FIGURE 2

BUSINESS SCENARIOS

A. T. KEARNEY

- VIRTUALLY ALL MANUFACTURED PARTS SUBCONTRACTED TO SPECIALTY MANUFACTURERS
- VAWT, INC. FUNCTIONS LIMITED TO WAREHOUSING, INSPECTION, SHIPPING AND RECEIVING OF VAWT COMPONENTS, MARKETING AND SALES
- CONSIDERS ONLY THE FOUR LARGEST POINT DESIGNS (120, 200, 500 AND 1600 KW), ASSUMED TO BE MARKETED TO CONCENTRATED USERS

ALCOA

- ONLY "SHELF" COMPONENTS AND MILL PRODUCTS (RAW BLADE EXTRUSIONS, TOWER TUBE SECTIONS, FLANGES, ETC.) PURCHASED FROM MANUFACTURERS
- VAWT, INC. FUNCTIONS INCLUDE (IN ADDITION TO WAREHOUSING, INSPECTION, SHIPPING, MARKETING AND SALES) SOME FABRICATION AND ASSEMBLY: BLADE BENDING AND END FITTING ATTACHMENT, TOWER FLANGE ATTACHMENT, ELECTRICAL CABINET MANUFACTURE, ALL LIGHT MACHINING AND FABRICATION
- CONSIDERS ALL SIX POINT DESIGNS, FOUR LARGEST TO CONCENTRATED USERS, FOUR SMALLEST TO DISTRIBUTED USERS

patents. While a patentee in the United States has one year from the date of the publication in which to file a patent application which may result in a valid patent, the requirements of many other important countries is such that no valid patent can issue if there has been publication prior to filing of an application in any one country. For this reason, in order to protect the Government's right to file foreign patents in all cases, the agencies which have this concern, demand as a contractual obligation that each proposed publication be reviewed prior to release for publication and provide that permission for publication can be withheld until a patent application has been filed. Taken by itself, this requirement would not be difficult if individual universities could conduct their own review, quite quickly, and bring agency attention to reportable inventions alluded to in proposed publications. However, at least one important agency requires submission of proposed publications to it, subject to its review and release. Such requirements can result in lengthy delays and are highly distasteful to the academic community as a deterrent to free and early publication. The actual fact is that only a very small percentage of proposed scientific publications contain reportable inventions and that only a very small percentage of reportable inventions are such as to warrant any concern over any foreign patent coverage. It is my estimate that large sums, in terms of money, man-hours of effort, paperwork and red tape are expended in this effort and that the values to be protected do not warrant the effort or expenditure. It would be interesting to determine from the various Federal agencies how much is expended in terms of effort and in the actual cost of procurement of foreign patents and to compare such expenditures with the dollar return to the Government or to some appraisal of the value of other benefits that the Government might derive.

In view of the foregoing, if I were to make recommendations for possible improvements in the areas of this discussion, such recommendations would be:

1. The development of a truly uniform mandatory Government policy for Universities and small business as to the handling of title to patents with title and transfer responsibility to rest in the contractor.

2. Easing of the requirement for reporting conceptual inventions, preferably tied to some understanding of feasability or possibility that completion of the invention is contemplated.

3. Provision in the procurement regulations for recognition of the fact that certain types of research projects should not require patent provisions but merely require publication of the results.

4. The evolution of a policy and regulations concerning the protection of the Government's right to file foreign patent applications which limit the requirements to those cases in which they are appropriate.

TABLE 3

DARRIEUS WIND TURBINE MANUFACTURERS

ALUMINUM COMPANY OF AMERICA
ALCOA CENTER, PA 15069
D. K. AI, P. N. VOSBURGH
412-339-6651

DOMINION ALUMINUM FABRICATING LTD.
3570 HAWKESTONE ROAD
MISSISSAUGA, ONTARIO, CANADA L5C 2V8
C. WOOD
416-275-5300

DYNERGY CORPORATION
P. O. BOX 428
1269 UNION AVENUE
LACONIA, NJ 03246
R. B. ALLEN
603-524-8313

TUMAC INDUSTRIES
650 FORD STREET
COLORADO SPRINGS, CO 80915
J. R. MCCONNELL
303-596-4400

face mounting inflation, unbelievable interest rates, and the constant threat of product liability--even though we only sell industrial supplies--we don't manufacture them.

As the Mayor of my city, I became acutely aware of the strong need in our American cities to undergird the efforts of our business communities--particularly small business--in a continuing effort to keep our tax base strong and viable and to be less and less dependant upon State and Federal funds.

This, indeed, should be your thrust for small business. Guide us--don't regulate us. Give us less government--not more. Listen to us--don't preach to us. We've been through it. We've coped with taxes, OSHA, more and more government ... as that cost us an arm and a leg in time and money.

You have heard this before--from my good friend George Lockwood who grows abalone in Monterey and who testified at your very first combined meeting in Washington, and from Milt Stewart--my good friend also--and a friend of all small business. Both of them are completely dedicated to the basic American premise that small business is indeed basic to our U.S. Economy.

Let me go back in history for a few moments and relate an incident as told to me by Arthur Levitt, former Chairman of the Board of the American Stock Exchange. In the autumn

TABLE 4

SANDIA VAWT COMPUTER CODES

▶ AERODYNAMIC MODELING

PAREP - Parametric representation of performance, fast working
SIMOSS - Single streamtube model
DART/DARTER - Multiple streamtube model
VDART2/3 - Vortex model, 2/3 dimensional

▶ STRUCTURAL AND DYNAMIC MODELING

SKEIN - Defines troposkeins under various loading conditions
SRD - Calculates centrifugal and aerodynamic forces on blades
MARC-H/MGX - Performs static, non-linear stress analysis and plots
VAWTDYN - Predicts dynamic turbine response to given initial conditions
TORIP - Predicts torque ripple, based on four degrees of freedom

▶ ECONOMIC MODELING

ECON-16 - Predicts cost/kW-hr based on given design, some optimization

▶ FIELD TESTING CODES

ATSTR - Turbine performance using BINS technique
PCMTS/SATD - Create time series records from transducers
QUIK - Calculates maximum, minimum, and average blade stresses
SPEC5 - Computes spectral density of time series
TRBTR - Computes torque ripple from time series
RUN17 - Automatic control operation of 17-M turbine

GEB:4710:1/8/80

tems, which goes back over a hundred years, which is the Agricultural Extension Service.

Mr. KING. Yes.

Mr. BROWN. And a key focus there was on the direct transfer of the newly generated knowledge from the laboratory of the university directly to the user through a trained person, the extension agent, who could follow through with that and see that it was working properly. We are not doing that.

Mr. KING. No.

And part of the problem you asked the question concerning the funding levels. To give you an example in the period of 10 years in that program the actual amount of increase in the Federal side is less than 20 percent over that period. That doesn't even cover the inflation cycle.

