25.7 |
| | Energy Supply Research and Technology Development; Petroleum Resource | Other | 76.9 |
| | Energy Supply Research and Technology Development: Solar | 10 MWe Solar Demonstration Plant | 41.0 |
| | | Other | 269.8 |
| | Energy Supply Research and Technology Development: Geothermal | 50 MWe Geothermal Demonstration Plant | 7.5 |
| | | Other | 119.2 |
| | Energy Supply, Research and Technology Development; Magnetic Fusion | Other | 70.8 |
| | Energy Supply, Research and Technology Development: Fuel Cycle R&D | Other | 178.9 |
| | Energy Supply Research and Technology Development; Breeder Reactor | Other | 279.7 |

Table RD-2 CONCEPT AND DEMONSTRATION DEVELOPMENT
(in millions of dollars)

| Agency | Agency Mission | Program | 1979 Budget Authority Estimate |
|---|---|---|---|
| Dept. of Energy (cont'd) | Atomic Energy Defense Activities: Weapons Activities | Waste Isolation Pilot Plant | 40.0 |
| | | Defense Waste Facility Savannah River | 75.0 |
| | | Other | 113.9 |
| | Atomic Energy Defense Activities: Special Materials Production, Process Development | Other | 12.4 |
| | Atomic Energy Defense Activities: Naval Reactor Development | Other | 265.6 |
| | Atomic Energy Defense Activities: Intelligence and Arms Control | Other | 28.4 |
| | | Dept. of Energy Sub Total | 2,857.9 |
| Dept. of Transportation | Ground Transportation | Advanced Group Rapid Transit Program | 8.0 |
| | | Other | 43.5 |
| | Air Transportation | Other | 77.3 |
| | Water Transportation | Other | 14.1 |
| | | Dept of Trans. Sub Total | 142.9 |
| National Aeronautics and Space Administration | Expand Scientific Knowledge of the Earth's Environment, the Solar System and the Universe: Ion-drive/Comet Mission Studies | Other | 5.0 |

Table RD-3 FULL-SCALE DEVELOPMENT
(in millions of dollars)

| Agency | Agency Mission | Program | 1979 Budget Authority Estimate |
|---|---|---|---|
| Dept. of Commerce | Oceans and Coastal Zone Policy | Ocean Fisheries and Living Marine Resources Survey Technology Development | 2.1 |
| | | Increasing Use of Ocean Fisheries and Living Marine Resources | .8 |
| | | Marine Calibration and Testing Services | 2.2 |
| | Oceanic and Atmospheric Technological Development and Applications | Aerocharting Research | .1 |
| | | Data Buoy Development and Maintenance | 8.3 |
| | | Environment Services Equipment Development | .8 |
| | | Satellite Environment Sensors | 2.3 |
| | | Automation of Public Forecast and Warning Field Operations and Services | 2.3 |
| | | Public Weather Research | .3 |
| | | Aviation Weather Research | .1 |
| | | Other | 1.7 |
| | Maritime Business Environment | Advanced Ship Development | 1.4 |
| | | Advanced Ship Operation | .7 |
| | | Maritime Research | .2 |
| | Maritime Technological Development and Application | Advanced Marine Technology | 1.5 |
| | | Dept. of Commerce Sub Total | 24.8 |
| Dept. of Defense | Strategic Offense | Minuteman Squadrons | 54.1 |
| | | Fleet Ballistic Missile Systems | 135.9 |
| | | TRIDENT | 265.6 |
| | | TOMAHANK Cruise Missile | 152.1 |

Table RD-3 FULL-SCALE DEVELOPMENT
(in millions of dollars)



| Agency | Agency Mission | Program | 1979 Budget Authority Estimate |
|---|---|---|---|
| Dept. of Defense (cont'd) | | Guided Glide Bomb | 26.0 |
| | | MAVERICK Close Air Support Weapon System | 58.5 |
| | | Other | 175.8 |
| | Tactical Warfare - Sea Control | LAMPS MK-111 Helicopter | 124.5 |
| | | Ship Development | 58.6 |
| | | Major Caliber Light Weight Gun | 6.2 |
| | | CSEDS (AEGIS) | 37.2 |
| | | Standard Missile Improvement | 49.1 |
| | | Vehicle Launch Standard | 22.3 |
| | | Tactical Tow Array Sonar | 25.2 |
| | | Other | 396.1 |
| | Tactical Warfare - Combat Support | CH-47 Helicopter Modernization | 19.5 |
| | | C-5A Airlift Squadron | 37.2 |
| | | Tri-Service Facility Command Supt. | 55.2 |
| | | Navy TRI TAC | 9.9 |
| | | Air Force TRI TAC | 33.6 |
| | | Tactical Operations System | 36.8 |
| | | Army/Navy/Marine Corps JINTACCS | 26.7 |
| | | AWACS | 58.6 |
| | | Wild Weasle | 2.0 |
| | | EF-111A | 8.8 |
| | | Precision Location Stuke System | 86.8 |
| | | CH-53F | 4.6 |
| | | Other | 649.9 |
| | Intelligence and Communications | General Defense Intelligence Program | 39.5 |
| | | Crytological Programs | 173.9 |
| | | Special Activities | 229.1 |
| | | Satellite Communications | 18.4 |
| | | Defense Satellite Communications System | 34.2 |

Table RD-3 FULL-SCALE DEVELOPMENT
(in millions of dollars)

| Agency | Agency Mission | Program | 1979 Budget Authority Estimate |
|---|---|---|---|
| NASA (cont'd) | Expand Scientific Knowledge of the Earth's Environment, the Solar System and the Universe: Conduct Physics and Astronomy Investigation | High-Energy Astronomy Observatory | 16.4 |
| | | Solar Maximum Mission | 16.2 |
| | | Space Telescope | 79.2 |
| | | Solar Polar Mission | 13.0 |
| | | Earth Orbiting Explorer Satellites | 29.8 |
| | | Other | 56.6 |
| | Expand Scientific Knowledge of the Earth's Environment, the Solar System and the Universe: Lunar and Planetary Exploration | Voyager to Jupiter and Saturn | 14.4 |
| | | Pioneer/Venus | 10.5 |
| | | Jupiter Orbiter/Probe | 78.7 |
| | | Other | 34.4 |
| | Expand Scientific Knowledge of the Earth's Environment, the Solar System and the Universe: Life Sciences - Biological and Space Medicine Investigations | Other | 16.2 |
| | Application of Space Technology | Earth Resources Satellite Landsat-D | 97.5 |
| | | Ocean Conditions Satellite Seasat-A | 3.0 |
| | | Earth Radiation Budget Satellite | 8.0 |
| | | Materials Processing in Space | 12.4 |

NOTES

1. The Science and Technology Base total for FY 1979, $12,052.2 million, shown in Table RD-1 includes $1,334.6 million in R&D facilities. See Special Analysis P, Research and Development, for further breakdown of R&D facilities.

2. The Department of Defense total for R&D in this display is $11,155.2 million. The FY 1979 budget totals for Defense RDT&E is $12,468 million. The difference of $1,312.8 million is in Program-wide Management and Support activities of $1,550.6 million less $237.8 million of R&D facilities which could not be assigned to agency missions nor appropriately categorized as science and technology base. These activities are broken down as follows:

Defense Program-wide R&D Management and Support
(in millions of dollars)

| | |
|---|---|
| Technical Integration | 144.4 |
| Test and Evaluation Support | 1,009.4 |
| International Cooperative R&D | 33.7 |
| Other Management Support | 363.1 |
| | 1,550.6 |

3. The National Aeronautics and Space Administration's total for R&D in this display is $3,610.1 million. The FY 1979 budget total for NASA R&D is $4,371.6 million. The difference of $761.5 million is in Research and Program Management of $914.0 million less $152.5 million of R&D facilities which could not be assigned to agency missions nor appropriately categorized as science and technology base.

4. Two facilities which have been designated as major system acquisitions are included in the $803.5 million for the Department of Energy R&D Facilities of the $1,872.3 million for science and technology base. These are:

| | (in millions of dollars) |
|---|---|
| - Tokamak Fusion Test Reactor | 42.0 |
| - Mirror Fusion Test Facility | 40.0 |

5. Special Analysis F, Research and Development, of the FY 1979 budget also includes the research and development activities of the Library of Congress. Since this display is of the Executive branch agencies only this legislative branch organization was not included. The Library of Congress budget authority estimate for FY 1979 is $4.7 million.

SEPTEMBER 5, 1978

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE
NATIONAL INSTITUTES OF HEALTH
BETHESDA, MARYLAND 20014

SEP 5 1978

The Honorable John B. Breckinridge
Chairman, Subcommittee on Antitrust, Consumers
and Employment
Committee on Small Business
House of Representatives
Washington, D.C. 20515

Dear Mr. Breckinridge:

I am responding to your letter of August 14 concerning the perception of some operators of small businesses that they have no chance for success in the competition for grants from the National Institutes of Health (NIH). In developing the information you requested, we interpreted your query to cover NIH contract awards as well as grants. We believe this broader interpretation is the more meaningful one in terms of the businessmen's concerns and our understanding of the area of interest of your Subcommittee.

The NIH uses several different types of awards in carrying out its mission. The three principal ones are research grants, research and development contracts, and station support contracts. The first two, as their names suggest, are used to support specific biomedical research activities in institutions outside the NIH such as medical schools, universities, and research institutes that traditionally have concerned themselves with the generation of new biomedical knowledge and its application to improve health care. The third type, station support contracts, is the means by which the laboratories, clinics and staff offices at the NIH procure the equipment, supplies, and services they need to conduct their research and research management efforts.

Research grants are by far the largest category of the three types of awards noted. During the most recently completed fiscal year (FY 1977), for example, NIH awarded 15,687 research grants totalling over $1.4 billion. Under present policy of the Department of Health, Education, and Welfare (DHEW), profit-making organizations are not eligible to compete for research grants. Therefore, small businesses do not receive any grant awards from the NIH. However, we are informed

ATTACHMENT I

National Institutes of Health
Contract Awards During FY 1977
(Dollars in Thousands)

| | Number | Dollar Value |
|---|---|---|
| 1. Total Number and Dollar of all Contract Awards [2(a) and (b)] | 4,426 | $495,704 |
| 2. Total Number and Dollar Value of Contract Awards | | |
| a. To Non-Small Business | 3,275 | $424,176 |
| 1. Profit Makers (non-small business) | 640 | $114,913 |
| 2. Non-Profits | 2,635 | $309,263 |
| b. Small Business (including small business, set-asides minority business, and 8(a) | 1,151 | $ 71,525 |

Prepared by the Division of Contracts and Grants, NIH
August 24, 1978

In coordination with the resident Small Business Administration procurement center representative and all research contracting officers at NIH, the NIH Small Business Specialist has established a class set-aside for conference support services.

All NIH research contract awards are publicized in the "Commerce Business Daily, Synopsis of U.S. Government Proposed Procurement, Sales and Contract Awards." In this way, small and minority firms will learn about projects that offer subcontracting opportunities and enable them to contact prime contractors directly. Moreover, all NIH research contracts over $10,000 contain a "Utilization of Small Business Concerns" clause whereby the contractor agrees to accomplish the maximum amount of subcontracting to small business performance. Also, NIH research contracts over $500,000 which offer substantial subcontracting possibilities, require the prime contractor, as a specific contract obligation, to pursue an active and documented small business subcontracting program which can be monitored and audited by the contracting officer.

The National Institutes of Health is currently planning to conduct a small business conference or seminar, whereby small and minority firms will gain a better appreciation of the nature of research contract projects of the several NIH Institutes, and learn more about their ability to compete for certain categories of prime contract awards and subcontract awards. It is expected that Government scientists who serve as project officers for contracts, together with contracting officers from particular NIH Institutes will be on hand to brief small and minority firms and answer any questions they may have on the NIH research contracting program. We also plan to give these firms whatever advance procurement information is available for prospective contracting requirements.

## PANEL ON INVENTION AND INNOVATION*

Robert A. Charpie, *Chairman*
Daniel V. De Simone, *Executive Secretary*

| | |
|---|---|
| Lawrence S. Apsey | Mark S. Massel |
| John F. Costelloe | Richard S. Morse |
| John F. Dessauer | Peter G. Peterson |
| John M. Fisher | Sidney I. Roberts |
| Aaron J. Gellman | John C. Stedman |
| Peter C. Goldmark | Dan Throop Smith |
| Earl W. Kintner | William R. Woodward |

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| | |
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| The Treasury Department | Stanley S. Surrey |
| Department of Justice | Donald F. Turner |
| Business & Defense Services Administration | Paul W. McGann |
| Small Business Administration | Padraic P. Frucht |
| Federal Trade Commission | Joseph E. Sheehy |
| Office of Science & Technology | William L. Hooper |
| Council of Economic Advisers | Edwin S. Mills<br>Paul W. MacAvoy |

### INTERAGENCY STAFF

| | |
|---|---|
| Andrew Canellas, | *Small Business Administration* |
| Cecil G. Miles, | *Federal Trade Commission* |
| Miles Ryan, | *Department of Justice* |
| Richard E. Slitor, | *The Treasury Department* |
| Larry L. Yetter, | *Department of Commerce* |

* *Affiliations are given in Appendix A*

# SUMMARY

In accordance with its charter, the Panel considered three main factors affecting invention and innovation: taxation, finance, and competition. On the basis of its analysis, the Panel concluded that there was no need to recommend any major changes in the present laws governing these three areas. However, it did make a number of specific proposals * aimed at improving the environment for invention and innovation.

With respect to the field of taxation, the Panel made several specific recommendations which it felt could provide justifiable encouragement to inventors and innovators. Among these recommendations are proposals providing for a more equitable treatment of innovation losses, an improvement of the stock option to make it a more effective instrument for attracting critically important management personnel to fledgling firms, and a reasoned approach to tax-deduction problems posed by several other areas of the tax laws.

The Panel found no reason for proposing any new federally snpported programs to furnish venture capital for the financing of new, technologically based enterprises. It did, however, make recommendations concerning the communication of venture-capital opportunities and the establishment of an effective Federal spokesman for such enterprises.

The Panel's review of the interaction between competition and innovation showed a need for greater understanding of this interaction and improvements in the coordination of antitrust and regulatory policies affecting both competition and innovation. No new antitrust or regulatory legislation was recommended, but the Panel did recommend, among other proposals, the establishment of a group to serve as an advisory resource to the antitrust and regulatory agencies, as well as a strengthening of the professional staffs of these agencies.

Throughout its review, the Panel was impressed by the need for promoting a basic understanding of the innovative process in all sectors of our society. The Panel felt that it would be highly desirable to encourage educational programs, studies, and regional seminars to further this understanding. Accordingly, the Panel's concluding recommendation proposes a White House conference on technological innovation, to dramatize the importance of this vital process, and urges that this conference be followed by a nationwide program for broadening recognition, understanding, and appreciation of the problems and opportunities associated with technological change.

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* *The complete list of the Panel's recommendations is set forth in Appendix E, page 79.*

## Appendix VII

"Technological Innovation: Its Environment and Management," Robert A. Charpie, Chairman, Panel on Invention and Innovation, U.S. Department of Commerce, January 1967

# TECHNOLOGICAL INNOVATION: Its Environment and Management.

Charpie Report

This report represents the views of the panel on invention and innovation, an advisory committee of private citizens convened by and reporting to the Secretary of Commerce. The views of the panel do not necessarily represent those of the Department of Commerce or of any other agency of the federal government.

January 1967

U.S. DEPARTMENT OF COMMERCE
John T. Connor, Secretary

J. Herbert Hollomon, Assistant Secretary
for Science and Technology

For sale by the Superintendent of Documents, U.S. Government Printing Office
Washington, D.C., 20402 - Price $1.25

ATTACHMENT II

NIH INITIATIVES INVOLVING
RESEARCH AND DEVELOPMENT CONTRACTS
WITH SMALL BUSINESSES

The National Institutes of Health has taken the following specific actions to ensure that a fair proportion of procurements for which small businesses can compete are in fact solicited from small businesses on either a direct solicitation or subcontract basis.

A NIH Small Business Specialist is appointed within this agency whose primary responsibility is to screen all research contracting requirements to ensure that small business and minority concerns receive adequate consideration including initiation of set-asides.

A Small Business Administration Procurement Center Representative is assigned to this agency on a part-time basis for the purpose of coordinating with the NIH Small Business Specialist in the screening of procurement requirements.

The NIH Small Business Specialist coordinates with the several NIH research contracting activities in responding to inquiries and requests for advice from small business and minority concerns on procurement matters. Such advice includes advance procurement information of interest to such concerns, the extent of financial assistance available under existing laws and regulations, and subcontracting opportunities under particular research projects.