Now, it is also in the NASA Application Center program we have a requirement to generate fees. OK. From the industrial side. And in our case we structure that fee program on the basis of our variable costs of the computer, printout cost, and et cetera.

But unfortunately this then restricts what we can do, because you only have a limited amount of base funds.

So we have had to concentrate those activities into the retrieval and dissemination, but by then making these same services available to the funded programs that deal on a one-on-one basis you can now make that same resource available to through the SBDC's to the university center programs who are working directly. They are funded on a basis of packaging working right with them, and we find this has started to work very well.

Mr. BROWN. Let me ask one more question. You have indicated, and it is obvious we are on the verge of a new information revolution really, I want to know how substantial is your computer data base, and is it networked with other data bases so that you feel you could do a comprehensive search or that you could acquire data from whatever source it might be in, or have we not moved to that stage in our capability to transfer information once it is located.

Mr. KING. We definitely network. We use the existing systems, Lockheed system, SBDC's Medlars. Of course, we have the direct lease line to the NASA computer researching on line over a 150-some data bases right now, and I think one of the things that is very interesting and in the beginning in 1976 in conjunction with Denver Research Institute we started a program of cost-benefit analysis as it relates to information, and on the basis of comparing the perceived cost and the perceived benefit from having used the information services.

What we are now seeing is that back 4 years ago the number of the percentage of clients that had a benefit from an information service was about 50 percent. That now is increasing on the samples from 1979 to about 88 percent.

This is partially because of the fact that the information bases themselves are getting better. You have more system. You have higher speed equipment, lower costs, and we are getting better trained searchers, plus an awareness that is growing on the business side of the value of using information.

Mr. BROWN. You network through land lines I presume, and I have been kicking around the idea of a dedicated satellite link that might be useful for networking purposes.

Mr. LLOYD. Mr. Lujan?

Mr. LUJAN. Thank you, Mr. Chairman.

One of the things that we have here that has proved very advantageous to the area, both from Los Alamos and from Sandia, is former employees going in and establishing a business. Is it very difficult to do that? It seems to me like that is an excellent way of having technology transferred into the private sector, letting the guy that has been doing the research at the laboratory go out and start his own business. It is an automatic transfer of technology. How difficult is it for someone to leave Sandia and go and start their own business with some technology they have perhaps put together or together with others?

Mr. BRANDVOLD. Well, it must not be difficult at all because we have experienced some amount of that happening. In the energy area, we welcome it. Perhaps you will remember the example of the novel automobile engine configuration which the fellow devised a few years ago. That engineer after a couple of years which resulted in making a laboratory model engine, was hired away by a Detroit company and is now working with them attempting to apply that kind of technology to their engine product line. We welcome that. I think that, as you said, is one of the most effective ways of getting the word out.

Mr. LUJAN. How about loans from industry to the laboratories or vice versa? We have that in Government where you take somebody from some department, send them to the State to, well, I don't know, to interpret whatever the feds are trying to put across, then after a while they go on back. Would or does that go on within the laboratories?

Mr. BRANDVOLD. We do have that. We can more effectively do it by industry people coming to us than we can have people going to industry at the present time. We do have ongoing programs that have been in place about 4 years that are open to all comers for either short or extended periods of time, people coming into the laboratory where we give them office space, full technical support. They work with an assignment exactly like one of our engineers. They have full access to the services of the laboratory and the other technical talent.

We have less success at this point in time with programs to provide laboratory experts to go to some of the industries. We do that a lot in point of fact on the contracts we have with the various industrial firms. Other than those contractual ways, we have more difficulty.

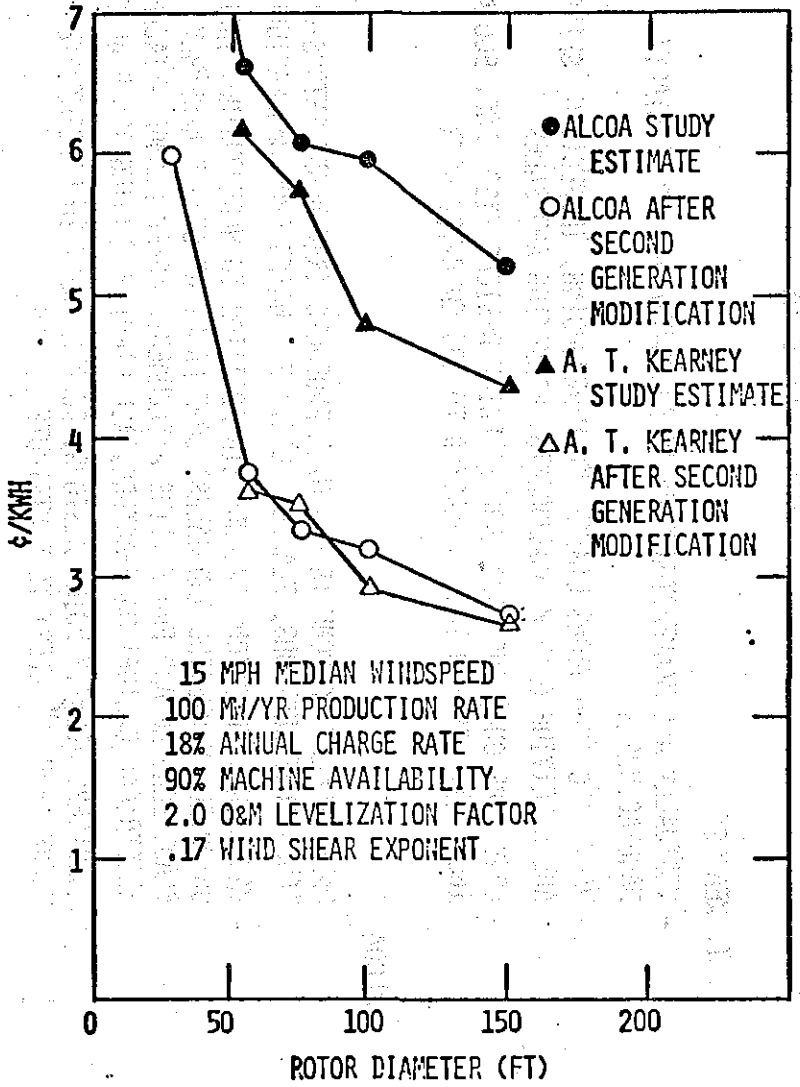
Mr. LUJAN. How about moonlighting, do you find that maybe someone in the laboratory has a particular expertise that a local company could use, does that happen? That seems like an excellent way to use this technology.

Mr. BRANDVOLD. It turns out that it doesn't happen very much. I think it is partly because in contrast with the kind of technology that Mr. Babb was mentioning in the previous panel, which is essentially the available now technology, the kind of work that we are principally doing is in the very advanced technologies. In those areas there really is limited community demand.

What we do try and provide assistance with, and I guess I would reiterate it is a very big problem, is assistance to the consumers and the businessmen about information that is available. It is the toughest thing in this country to find, to wade through the massive amount of material and pick out the nuggets of information that are useful to a particular individual or to a particular company.

FIGURE 3

ESTIMATED ECONOMIC IMPACT OF SECOND GENERATION MODIFICATION



nesses and the disadvantaged business firms and try to help Glen find these kinds of firms.

I have already turned in a statement. I think you have a copy of it. I will just give you a little brief on it.

We started our small business program way back in the 1950's and in the early 1970's, about 1971, we started an aggressive disadvantaged business program. Our current figures, you can see them there in the report, shows that we are placing about 53 cents out of every dollar that we spend with the small business firms and about 6 cents out of every dollar goes to disadvantaged business firms.

We work with labor surplus area firms and also women-owned businesses.

I am spending about 40 percent of my time out in the community working with the National Minority Purchasing Council. I am also on a committee at the chamber of commerce. We are trying to look at some of the problems of small business firms in New Mexico.

When a small business firm comes into Sandia, I am usually the first one that shakes hands with him and try to find the correct buyer to talk to him about his commodity. Since Sandia is a high-technology company, we do get into some areas where we have difficulty finding the capable small business firms and the disadvantaged firms to put into the quoting process.

I did hear one statement made earlier that about 97 percent of the energy dollars are going to large business. Much of that does filter down to the small businesses, but if you look at our numbers in the solar area, only about 61 percent of those dollars go to the large business and the small business firm is sharing about 35 percent and the disadvantaged about 4 percent.

So we think it is working in our company. We are aggressively looking for them. We are using the SBA PASS system to do some searching. There is not enough registered in the PASS system yet, but we are working cooperatively with the Regional Office in Dallas and are going to all the 8,300 firms that we have listed in our directory as small businesss firms. We are sending them an application asking them to get into the PASS system because not only will it be good for us, but it will be good for other agencies so they can locate them.

I would say that if we have had any successes, much of it has to be dependent upon the technical staff accepting the program. I think you just heard some of that from Glen.

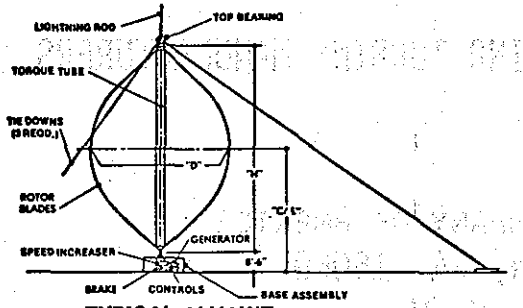
If it is not acceptable to the technical staff, the poor buyer is not going to make the program work.

In our company, a part of the buyer's performance, is based on, how he works with the small business and the minority business firms in giving opportunities for giving them an opportunity to quote.

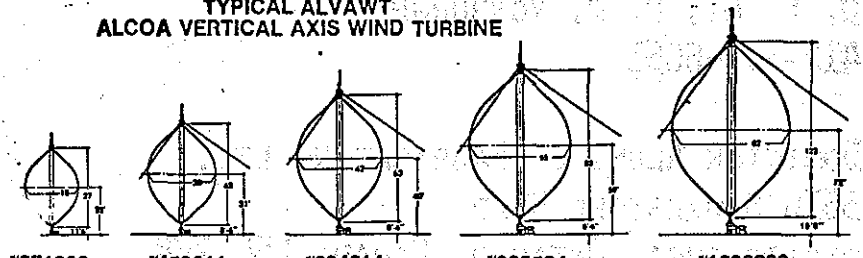
Now, one of the questions that is sure to come up is how you make this program really work. I don't know how you legislate motivation, but we seem to have that kind of a spirit going at our company. We think that motivation is one of the things that makes it work.

One of the programs we have been working very closely in is with the Small Business Administration. They have a program where the prime contractors are invited to nominate their best small business

FIGURE 4



TYPICAL ALVAWT
ALCOA VERTICAL AXIS WIND TURBINE



#271806 #453011 #634214 #835524 #1238229

BASIC ALVAWT MODELS

ALVAWT Model	Generator Capacity	Projected Annual Energy (MWh) Sites with Mean Annual Winds @ 12 mph	@ 15 mph	@ 18 mph
#271806	08 kW	08	16	25
#453011	22 kW	25	45	70
#634214	57 kW	56	110	160
#835524	112 kW	120	235	355
#1238229	300 kW	325	625	935
#1238229	500 kW	265	635	1,125

ALVAWT PERFORMANCE SPECIFICATIONS
CONSTANT SPEED MACHINE WITH VARIABLE TORQUE
SEA LEVEL CONDITIONS ARE ASSUMED

A small example. Somebody in the shoelace business perhaps looking for a new way to bind plastic to string to make a better shoelace. We know that NASA has been in the adhesives business for a long while and we have a number of ways that we try to retrieve the information and put the technology into the hands of the person who needs it.

We do this in the Rocky Mountain Region in general. NASA has an additional six such organizations, most of which are located at universities around the country. The way we get the information out is through a terminal at the university. We then supply the raw information in the form of a computer printout, if that is so desired by the customer, or we will engage in a technical evaluation of the information that has been retrieved. This is where we believe that we are quite different than most of the technical information centers around the country who are in the business primarily to retrieve information and without any value added put it into the hands of the user.

Another technique that we use that we have found to be very useful is through a technology coordinator. We actually have a person at the Johnson Space Center in Houston whose job it is to help us retrieve information that is actually not yet printed or in a retrievable file. This has been very successful. I might give a brief example. It didn't actually come out of the Technology Application Center, but one of our sister organizations. You may be aware of wire that has memory and has been used for orthodontics. You can preshape the material and put in into a youngster's mouth and heat it up to a certain temperature and it assumes a predetermined shape. It is very useful. NASA didn't develop it as an orthdontics material, but it has been modified to fit that need.

The information for that actually came from or through the Technology Coordinator System. Most of it wasn't written down. It was actually in the minds of the people working at NASA laboratories and it was retrieved by putting the user in touch with the people who had it floating in their mind.

We also engage in short courses. We have heard from previous witnesses that education is a very big part of innovation and the acceptability of technologies. We try to find those technologies that are of particular interest or seem to have a broad interest and host short courses, seminars, executive briefings, that kind of education. An example in that area would be the energy conservative housing symposium that we held here in Albuquerque 2 or 3 years ago. The audience that we were attempting to attract at that time were in the building trades, also in the municipal government because we knew that codes would be involved. We find that these are rather successful endeavors. Unfortunately we don't have the personnel or the funding to engage in a heavy load of such short courses and seminars.

I think with that that I would like to entertain questions.