Recognizing that the small and minority business community at large may not be entirely conversant with the NIH research contracting program, or the areas in which such sources can make a contribution and compete for prime and subcontract awards, the NIH has issued a Synopsis in the December 6, 1976, and June 27, 1978, Commerce Business Daily to locate small business and minority business firms with expertise in biomedical research and development services. In addition, a similar synopsis was published in the July/August 1978 American Association for Small Research Companies News to locate Small and Minority Businesses with Biomedical Research and Development Capabilities.

Upon request Small Business concerns are provided with a copy of the NIH Guide to Grants and Contracts which includes a mailing list application that will place the firm on the NIH computer mailing list. The Guide provides a detailed description of the research interest of each of the Institutes and Divisions of NIH.

that DHEW staff, in developing implementing instructions for the Federal Grants and Cooperative Agreement Act of 1977 (Public Law 95-244), are reconsidering this restriction and may eliminate it. Mr. Matthias Lasker, Director, Division of Grants Policy and Regulation Development, DHEW, (245-8901) could provide more specific information on this possible Departmental policy change. Should this policy change occur, it would create new opportunities for support for those relatively few small businesses and other commercial organizations that engage directly in biomedical research.

Small businesses do, of course, receive subcontracts and purchase orders from grant-eligible institutions for activities in support of NIH-sponsored research. I regret that the expenditure reports required of grantee institutions are not sufficiently detailed for us to be able to document the scope of this small business involvement but I estimate that over 10 percent of the grant funds are involved.

Under existing Departmental policy profit-making organizations in general--and small businesses specifically--are eligible for both research and development contracts and station support contracts. Approximately $500 million of awards were made by NIH in FY 1977 in these categories. Attachments I and II are a tabulation of the NIH awards in these two categories for fiscal year 1977 and a summary description of our special efforts to increase the number of awards to small business in the future.

I hope the information above and in the attachments is helpful to you.

Sincerely yours,

Donald Fredrickson

Donald S. Fredrickson, M.D.
Director

Attachments

# APPENDIX VI

CORRESPONDENCE BETWEEN HON. JOHN B. BRECKINRIDGE, CHAIRMAN, SUBCOMMITTEE ON ANTITRUST, CONSUMERS AND EMPLOYMENT, COMMITTEE ON SMALL BUSINESS, AND DR. DONALD S. FREDRICKSON, DIRECTOR, NATIONAL INSTITUTES OF HEALTH, OF:

AUGUST 14, 1978

JOHN BRECKINRIDGE, KY.
CHAIRMAN

HENRY B. GONZALEZ, TEX.
BERKLEY BEDELL, IOWA
THOMAS A. LUKEN, OHIO
JAMES M. HANLEY, N.Y.
RICHARD H. ICHORD, MO.
HENRY J. NOWAK, N.Y.

M. CALDWELL BUTLER, VA.
WILLIAM S. COHEN, MAINE
LARRY PRESSLER, S. DAK.

STEVEN ENGELMYER
SUBCOMMITTEE COUNSEL
202-225-7767

United States House of Representatives
Committee on Small Business
Subcommittee on
Antitrust, Consumers and Employment
2361 Rayburn House Office Building
Washington, D.C. 20515

14 August 1978

Dr. Donald S. Fredrickson
Director
National Institutes of Health
9000 Rockville Pike
Bethesda, Maryland 20015

Dear Dr. Fredrickson:

It has recently come to my attention through conversations with small businessmen that many small businesses believe that they have no chance for success in the competition for grants from the National Institutes of Health. If this perception is correct, please advise me as to what prohibits the National Institutes of Health from granting equal opportunity to small business concerns to participate in the NIH grant programs. If this perception is incorrect, please advise me as to what NIH is doing to correct this mistaken perception.

I also request that you provide me with the figures for the percentages of your grants that have gone to small businesses in the last five years.

I thank you for your prompt attention to these requests. With best wishes, I am

Sincerely yours,

John B. Breckinridge
Chairman
Subcommittee on Antitrust,
Consumers and Employment

JBB/fdd

Table RD-3 FULL-SCALE DEVELOPMENT
(in millions of dollars)

| Agency | Agency Mission | Program | 1979 Budget Authority Estimate |
|---|---|---|---|
| | | Other | 36.3 |
| | Support, Including Tracking and Data Acquisition | Other | 305.4 |
| | | NASA Sub Total | 2,655.7 |
| | | TOTALS | 9,029.5 |

Table RD-3 FULL-SCALE DEVELOPMENT
(in millions of dollars)

| Agency | Agency Mission | Program | 1979 Budget Authority Estimate |
|---|---|---|---|
| Dept. of Defense (cont'd) | | Long Haul Communications | 30.1 |
| | | Other Intelligence Programs | 18.2 |
| | | Other | 264.9 |
| | | Dept. of Defense Sub Total | 5,974.1 |
| Dept. of Energy | Energy Supply, Research and Technology Development: Fuel Cycle R&D | National Waste Terminal Storage Facility | 25.0 |
| | Atomic Energy Defense Activities: Weapon Activities | Other | 293.3 |
| | | Dept of Energy Sub Total | 318.3 |
| nspor- | Ground Transportation | Research Safety Vehicle Program | 7.3 |
| | | Other | 27.7 |
| | Air Transportation | Discrete Address Beacon System | 7.2 |
| | | Microwave Landing System | 7.3 |
| | | Flight Service Stations | 3.9 |
| | | Other | 3.2 |
| | | Dept. of Trans. Sub Total | 56.6 |
| National Aeronautics Space Administration | Space Transportation System | Space Shuttle | 1,439.3 |
| | | Space Laboratory | 39.0 |
| | | Expendable Launch Vehicles | 76.5 |
| | | Other | 272.9 |

Table RD-3 FULL-SCALE DEVELOPMENT
(in millions of dollars)



| Agency | Agency Mission | Program | 1979 Budget Authority Estimate |
|---|---|---|---|
| Dept. of Defense (cont'd) | | B-1 Bomber | 105.5 |
| | | Cruise Missile Carrier | 41.2 |
| | | Air Launched Cruise Missile | 237.8 |
| | | Other | 112.6 |
| | Strategic Defense | Space Defense Systems | 73.0 |
| | | Other | 43.8 |
| | Strategic Control | ELF Communications | 40.5 |
| | | E-4 Airborne Command Post | 32.1 |
| | | Other | 254.5 |
| | Tactical Warfare - Land | Aerial Scout | 5.5 |
| | | Remotely Piloted Vehicles | 22.0 |
| | | Stand-off Target Acquisitions System | 36.9 |
| | | FAC-X | 1.0 |
| | | COBRA TOW Helicopter | 10.8 |
| | | Infantry Fighting Vehicle | 28.9 |
| | | XM-1 Tank | 78.4 |
| | | Advance Attack Helicopter | 177.4 |
| | | HELFIRE Missile | 65.1 |
| | | Copperhead Missile System | 13.0 |
| | | STINGER Missile System | 24.6 |
| | | PATRIOT Missile System | 228.4 |
| | | ROLAND Missile System | 22.7 |
| | | Landwire Warfare | 14.9 |
| | | Other | 158.9 |
| | Tactical Warfare - Air | Navy Air Combat Fighter (F-18) | 473.6 |
| | | Air Force Air Combat Fighter (F-16) | 107.9 |
| | | AV-8B Aircraft | 35.6 |
| | | Ground Launch Carrier Missile | 33.0 |
| | | Low Altitude Airfield Attack Missile | 26.0 |
| | | High Speed Anti-Radiation Missile | 43.4 |

Full-Scale Development

Table RD-3 includes five agencies which have programs (major system acquisitions) which are directed to specific agency mission needs. These program efforts are in the final engineering and/or operational development phase. The data entries labled "Other" are aggregates of all non-major system programs in this stage of development for the agency missions shown.

Table RD-2 CONCEPT AND DEMONSTRATION DEVELOPMENT
(in millions of dollars)

| Agency | Agency Mission | Program | 1979 Budget Authority Estimate |
|---|---|---|---|
| Dept. of Energy (cont'd) | Energy Supply, Research and Technology Development: Nuclear Research and Applications | Other | 249.7 |
| | Energy Supply, Research and Technology Development: Little Water Reactor Facilities | Other | 6.5 |
| | Energy Supply, Research and Technology Development: Hydroelectric | Other | 8.0 |
| | Energy Supply, Production, Demonstration, and Development: Alternate Fuels | Other | 1.0 |
| | Conservation: Electrical Energy Systems and Energy Storage | Other | 93.9 |
| | Conservation: End Use to Improve Efficiency | Other | 277.5 |
| | Conservation: Improve Conversion Efficiency | Other | 77.0 |
| | Conservation: Energy Extension Service | Other | 25.0 |
| | Atomic Energy Defense Activities: Nuclear Materials, Security and Safeguards | Other | 40.1 |

Table RD-2 CONCEPT AND DEMONSTRATION DEVELOPMENT
(in millions of dollars)

| Agency | Agency Mission | Program | 1979 Budget Authority Estimate |
|---|---|---|---|
| Dept. of Defense (cont'd) | | Anti-Submarine Warfare Surveillance | 12.4 |
| | | Long Range Accoustic Propagation | 13.6 |
| | | Advanced Surface-to-Air Weapon System | 19.5 |
| | | Submarine Sonar Development | 52.3 |
| | | Advanced Anti-Submarine Warfare Torpedo | 44.3 |
| | | Shipboard Intermediate Range Combat System | 14.5 |
| | | Other | 368.8 |
| | Tactical Warfare - Combat Support | SINCGARS-V | 12.7 |
| | | Navigation Satellite | 11.5 |
| | | NAVSTAR GPS | 35.3 |
| | | Combat Support Mobility | 1.8 |
| | | Other | 182.4 |
| | Intelligence and Communications | Advance Space Communications | 30.4 |
| | | Space Shuttle | 169.5 |
| | | Other | 86.9 |
| | | Dept. of Defense Sub Total | 2,350.3 |
| Dept. of Energy | Energy Supply, Research and Technology Development: Biomass | Other | 26.4 |
| | Energy Supply Research and Technology Development: Coal Resource | Solvent Refined Coal Demonstration Plant | 20.0 |
| | | Low BTU-Fuel Gas, Small Industrial Demonstration Plant | 9.0 |

Table RD-2 CONCEPT AND DEMONSTRATION DEVELOPMENT
(in millions of dollars)

| Agency | Agency Mission | Program | 1979 Budget Authority Estimate |
|---|---|---|---|
| Dept. of Commerce | Oceans and Coastal Zone Policy | Oceanographic Instrumentation Development | 1.0 |
| | | Marine Technology and Instrument Development | 1.2 |
| | | Other | .2 |
| | Oceanic and Atmospheric Technological Development and Application | Other | 1.6 |
| | Maritime Business Environment | Advanced Ship Development | 1.4 |
| | | Advanced Ship Operations | .7 |
| | | Maritime Research Development | .2 |
| | Maritime Technological Development and Application | Advanced Marine Technology | 1.4 |
| | | Dept. of Commerce Sub Total | 7.7 |
| Dept. of Defense | Strategic Offense | Advanced ICBM Technology (M-X) | 158.2 |
| | | Advanced Ballistic Reentry System | 105.0 |
| | | Strategic Bomber Enhancements | 63.3 |
| | | Other | 35.2 |
| | Strategic Defense | Ballistic Missile Defense Advanced Technology | 113.5 |
| | | Ballistic Missile Defense System Technology | 114.0 |
| | | Other | 40.1 |

Table RD-1 SCIENCE AND TECHNOLOGY BASE
(in millions of dollars)

| Agency | 1979 Budget Authority Estimate |
|---|---|
| Department of Agriculture | 624.6 |
| Department of Commerce | 293.9 |
| Department of Defense - Military | 2,830.8 |
| Department of Energy | 1,872.3 |
| Department of Health, Education & Welfare | 3,299.1 |
| Department of Housing & Urban Development | 57.0 |
| Department of Interior | 344.4 |
| Department of Justice | 42.8 |
| Department of Labor | 40.4 |
| Department of State | 2.9 |
| Department of Transportation | 163.5 |
| Department of Treasury | 7.1 |
| Advisory Committee on Intergovernmental Relations | 1.8 |
| Agency for International Development | 75.7 |
| Arms Control & Disarmament Agency | 3.7 |
| Civil Service Commission | 4.3 |
| Consumer Product Safety Commission | 4.1 |
| Corps of Engineers - Civil Works | 27.6 |
| Environmental Protection Agency | 352.7 |
| Federal Communications Commission | 3.8 |
| Federal Trade Commission | 1.2 |
| General Services Administration | 0.1 |
| National Aeronautics & Space Administration | 796.9 |
| National Science Foundation | 867.6 |
| Nuclear Regulatory Commission | 155.5 |
| Smithsonian Institution | 33.6 |
| Tennessee Valley Authority | 32.1 |
| Veterans Administration | 112.7 |
| TOTAL | 12,052.2 |

DISPLAY OF RESEARCH AND DEVELOPMENT BY AGENCY MISSIONS

This display presents the budget authority for research and development (R&D) as contained in the President's FY 1979 Budget for 28 executive branch departments and agencies. It is intended to supplement the budget by providing an initial breakdown of R&D into the agency missions the effort supports. As noted in Part 7 of the President's Budget regarding the first complete national needs presentation, this display is also, of necessity, experimental.

The R&D data is presented within the three categories of:

-- science and technology base;
-- concept and demonstration development; and
-- full-scale development

Within the latter two categories, programs are displayed by agency mission.

Definitions

For the purpose of this display, the following definitions apply:

Basic research is systematic, intensive study directed toward greater knowledge or understanding of the subject studied.

Applied research is systematic study directed specifically toward applying new knowledge to meet a recognized need.

Development is the systematic application of knowledge toward the production of useful materials, devices, and systems or methods; including design, development, and improvement of prototypes and new processes to meet specific functional or economic requirements. Development may be categorized as:

-- Technology development, which is the systematic application of knowledge toward proof of technology, including development of non-specific application prototypes and processes (i.e., those activities that precede the first key decision described in section 9a of OMB Circular No. A-109).

CHART 8.

## MISSION ORIENTED
## DEPT. OF TRANSPORTATION R&D

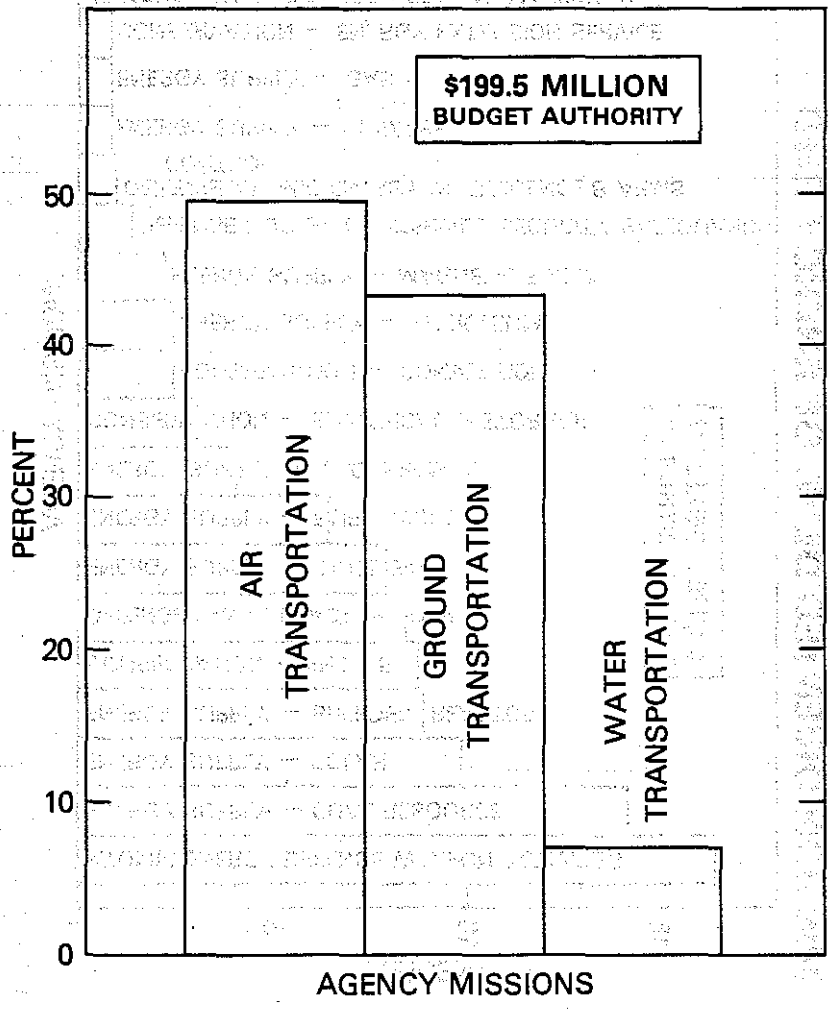


CHART 6.

## MISSION ORIENTED NASA R&D

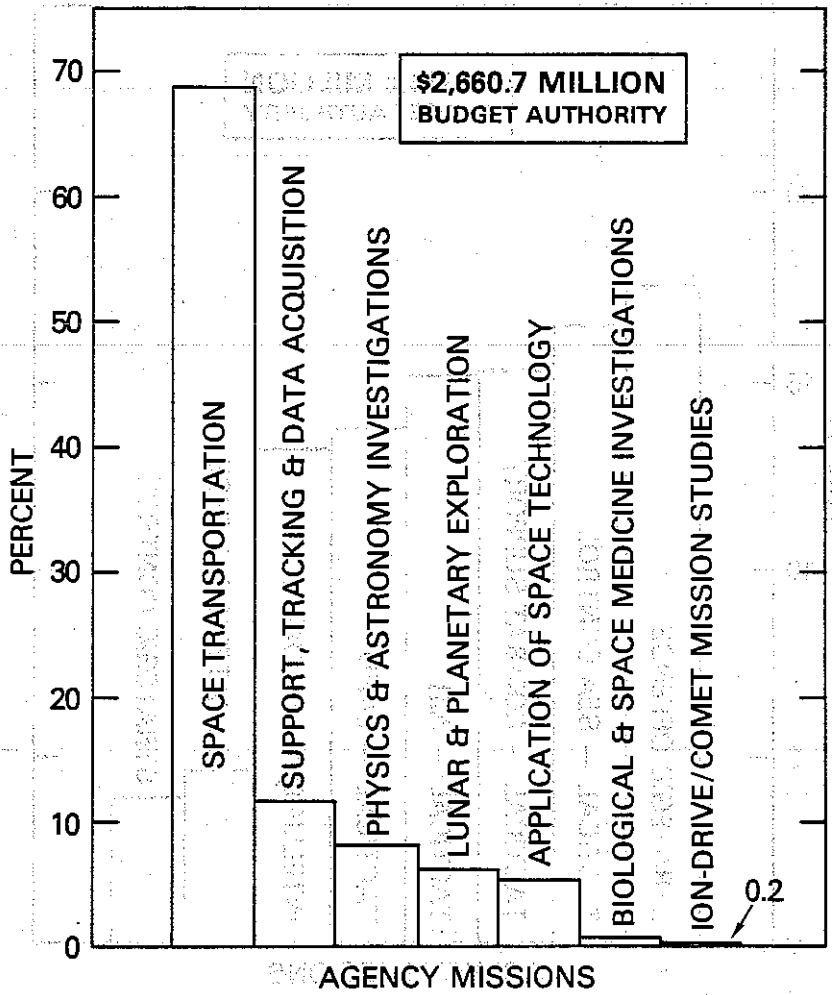
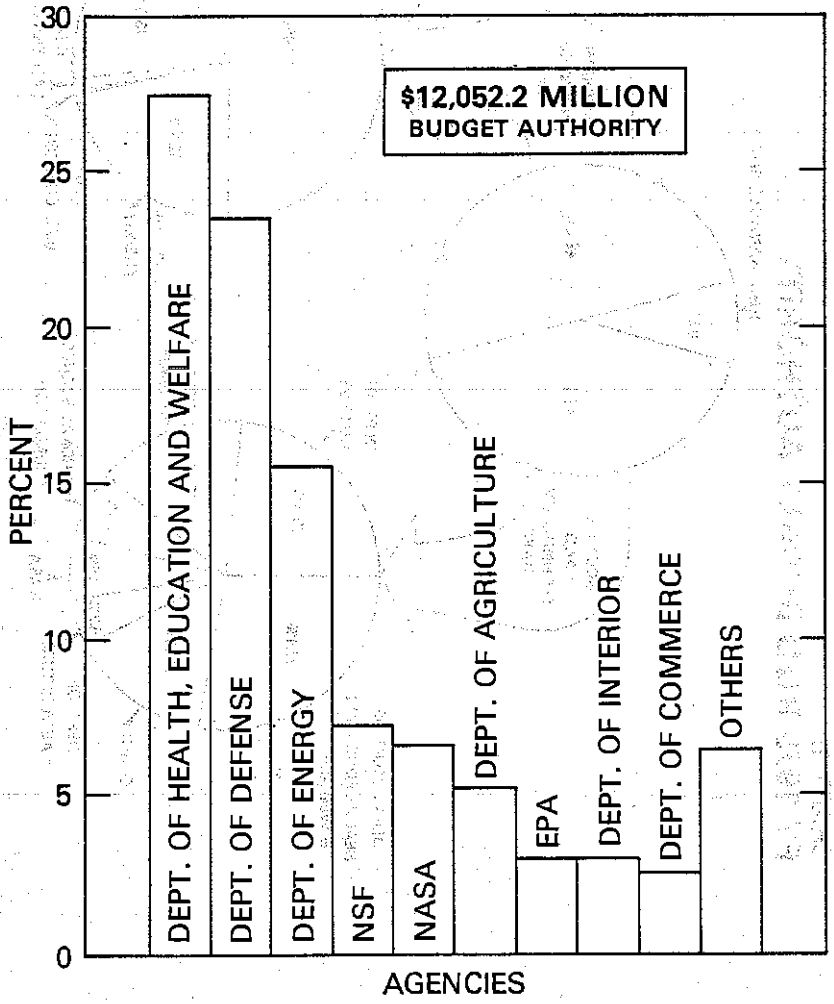


CHART 4 - AGENCY MISSIONS: FY 1979 R&D BUDGET AUTHORITY
(in millions of dollars)

| | | | |
|---|---|---|---|
| Dept. of Defense: | Strategic Offense | 1,466.5 | |
| | Strategic Defense | 384.4 | |
| | Strategic Control | 327.1 | |
| | Tactical Warfare - Land | 1,141.3 | |
| | Tactical Warfare - Air | 1,265.7 | |
| | Tactical Warfare - Sea Control | 1,371.0 | |
| | Tactical Warfare - Combat Support | 1,273.3 | |
| | Intelligence and Communications | 1,095.1 | |
| | Defense Total | | 8,324.4 |
| Dept. of Energy: | Energy Supply, Research and Technology Development - Biomass | 26.4 | |
| | - Coal Resource | 448.0 | |
| | - Gas Resource | 25.7 | |
| | - Petroleum Resource | 76.9 | |
| | - Solar | 310.8 | |
| | - Geothermal | 126.7 | |
| | - Magnetic Fusion | 70.8 | |
| | - Fuel Cycle R&D | 203.9 | |
| | - Breeder Reactor | 279.7 | |
| | - Nuclear Research & Applications | 249.7 | |
| | - Little Water Reactor Facilities | 6.5 | |
| | - Hydroelectric | 8.0 | |
| | Energy Supply, Production Demonstration, & Dev.: Alternative Fuels | 1.0 | |
| | Conservation: Elec. Energy Syst & Energy Storage | 93.9 | |
| | Conservation: End Use to Improve Efficiency | 277.5 | |
| | Conservation: Improve Conversion Efficiency | 77.0 | |
| | Conservation: Energy Extension Service | 25.0 | |
| | Atomic Energy Defense Activities: | | |
| | - Nuclear Materials, Security and Safeguards | 40.1 | |
| | - Weapons Activities | 522.2 | |
| | - Special Materials Production Process Development | 12.4 | |
| | - Naval Reactor Development | 265.6 | |
| | - Intelligence & Arms Control | 28.4 | |
| | Energy Total | | 3,166.2 |
| NASA: | Space Transportation | 1,827.7 | |
| | Expand Scientific Knowledge of the Earth's Environment, the Solar System and the Universe: | | |
| | - Conduct Physics and Astronomy Investigative | 211.2 | |
| | - Lunar & Planetary Exploration | 138.0 | |
| | - Life Sciences: Biological and Space Medicine Investigations | 16.2 | |
| | - Ion-Drive/Comet Mission Studies | 5.0 | |
| | Application of Space Technology | 157.2 | |
| | Support, Including Tracking & Data Acquisition | 305.4 | |
| | Space Total | | 2,660.7 |
| Dept. of Transportation: | Ground Transportation | 86.5 | |
| | Air Transportation | 98.9 | |
| | Water Transportation | 14.1 | |
| | Transporation Total | | 199.5 |
| Dept. of Commerce: | Oceans and Coastal Zone Policy | 7.5 | |
| | Oceanic & Atmospheric Tech. Dev. & Application | 17.5 | |
| | Maritime Business Environment | 4.6 | |
| | Maritime Tech Dev. and Application | 2.9 | |
| | Commerce Total | | 32.5 |
| | TOTAL | | 14,393.3 |

CHART 2.

## SCIENCE AND TECHNOLOGY BASE



I hope that this presentation of research and development data proves to be a useful supplement to the President's Budget.

Sincerely,

(Signed) Jim McIntyre

James T. McIntyre, Jr.
Director

Enclosures:

Identical letter sent to:

Robert N. Giaimo
Chairman, House Budget Committee

Warren G. Magnuson
Chairman, Senate Appropriations Committee

Edmund S. Muskie
Chairman, Senate Budget Committee

# Appendix V

Letter Dated May 17, 1978, to Hon. George H. Mahon, Chairman, Appropriations Committee, U.S. House of Representatives, From Hon. James T. McIntyre, Jr., Director, Office of Management and Budget

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF MANAGEMENT AND BUDGET
WASHINGTON, D.C. 20503

MAY 17 1978

Honorable George H. Mahon
Chairman, Appropriations Committee
U.S. House of Representatives
Washington, D.C. 20515

Dear Mr. Chairman:

On July 7, 1977, we wrote that we would develop additional information on fiscal year 1979 research and development (R&D) to supplement our other efforts to meet the requirements of Section 601 of the Congressional Budget Act of 1974 for a display of national needs, agency missions, and basic programs. Through this R&D focused review we seek to gain additional experience in portraying agency missions and thereby to lay the groundwork for future improvements in the presentation of budgeting data in terms of needs, missions, and programs.

I am pleased to submit at this time the additional mission-oriented R&D data. As noted in the President's FY 1979 Budget concerning the first overall national needs presentation, the enclosed charts and display are also, of necessity, experimental and subject to further discussion and improvement.

It is important to continue efforts to create budget aggregates that can better describe the end-purposes that the Federal Government seeks to accomplish. As the President stated in his budget message, our resources are scarce while the demands upon them are seemingly unlimited. In order to perform the difficult task of allocating these resources to important national needs, we must: (a) have a clear conception of what discrete end-purposes — national needs — we seek to accomplish; and (b) know which activities are contributing to achieving which of these ends.

The primary purpose of the mission-oriented budget display is to give the Nation's highest decisionmakers a framework within which the budget choices they make can be related to national priorities and not be just allocations of funds between intermediate activities or organizations which sometimes tend to become end unto themselves. Such an approach is also a useful supplement to zero-base budgeting under which, ideally, we would attempt to rank all the programs and activities that are, in fact, competing for funds to achieve a common or similar end-purpose.

Professional venture capitalists, accustomed to financing the creation of 12 to 15 new technology companies each year, have testified that their industry, in the past four years has been "lucky to finance any new high technology companies." This dearth of venture capital hurts more than small business; it threatens U. S. technological leadership.

Since 1965 the rate of inventions and innovations in the United States has declined markedly, while the number of U. S. patents issued to foreign nations has grown dramatically. This portends very serious consequences for U. S. technological leadership, and it has potential for increasing the pressure on our domestic growth and job creation capabilities, as well as lessening the competitive position in world markets.

In addition to this list of difficulties, small research and development businesses face a range of problems in the Federal Government itself, beginning with procurement policy. A memorandum, dated March 10, 1977, by Robert F. Trimble, Assistant Administrator for Contract Administration, Office of Federal Procurement Policy, states that "small firms encounter impediments in the federal research and development procurement process, not found in the private sector, in these areas: stability and efficiency of research and development funding; administrative requirements; nature and timing of request for proposals; treatment of proposals; contact with technical personnel."

Moreover, the memo affirms that the bulk of federal expenditures in research and development is in the development phase of technological innovations as opposed to basic and applied research. The largest share of this disbursement goes to larger firms. Paradoxically, small businesses have high capability in the basic research area, but lose their competitive position to colleges and universities and other federally-funded nonprofit research institutions.

If the Federal Government is to increase the utilization of small business in the research and development field, it must reduce the regulatory burden, especially procurement and new product regulations; require agencies to adopt uniform management practices for research and development contracts let through competitive bidding; expand access to research and development contracts for small businesses; and adopt government policies that will increase the availability of venture capital to high technology companies.

In addition, Congress must enact tax legislation that will encourage capital formation.

# APPENDIX IV

LETTER DATED SEPTEMBER 6, 1978, TO HON. THOMAS J. MCINTYRE, SENATE SMALL BUSINESS COMMITTEE, AND HON. JOHN B. BRECKINRIDGE, CHAIRMAN, SUBCOMMITTEE ON ANTITRUST, CONSUMERS AND EMPLOYMENT, COMMITTEE ON SMALL BUSINESS, FROM HILTON DAVIS, VICE PRESIDENT, LEGISLATIVE ACTION, CHAMBER OF COMMERCE OF THE UNITED STATES

ADVANCING VOLUNTARY LEADERSHIP IN A CHANGING WORLD

Chamber of Commerce of the United States
1615 H STREET, N.W.
WASHINGTON, D.C. 20062

HILTON DAVIS, VICE PRESIDENT
LEGISLATIVE ACTION
202-659-6140

September 6, 1978

Honorable Thomas J. McIntyre
Senate Small Business Committee
Washington, D. C. 20510

Dear Senator McIntyre:

The utilization of small business capabilities by federal agencies is of concern to the National Chamber, the largest federation of business people and business organizations in this country. Our 76,000 members span the spectrum of the diverse U.S. economic system and include more than 72,000 business firms; 2,600 chambers of commerce; and 1,200 trade and professional associations.

Over 56,000 of our business members, or 83 percent, have fewer than 100 employees; and over 31,000, or 46 percent, employ less than 20 persons.

According to a report by the Office of Federal Procurement Policy, small business received only 8 percent of the awards and 4 percent of the dollars from federal research and development contracts.

Clearly, steps should be taken by the Federal Government to utilize small business more in research and development activities.

This brief statement will attempt to point out the contributions of small business to the national economy in general and to research and technology development in particular; it will present information on impediments to growth of small business in technological fields and recommend steps to remove or reduce those impediments.

## Contributions of Small Business

The importance of small business to our economy is undisputed. There are 14 million business enterprises in the United States and 97 percent of them are small businesses, according to the Small Business Administration. They provide 55 percent of all private employment and account for 48 percent of the gross business product and 43 percent of the gross national product.

# APPENDIX III

## LETTER TO HON. JAMES T. MCINTYRE, DIRECTOR, OFFICE OF MANAGEMENT AND BUDGET, FROM GAYLORD NELSON, THOMAS MCINTYRE, AND JOHN B. BRECKINRIDGE, MEMBERS OF CONGRESS, OF AUGUST 10, 1978

GAYLORD NELSON, WIS., CHAIRMAN
IAB J. MCINTYRE, N.H.
NUNN, GA.
IAM D. HATHAWAY, MAINE
D K. HASKELL, COLO.
C. CULVER, IOWA
LOWELL P. WEICKER, JR., CONN
DEWEY F. BARTLETT, OKLA.
BOB PACKWOOD, OREG.
WILLIAM B. CHERKASKY, EXECUTIVE DIRECTOR
HERBERT L. SPIRA, CHIEF COUNSEL
ROBERT J. DOTCHIN, MINORITY STAFF DIRECTOR

United States Senate

SELECT COMMITTEE ON SMALL BUSINESS
WASHINGTON, D.C. 20510

August 10, 1978

The Hon. James T. McIntyre
Director
Office of Management and Budget
Executive Office Building, Room 252
17th and Pennsylvania Ave., N.W.
Washington, D.C. 20503

Dear Mr. McIntyre:

As you know, the Senate and House Small Business Committees have begun hearings on the role of small business in the national effort to encourage innovation. At the initial session, we reviewed a series of past studies showing that smaller enterprises account for more than one-half of all inventions and innovations. We are particularly impressed with a 1977 inter-agency study by the Office of Management and Budget (OMB). That study found small businesses "have compiled a striking record of innovation" and that this sector is under-utilized in Federal procurement of research, thereby creating a shortfall in the nation's innovation.

During the hearings, we commended the President for initiating a government-wide review of policies to encourage innovation.

Since a convincing case has been made for promoting increased innovation through assisting small business, we would like to request that action be taken at this time to commence such a policy.

For example, the first of the OMB recommendations is that Federal agencies develop formal programs for increasing R&D contracts for small research businesses. It would seem to us that such basic plans would be an essential foundation for any efforts to expand the small business half of the innovation process.

Our understanding is that implementation of this recommendation could be accomplished by Executive Order, and we would request that the OMB take such action at this time as groundwork for whatever other action may be taken pursuant to the OMB report, and the Presidential review when that is concluded.