[The prepared statement of Dr. Morain follows:]

TABLE 5

MAJOR PURCHASED ENGINEERING

COST STUDIES	ALCOA A. T. KEARNEY, INC.
LOW COST 17 METER FABRICATION	ALCOA
BLADE DESIGN (17 M TURBINE)	KAMAN
AERODYNAMIC MODELS	TEXAS TECH UNIVERSITY
AERODYNAMIC TESTING	LTV WICHITA STATE UNIVERSITY
FLUTTER ANALYSIS	MIT, NORMAN HAM
TRANSMISSION STUDY	PHILADELPHIA GEAR STEARNS-ROGER
ELECTRICAL SYSTEM (17 M TURBINE)	KATO
ELECTRICAL/MECHANICAL SYSTEMS ANALYSIS	POWER TECHNOLOGY, INC.
FOUNDATION/ANCHOR STUDY	UNIVERSITY OF NEW MEXICO/CERF
TURBINE TEST METHODS	VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY
ELECTRICAL INVERTER DEVELOPMENT	WINDWORKS, INC.
TURBINE BLADE MOUNT	SUN COUNTRY INDUSTRIES
VAWT BLADES	MAGNODE PRODUCTS, INC.
STRUCTURAL DESIGN ANALYSIS	HIBBETT & KARLSON, INC.

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Section 3 Documents and Publications

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Exhibit F - Summary of Prices

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Exhibit G - Examples of BIAS Program Users

Exhibit H - User Responses to TAC Services

Section 5 Budget and Finance

Exhibit I - FY '78 Income and Expenditures by Source

Exhibit J - Three-year Trends for Cash Income and Value of Work in Progress

Mr. LUJAN. Does the average firm have much interplay with the laboratories? For example, if you found a new metal that would reflect better, something like that, could that firm out there pick it up and be able to change the materials that they are using in a collector or some other product that they are marketing?

Mr. BRANDVOLD. In the areas that we work in—which is high-technology solar areas, high-technology geothermal logging—we have got a lot of examples of that. The industry people have very quickly picked up the things that we have worked on. We worked on a high-temperature capability logging tool for the geothermal well business. It is a little business, maybe less han 50 geothermal wells are drilled a year as compared to 40,000 oil and gas wells. So a market which is not attractive for a well logging company to spend a lot of specific money to develop well logging and completion tools for. We took some high-temperature electronics capability, made some prototypes, and now one of the existing well logging companies is about to come on the market with a 500° F. capable set of logging tools which they will sell to the industry. So we see that happen.

Mr. LUJAN. What can we specifically in the Congress do to encourage all of the things that you learned to research in Sandia, other than making weapons, that are available to anyone out there—I know the patent process and all that has some problems—but is there anything that you can see what we in this committee could pose to make it more readily available? That is the purpose of these whole hearings.

Mr. BRANDVOLD. Absolutely. By far the best thing that could be done is to, I believe, mandate some improvements in the information dissemination system. Right now we have a single national center in the country, the National Technical Information Service, which all of the Government agencies are required to submit their reports to, and, in fact, are prohibited by Government regulations from doing otherwise. We have Government Printing Office restrictions on how many copies of reports can be printed and we are prohibited from printing enough copies to provide them directly to people who ask for them. We refer them to the National Technical Center. Their response time, and, I am sure, for a variety of reasons, is less optimum than, I think, could be achieved. I believe also the country is too darn big and the technology areas are too diversified to expect a single place to be able to keep current in every single technology field.

So one of the first things that I would say is to take the major consumer areas, assign that responsibility more broadly, set up a better network of local and regional centers to access that information system, and that single thing would be the biggest benefit that we could provide.

Mr. LLOYD. Mr. Roth?

Mr. ROTH. Mr. Chairman, I appreciate very much the testimony of Mr. Brandvold, but I think that I will wait and see how much time we have left at the end.

STATEMENT OF JAY HUGHES, SMALL BUSINESS REPRESENTATIVE, SANDIA LABORATORIES

Mr. HUGHES. I am the small business representative from Sandia Laboratories. I am the liaison officer. I try to look after the small busi-

Using this vast network and its trained staff, TAC is amply qualified to extend its services and skills into many fields of expertise. Its contributions in technology transfer, informing the nation about new developments in energy, assisting small businessmen to better meet competition, and its involvement in the remote sensing field are nationally recognized. Organizationally, TAC has the following programs and capabilities:

1. Information Retrieval - Just a few years ago the number of available computerized information resources could be counted on the fingers of one hand. The "information explosion" of the 1970's has changed this solitary situation. TAC has kept in step with this happening and currently it employs a full-time information scientist to manage 150 computerized information files containing 35,000,000 reports developed during the last 12 years. The files are used interactively on a daily basis through the use of modern electronic terminal equipment installed in TAC's facility. The end is not yet in sight and TAC anticipates a 10-20% growth in new automated files during 1980. The information program provides informational support to the entire TAC organization.
2. Information Analysis - Industry is a major connoisseur to technical information and is constantly concerned about its availability, quality, and quantity. Fortunately, TAC's staff understands the nature of industrial information requirements and is prepared to handle even the most complex of technical situations. TAC functions as a full service

firm of the year, the one that they think is the best. We have been fortunate that out of the last six times our nominee has won the regional honors and has gone to national. They have not won the national yet. I think it should be emphasized that in this program the small business firm who wins even regional honors gets a lot of publicity out of it from the Small Business Administration and a lot of them use it in their brochures. It opens doors for them into the large agencies.

In our local area and in the New Mexico Minority Purchasing Council, we are conducting sales training programs for disadvantaged entrepreneurs. They attend for 12 weeks and get 2 hours a week on how to sell themselves, how to sell their product, and how to keep their books. So we do have some of these kinds of benefits in the community, as well as our local buying group that works very closely with machine shops in this area. Each year we conduct two sessions on a position dimensioning course which aids the small business machine shop in his inspection procedures. This results in the product having less rejections. That saves them time and saves us money.

These are some of the kinds of activities we are trying to do to help get the small firms involved in our awards process.

That is just a brief and I would be happy to answer any questions.

Mr. LUJAN. I just wanted to make a comment, Mr. Chairman.

As you know, I keep pretty close tabs on that program and the success of that program is just great as far as Sandia is concerned. We are very pleased with it and think you do a good job with the program. If there is any criticism, and I hate to say it in front of my friends from Wisconsin and California, it is that not all the small business firms are just in New Mexico. We would like to do something about localizing it a little more, but we think that you are doing an excellent job. We can let Wisconsin and California have a little bit of the business, but not too much.

Mr. LLOYD. Even with the abundance of the good things you have here, you are always willing to share; right,

Thank you.

STATEMENT OF DR. STAN MORAIN, TECHNOLOGY APPLICATION CENTER

Dr. MORAIN. Thank you.

The Technology Application Center, I should indicate at the beginning, is a part of the University of New Mexico. Therefore, it is a not-for-profit organization. We are also funded by NASA under a NASA contract and have been so funded for the last 15 years or so.

We like to describe ourselves as brokers in technology, remembering, of course, this is a not-for-profit kind of brokerage.