100. Mansfield, Edwin, John Rapoport, Jerome Schnee, Samuel Wagner and Michael Hamburger, Research and Innovation in the Modern Corporation (Norton, 1971) 249p.

134. Rabinow, Jacob, "The process of invention" in David V. De Simone (editor), Education for Innovation (Pergamon, 1968) 189p.

135. Rabinow, Jacob, Statement to the House Subcommittee on Domestic and International Scientific Planning and Analysis of the Committee on Science and Technology (29 April 1976).

142. Rotondi, Thomas, Jr., "Creativity and organizational identification in research and development environments," Public Personnel Management, v.3, n.1, February 1974, p.53-58.

156. Schmookler, Jacob, "Inventors past and present," Review of Economics and Statistics, v.39, n.3, August 1957, p.321-333.

159. Schmookler, Jacob, "The size of firm and the growth of knowledge," Statement to the Senate Subcommittee on Antitrust and Monopoly of the Committee on the Judiciary (26 May 1965) in Zvi Griliches and Leonid Hurwicz (editors), Patents, Invention, and Economic Change: Data and Selected Essays (Harvard University, 1972).

163. Schumpeter, Joseph A., Capitalism, Socialism and Democracy (Harper and Row, Third Edition, 1950) 431p.

177. U.S. Commission on Government Procurement, Report (U.S. Government Printing Office, December 1972).

178. U.S. Commission on Government Procurement, Research and Development Study Group, Final Report (U.S. Commission on Government Procurement, February 1972).

179. U.S. Government, Public Law 94-282, National Science and Technology Policy, Organization, and Priorities Act of 1976 (11 May 1976).

183. U.S. National Science Foundation, Research and Development in Industry, 1973: Funds, 1973; Scientists and Engineers, January 1974 (U.S. Government Printing Office, May 1975) 85p.

184. U.S. National Science Foundation, Science Indicators, 1974 (U.S. Government Printing Office, December 1975) 250p.

## Stability of Overall Funding

Federal R&D funding is less stable than the situation faced by the small firm in the private sector. The small firm share is even less stable than the overall funding, according to the Research and Development Study Group of the U.S. Commission on Government Procurement, cited above. The following recommendation is taken from Section 102(c)(3) of Title I of the National Science and Technology Policy, Organization, and Priorities Act of 1976.

RECOMMENDATION ELEVEN. "Federal promotion of science and technology should... recognize the singular importance of stability in scientific and technological institutions...", considering small firms as a whole to be an institution.

## Advocacy and Quotas

The above recommendations will do much to remove the impediments faced by small firms in the Federal R&D procurement process. In the event they are insufficient, broader measures will be necessary. Quotas, goals, and increased set-asides are compelling but relatively rigid measures which involve a presumption that a proper and specific amount of small business participation can be established before the innovative ideas of both small and large firms are known. The establishment of quotas or goals would also precede the knowledge of the specific R&D needs. Advocacy, on the other hand, is less compelling but avoids these rigidities, since it operates on a case-by-case basis.

RECOMMENDATION TWELVE. If necessary, the advocacy and/or quotas for small business participation in the R&D procurement process should be increased.

The above measures should ensure that small firms will make a contribution to the Federal R&D process comparable to their contributions in the private sector.

impaired greatly rather than slightly. Waterman also asked how difficult it would be to reduce these administrative requirements sufficiently to remove the impediments to small business in competing for R&D procurements. Of the 370 with an opinion, 53% felt that it would be impossible or very difficult, 30% felt that it would be somewhat difficult, and 18% felt that it would be fairly or very easy.

The Office of Federal Procurement Policy is currently integrating and unifying the various procurement regulations. This will be an aid to small business, after small firms have adjusted to the new regulations. When the synthesis has been completed, the following recommendation will be in order.

RECOMMENDATION SEVEN. All administrative requirements should be scrutinized with a view to determining which requirements are not cost-effective when applied to small business, that is, which requirements incur costs to small business greater than the benefits resulting from the application of the requirements.

## Treatment of Unsolicited Proposals

If the small firm has identified an interest in R&D which will not be expressed in an RFP, it can prepare an unsolicited proposal. There is frequently a reluctance to fund unsolicited proposals because of the lack of competition. Consequently such proposals are often rejected and/or result in the issuance of an RFP based on the need addressed by the unsolicited proposal. (Using any innovative ideas from the unsolicited proposal would constitute a violation of proprietary information.)

Waterman (p.126) asked how often unsolicited proposals were received from large or small firms which resulted in the initiation of R&D procurements. Of the 528 with an opinion, 17% said very often, 74% said occasionally, and 9% said never. Waterman also asked how frequently small firms submitted unsolicited proposals. Of the 480 with an opinion, 12% said very often, 78% said occasionally and 10% said never.

As recognized by the Research and Development Study Group of the U.S. Commission on Government Procurement, unsolicited proposals are an important governmental method of obtaining creative innovations from the outside world (v.1, p.165). Also according to the Group, "The predominant method by which small businesses achieve support is the unsolicited proposal" (v.2, p.101). Consequently, it seems in order to repeat a Commission recommendation being implemented by the executive branch.

The second reason why it is more difficult to identify Government needs and their timing is that the overall needs are established by a bureaucratic and political process which is not as orderly and therefore harder to predict than the market process of the private sector. At this overall level, it is easier to identify the Government needs once they are established, but their timing is harder to predict.

Identifying Government needs takes the forms of interpreting a Request for Proposals, identifying the context of an RFP so as to better understand the work desired, anticipating the issuance of an RFP to avoid the rush of preparing a proposal in the time allowed, and identifying Government interests in R&D which will not be expressed in an RFP but might include interest in an unsolicited proposal. As the system now operates, all of these forms of identifying Government needs can best be accomplished by contact with technical Government personnel, an activity in which the large firm has an advantage of scale. As the U.S. Commission on Government Procurement put it, "small business firms...are at a disadvantage in pursuing sales opportunities...since they usually have limited resources" (v.1, p.132). Danhof (p.237) adds: "The firm that first becomes aware of an agency's interest in an area through the receipt of a Request for Proposal will normally find itself severely if not impossibly handicapped should it wish to submit a proposal.... A staff experienced in dealing with the government also offers the advantage of interpreting an agency's expression of a specific interest by considering it against a broad background." Mansfield et al found in their sample that "40 percent of the firms said that there was often insufficient time to respond to requests for proposals" (p.60).

These impediments to small firm participation are not found to the same extent in the private sector; they lead to the following recommendations.

RECOMMENDATION TWO. The period during which responses are accepted to a Request for Proposals should be lengthened in not a few cases.

RECOMMENDATION THREE. "... agencies should clearly specify in RFPs as precisely as possible the limits of what they are prepared to accept...." (Biderman and Sharp, p.40).

TA 2

FEDERAL R&D OBLIGATIONS TO ALL PERFORMERS, FY 1975
(Millions of Dollars)

| Agency | Obligations to All Performers: Industrial Firms Amount | Industrial Firms % | All Performers | Total R&D | Research: Basic | Research: Applied | Development |
|---|---|---|---|---|---|---|---|
| Defense | 5606.837 | 62% | 9012.472 | 9012.472 | 3% | 17% | 80% |
| NASA | 1791.797 | 58% | 3064.413 | 3064.413 | 8% | 18% | 74% |
| ERDA | 501.588 | 24% | 2072.252 | 2072.252 | 12% | 17% | 71% |
| Transportation | 161.911 | 52% | 311.563 | 311.563 | * | 17% | 83% |
| NIH | 97.073 | 5% | 1845.518 | 1845.518 | 28% | 59% | 13% |
| Interior | 63.766 | 23% | 280.810 | 280.810 | 39% | 38% | 23% |
| EPA | 51.078 | 20% | 257.657 | 257.657 | 7% | 48% | 45% |
| NSF | 17.744 | 3% | 595.021 | 595.021 | 82% | 14% | 4% |
| Agriculture | 1.635 | * | 420.082 | 420.082 | 37% | 59% | 4% |
| Total Above | 8294.229 | 46% | 17859.788 | 17859.788 | 11% | 23% | 65% |
| All Agencies | 8385.317 | 44% | 19044.260 | 19044.260 | 11% | 25% | 64% |
| Coverage: Total Above as % of All Agencies | | | | 94% | 94% | 87% | 97% |

Source: Science tion (f coming)

The percentage of R&D obligations going to industrial firms varies from less than 1/2% for Agriculture to 62% for Defense, with an overall percentage of 44% for all agencies. The percentage breakdown of R&D obligations to all p formers into basic research, applied research, and development again indicates a basic pattern with respect to de ment: agencies with a greater percentage of development in their R&D use industry more. The notable exception to is ERDA, which had 71% of its R&D in the form of development but 64% of the total in the form of obligations to Federally Funded Research and Development Centers.

Overall rates of small business participation in obligations to all performers can be calculated by multiplying t small business percentage of total business awards (from Table 1) by the ratio of industrial obligations to oblig to all performers. In descending order, these overall rates are: Transportation 16.6%, EPA 7.5%, NASA 5.6%, Inte 4.8%, Defense 3.5%, ERDA 1.6%, NIH 1.4%, NSF 1.4%, and Agriculture 0.4%. The overall rate for all nine agencies is 3.6%. These calculations assume that the differences between the business awards data and the indust obligations data are distributed to small and large firms in the same manner as the business awards data.

TABLE I

FEDERAL R&D AWARDS TO BUSINESS, FY 1975
(Millions of Dollars)

| Agency | Awards to Business: Small Business Amount | Small Business % | Awards to Business: Total Business | Obligations to Industrial Firms: Total R&D | Research: Basic | Research: Applied | Development |
|---|---|---|---|---|---|---|---|
| Defense | 316.4 | 5.6% | 5601.5 | 5606.837 | 1% | 14% | 85% |
| NASA | 216 | 9.6% | 2255 | 1791.797 | 2% | 9% | 90% |
| ERDA | 16.773 | 6.5% | 258.166 | 501.588 | * | 12% | 88% |
| Transportation | 25.304 | 31.9% | 79.224 | 161.911 | - | 16% | 84% |
| NIH | 25.188 | 25.9% | 97.073 | 97.073 | - | 54% | 46% |
| Interior | 12.904 | 21.0% | 61.499 | 63.766 | 2% | 53% | 45% |
| EPA | 44.360 | 37.2% | 119.264 | 51.878 | - | 55% | 45% |
| NSF | 7.946 | 45.6% | 17.420 | 17.744 | 37% | 50% | 13% |
| Agriculture | .5 | 100.0% | .5 | 1.635 | 27% | 57% | 16% |
| Total Above | 665 | 7.8% | 8490 | 8294.229 | 1% | 14% | 85% |
| All Agencies | | | | 8385.317 | 1% | 14% | 85% |
| Coverage: Total Above as % of All Agencies | | | | 99% | 94% | 97% | 99% |

Sources: Awa from agencie obligations National Sci Foundation ( coming).

The amounts going to small business range from $1/2 million for the Dept. of Agriculture to over $300 million for D The percentages of total business awards going to small business range from 5.6% for Defense to 100% of the small Agriculture amount. For the nine agencies as a whole, small business receives $665 million, or 7.8% of total busine awards.

Agencies with a high proportion of development in their R&D obligations to industrial firms have a relatively low r of small business participation. Defense, NASA, and ERDA have the highest proportions of development in their R&D industrial obligations and the lowest proportions of small business awards to total business awards. Transportation is a notable exception with a large element of development but a high rate of small business participation. NIH, In and EPA all have approximately 45% development in their R&D obligations to industrial firms; their small business participation rates range from 21% for Interior to 37% for EPA. NSF and Agriculture have the smallest emphasis on development and the highest small business participation rates.

The small firm offers its employees "the opportunity to influence their own environments to a greater extent... many small companies offer a more powerful appeal to those technical people who are particularly confident of their own abilities.... Many large firms typically hire great numbers of men just out of college, many of whom are relatively unproductive until they have acquired some 'seasoning.' It is extremely difficult to appraise a young, technically trained person.... By contrast, small firms typically hire men who have already demonstrated technical competence in larger organizations.... It is difficult to evaluate performance in the large development organization... and large-company personnel policies often make it extremely unlikely that he will be fired for mediocre performance" (Cooper, p.79).

## Summary of Differences between Small and Large Firms

The differences described above between the incentives and capabilities of small and large firms and the individuals comprising them do not, as a whole, clearly favor either the small firm or the large firm. It becomes necessary then, as it would in any event, to look at the empirical evidence.

## Empirical Evidence

In 1975, Kamien and Schwartz surveyed the empirical work that had been done on the innovative capacities of small and large firms. These studies were characterized by a limited number of innovations and/or industries considered. Taking the studies as a whole, Kamien and Schwartz (p.11) found that "There generally appear to be economies of scale in the innovation production function up to a modest size...", that is, innovation appears to be more efficiently accomplished as firm size increases up to a modest size. Concerning the output of innovations vs. firm size, they found that "the evidence indicates that research output intensity does tend to increase and then decrease with increasing firm size" (p.3).

Since then Gellman Research Associates have completed a study for the National Science Foundation (NSF, December 1975) on 500 major innovations which were introduced into the market during 1953-73 in the United States, the United Kingdom, Japan, West Germany, France or Canada. "The innovations were selected by an international panel of experts as representing the most significant new industrial products and processes, in terms of their technological importance and economic and social impact" (p.100). Of the 319 innovations produced by U.S. industries, 24% were produced by companies with less than 100

This leads into an advantage of small companies, "where communications between development, production and marketing are easy and a common objective, with strategies to implement it, can be understood by all concerned" (Dayton, Harlow, and De Noghton; p.5). This must be qualified by the realization that "there is a tendency on the part of the small company to contract out more of its specialized R&D work... about one-third of all industrial R&D contracting is done by small companies" (Hogan and Chirichiello, p.312). Also, some large firms partially replicate small firm ease of communications by instituting small project teams for new products.

Schmookler (1957) found that about 20% of inventions patented in 1953 came from employees in the operating end of industry who were, almost without exception, employed by small and medium-sized firms. His explanation of this phenomenon in 1965 (p.44-45) is worth quoting at length, for it has broad implications: "I would suggest that there is a marked difference in both opportunity and incentive between an operating man in a small firm and one in a large firm...

(a) A simple increase in size of the enterprise tends to make the productive process less comprehensible to the men who engage in it, simply because each man sees less of it.

(b) Big firms tend to be more than mere scaled-up versions of small ones: they cut the work up finer and narrow each man's responsibility, thereby further reducing his range of vision. Understanding less of what is going on, each man is less able to contribute to its improvement...

(c) ... The extreme division of labor and the larger numbers of individuals involved create a greater need for coordination and control by management, and of one tier of managers by another above it. Each man's influence is watered down, and his suggestions have less chance of acceptance... The channels of communication tend to become clogged if only because they are so long...

(d) As the organization becomes more formal, engineering and research men who are supposed to do the thinking tend to resent and discount suggestions by production and sales men who are supposed to do the doing..."

As Schmookler points out, innovation requires more approvals in the large firm, which may not be forthcoming: "In a complex organization the overriding problem often is maintaining an

## Firm Incentives

By definition, the small firm begins with a smaller share of the market than the large firm and therefore has more to gain from innovation, unless the large firm is entering a new market. This comparison must be tempered by two considerations. First, if the large firm can affect price by changing its output, it can capture more of the benefits accruing to the users of the product by keeping output restricted, thereby keeping the price higher. Second, the larger firm has an incentive to innovate to forestall being preempted. As Schumpeter (p.85) put it: "The business man feels himself to be in a competitive situation even if he is alone in his field." But potential competition will not, in general, be as compelling as existing competition, particularly as felt by the small firm.

The small firm has relatively more to lose from an unsuccessful innovation in the sense that it is more likely to go bankrupt. But the large firm has a greater potential absolute loss to the extent that the innovation would make productive equipment obsolete. This leads to a difference in the kinds of innovations valued: "The largest company, which obtains the biggest economies of scale and hence high profits from existing products, has a strong interest in cost-reducing improvements in production techniques which further strengthen its position. Small companies which are having difficulty in competing in the big league for existing products have a bigger incentive to try to enlarge their market share by innovating radically new products" (Layton, Harlow, and De Hoghton; p.72).

Overall, the small firm would seem to have a greater incentive to innovate, particularly in the form of new products, and particularly if the driving force of the firm is not adverse to taking a risk.