What we are attempting to do under the charter from NASA is to discover within the space program those technologies that might be altered in some way and utilized in a secondary fashion in the private sector. So we are really in the business of trying to locate potential technologies, on the one hand, and broker those in such a way that we can find somebody in the user community who can utilize that technology.

and conducting customized training and short courses for specific interest groups.

Project oriented services of the Remote Sensing Program include applications of remote sensing to: land use, forestry, energy resource idnetification and development, environmental studies, heat loss surveys and other earth resources problems. The Remote Sensing Program is also a designated representative of NASA for the dissemination, nationally and internationally, of all earth oriented space photography for Skylab, Apollo, and Gemini space flights.

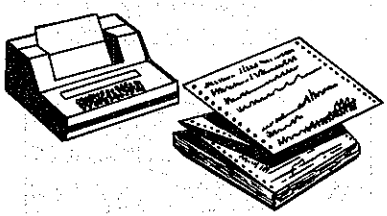
Technology Application Center

EFFORTS IN PROMOTING INNOVATION AND TECHNOLOGY TRANSFER

Briefing Material
for
House Committee on Science and Technology
March 21, 1980

TAC'S COMPUTERIZED LIBRARY

TAC has assembled the world's largest computerized library, containing over 30,000,000 citations to articles, patents, papers, technical reports, proceedings, and reports of research in progress. By accessing nine computers throughout the United States, we can quickly perform a literature search and locate articles on virtually any subject. The search is a retrospective examination of the literature available in a subject area. The initial result of the computerized search is a collection of bibliographic citations with annotations or abstracts which can be expanded to include full articles on that subject. References to specialists working in the field are also obtained.



Sample Literature Search Citation

ACCESSION NUMBER	78A26623
TITLE	SPACE INDUSTRIALIZATION—REDEFINING THE WORLD
AUTHOR	McHUGH, D.
SOURCE	POLYTECHNIC ENGINEER, V. 18, P. 8-17, NOVEMBER 1977
ABSTRACT	SPACE INDUSTRIALIZATION HAS BEEN DEFINED AS THE USE OF THE PROPERTIES OF THE SPACE ENVIRONMENT (SUCH AS WIDE OVERVIEW, HIGH VACUUM, VARIABLE GRAVITY, INTENSIVE ENERGY, OR THE USE OF MATERIALS FROM EXTRATERRESTRIAL BODIES, LIKE THE MOON) TO PRODUCE UNIQUE PRODUCTS OR SERVICES WHICH CORPORATIONS, GOVERNMENTS, OR INDIVIDUALS WILL PAY FOR. ATTENTION IS GIVEN TO GEOSYNCHRONOUS SATELLITE SOLAR POWER STATIONS, LARGE PUBLIC SERVICE PLATFORMS IN SPACE, BIOLOGY-RELATED ADVANCES POSSIBLE ON THE BASIS OF NEW SPACE PROCESSING TECHNIQUES, THE DEVELOPMENT OF A NEW MATERIALS SCIENCE UNDER SPACE CONDITIONS, THE EMPLOYMENT OF LUNAR MATERIAL FOR THE BUILDING OF SPACE-BASED STRUCTURES, THE CONSTRUCTION OF CYLINDER COLONIES IN SPACE, ADVANTAGES AND POSSIBILITIES OF ASTEROID MINING, GENERAL ASPECTS OF SPACE COLONIZATION, FUSION RESEARCH IN SPACE, AND THE CREATION OF HIGHLY MOBILE HABITATS CAPABLE OF REACHING AND OPERATING AROUND THE FURTHEST PLANETS.
SUBJECT TERMS	EXTRATERRESTRIAL RESOURCES, SPACE COLONIES, SPACE MANUFACTURING

MAJOR DATA BASES

NASA's International Aerospace Abstracts and the *Scientific and Technical Aerospace Reports.* Covering the period 1966 to present, this multidisciplinary data base is the repository of all NASA-funded project work.

The Department of Energy's *Energy Data Base.* Covering the period 1974 to present, this file contains citations to articles on all energy fields.

Engineering Index, 1970 to present. This file is the major resource for all aspects of engineering.

Chemical Abstracts, 1970 to present. The basic depository of information for all aspects of chemistry.

Biological Abstracts and *BioResearch Index,* 1969 to present. The major data base in the life sciences, covering 8,000 journals from over 100 countries.

IFI/Plenum Index to Chemical, General, Electrical, and Mechanical Patents, covering chemical patents from 1950 to present and all others from 1971 to present.

World Patent Index, 1964 to present. A major resource containing citations to patents issued around the world.

National Technical Information Service, 1964 to present. This file contains citations to all government-funded research in all fields of interest to the U.S. Government.

Library of Congress Bibliographic Data Base, 1965 to present. This file is essentially the Library of Congress card catalog.

Predicasts Market Abstracts, 1972 to present. The basic resource file for business, industrial, and economic articles.

Psychological Abstracts, 1967 to present. The major depository for articles in all areas of psychology.

Smithsonian Science Information Exchange, current reports of ongoing research in all scientific and technical fields.

Mechanical Engineering, 1973 to present. The basic resource file for articles in mechanical engineering.

American Petroleum Institute *Central Abstracting and Indexing Service,* 1964 to present. The major data base covering literature relating to the petroleum refining and petrochemical industry.

American Statistical Index, 1973 to present. Statistical coverage of the entire spectrum of social, economic, and demographic data collected and analyzed by all branches and agencies of the U.S. Government.

Congressional Information Service Index, 1970 to present. This file covers publications emanating from the work of committees and subcommittees of the U.S. Congress: Hearings, Reports, Committee Prints, and all other documents.

Section 1

Executive Summary

Although a majority of Americans can quickly relate to NASA's landing of spacemen on the Moon's surface or the flybys of Jupiter and Saturn, most do not realize that the advanced technology developed as a result of these spaceflights is being applied daily in almost every field of human endeavor. It might also surprise many Americans to learn that they have easy access to this vast storehouse of knowledge regardless of the size and nature of their business, the kinds of products they produce, or the types of services they offer.

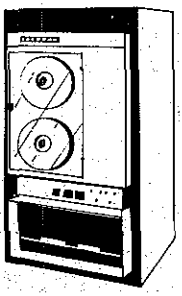
The congressional directive which formed NASA in 1958 required that the results of all agency-funded research and development be published and made generally available. To carry out this directive, NASA created its Technology Utilization Office with seven regional centers to assist the public in acquiring and adapting the results of agency funded R&D. Since then, thousands of commercial applications for the developed technology have been discovered by non-aerospace companies. The Technology Application Center (TAC) at the University of New Mexico in Albuquerque is one of these seven regional centers. It has emerged as the single largest information facility in the Rocky Mountain Southwest. During the past fifteen years it has served all segments of the private and public sectors in this region.

It employs a multidisciplinary staff capable of interfacing the most complex of organizations as well as interacting with the world's latest and most advanced computerized information networks.

AERIAL AND SATELLITE PHOTO SEARCHES

TAC is an affiliate to the National Cartographic Information Center and provides computerized photo search services. Through access to the vast amounts of cartographic data stored in the data base at the EROS Data Center in Sioux Falls, South Dakota, TAC searches can locate photos from the SKYLAB, APOLLO, and GEMINI manned missions as well as LANDSAT images for any location on Earth. NASA high altitude photos and lower altitude photos from such agencies as USGS, BLM, and the Bureau of Reclamation are also searchable. Copies of photos retrieved by a search can be ordered through TAC for reasonable prices. Searches may be initiated by a telephone call and cost $10 per search.





NASA COMPUTER PROGRAMS

Like hardware technology, computer programs have secondary applicability; programs developed for one purpose can often be adapted to another. NASA has created a library of over 3,000 programs with applications such as structural analysis, energy management, electronic circuit design, fluid system design, computer graphics, data base management, etc. These programs are available for sale at reasonable prices.

The Technology Application Center can help you locate the computer program you need to make your operation more efficient.

NASA'S TECHNOLOGY COORDINATORS

In addition to the information retrieval and analysis services described above, TAC also provides clients with a unique, informal information service through its technical coordinator at the Johnson Space Center in Houston.

NASA has created an active network of veteran engineers at each field center to supply names and telephone numbers of individuals currently working in your problem area. These coordinators collect information that has not yet been published or added to computer data bases thereby providing the very latest "state-of-the-art" technology.

This feature sets the NASA Industrial Applications Centers apart from most other information retrieval services. This vital part of TAC's attempt to help solve your problem is offered at no extra cost.

TAC's Application Engineers are ready to begin work on your problem now! Call or write today and let us help you find solutions.

Manager of Client Services
Technology Application Center
University of New Mexico
Albuquerque, NM 87131
505/277-3622

organization and directs all information details from the definition to interpretation and application. TAC is proud to have served some charter firms information requirements since 1965 and this speaks well for TAC's performance and its quality products. Rates and delivery times are reasonable and competitive.

3. The Energy Documents Program - TAC was actively performing energy information retrieval and studies long before most organizations realized an energy crisis was eminent. The federal government used TAC's energy information retrieval capabilities to develop state-of-the-art reports and for advanced research support in areas such as: coal gasification, gas turbines, geothermal, and photovoltaics. Today TAC provides quarterly bibliographies to a national audience in solar thermal, hydrogen energy, heat pipe technology, and the remote sensing of natural resources, including minerals, petroleum, and geothermal phenomena. Workshops have been conducted regularly in heat pipes, coal gasification, hydrogen gas production, storage and distribution, energy conservation, and heat pumps for cooling and heating.
4. The Remote Sensing Program - The Remote Sensing Program is involved in earth resource survey technology, with particular emphasis on its application by the industrial and governmental communities. Activity focuses on (1) performing feasibility studies which evaluate specific remote sensing techniques for resource inventory; (2) performing resource inventories of specific areas under client contract; and (3) organizing

Section 2

Information Resources

TAC's Information Resources

We hear the questions frequently . . .

Where and how does TAC get all of its information?

What kind of information is available to TAC?

All of the information used by TAC to answer questions for its clients comes from computers. Numerous computers around the nation are connected to TAC's office via telephone lines and a computer terminal. Each computer stores many different sets of information, or files, on a given subject which can be quickly accessed through the terminal by using "keywords". This process might be compared to the visual use of an index in a textbook. These keywords can also be combined to narrow a field of interest so that only information pertinent to the question is retrieved.

The information retrieval specialists at TAC are experts in the process of selecting the proper computer data bases and then using the most logical keywords when looking for answers to clients' questions.

A complete list of all the computer files available to TAC is included with this article. The files are organized by general categories such as Engineering, Business, Medical, etc. Each file contains thousands of citations to articles, patents, papers, technical reports, and proceedings. (Total available number is well in excess of 40 million citations).

TAC encourages its clients to read the list of files available so that together we can prevent overlooking a source that might have some potential. A complete explanation of each file and its contents is available upon request.



A DIVISION OF THE INSTITUTE FOR APPLIED RESEARCH SERVICES
UNIVERSITY OF NEW MEXICO

NASA

NASA's Technology Application Center
provides
TECHNICAL INFORMATION SERVICES

Exhibit A

for
THE PRIVATE SECTOR

Through its Technology Utilization Program, NASA seeks to promote wider use of its vast technological resources. The TECHNOLOGY APPLICATION CENTER (TAC) is one of seven NASA Industrial Applications Centers located across the country. TAC's goal is to help your company save time and money by tapping the world's largest computerized library of technical information. By taking advantage of TAC's services, your company and the nation can benefit through increased industrial efficiency and productivity.

TAC'S INFORMATION SERVICES

The Comprehensive Study—TAC will put one or more of its Application Engineers to work on your technical problem. After consultation with your staff, the TAC Application Engineer will conduct a wide-ranging computerized literature search. He will review the search results and order reprints of articles and government reports which are potentially relevant to your problem. Following thorough study of these documents and telephone conversations with NASA engineers with experience in the problem area, the Application Engineer will prepare a report. This report will contain the literature search results, reprints of relevant documents, a commentary on his analysis of the documents and his conversations with experts, and will provide recommendations for your future action. The price of each Comprehensive Study is quoted individually. The average price is $2000. Delivery is made in six weeks.

The Evaluated Literature Search—This search report is a bound bibliography in which a TAC Application Engineer has reviewed and categorized each citation retrieved according to topic and relevancy. In many cases, the Application Engineer will supplement the computer search with a manual search and with a list of specialists working in the problem area.

The price of the Evaluated Literature Search is set at $150 for the first data base searched and $100 for each additional data base searched. The average price is $450. Delivery is made in three weeks.

The Unevaluated Literature Search—The search report is a computer printout of citations resulting from the TAC Application Engineer's computer literature search. The Application Engineer can often supplement the search report with a list of specialists working in the problem area.

The price of the Unevaluated Literature Search is set at $75 for the first data base searched and $50 for each additional data base searched. The average price is $225. Delivery is made in two weeks.

The Current Awareness Service—The Current Awareness Service is a personal, technical update designed to provide you with monthly or quarterly reports regarding all new articles in your specific field. Our engineers program various computers to search thousands of new citations and to select those which conform to your customized profile. The Current Awareness Service is priced annually at $150 for the first data base and $75 for each additional data base programmed.

The Document-on-Demand Service—The Document-on-Demand Service provides you with documents, reports, and articles identified through the searches. Many of these publications cannot easily be obtained from traditional library sources; but, on a cost recovery basis (plus a $3 handling charge per order), we are happy to serve as your personal agent to retrieve desired publications quickly.