## Firm Capabilities

The second group of differences between small and large firms are the capabilities of the firms as a whole. The first point to be made is that the average size of the R&D establishments in large firms is roughly 100 times the average size of small firm R&D establishments. According to National Science Foundation data (May 1975, Tables B-13 and B-25), the average company which had less than 1,000 employees and which performed R&D in 1973 had three R&D scientists and engineers. The corresponding figure for companies with 1,000 employees or more was 281 R&D scientists and engineers. This means, of course, that certain projects are simply beyond the scope that small

## THE APPROPRIATE SMALL FIRM SHARE

The question of whether small firms have an appropriate share of Federal R&D procurements is not amenable to anything resembling precise measurement. In discussing the "fair proportion" language of small business legislation, the U.S. Commission on Government Procurement said that "Fair proportion can be a rigidly defined or a fluid concept. A rigid definition, such as awarding a fixed percentage of Government procurement to small business, would not be in the Government's interest, even though the percentage might be adjusted from year to year. We believe fair proportion should be recognized as a working concept that expands or contracts from year to year with the types of procurement by the Government, state of the economy, and fluctuations of particular industries" (v.1, p.127-128). To address this working concept, it is necessary to examine the performance of small firms in the context of what can be accomplished by Federal R&D contracts with industrial firms.

In the first instance, there is the work for which the Government has contracted. How do small firms perform? This is part of the larger question of small firm innovative capacity vs. resources expended, which is discussed below. But Waterman addressed this particular part of the question in his 1971 survey of 568 technical and procurement personnel "who have any influence on the selection of sources for R&D procurement" (p.181) in 47 offices in the Department of Defense, National Aeronautics and Space Administration, and the Department of Transportation. These offices were estimated to be 71% of the number of offices procuring R&D in these three agencies. Waterman asked how effectively small firms have performed on R&D contracts, as compared to large firms. Of the 485 respondents with an opinion on this question, 82% felt that small firms had performed adequately or better as compared to large firms, 29% felt that small firms had performed fairly effectively or better, and 9% felt that small firms had performed highly effectively.

The second aspect of what can be accomplished by Federal R&D contracts with industrial firms is business use of the R&D performed. This is also part of the larger question of small firm innovative capacity addressed below. This particular aspect of the question may not be of major importance, for as Arthur D. Little, Inc. put it in a recent study for the Experimental Technology Incentives Program of the National Bureau of Standards, "Federally-funded civilian research and development is not sufficient to bring about technological change in the private sector to any significant extent" (p.1).

## FEDERAL R&D OBLIGATIONS TO ALL PERFORMERS, FY 1975

(millions of dollars)

| | Obligations to All Performers | | | | | | |
|---|---|---|---|---|---|---|---|
| | Industrial Firms | | All Performers | Total R&D | Research | | Development |
| Agency | Amount | % | | | Basic | Applied | |
| Defense | 5706.837 | 62 % | 9012.412 | 9012.412 | 3 % | 17 % | 80 % |
| NASA | 1791.797 | 58 % | 3064.413 | 3064.413 | 8 % | 18 % | 74 % |
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| Transportation | 161.911 | 52 % | 311.563 | 311.563 | * | 17 % | 83 % |
| EPA | 97.673 | 5 % | 1845.518 | 1845.518 | 38 % | 59 % | 13 % |
| Interior | 63.766 | 23 % | 280.810 | 280.810 | 39 % | 38 % | 23 % |
| NIH | 51.818 | 20 % | 257.657 | 257.657 | 7 % | 48 % | 45 % |
| NSF | 17.7444 | 3 % | 595.021 | 595.021 | 82 % | 14 % | 4 % |
| Agriculture | 1.635 | * | 420.682 | 420.682 | 37 % | 59 % | 4 % |
| Total Above | $7244.329 | 46 % | 17859.788 | 17859.788 | 11 % | 23 % | 65 % |
| All Agencies | $8385.317 | 44 % | 19044.260 | 19044.260 | 11 % | 25 % | 64 % |
| Coverage: Total Above as % of All Agencies | | | | 94 % | 94 % | 87 % | 97 % |

Source: National Science Foundation (forthcoming).

The percentage of R&D obligations going to industrial firms varies from less than ½ % for Agriculture to 62% for Defense, with an overall percentage of 44 % for all agencies. The percentage breakdown of R&D obligations to all performers into basic research, applied research, and development again indicates a basic pattern with respect to development: agencies with a greater percentage of development in their R&D use industry more. The notable exception to this is ERDA, which had 71 % of its R&D in the form of development but 61 % of the total in the form of obligations to Federally Funded Research and Development Centers.

Overall rates of small business participation in obligations to all performers can be calculated by multiplying the small business percentage of total business awards (from Table 1) by the ratio of industrial obligations to obligations to all performers. In descending order, these overall rates are: Transportation 16.6 %, EPA 7.5 %, NASA 5.6 %, Interior 4.8 %, Defense 3.5 %, ERDA 1.6 %, NIH 1.4 %, NSF 1.3 %, and Agriculture 0.4 %. The overall rate for all nine agencies is 3.6 %. These calculations assume that the differences between the business awards data and the industrial obligations data are distributed to small and large firms in the same manner as the business awards data.

7. Profit-making firms should not be excluded from making proposals or receiving awards on R&D work that is not assigned to in-house laboratories.

8. Agencies should consider allowing greater amounts of independent research and development and bid and proposal costs than currently authorized when negotiating contracts with small technology based firms.

9. Methods should be developed for collecting and reporting data on small business share of R&D contract awards.

10. Establish small business set-asides similar to those for supplies.

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

- Submittal of unsolicited proposals is frequently discouraged.

- Burdensome administrative requirements for contract solicitation, evaluation, award, and performance impair the ability and desire of small firms to compete for R&D contracts.

Conclusions

Though the responsibility for retention of a high technology capability in the United States is shared by both the private and public sectors, the large annual Federal expenditures for R&D places a unique responsibility on Federal agencies. New techniques must be devised to encourage innovation by all sources, with particular emphasis on small R&D firms. In the placement of R&D work, Government managers should carefully consider the ultimate beneficial effect of using small firms and not give undue consideration the immediate security that may appear to exist by awarding R&D contracts to large firms.

RECOMMENDATIONS OF AD HOC INTERAGENCY PANEL

The interagency panel chaired by Mr. Rabinow developed the following recommendations based on its analysis of this problem:

1. Federal agencies should develop formal programs which encourage the increase of Federal R&D awards to small technology based firms.

2. Large research and technology programs should be divided where feasible into discrete parts to permit solicitation of proposals and award of contracts to small technology based firms in lieu of making a limited number of awards with consolidated requirements that only large firms can accomplish.

3. Subcontracting to small firms should be encouraged in contract solicitations, source selection criteria, and negotiations for R&D work. A prime contractor's record in subcontracting to small technology based firms should be a factor in fee awarded in award fee and incentive type contracts.

SUMMARY OF REPORT OF WILLIAM K. SCHIRER

Importance of Small R&D Firms

Many analysts believe that small firms have a better record for innovation than large firms. Richard Morse recently wrote that "a disproprotionate number of innovative ideas emanate from our smaller technically based companies."* The reasons for this phenomenon are varied. Some believe that managers of small R&D firms have a greater incentive to innovate while conversely, in some cases, the marketing plans of large firms dictate that technical improvements to their products be held to a minimum. There also is a possibility that researchers in large firms tend to overspecialize to a greater extent than researchers in small firms. Mr. Rabinow has observed that, "When one narrows his specialization, he probably comes up with fewer ideas. If one loads the dice in favor of a certain art, one cuts off analogous arts, which I think are important. The more an inventor can pull out of related and unrelated arts, the more original his ideas are likely to be."

Empirical evidence indicates that in a comparison of firms with less than 1,000 employees and those with over 1,000 employees:

- Firms with less than 1,000 employees accounted for almost one-half of major U.S. innovations during 1953-73.
- The ratio of innovations to sales is about one-third greater in firms with less than 1,000 employees.
- Firms of less than 1,000 employees have a ratio of innovations to R&D employment which is approximately four times greater.
- The cost per R&D scientist or engineer is almost twice as great in firms of over 1,000 employees.

Federal Government Utilization of Small Firm Capabilities

A striking disparity appears to exist between the capabilities of small technology based firms and their utilization by Federal agencies. Data collected by the National Science Foundation and supplemented by the Office of Federal Procurement Policy shows that only eight percent of Federal R&D contract awards to industry and only about three and one-half percent of obligations to all R&D performers** were made to small firms in FY 1975; that

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* Op Cit

** Industry, in-house laboratories, educational institutions, and federally financed R&D centers.

## Executive Summary

### Findings

1. Small firms have compiled a striking record of innovation in the private sector:

   - Firms with less than 1,000 employees accounted for almost 1/2 of major U.S. innovations during 1953-73.
   - The ratio of innovations to sales is about 1/3 greater in firms with less than 1,000 employees than in firms of over 1,000 employees.
   - Firms of less than 1,000 employees have a ratio of innovations to R&D employment which is approximately four times greater compared to firms with more than 1,000 employees.
   - The cost per R&D scientist or engineer is almost twice as great in firms of over 1,000 employees than in firms with less than 1,000 employees.

2. Small firms receive 8% of Federal R&D awards to industry and about 3 1/2% of obligations to all performers, including in-house performers of R&D. The share of companies with less than 1,000 employees in total company R&D funds, including subcontracts, is 1/3 greater than their share of Federal R&D funds.

3. Small firms face impediments in the Federal R&D procurement process, not found in the private sector, in the following areas:

   - stability and efficiency of R&D funding
   - administrative requirements
   - nature and timing of RFPs
   - treatment of proposals
   - contact with technical personnel.

In establishing the panel, we noted the increasing concern that our Country will lose significant high technology capabilities absent a concerted effort to increase small business research and development awards by the Government. The report of the panel, which is attached, confirms this concern. As a means to bring the recommendations of the panel to the attention of executive branch agencies, we have drafted the attached memorandum on which we would appreciate your views. Comments on this proposed action are requested by April 1, 1977.

/s/ Robert F. Trimble

Robert F. Trimble
Assistant Administrator
for Contract Administration

Attachments

cc:
OFPP/CA:File/Chron/Reading
Mr. Trimble
Mr. Currie
OFPP/CA:RFTrimble:bes 3/9/77

have done just as well on these procurements.

His answer was: "Well, I did not know you people existed."

I said: "Well, what effort did you make to try to see if anyone existed?"

He laughed and said: "Well. you have to realize that when I come in in the morning there is a stack of procurements two feet high on my desk."

He said: "These things go across my desk so fast that if I blink I might miss something."

He said: "By the time these procurements come to my desk, they have justification that it not be a set-aside from the contracting people and from the technical people and from other people, all kinds of justifications.

"By the time it gets to my desk, it is too late. I do not have the time to really do anything about it because I have so many of them."

So, what I am really saying is this. There are apparently a lot of people out there who carry a title of small business specialists, but there does not seem to be a very effective mechanism of educating and bringing the small business specialist together with the small businesses out there which do certain things and then tie that together with people within the location that have a certain need.

From my standpoint, I have tried to do this myself. It is terribly inefficient. It is extremely costly, and the normal response when you make an inquiry is that you get back a great big packet of forms—particularly form 129. Every agency, every location has its own slight variation, so there is no such thing as xeroxing one and sending it to everybody.

Also, you supposedly end up on computer lists, and I have never found one that works.

So, there is some area there that could be improved in the efficiency where the needs are brought together with the vendors through the small business specialists.

Apparently they have the interest. They certainly have the manpower. But somehow they need more help than they are getting.

Mr. GLOVER. Has the Small Business Administration been helpful to you?

Dr. GARBER. The Small Business Administration, up until recently, has been pretty useless to me.

The reason is that the Small Business Administration just is not set up to handle the kinds of problems and the kinds of questions that affect some science technology-based companies like my own. They deal with gas stations and things like that. They can do that fine.

Apparently there is a very good chance that there is a new era at the SBA right now. There is a new person named Milton Stewart who is head of the Office of Advocacy. I believe Mr. Stewart is very much tuned in on the need to have some type of recognition of the problems of the firms that I have addressed myself to. They are unique enough that perhaps within the SBA they should be looked at a little bit differently than everyone else has been looking at them.

There does seem to be some encouragement that something like that might happen. If it did happen, that would really be good. Then you could talk with people who understand that you may be wanting to buy a piece of equipment worth $100,000, but a year from now it might only be worth $10,000.

Also, I wonder if you think that minimum small business amounts, which forced the National Science Foundation to begin actively working for small business could be applied, as well, on a larger scale? Should we set similar amounts for other agencies?

Dr. GARBER. I am familiar with the program at the NSF. One concern I do have about it is that I am not convinced that people at NSF have a sufficient understanding of the workings of the private sector to be able to identify areas already existing in the private sector that this program might be hurting.

For example, I gave an example of the regional instrumentation facilities program. It had the appearance of a grand idea and it had the appearance of helping everybody, but there was not anyone in NSF who was able to realize that in their effort to help one part of our private sector they were going to be hurting another part.

So, my answer really is not that it is not good. It may be good. I am just concerned, though, that there are not enough devil's advocates over at NSF to make sure that in the process of helping one firm they are not, in fact, hindering the innovation in another firm.

Mr. GLOVER. You are talking about the solicitation program?

Dr. GARBER. I am talking about the program that Dr. Sanderson described this morning.

Mr. GLOVER. The innovation center or the small business effort?

Dr. GARBER. The small business program which they have a phase I and a phase II. I think they call it the small business innovation program where they give out grants to demonstrate the feasibility for phase I and then phase II as a follow-up.

Mr. GLOVER. Could you address yourself to the second part of the question as to whether we should have the minimum small business amount required of other agencies?

Dr. GARBER. Philosophically, I am against this, but I think the realities are such that that is the only way we are going to accomplish what we are after here.

I would much prefer to compete with a Franklin Institute on an equal footing, knowing that they are competing according to the same ground rules rather than gain an award because we fell into some quota for which our competition could not qualify.

What are the realities? Overnight could the ground rules be adjusted so that Franklin Institute now has to compete against a firm like mine on an equal footing? Would that be the case? Probably not.

So, in the end having some type of quotas probably would be much better than having no program at all.

Ultimately, however, I think everyone would benefit if non-profit organizations were not able to compete unfairly against private sector firms. Let us make everybody live according to the same ground rules.

Mr. GLOVER. You mentioned several discussions about the problems with university funding. Can you think of a way in which we could work this out where universities would not be put out of the business entirely, but industry would still be able to do its part?

Dr. GARBER. Let me use my example of the regional instrumentation facilities program. I am as much a product of our university system as I trust that you are. I do not think that any of us want to

was like to be a small businessman and compete against someone who does not pay taxes.

At the conclusion of my testimony—March 14—Congressman Waggonner made the following statement:

Mr. WAGGONNER. I want to thank Dr. Garber for having the intestinal fortitude to come down and speak up for a struggling small business for something I think exists not just in Philadelphia in the Franklin Institute, but in many, many more instances, and I think it is something the committee should take a look at.

You let this go unchecked, and every State university, every State institution, everyhody with something in the way of professional capability to maintain their tax-exempt status, they will finance it with outside work, and this was not the intent of their being.

To date, no action has been taken. Considering the substantial efforts of my part and others similarly situated to state legitimate problems requiring congressional and Federal action, it is simply shocking that nothing has happened. There is no way to adequately verbalize my frustration with a governmental process that fails to be responsive.

My great concern at this time is that recommendations already before your committee and the administration to assist small science/technology firms will not be implemented on a crash basis or any basis.

I turn now to recommendations.

I do not expect that actions will be taken immediately to solve all the problems I have shared with you today. However, I can think of no reason why the recommendations in the Rabinow report cannot be implemented by January 1, 1979.

Problems which I have described which are not effectively addressed by the Rabinow report are real ones which seriously interfere with innovation and deserve your priority attention in seeking solutions.

I thank you for this opportunity to appear before your committee. I will be pleased to answer any questions about my testimony.

Mr. GLOVER. Thank you very mueh for your statement.

Let me ask you a couple of questions.

This subcommittee has done extensive analysis of the future of small business. No matter what data we have examined, be it profits, sales, market share assets, we have found that small business is losing out.

Despite the declining role of small business elsewhere, small business has maintained its importance in the area of innovation.

Could you explain this apparent inconsistency?

Dr. GARBER. This is a difficult kind of question to respond to, but I think it really comes down to the concept that you have to be inuovative just to survive. It is hard to verbalize, but I will try my best to do it.

Innovation is somewhat of a mental process. Maybe you could even liken it to a muscle, since if a muscle is not used, it atrophies. You use your brain cells to innovate, even if it is to innovate to survive.

You develop an ability to be innovative.

The small businessman today, with the problems he has and the regulations that he has to deal with, which have nothing at all to do with science and technology, has learned to become innovative just to survive.

The small businessman today may be losing sales and he may be losing market shares—I will accept those as statements, although I

other hand, one that prostitutes its charter by performing commercial services in the private sector.

I will not try to think my way through it now, but I would like to keep this channel open and pursue it further.

I would welcome anything you would want to add.

Any other information or material or data that you would like to have incorporated in the record, make it available and then we will ask you to respond to counsel's questions.

Dr. GARBER. Fine. Some programs, as wrong and as detrimental as they are to the small science/technology business community, are actually being encouraged by the Federal Government.

For example, several years ago, the National Science Foundation set up a "demonstration" project at Case Western Reserve University, Cleveland, involving the field of surface analysis, and specifically involving a new emerging analytical technique called ESCA—electron spectroscopy for chemical analysis.

Part of the funding came from NSF and the other part from local Cleveland industry.

Although in other parts of the United States, private capital was being invested to set up commercial ESCA services, the NSF funding has destroyed any possibility for a private sector ESCA service to exist in Cleveland.

The industrial "contributors"—and "contributors" should certainly be in quotation marks—get their ESCA services done more cheaply than if they were done in the private sector, and the university and the faculty member in charge quite understandably have become strong proponents for this program. This has become a very big business—all helped with NSF funding.

Some NSF officials claim this program to be a substantial success and have used it as an "example" for future NSF programs. But for the private sector vendors of R. & D. services, it has been an unmitigated disaster, and future projects of this type spell disaster for segments of the private laboratory analytical community.

Just the threat of such centers being established is making it extremly difficult for firms such as ours to borrow the funds for new scientific equipment.

I turn now to the NSF regional instrumentation facilities program which I would like to use as my next example. This is a program that is still being put together, and the initial awards are yet to be made.

In mid-April of this year, I became aware of a new proposed program being organized by NSF. In a sense, it was like reading my own corporate reason-for-being, as after referring to the ever-increasing cost of analytical instrumentation, NSF was proposing to set up regional facilities around the United States to make such instrumentation more readily available to industry on a time-shared basis. Supposedly, this was one NSF response to the Congress desire that it do more for the private sector.

Of course, I was flabbergasted, inasmuch as for 8 years I had been investing in my own regional instrumentation facility which, by now, had expanded to the point where many substantial R. & D. projects could be undertaken. Although the NSF program announcement did, in fact, state that private firms could apply, anyone familiar with such announcements clearly read this to be just another aid-to-academia program.

free entry of scientific equipment, even though it is clearly destined for substantial use for the benefit of commercial firms.

I was referred to the Department of Commerce—which had referred me to Customs.

The answer was that Commerce rules on the technical merits, and Customs rules on the information contained in the duty-free entry application. However, Customs has no enforcement procedure in the event the duty-free items turn out to be used for commercial purposes.

As a not-for-profit, Franklin can apply for duty-free entry whereas private sector firms cannot.

3. The U.S. Postal Service.

Inquiry was made as to why Franklin can send out advertising material under their nonprofit mailing permit. The Postal Service said that the not-for-profit status granted by the IRS is sufficient; if the activity meets with approval at IRS, then it is OK with the Postal Service.

4. The Federal District Court—*Structure Probe, Incorporated* v. *Franklin Institute*, eastern Pennsylvania—No. 72–2071.

In October 1972, a two-count suit was filed by our firm against Franklin alleging antitrust violations and violations of its corporate charter.

After numerous delays on the part of the defendant, an astonishingly slow Federal court system, a 5-week Federal trial, and almost $100,000 poorer, a decision was finally handed down against us in May 1978.

We could not convince the Federal court that Franklin was violating the law.

We remain convinced that there are significant differences between not-for-profit and for-profit commercial firms, and that the court did not take proper consideration of these issues. We are in the process of appealing the decision.

If our efforts to apply existing laws to the abuses we have identified ultimately fail, it only will emphasize the need for reform in present laws and policies.

The next area that I would like to go into by way of an example is unfair competition from universities.

I do not want to confuse, now, the Franklin Institute with the universities. It is not a university. It is strictly a not-for-profit, section 503(c)(3), like Battelle, Stanford Research, and institutions like that.

A second shock I have experienced is blatant competition from universities. Take Lehigh University in Bethlehem, Pa., as an example.

We routinely encounter Lehigh competitively, as they are very much in the business of selling research services to industry. But they do it in what appears to be a very devious way.

From what I can piece together, what they have set up is an industrial affiliates program. Major firms listed on the New York Stock Exchange in the Allentown-Bethlehem, Pa., area contribute a sum of money annually which qualifies them as an affiliate.

The rumor is that the commercial firms show the payment as a contribution, and some parties annually publicize it as a contribution to Lehigh. But it appears to be a disguised payment for future services to be rendered.

The services are, in fact, performed on expensive electron microscopes, electron microprobes, and surface analysis, and other equipment—virtually identical to the type owned by our firm.

At Du Pont, I continued working in that area, as I was in charge of a major electron microscopy facility which was used for solving various problems of importance to the plastics department.

These were exciting times for me because for the first time I was able to appreciate how my basic understanding of polymer physics generally and of electron microscopy specifically, could be harnessed to solve pressing problems of the Du Pont Co.

However, after 1½ years, I began to get bored. My salary increases were "determined by the computer." An office mate, who reported for work 7 months before I did, received raises 7 months before I did no matter how well I performed. I knew what my raise would be from what his raise was.

I had a feeling of loss over my own destiny. If I wanted to remain in basic research as opposed to advancing up the ladder of management, it seemed as if I was doing at age 27 what I would be doing for the rest of my life. And no matter how well I did—or did not do—in future years, I sensed that my salary increments would always be determined, at least to a major degree, by the "computer."

By the fall of 1969, I knew I had to make a change, and what I was looking for was a place where I would be 100 percent accountable for my own technical decisions. If I made the right one, I wanted to benefit. And if I made the wrong ones, I was perfectly willing to suffer the consequences. I saw no alternative but to form my own framework, meaning my own business.

Structure Probe, Inc. came into existence in April 1970. After a very rocky and painful startup period, we slowly began to establish ourselves as a regional instrumentation center for performing scanning electron microscopy—SEM.

At the time, an SEM with associated accessories cost over $100,000, and it still was a new emerging instrumental method, yet to become an accepted tool for research.

Through my background, both at Case as well as Du Pont, coupled with then-current understanding of the literature, I was able to appreciate the potential for the SEM better than most, particularly for industrial applications.

Not only did we have a state-of-the-art SEM, but also a state-of-the-art understanding of its potential use in an industrial laboratory to solve problems.

My predictions have proved correct because the SEM was the "growth" instrument of the solid state sciences of the 1970's.

Structure Probe, Inc., has played a nationally recognized role in the application of the SEM to industrial research and problem solving.

The last areas I would like to touch upon are going to be some concrete examples of Government policies which have seriously stunted our future growth.

While I take great satisfaction from establishing and nurturing my own small science/technology firm, I want to share with you ways in which the Government has created a legal and policy environment which has seriously stunted my growth, diverted my energies, limited my ability to innovate, and eroded my future potential.

My focus will be on a few aspects of Federal inhibitions to innovation but ones special to the plight of many small technology-based laboratories and private professional services firms.

Remember, we are not actually speaking about items as cheap as automobiles but scientific instrumentation costing $100,000 or frequently more.

It should be no surprise then, that the attitudes developed by students in graduate school become the dominant ones as the student makes he transition to the industrial researcher. The student learned well, and he, too, like his teachers, has not learned the concept of doing it for the least amount of money.

He, too, wants to build up his empire, purchase more equipment, hire more people, and become a department manager—all of which will enable him to earn a higher salary—irrespective of what is actually being produced in his laboratory.

What is it, then, that enables the faculty member and researcher in large industry to purchase facilities far beyond their actual costs? To me, the phrase that describes it best is "lack of accountability."

In the university setting, the facility member is dealing with a Federal funding agency and through the proposal process, is applying for funding.

The Federal review and audit process does not make faculty members accountable for how moneys are spent. And if a faculty member proposes the purchase of a Cadillac rather than a Chevrolet even though a number of Cadillacs already exist nearby on his very own campus, it seems to matter not. The Cadillac gets approved; accountability is absent.

Representative BRECKINRIDGE. Let me interrupt at this point.

You are sounding like another witness we had yesterday, I think it was, who made the point that they were really not engaged in innovation and development until you reach that point where you had an item that would reach the market. But there is a lot of research going on directed for research purposes and not for marketing purposes.

I do not know whether this is part of the same pattern or not.

Dr. GARBER. It is a little different than what I am trying to say here. I know myself that if we really need something, then we buy it. But if we can get by, basically accomplishing the same thing with less money, then we might go somewhere else and do it. That is the way we will do it.

But in a university setting, everybody wants to build up their own empires. The field that I know best, namely, electron microscopy—there are Chevrolets and Cadillacs. But there is a lot of prestige associated with buying a Cadillac.

Representative BRECKINRIDGE. Then I take it, without having any specific case in mind, that the testimony we had from earlier witnesses, namely the HEW witnesses, with particular reference, perhaps, to that portion of the statutes which they say impose on them the requirement of doing business with not for profit and/or thereby educational institutions or other foundations, is perhaps one of those nonproductive Federal investments that you have reference to here; is that right?

Perhaps then that section of the law should be looked at in the context of your commentary.

Dr. GARBER. I think you are anticipating one of my major conclusions by a few pages.

To grasp the fundamental consequence of this conclusion to the future health and well-being of the U.S. economy requires a precise understanding of what we mean by innovation—something the OMB document fails to do.

How can we measure our position in innovation, unless we agree on some definition and how it is to be measured?

This gets me to my second major area of the definition of "innovation."

"Innovation" is to science and technology as money is to banking. Without it, we all agree, there would be no leadership in science and technology. Without it, the United States would lose its position as the world leader of science and technology.

The dictionary defines "innovation" as: (a) the introduction of something new, and (b) a new idea, method, or device:

Certainly, one might cite: One, the number of patents applied for, or two, the number of patents issued as measure of the extent of innovation deriving from a certain segment of the technical community.

I would maintain that this view is too narrow, as there are many areas where one can be innovative, but the action does not turn up in the patent statistics.

I recall that Dr. Hess yesterday was making this point also, that there are many areas of innovation that do not show up in statistics like that.

Too often, we look at a particular development or product, draw some conclusion about it, but seldom ask: "At what cost?"

I am a great believer that the biggest fool, given enough time and money, can do anything, but the truly smart, the truly innovative person is the one who can get to the same end result using the least amount of time and money.

Some of our foreign trading partners are learning how to get more technical development per unit cost than we can. For the same cost they develop two new products to our one. That, gentlemen, is another valid example of innovation.

Representative BRECKINRIDGE. May I interrupt?

What suits your convenience in terms of how we proceed? Do you want the committee to interject as we go along or wait until you are through?

Dr. GARBER. Whatever you would like to do is fine with me, Mr. Chairman.

Representative BRECKINRIDGE. Inasmuch as we are following your draft, it will not hurt to interrupt.

One of the problems I have with these hearings that we are engaged in is this.

There is the generality of the statements that are made. This is not intended as a criticism. We speak from our knowledge and our experience and we arrive at general conclusions and then these are what we address our attention to.

Wherever it is possible to document or illustrate—not just with a "for instance" or an example—I think for the purposes of the record later that it is useful and wherever you would find it would contribute to the record to supplement later in that regard, I wish you would feel free to do so.

I know I am putting a burden on you, but I would open the record to that.

solving problems not only for industrial but for Government and academic clients as well.

The work we perform covers a wide range of scientific disciplines, from metallurgy, ceramics, and electronics to polymers and the life sciences. I should really say that our activity is in virtually every area where solid materials are made or created or studied or worked with.

Our gross sales, including those from a related microscopy supply division, are slightly over $1 million annually.

My technical and professional career started with a B.S. in chemical engineering at the University of Illinois in 1963, and continued with an M.S. in 1965 and a Ph. D. in 1967 from Case Institute of Technology in Cleveland.

I have lectured widely, both to professional society meetings and as a consultant to a number of private firms.

Structure Probe, Inc., was founded in 1970 with virtually no capital and from an initial two employees, has grown to an organization employing about 25, approximately half professional, spread between three locations, two in the United States and one in Canada.

I am very proud of the fact that in 8 years of business, which covered some tough economic times for small businesses, we have never laid off a single person for lack of work.

I am greatly honored to have this opportunity to share with you some thoughts on the subject of science, technology, and small business. During my few minutes before you today, I should like to accomplish several objectives:

1. Define what to me is a science/technology-based small business.
2. Define what to me is "innovation." You will note that in the entire 2 days of testimony, except for one witness, there was virtually no attention to what we really do mean by innovation. The one reference that I can recall was from Mr. Baruch. I think innovation itself was used in the definition.
3. Comment on the recently released OMB document prepared by the Rabinow panel dated March 10, 1977.
4. Describe the founding of Structure Probe, Inc., its growth and some of the problems we face.
5. Provide examples of Government policies that have seriously stunted our future growth. These are as follows:

First. to assess the impact of unfair competition from the not-for-profit Franklin Institute as a private sector scientific laboratory; second, describe the effect of unfair competition from academic institutions on the small high technology firm; third, analyze the relationship the NSF regional instrumentation facilities program has to the innovation process; and fourth, document the past Government history of doing nothing to help a small high technology firm like mine.

Let me start first with the definition of science/technology-based small business, or I should say, my definition.

The reason why I think this is very important at this point is that we are really dealing with a special breed of animal here. We are not talking about small businesses generally.

When I refer to small technology-based businesses, I am not talking about automobile dealerships which conduct their businesses in 1978 just as they did in 1968. Nor am I speaking of hair styling salons, insurance sales firms, or even small bakeries or machine shops, or a myr-

One or the other should probably take leadership. I would agree with you.

Mr. GLOVER. Thank you very much.

The other part of my question, I guess, is this.

Do you think you will have a program something like the National Science Foundation program on the drawing boards or are you at least going to evaluate the possibility of coming up with such a program?

Mr. TASHJIAN. Our requirements are generated in a different form than theirs. Our requirements are program specific. Recognize that I do not generate requirements, but I execute them.

So, our requirements tend to be generated by people on electric vehicles or in the solar program or the fossil program. They are related to technologies in which they have concerns.

Like enhanced oil and gas recovery, for example.

Mr. GLOVER. If you explored the NSF program a little bit more, I think you will find they set out specific areas that they had need for information in. They designed it. They did not just solicit for anything. They designed specific areas and said: "We need ideas in the area of so-and-so."

Mr. TASHJIAN. To some extent our program works like that, but it is not as structured as theirs, from what I can see. But I think it is a comparable system because it is generating forward requests for basic research in some areas where we do not have knowledge.

The solicitation document asks for a solution to a certain problem. We get a multitude of technologically different approaches and different risks and different costs risks and different time periods.

We have a program similar to theirs, but from what I heard today, theirs is much more structured. They examine a universe and identify areas and go at it in a much more structured way.

I think we are accomplishing close to the same thing in the energy area.

Mr. GLOVER. Thank you.

As you stated, we will look forward to continue working with you.

Mr. TASHJIAN. Yes, we will be happy to do that.

Mr. ZEPP. We want to thank you for your testimony.

At this point we will take a short recess.

[Recess taken.]

Representative BRECKINRIDGE. The committees will come to order.

Mr. Patten?

## STATEMENT OF HON. EDWARD J. PATTEN, A U.S. REPRESENTATIVE FROM THE STATE OF NEW JERSEY

Representative PATTEN. I am particularly happy to introduce Dr. Charles A. Garber to you today.

As you know, my district is in the heart of the single largest research and development concentration in the world. Firms such as Dr. Garber's, those small high-technology firms, are thought of by other firms as being as much of a natural resource for an area as cheap power and water. Firms such as Dr. Garber's act as magnets for attracting new technology-oriented industry to an area.

I am now encouraging the Congress and the administraton to implement specific policy recommendations for firms such as Dr. Garber's

to approve the product for technical feasibility and commercial viability.

They submitted their product and their statements to NBS and got a letter back which really did not refer to any specific reasons for turning down their product. But their product was turned down.

They were flabbergasted when it happened. They are in the process of being written up in national magazines, such as Popular Mechanics, Mechanics Illustrated, and several others.

As far as commercial viability goes, they already are selling nationally and have orders coming in to fill. Their problem is getting the capital so they can fill those orders.

As far as technical feasibility goes, NBS told them that it was not technically feasible because plastics do not work in solar collectors.

This week one of the gentlemen came down to Washington and went over and met with the people with NBS who turned their project down. He came back to see me after he did. He was flabbergasted at the reaction and the lack of awareness on the part of the people at NBS as to what their product actually was all about.

He generally felt their product had been turned down just because of a bias against plastic, a bias which they, themselves concede. It was a problem they had encountered, that is, that plastics have many problems. They do not last for many years. They do not have the expanding ability when the water freezes.

The point is this. Their product was something new. It is something that is used in telephone wires and other things which are subject to severe sunlight and weather pressures and which stands up.

They went to NBS and NBS turned them down.

NBS is reevaluating the product and hopefully their answer, particularly now that the gentleman came down to Washington, went in and spent a day talking with them, will be different.

But it is a problem that exists in the country. This one, again, is not one that is particularly one for the Department of Energy because they were not going for a research and development grant. They were going for commercial funding for capital for commercialization purposes.

Hopefully, the solar loan bill that we passed will provide them with that loan if they cannot get one before it is on line.