FGI	Foundation Grants Index, 1973-present
FND DIRECTORY	Foundation Directory, Current
FROST & SULLIVAN	Frost & Sullivan Defense Market, 1975-1977
GRANTS	Grants Index Prepared by Oryx Press, Current
LABORDOC	International Labour Documentation, 1965-present
LIBCON/E/T	Library of Congress Bibliographic Data Base, 1965-present
MANAGEMENT	Management Contents, 1974-present
NAT FND	National Foundations, Current
NEW MEXICO STATE	New Mexico State Agency Documents, 1950-present
PIRA	Printing & Publishing Industry Paper & Board, 1975-present
PROMPT	Predicasts Markets Abstracts, 1972-present
P/E NEWS	Petroleum and Energy News, 1975-present
PTS F&S INDEXES	Predicasts Funk & Scott Indexes, 1972-present
PTS FND ANN	Predicasts Foreign Annual Time Series, 1978-present
PTS INT STAT ABS	Predicasts International Statistics, 1972-present
PTS US ANN	Predicasts US Annual Time Series, 1978-present
PTS US REG	Predicasts US Regular Time Series, 1977-present
PTS US STAT ABS	Predicasts Domestic Statistics, 1971-present
PTS WEEKLY	Predicasts Weekly Indexes, Current
QUEBEC	French Canadian Newspapers, 1973-present
TECHNOTEC	Technology Exchange Service-CDC, Current
WORLD TEC	World Technology Exchange-CDC, Current

ENVIRONMENTAL AND POLLUTION

ALIS	Arid Lands Information System
APTIC	Air Pollution Technical Information Center, 1966-present
ASFA	Aquatic Sciences and Fisheries Abstracts, 1975-present
EMIC	Environmental Mutagens Information Center File, Current
ENERGYLINE	Environment Information Center, 1971-present
ENVIROLINE	Environment Information Center, 1971-present
ENVIRON	Technical Assistance Data System (TADS), 1972-present Oil Hazardous Materials Spills (OHMS), 1972-present
ESR	Energy Environment and Safety, 1977
ETI	Environmental Teratology, Current
FWRS	Fish and Wildlife Reference Service, 1965-present
HRP	Heated Effluents, 1774-present
MGA	Meteorological and Geastrophysical Abstracts, 1972-present
MRIS	Maritime Research Information Service, 1970-present
NBI	National Biomonitoring Inventory, Retrospective to 1977
NEMSCO	NODC Index for Instruments Measured Subsurface Current Observations, 1975-present
OCEANIC	Oceanic Abstracts, 1964-present
POLLUTION	Pollution Abstracts, 1964-present
SWIES	Solid Waste Information Retrieval System, 1964-present
TOXMAT	Toxic Materials, 1968-present
WAMIS	Watershed Management Information System
WRA	Water Resources Abstracts, 1968-present
EPD	Environmental Periodicals Bibliography, 1974-present

MEDICAL AND PHARMACEUTICAL

AVLINE	NLM-Audio Visuals, 1900-1974
BIS	Brain Information Service, 1968-present
CANCER PROJ	Cancer Research Projects, 1974-present
CANCERLINE	National Cancer Institute Data Base, 1963-present
EPILEPSY	Epilepsy Data Base, 1945-present
EXCERPTA MEDICA	Medical Research Literature, 1974-present
HOSPITAL MANG	Cooperative Information Center for Hospital Management Studies
IPA	International Pharmaceutical Abstracts, 1970-present
MEDLINE	Medlars II, 1966-present 3,000 Journals
NCDAI	National Clearinghouse for Drug Abuse Information, 1970-present
NCIAAA	National Clearinghouse of Information on Alcohol Abuse of Alcoholism, 1970-present
NCMHI	National Clearinghouse for Mental Health Information, 1970-present
PNI	Pharmaceutical News Index, 1976-present
POPINFORM	Population Information Program Data Base, 1950-present Population Information Program (PIP) Prostaglandin Information Center (GWU-PG) International Institute for the Study of Human Reproduction (CUIISHR) Center for Disease Control, Family Planning Evaluation Division (CDC-FPED) East-West Communication Institute (EWCI)
TOXLINE	Toxicity Bibliography, 1966-present Chemical-Biological Activities, 1965-present Abstracts on Health Effects of Environmental Pollutants, 1972-present International Pharmaceutical Abstracts, 1970-present Hayes File on Pesticides, 1930-1978

EDUCATION/HUMANITIES/SOCIAL SCIENCES

AHL	America: History and Life, 1964-present
AIM/ARM	Abstracts in Instructional Materials and Vocational and Technical Education, 1967-present
ART	Modern Art Bibliography, 1974-1976
CDI	Comprehensive Dissertation Index, 1861-present
CIS INDEX	Congressional Information Services, 1970-present
CHILD ABUSE	Child Abuse and Neglect, Current
CRECORD	Congressional Record, 1976-present
ERIC	Educational Resources Information Center, 1966-present
EXCEP/EXCEP CHILD	Exceptional Child Education Abstracts, 1966-present
FGI	Foundation Grants Index, 1973-present
FND DIRECTORY	Foundation Directory, Current
GRANTS	Grants Index Prepared by Oryx Press, Current
HIST ABS	Historical Abstracts-Parts A and B, 1973-present
LIBCON/E/T	Library of Congress Bibliographic Data Base, 1965-present
LLBA	Language and Language Behavior Abstracts, 1973-present
MAG INDEX	Magazine Index, 1977-present
NCJRS	National Criminal Justice Reference Service, 1967-present
NICEM/NIMIS	National Information Center for Educational Media
NTIS	National Technical Information Services, 1964-present
PAIS	Public Affairs Information Service, 1976-present
PSYCH ABS	Psychological Abstracts, 1967-present
SEX	Institute for Sex Research-Indiana, 1948-present
SOC ABS	Sociological Abstracts, 1963-present
SOC SCISEARCH	Social Sciences Citation Index, 1972-present
SSIE	Smithsonian Science Information Exchange, 1974-present

PATENT INFORMATION

TAC has pulled together patent information from 16 computerized data bases. We provide information on how many patents are held by a particular company and in what countries, as well as a monthly update on patents issued in a particular area.

With the speed of the computer, our specialists quickly locate patent literature on a specific subject, saving many costly hours in the library hand searching for the same material. The result of our search is a citation containing information on who holds the patent rights, the inventor, and the assignee, class and classification codes issued. Also included are the cross-reference class codes, foreign patent number and the U.S. patent number. Often there is a short description of the patent itself.

All requests for patent information are considered proprietary by the Technology Application Center and are held in strict confidence.