I guess that is all I have.

Mr. Glover?

Mr. GLOVER. I would address this to you. I do not know whether you were here when the NSF testified.

Mr. TASHJIAN. Yes.

Mr. GLOVER. He described the small business solicitation program at NSF as saying that they had received awards.

I wonder to what extent you have a very similar program, either in existence or on the drawing board, which would allow that kind of innovative approach to the whole area of research and development?

Mr. TASHJIAN. I think to some extent we have something in common with the National Science Foundation in the sense that unlike NASA or DOD, we do not consume our own technology. We are interested in furthering technology, but limited to the energy areas.

I think the National Science Foundation may be looking at broad areas of national need which may be outside the energy field.

There is the feeling that DOE is not there to help new ideas.

My original question was going to be with regard to the NBS–DOE energy-related invention and evaluation program. To turn the focus off the Department of Energy for a moment, my question to you was going to be, what degree of competence do you have in the technical expertise of NBS?

Mr. TASHJIAN. I am not sure I am technically qualified for this. I would say this.

A large number of proposals have gone to the National Bureau of Standards. If I understand correctly, some 50 of them have come to us, so I think it represents a fairly small percentage.

Whether or not they are receiving ideas for inventions that are without merit, or whether they are too narrow in their definition, I do not know, but I would say that from where I sit it has not been a particularly successful program. We have not had a large number, however.

I mentioned unsolicited proposals. I ought to repeat that.

Any individual who has an idea which is unique and unknown to us can submit unsolicited proposals. We encourage that. We have a booklet that tells people how to submit them. At one time we had a peak of over 5,000 unsolicited proposals in-house. I think we currently have 2,000-and-some.

Mr. ZEPP. Could you give us a breakdown on the percentage of small business contracts which go to unsolicited proposals?

Mr. TASHJIAN. One of the things that I have done in our data system is this: As of about a month ago, we now identify all proposals, if they are small business. Obviously, when you get a letter from a company, he does not normally say that he is a small business. He presents his idea.

I have asked that we identify anyone coming from small business. We look at the acceptance rates so we will be able to answer that question.

However, I would say this. The ones I have looked at show me that there is a large number from individuals and small companies and universities. Our acceptance rate is something around 30 percent or 35 percent.

So, I have to say that in my judgment a substantial number have gone to small business. I cannot prove it. However, I have begun to develop the statistics, so I will, at some point, be able to do that.

I always hold this door open. If an individual or technically oriented small business feel they have an innovative idea, they should then submit it to the Department of Energy. It will be evaluated. It will receive an acknowledgement and the proposer will receive an appraisal of his idea.

Another thing we have done is this: In the solar area we have shown a preference for small business concerns in the solicitation document.

For example, for our solar nonresidential program, we have encouraged teaming arrangements with small business manufacturers of solar equipment in our solicitation document. We had four categories:

Category 1 was that the solar system as supplied by a small business and that a small business concern was going to participate alone or as a part of a joint venture or a consortium.

Department of Energy that any kind of construction contract for $2 million or less must go to small business. That is not in R. & D. but is an example of what can be done.

As far as I know, that is the highest threshold of any Government agency. That works for construction. So I have asked for a list of procurement items that we could call class set-asides. We are reviewing the list at headquarters that the field submitted.

So I think there are a number of initiatives which in the aggregate will move that percentage up. I am optimistic.

Representative BRECKINRIDGE. I do not want to take any more time, Mr. Chairman.

I want to thank the gentleman.

I think these initiatives are promising. I think the committee, along with Mr. Baldus' committee, will be interested in any additional suggestions you may have. We make it a practice to keep the record open. If we have any further questions, we will take the liberty of letting you have them also.

I have great hopes that the joint experience of all these agencies, as reflective of the President's task force in this particular area of very limited investment, from your point of view, will be very large, of course, from a national point of view. This will result in the exchange of experience and ideas such as you have outlined here, which will expedite the process.

Mr. TASHJIAN. I am sure they will.

May I make one additional comment? I mentioned this to Mr. Baldus.

I think part of our concern is this. I meet with a lot of small business companies and small business associations. Their concern is for the complexity and the redtape of the Government procurement process.

That is a valid observation. However, I think in part the constraints we operate under are self-inflicted.

The Commission on Government Procurement a few years ago identified some 39 socioeconomic programs that we piggybacked on the government procurement process.

I think that system has gotten more complex. We use the Government purchasing power to sort of pursue every goal or try to do everything in this country. We have made it so complex that it is very difficult for an average man to get a Government contract.

What I have recommended is this. Maybe those programs are at too low a threshold. Maybe they should apply at $100,000 or $50,000 and not at $2,500 like a lot of them are. It would not be as onerous to small business concerns. That is an area that we talked about.

Maybe it is an area where Congress could do something to say:

Well, for small business concerns we will waive the cost accounting standards or we will waive vocational rehabilitation or we will waive "hire the veterans," or whatever the clause might be that causes the filling out of forms and the surveillance onsite and so on.

Representative BRECKINRIDGE. Thank you.

Representative BALDUS. Mr. Breckinridge and I will have to go to the floor. We will turn this over to counsel.

Mr. ZEPP. Mr. Tashjian, the line of questioning that Mr. Breckinridge has been pursuing is significant to the discussion we were having

a terminal in each of our offices so we can access the centralized computerized list.

I have to say in all fairness that my job is buying. It seems to me there are other agencies in this Government which are responsible for creating central lists and making them available to every department.

I think we have shown some initiative on our own to create a mechanized list. We have paid contractors. We have paid a minority firm to go out and find for us high technology firms. We started off with 63,000 names. He went to every Government department. He went to small business associations. He went to business development corporations. He netted for us 750-some companies who were viable and who could bid on that kind of high technology work that we do.

We have reproduced that list. We have given it to all our buying offices and we have given copies to GSA, SBA, and others.

I am saying in response and in self-defense, I guess, that I have exhausted all my known sources and I have certainly expended a lot of effort in trying to locate those firms and trying to make those firms available in establishing a system that challenges every buyer to see if he can go to a small business.

Maybe 2.6 percent is good or bad. I do not know. All I know is that I am making substantial efforts to locate those firms.

I have dealt with the American Association of Small Research Companies. It is the only association I know that is an association of small research companies. We have sponsored, for the last 2 years, symposia. We have paid for their newsletter for the last 3 or 4 months, that is, the Department of Energy has paid for them.

I have other initiatives which I have outlined in my statement. I think in the aggregate we are taking what could be reasonably expected for us to do to get awards to small businesses. I certainly am receptive to any suggestions there might be as to what else we can do.

We do participate with the Small Business Administration. We have a number of good initiatives going in advertising our efforts.

I can go through a more structured form. Some mention was made of the Rabinow report. I am familiar with it. I was a part of an interagency group that reviewed it. We came back to our ageney and we looked at what we could do to implement those recommendations.

If you like, I can tick off some of the things that we have done.

However, just exortation in and of itself will not get us anywhere. I think we have tried in a structured manner. We do it through people. We had a 2-day conference of all of our DOE small business representatives where we talked about goals and performances.

In a motivational area we assigned goals and we trained our people and devised forms.

Representative BRECKINRIDGE. I do not want to beat this one to death. I do think the point is very simple. You are having less luck than a lot of other people around. Maybe you are trying harder because you are second. I do not know, but if so, you will end up first.

Mr. TASHJIAN. I am trying to get there.

Representative BRECKINRIDGE. I will trust that 2.6 is going to show some sort of dramatic change through the efforts you are describing. If all of these efforts result in your ultimately reaching an increasingly large audience, then you are going to reach it. There should be a dramatic change in this percentage.

You have established the exception to the rule, if it does not change.

If you want to talk about capital investments, break them out. I will take that part out of our conversation. If you want to talk about major capital investments or Clinch breeder reactors—which the President may or may not veto and which may or may not ever get into being—and if you want to talk about a gasification plant and/or liquification plant—which we may or may not ever have and if we do we will only have two or three of them—then set those aside and put any price you want on them.

But let us talk about what is left. Let us talk about the record there in terms of your program. Then let us talk about what we really want to be talking about, which is not what you have done since you have inherited and put together the multiplicity of agencies which nobody holds anyone responsible for except the Congress, but let us talk about what is going to be done.

Mr. TASHJIAN. Yes. I think, however, that I will respond in this way.

When you look at basic research, I think we have a multitude of basic researeh programs that involve a lot of small concerns. They involve a lot of universities.

The ability of small companies to respond in the researeh side where large capital investments are not involved is the area in which there is the greatest payoff, as you have said.

But sometimes there is recognition that some of the large development eontracts that we have had do not go to small companies because a large capital investment is a requirement. That is the point I was trying to make.

I think you have made a good point.

Representative BRECKINRIDGE. I will not argue with the major capital investment point. That is not what we are addressing here today.

Who is responsible for the implementation of whatever policy you may have with referenee to the maximization of small business participation in the R. & D.? Where does this show up on your chart?

Mr. TASHJIAN. It is my responsibility. I would like to describe for you the cycle in which it operates.

When a Government aetivity or program manager decides that he wants to make a purehase for goods or services or development or whatever it is, he will generate a purchase request which says: "I want researeh in this area." or "I want support service." or "I want to buy production of something." That request comes to the activities that are under my function or responsibility.

We have a form in DOE whieh we utilize to examine every purchase request to see if it is acceptable for small business or minority business or if it ean be broken out.

We do that so that we will try in every case to see if, in faet, there is adequate justification for setting it aside for small business. We make a substantial number of set-asides.

So, I am saying that the customer tells me what he wants. Then I decide if we can get it from Small Business.

Sometimes we get into a wrestling contest, but we try. We do that on a 100-percent basis. Every proeurement is reviewed. So I have not only institutionalized the system, but we look at it again.

Representative BRECKINRIDGE. What sort of staff have you assigned to this evaluation in the analytical process that determines the competence of small business and its availability and the savings?

3. Definition of research and development procurement to be used in the Federal Procurement Data System:

FPR 1-3.211 - "...experimental, developmental, or research work, or for the manufacture or furnishing of property for experimentation, development, research or test."

Sincerely,

M. J. Tashjian, Director
Procurement and Contracts
Management Directorate

You have not addressed part of the remaining $6 billion with that argument, as far as I am concerned.

Mr. TASHJIAN. We had some discussion here earlier about what percent of the DOE procurement budget goes to the nuclear weapons and to the nuclear testing and weapons production. About half of it does.

So, if you back out that portion which is involved in the design and test and production of nuclear weapons, it is approximately half of our procurement budget.

Representative BRECKINRIDGE. That would leave us with a figure of $2.5 billion for commercial, if you want to call it that, or nondefense, if you want to call it nondefense.

Mr. TASHJIAN. I have not included Clinch River in that.

Representative BRECKINRIDGE. One hundred seventy-nine million dollars of $2.5 billion is what percent? It is not much of a percent at all.

Mr. TASHJIAN. It is not.

Representative BRECKINRIDGE. It is at the bottom of the totem pole.

Let me go at it another way.

Mr. TASHJIAN. I am saying this.

Representative BRECKINRIDGE. Let me go at it another way.

On a contract basis how many go to majors and how many go to small business? I am not talking about reference to dollars.

You said you had a maximum of $50,000 per grant. I do not want to limit you to that.

Mr. TASHJIAN. That was one program. I was giving an example.

I do not know the number on an award basis.

Representative BRECKINRIDGE. I do not know that it indicates anything. I am trying to get a handle.

Mr. TASHJIAN. If I had to guess, I would say it is a higher number.

Representative BRECKINRIDGE. How many contracts of what size have you with major oil companies, for example, in the area of research and development?

Mr. TASHJIAN. I really cannot tell you off the top of my head. I am saying this. You have a good point.

A more representative figure would be numbers rather than dollars because one large dollar program tends to dwarf.

If you would like, I will try to determine that number and submit it for the record.

Representative BRECKINRIDGE. Fine.

Representative BALDUS. Without objection, so ordered.

[Subsequent information was received and follows:]

paperwork on these proposals. There is the booklet and the pre-addressed sheet.

So, yes, I think you are right. I think we need to do more of that. We need more publicity.

Representative BALDUS. I am interested. I will ask the committee counsel to follow that and to look into that particular facet of the problem.

Are there questions?

Mr. Breckinridge?

Representative BRECKINRIDGE. Thank you, Mr. Chairman.

I understand we are talking roughly about a $7 billion procurement budget, $6.9 billion, plus; is that right?

Mr. TASHJIAN. Yes.

Representative BRECKINRIDGE. I believe 10.3 percent of that, or $179 million goes to procurement for small business.

I understand that 2.6 percent of that goes to R. & D. small business procurement; is that right?

Mr. TASHJIAN. Yes; I think that is in the ballpark, yes.

Representative BRECKINRIDGE. Without becoming involved in the differences of opinion and just taking the testimony, have you heard the other witnesses here today?

Mr. TASHJIAN. Not the full day, but I have heard enough to answer you.

Representative BRECKINRIDGE. The striking thiug about these data—and I am not trying to argue it because I just want to get to a point of discussion with you—is that where we have a stated average of 23 percent to 26 percent of Federal procurement dollars going to small business, we find that the R. & D. dollar, or a percent of that, is around 3.5 percent. We have been, as you know, complaining about the relative insignificance of that investment in that segment of our business community.

Our testimony shows that it is at half the cost of R. & D. investment in major companies and that it generates more than half the innovation development and inventions of the Nation at less than half the cost and at 2.6 times the effectiveness.

So, here we end up with one of larger procurement dollars in one of our most important areas where innovation and development has got to be the guideline. It is the smallest of investments, if we take just national averages.

I guess the question is: Are these data correct? And, if not, I want to be corrected.

Go right ahead.

Mr. TASHJIAN. There is a question in my mind as to the definition of research and development. I notice that one of the witnesses talked about the lack of a good data system. I would be the second to verify that.

It is very difficult when you have thousands of transactions. I have 41 activities around the country which are involved in the procurements of grants or some sort of activity. It is difficult to get commonality of definitions to try to arrive at some hard statistics.

What is research and development to one man is not to another. If you have a demonstration or if you are building a pilot plan, is that research development or are wo talkmg about basic research or engi-

guarantee area, for example, we have $30 million set-aside for small business, of which $9 million has now been granted. We have had two guarantees go through for small business. The remaining $21 million is available. We have advertised that in the Commerce Business Daily.

So, in the Department of Energy we do more than just handle contracts. We handle grants and loan guarantees. I am trying to move the small business rationale into those areas also. It has not been done in the past.

I think we are moving in the right direction. I cannot give you numbers yet, but I think in the loan guarantee program, we have two or three areas where we have been able to do this, such as in the electric, hybrid-vehicle, and the geothermal loan guarantee program.

I will try to set a certain percentage aside in the unsolicited proposals and examine the same thing in the grants area.

Representative BALDUS. This committee, I am sure, as you know, will be giving you continued support in that. We can assure you of our interest in that.

I would like to turn to the GAO report. Do you have a copy?

Mr. TASHJIAN. I do.

Representative BALDUS. On page 4, the second paragraph, reads: "We did not verify what was included in the 10.3 percent reported by DOE because supporting documentation for that amount was not readily available.

"DOE officials responsible for making this computation told us that supporting documents are not normally kept at headquarters and the data base at which those documents were based has since been updated to include data from all DOE predecessor agencies and no longer reflects the same amount."

I do not quite understand what that means.

Mr. TASHJIAN. We do not keep a copy of all the contracts because we have several field activities which write contracts. We require a quarterly report of their statistics.

What we have in the headquarters is a computation of the data. If you were to ask me, for example, if the San Francisco office reported 8 percent of their awards for small business and if you asked us to show those contracts, I do not have them. All I have is a report of that office.

In addition, bear in mind that the Department of Energy was a merger of ERDA, FEA, and FPC. So, what has happened is that in amalgamating our records, it is pretty hard to get an audit trail to the predecessor agencies.

So, we were trying to make two points. One is that we do not have a copy of every DOE contract in Washington. We are decentralized.

Second, there have been some perturbations since DOE was formed on October 1 which might be difficult to reconstruct and audit.

But it is a one-time abboration. I think from here on in, you can clearly see the performance of all our field offices which will be available.

The GAO wanted to say: "Trace the performance of one of our field offices." Then they could have their field office in California visit the DOE field office in San Francisco and say: "You reported this. Would you show us the awards against your base?"

some people would view our nuclear program as a highly technologically successful program.

So, I guess I am really not in a position to comment whether or not there would be greater technology advancement if they were small business concerns.

These facilities do, of course, subcontract some elements to universities and to other research activities.

It is difficult to give an assessment as to whether or not we are paying a penalty by having a large corporation operate those facilities.

Representative BALDUS. I understand there are two sides of that. There is the military. A portion of that is either secret or top secret at some level of that. Then there is the research and development for resolving our energy problems.

It would seem to me that the Government-owned and operated entities are Government property. I know it is not in your bailiwick, but can you describe how you make available to the public that information which logically is bought and paid for by the public and is available to them?

Mr. TASHJIAN. The areas of non-nuclear energy, where there is no classification problem, is about half of our work. I do not want to overemphasize the nuclear side. It is about 50 percent of our procurement budget. But the other 50 percent is not.

It is in fossil and solar and other areas in which there is a requirement to transfuse that technology.

We have a clause that we put into our contracts that requires the rendering of a report. That report goes to our technical information center. It is the center in Oak Ridge, Tenn.

That repository at Oak Ridge is available to the general public. They can write and get copies of any reports rendered by any contractor.

So, we recently had an exercise of monitoring that situation to see—including this clause—whether or not reports are flowing to Oak Ridge and what the usage is.

Our review showed that in some cases we failed to include that clause. So we have issued a letter to remind our contracting officers that they are to put that clause in there to say, as "a condition precedent to completion of final payment of the contract, this report must be rendered to the Technical Information Center."

Then we are doing some post-surveillance. We are looking to see to what extent it has been complied with.

However, you see the principal mission of the Department of Energy, if you take out the nuclear side, is, in fact, to push technology and put it in the public domain.

So, there is a fairly substantial amount of resources at the Technical Information Center. I guess maybe 80 or 100 people are involved in maintaining and making available to the general public all those technical reports.

There is a very structured effort in that area.

Representative BALDUS. Our business is small business here. But the business of any company is to make money. If they are very close, very familiar, and very intimate with the developments, then it would seem to me they would be the first beneficiaries which would be able to spin off and use that in some other related field.

Do you anticipate that DOE will follow GAO's recommendation?

Mr. TASHJIAN. I think we can break it out. I think we can do that. I think the report is slightly misleading. Let me explain.

This reporting procedure predated my coming to ERDA, and now DOE. It is not my invention.

However, these plants that are Government owned that are operated by contracts historically have been treated as an extension of the Government, that is to say, their budget is integrated with the DOE budget.

It is not in the sense of a prime contract that we might give. It is in the sense that they are part of an establishment predating from the AEC.

Another manifestation of their specialized character is this. GAO itself, will recognize protests by subcontractors to these Government contractors when normally they will not entertain protests from subcontractors.

So, they are then placing these facilities in the same mode as the Government. They are entertaining the protests from the sub.

When you look at the integrated budget and when you look at the manner in which they are executing, in a sense, the Government mission, I think that the administrations in the past—and I continue to feel this—that they are an extension of the Government. They are agents expending our money. It is not like writing a normal prime contract.

In the past it had been included as a part of the agency performance.

If you break it out separately—I think there should be an understanding that it really is a part of our principal arm.

I meet with the purchasing agents. There is a far different relationship between these prime contractors who operate Government-owned facilities in the nuclear field than there is in what I would call all other contractors.

We do not report the subcontracts from the other DOE contractors. But historically these GOCO contractors have been part of the organization.

What GAO said was that they recommend that we break it out. We will be happy to do that. From my point of view they operate, in a great sense, as an agent of the Government.

Representative BALDUS. Is the prime contractor's responsibility passed on to the subcontractors?

Mr. TASHJIAN. Yes; they do. But again, let me say this.

For these operating contractors who run these facilities, I have established a small business set-aside program identical to a Government purchasing office. All of the Department of Energy purchasing offices are manned by civil servants and have a small business set-aside program.

I have instituted an exact program with these operating contractors. I have not required it of any other contractors because I do not think I have the authority.

I am saying that in my view that they look a lot like a Government office. They operate under the ground rules. GAO reviews protests of our GOCO contractors' procurements. They are part of our budgeting system. We use them in our set-aside program.

Historically, then, we have included their awards. We have assigned them goals. I have given them goals just like I have given goals to our

AS A FURTHER EXAMPLE OF SMALL BUSINESS EHV PARTICIPATION, DOE IS ABOUT TO AWARD A SMALL BUSINESS SET-ASIDE PROCUREMENT TO FIVE SMALL FIRMS AT APPROXIMATELY $100,000 EACH. THIS PROCUREMENT IS FOR THE PRODUCTION OF 10 VEHICLES WITH AN OPTION FOR 50 ADDITIONAL VEHICLES TO BE BUILT IN ANY COMBINATION DOE DESIGNATES.

## SUMMARY

IN REPRESENTING THE DEPARTMENT THIS MORNING, I WISH TO REEMPHASIZE OUR COMMITMENT TO INCREASING THE REPRESENTATION OF SMALL BUSINESS RESEARCH AND DEVELOPMENT FIRMS IN DEPARTMENTAL PROGRAMS.

I AM AVAILABLE TO RESPOND TO ANY QUESTIONS OF THE SUBCOMMITTEE.

ECONOMIC AND SOCIAL CONDITIONS. FOR PURPOSES OF DOE'S PILOT SMALL GRANTS PROGRAM, GRANTS, COOPERATIVE AGREEMENTS OR CONTRACTS MAY BE MADE TO OR WITH SMALL BUSINESSES, INDIVIDUALS, LOCAL NON-PROFIT ORGANIZATIONS AND INSTITUTIONS, STATE AND LOCAL AGENCIES AND INDIAN TRIBES. THE INVOLVEMENT OF SMALL FIRMS IS COMPATIBLE WITH AND CRITICAL TO SMALL SCALE, APPROPRIATE ENERGY TECHNOLOGY. FUNDS ARE TO BE USED TO PROVIDE A COORDINATED AND EXPANDED EFFORT FOR THE DEVELOPMENT AND DEMONSTRATION OF ENERGY-RELATED SYSTEMS APPROPRIATE TO THE NEEDS OF LOCAL COMMUNITIES. IN FY 1978, APPROXIMATELY $3 MILLION WILL BE OBLIGATED UNDER THE APPROPRIATE TECHNOLOGY GRANTS PROGRAM.

ELECTRIC AND HYBRID VEHICLE PROGRAM

THE DOE HAS AUTHORITY TO PROVIDE LOAN GUARANTEES AND PLANNING GRANT INCENTIVES TO ENCOURAGE SMALL BUSINESSES TO PARTICIPATE IN THE DEVELOPMENT OF ELECTRIC AND HYBRID VEHICLES (EHV). SMALL FIRMS HAVE BEEN ENCOURAGED TO PARTICIPATE IN TECHNOLOGICAL DEVELOPMENT BOTH AS PRIME AND SUBCONTRACTORS IN VEHICLE SYSTEMS DEVELOPMENT. DOE HOPES TO ESTABLISH A PRIVATE SECTOR BASE OF SMALL FIRMS CAPABLE OF FURNISHING COMPONENTS TO AN EMERGING ELECTRIC AND HYBRID VEHICLE INDUSTRY.

10. Small Business Planning Grants. Awarding planning grants to eligible small business firms to defray bid and proposal costs associated with submission of unsolicited proposals and other research and development competitive actions under the Electric and Hybrid Vehicle Program.

Following my statement, I shall be pleased to discuss recommendations of an ad hoc interagency panel chaired by Mr. Jacob Rabinow that considered the topic of increased use of small technology based firms. As you are aware, ERDA, a predecessor agency, participated in that panel. As a successor agency to ERDA, DOE has taken numerous steps which meet the intent of the Rabinow recommendations.

In addition to the above procurement initiatives which we feel strengthen our efforts with respect to small business participation in our research and development procurements, other DOE activities have programs which are tailored to small companies. These programs are as follows:

Energy Cost Reduction Program

The central purpose of this program is to provide technical assistance to small business concerns on practical

BEEN GUARANTEED BY THE FIRST OF THIS YEAR, DOE PUBLICIZED THE AVAILABILITY OF $21 MILLION IN REMAINING SMALL BUSINESS GEOTHERMAL GUARANTEES IN THE FEBRUARY 17 EDITION OF THE COMMERCE BUSINESS DAILY.

5. DOE/SBA MEMORANDUM OF UNDERSTANDING. DOE AND SBA EXECUTED A MEMORANDUM OF UNDERSTANDING ON JULY 3, 1978, TO FORMALIZE THE RELATIONSHIP BETWEEN DOE AND SBA HEADQUARTERS AND FIELD OFFICES. UNDER TERMS OF THE MOU, WE SHALL DISSEMINATE INFORMATION TO SBA REGARDING APPROPRIATE ENERGY PROGRAMS, INCLUDING RESEARCH AND DEVELOPMENT, WHICH ARE SUITABLE FOR SB/MB PARTICIPATION. SBA'S REGIONAL OFFICES WILL RECIPROCATE BY PROVIDING ASSISTANCE, SMALL AND MINORITY SOURCES, AND ARRANGE FOR INVENTOR REFERRALS.

6. SET-ASIDES BY DOE OPERATING CONTRACTORS. DOE INSTITUTED UNIFORM SMALL BUSINESS SET-ASIDE PROCEDURES AT DOE-OWNED, CONTRACTOR-OPERATED PLANTS AND LABORATORIES. IN THIS MANNER, PROCUREMENT ACTIONS MAY BE RESTRICTED EXCLUSIVELY

PLACED WITH SMALL HIGH TECHNOLOGY FIRMS:

1. Test of Mandatory Subcontracting to Small Business. DOE is a participant in a test program sponsored by the Office of Federal Procurement Policy through which selected prime contracts contain negotiated levels of SB subcontracting.

2. DOE/SBA Joint Funding of Procurement Automated Source System (PASS). The purpose of this project is to develop, test, operate, and maintain an automated, centralized data base of small business research and development procurement sources. Though initially accessible to DOE and SBA, this system will become available to other authorized user departments and agencies.

3. Small Business Procurement Digest. DOE has been examining procurement requirements imposed on small research and development firms through the procurement process. To

# DEPARTMENT OF ENERGY

STATEMENT OF M. J. TASHJIAN, DIRECTOR, PROCUREMENT AND CONTRACTS MANAGEMENT DIRECTORATE, FOR THE SENATE SMALL BUSINESS COMMITTEE; HOUSE SMALL BUSINESS COMMITTEE; SUBCOMMITTEE ON ANTITRUST, CONSUMERS AND EMPLOYMENT AND SUBCOMMITTEE ON ENERGY, ENVIRONMENT, SAFETY AND RESEARCH.

MR. CHAIRMAN:

SECRETARY SCHLESINGER HAS ASKED ME TO APPEAR TODAY BEFORE THIS JOINT HOUSE-SENATE COMMITTEE TO DISCUSS ACTIONS WHICH THE DEPARTMENT OF ENERGY (DOE) IS TAKING TO ASSIST SMALL BUSINESS FIRMS IN OBTAINING A LARGER SHARE OF OUR RESEARCH AND DEVELOPMENT PROCUREMENTS.

TODAY, I WILL ATTEMPT TO SUMMARIZE STEPS TAKEN BY DOE TO ENHANCE THE REPRESENTATION OF SMALL BUSINESS RESEARCH AND DEVELOPMENT FIRMS IN DEPARTMENTAL PROGRAMS. MUCH OF THE SUBJECT MATTER I AM COVERING HERE IS CONTAINED IN A SEMIANNUAL REPORT REQUIRED BY PUBLIC LAW 95-238, DEPARTMENT OF ENERGY ACT OF 1978, CIVILIAN APPLICATIONS.

WE SHALL BE TRANSMITTING THIS REPORT TO INTERESTED COMMITTEES OF CONGRESS, INCLUDING HOUSE AND SENATE SMALL BUSINESS COMMITTEES IN THE LATTER PART OF AUGUST AS REQUIRED BY SECTION 204(B), PUBLIC LAW 95-238.

INASMUCH AS A LARGE PERCENTAGE OF DEPARTMENTAL OUTLAYS ARE IN THE FORM OF PROCUREMENT ACTIVITY, I SHALL FOCUS ON OPPORTUNITIES FOR SMALL RESEARCH AND DEVELOPMENT FIRMS IN AGENCY PROCUREMENT. IN MARCH OF THIS YEAR,

not dealing with a permissible cost, and a grant for this purpose could not be authorized without the clear authorization that is lacking in this case.

The start-up of new ventures similarly in itself infringes general requirements of grant law since it is a normal principle of grant law that grant funds may not be used to meet the cost of expenses before the approval of a project. Start-up of new ventures not yet approved would not be an appropriate use of grant funds except perhaps in the case of funds ear-marked specifically for the development of a defined new program which is clearly not the case here.

CONCLUSION: Consistently with this approach, Grants Administration Manual section 1-10-20-B expressly provides that

> "...selection of contracts [rather than grants] is mandatory whenever: ... 3. payment of an amount in excess of actual costs (i.e., profit or fee) is intended."

Accordingly, I am in agreement with the conclusion you have reached that in general a grant to a non-profit corporation should not include any increment above actual cost properly computed. The general rule would yield in a particular case if the statute carried authority for such increment but this would require a very clear showing.

P. B. M.

wherever feasible and not inconsistent with the purposes of this section. If the grant is under this section, a very clear intent to preclude increments above cost is reflected.

Section 309(c) authorizes provision for training persons engaged or preparing to engage in adult education programs to carry out the purposes of the Title including the payment of such stipends and allowances (including travel and subsidy expenses if any) for such persons and other individuals as the Commissioner may determine by regulation. The Commissioner may provide training directly or by contract or by making grants to institutions of higher education, state or local educational agencies, or other appropriate public or private organizations or agencies.

The sum of $12,000 has been set aside to furnish to the grantee an increment above cost in the event that that is permissible. The purposes for which this is intended apparently include a list which runs from (1) purchase of capital equipment and (2) lease-hold improvements to (8) cost-sharing grants and (9) off-set certain costs of doing business that are not properly chargeable to a project. Let us take the first and most plausible of these items as an example. If the capital equipment to be purchased is specifically needed for the purposes of the specific project, it may then be a cost of the grant and will not be an increment above cost. As a possible grant cost, it will be governed by the principles of Appendix D of 45 CFR Part 74 on the Administration of Grants which is taken essentially from OMB Circular A-21 dealing with principles for determining costs applicable to research and development under grants and contracts with educational institutions. Part II of D is applicable to training and other educational services under grants and contracts with educational institutions (I am assuming that Syracuse University Research Corporation is as it appears to be, an educational institution but, if it is not, very similar analysis would nevertheless apply). With respect to capital expenditures, equipment and other

as reimbursement for work performed or costs incurred shall be accounted for as reduction of liabilities to pay for such work or costs. The unspoken but clear premise in these accounting principles is that the grant, at the most, pays for work done and costs properly incurred and not for general support.

The same underlying assumption will be found in the standard language of normal grant statutes which typically presume that grants are made to meet the costs of a program undertaken by the grantee and typically presume that the amount of the grant will be less than or at the most the full amount of the actual costs of the approved program.

To take one example out of many, the International Educational Act of 1966 (P.L. 89-698) section 101(b) provides that "grants under this section may be used to cover part or all of the cost of establishing, strengthening, and operating research and training centers...". Some statutes expressly require that grants be limited to a part and not the whole costs. Other statutes are less explicit but in context carry the same implication that the grant must not exceed the cost.

The general government policy on cost-sharing in research grant, whether specified by statute or not, is defined, among other places, by GSA's FMC 73-3, 38 FR 34731 (OMB Circular A-100). This policy clearly runs counter to the payment of increments above cost in such grants.

SOME EXCEPTIONS: Obvious exceptions are the statutes which provide for the payment of stipends in a fixed amount to individuals without reference to whether the individual's costs will exceed the amount of the stipend or not. A further explict exception is the authority to permit a grantee to retain research equipment in certain cases, 42 USC 1892, OMB Circular A-101. A further exception, quite unusual in character, is section 301 of the Public Health Service Act (42 USC 241). Subsection (d) explicitly

GENERAL RULE: The approach you have taken seems to me to be entirely in accord with traditional views of the grant concept. In general, increments above cost are not authorized in grant programs and should be permitted only if the enabling legislation quite clearly authorizes it.

The underlying principle is well expressed in an opinion of the Supreme Court which deals with the construction of a grant to a state. The argument however would seem to apply with all the more force to a grant to a non-profit corporation:

> "There was no reason why the United States should provide that the State of Michigan should actually receive a profit over and above the payment to it of all its expenses for the construction of the canal and for keeping it in repair. If through the action of the United States, a public work of national importance were constructed within the boundaries of that State, and the State itself were reimbursed for every item expended by it in the construction and in the keeping of such work in repair, it would certainly seem as if the State could properly ask no more." United States v. Michigan, 190 US 379, 397 (193)

The General Accounting Office, Policy and Procedures Manual for Guidance of Federal Agencies, subsection 16.8(c) defines a grant as follows:

> "Except as otherwise expressly authorized by law, Federal grants are payments in cash or in kind made to provide assistance for specified purposes."

If a particular activity is specified as an authorized grant activity in the grant and its enabling statute (or reasonably included as an auxiliary activity intended to be covered by the specified activity), then its cost will