Sample Patent Citation

PATENT NUMBER	4,160,508
TITLE	CONTROLLER ARM FOR A REMOTELY RELATED SLAVE ARM
PATENTEE	AISALISBURY, J. K., JR.
ASSIGNEE	CORP: NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
ABSTRACT	A SEGMENTED CONTROLLER ARM CONFIGURED AND DIMENSIONED TO FORM A MINIATURE KINEMATIC REPLICA OF A REMOTELY RELATED SLAVE ARM IS DISCLOSED. THE ARM INCLUDES: (1) A PLURALITY OF JOINTS FOR AFFORDING SEGMENTS OF THE ARM SIMULTANEOUS ANGULAR DISPLACEMENT ABOUT A PLURALITY OF PAIRS OF INTERSECTING AXES, (2) A PLURALITY OF POSITION SENSING DEVICES FOR PROVIDING ELECTRICAL SIGNALS INDICATIVE OF ANGULAR DISPLACEMENT IMPARTED TO CORRESPONDING SEGMENTS OF THE CONTROLLER SHAFT ABOUT THE AXES, AND (3) A CONTROL SIGNAL CIRCUIT FOR GENERATING CONTROL SIGNALS TO BE TRANSMITTED TO THE SLAVE ARM. THE ARM IS CHARACTERIZED BY A PLURALITY OF YOKES, EACH BEING SUPPORTED FOR ANGULAR DISPLACEMENT ABOUT A PAIR OF ORTHOGONALLY RELATED AXES AND COUNTERBALANCED AGAINST GRAVITATION BY A CANTILEVERED MASS.
SUBJECT TERMS	/ARM (ANATOMY)/BODY KINEMATICS/MANIPULATORS/REMOTE HANDLING/CONTROLLERS/JOINTS (ANATOMY)/PATENTS/RADIATION PROTECTION
CLASSIFICATION	US-PATENT-CLASS-414-4

PRICES FOR PATENT DATA BASE SEARCHES

Retrospective Search	$75.00 per data base
except:	
World Patent Index	$185.00 per search
American Petroleum Institute	$150.00 per search
Current Awareness Search (monthly update service)	$300.00 per year
Patent Copy Service	$5.50
plus . . .	
domestic patents	.30 per page
foreign patents	.75 per page

LICENSING NASA PATENTS

Several thousand inventions result each year from the research supported by NASA. The inventions having significant commercial potential are usually patented by NASA. These inventions cover practically all fields of technology. NASA encourages use of these inventions by the granting of nonexclusive and exclusive licenses for the patents held by NASA.

The Technology Application Center can locate NASA inventions of interest to you and help you begin the patent licensing process.

PHOTO SEARCHING

The Remote Sensing-Natural Resources Division of TAC has long been a central information and distribution center for all types of aerial and satellite photography. Our range of capabilities in this activity has greatly expanded with the governor's appointment of our center as New Mexico's official affiliate to the National Cartographic Information Center (NCIC). In our role as an NCIC affiliate, we are now able to provide the user community with the most complete and up-to-date information on aerial and satellite photography of New Mexico as well as worldwide.

Time and effort spent locating photographic and cartographic data often resulted in costly duplication. The United States government recognized the need for a central information center and established the National Cartographic Information Center as a repository for this data. A national office was organized in Reston, Virginia, and to assist in handling the large number of requests, regional and state offices were established. These affiliates are able to offer personalized service to users requesting photographic products of localized areas.

Our division's experienced personnel and long history in remote sensing allow us to provide just the type of personalized counseling people need to sort through the vast amounts of photographic data currently available. Our direct computer links to nationwide data bases and our extensive microfiche and index files provide quick and easy access to this data. The computer searches have provided valuable assistance to geologists, hydrologists, planners, attorneys, botanists, students, large corporations, small businesses and government agencies.

We are equipped to help select the type of coverage best suited to specific needs, locate it and place the order. It is our job to make all the contacts and do all the work necessary to provide the final product. As an additional service, we are also prepared to provide interpretation assistance at any level.

The questions most often asked when looking for aerial or satellite photography of a selected area are what types of photos are there?, what exact area do they cover?, and how do I obtain copies of them? While TAC can certainly help answer these questions we also offer services which extend much further. We will discuss the problem or problems being faced and offer guidance on the appropriate type of photography. It is quite common that the image most suitable to satisfy the project needs is not necessarily the one you originally had in mind. TAC is also prepared to interpret the data in photographic or digital form, providing a full evaluation and report.

Past photo search clients have covered a wide range of professions and situations. TAC has assisted geologists searching for minerals in Central Africa; planners preparing resource bases for small cities; lawyers preparing litigation on water rights and rights-of-access; ranchers searching for water supplies on their range; and even individuals looking for exhibit and display materials. Photo searches are as simple or as complex as the situation demands. TAC offers two types of searches when dealing with a request: computerized and manual.

COMPUTER SEARCH—This search is conducted on our in-house terminal to access the vast amounts of cartographic information stored in the computer bank at the EROS Data Center, Sioux Falls, South Dakota. Through this search method we can locate satellite photos from the Skylab, Apollo and Gemini manned satellite missions as well as Landsat RBV and MSS satellite images for any geographic location on Earth. NASA high altitude photos and the lower altitude aerial mapping photographies from such agencies as USGS, BLM and Bureau of Reclamation to name a few, are also included in computer searches. The user will receive a printout listing all available photography relevant to his request. Each printout contains information on the photograph's scale, quality, cloud cover, film type, photo identification number, and date of exposure.



Amy Budge performing photo search on computer terminal.

If time and the size of the search permit, we will perform the search on the terminal in the client's presence.

MANUAL SEARCH—Manual searches utilize microfiche and index files to locate photography over a specific area. Upon receiving a search request, we check all files for relevant data. This includes producing hard copies of information from the microfiche on our printer, contacting appropriate holding agencies and producing a list of data pertinent to the search question.

Our microfiche files contain data on Landsat, Skylab, NASA Aircraft and USGS photography as well as a cross-referencing system to aid in locating photography. Updated frequently, these files provide historical and current information. Landsat microfiche, organized by path and row, contains data on images around the world, from 1972 to the present. Information on Skylab missions over the United States is also on microfiche. The NASA Aircraft and USGS coverage applies to New Mexico only. The microfiche contain indexes for USGS aerial mapping photography, from which individual frames over a given area can be identified. Photos can be ordered directly from these indexes, cutting data acquisition time in half. USGS data is found for projects flown in the early 1940's to the present, providing the user with an historical overview.

Our index files contain cartographic information held by such agencies as the Forest Service, Agricultural Stabilization and Conservation Service, National Archives, Soil Conservation Service and any private firms that have entered their data into the NCIC system.

Searches may be initiated by a phone call or an appointment. Computer searches are $10.00 per search and manual searches are $10.00 per hour. All photo orders may be placed through our office.

Please direct all inquiries regarding photo searching and ordering to: Amy Budge, Photo Searches, Technology Application Center, University of New Mexico, Albuquerque, NM 87131, (505) 277-3622.


The World's Largest
Technical Data Bank
Is Just A Phone Call
Away ...

Price Schedule for Products and Services

SERVICES

Computer Search*	$10.00 per search
Manual Search*	$10.00 per hour
Use of Archive*	$10.00 per hour

*$10.00 minimum

PRODUCTS

Skylab, Apollo and Gemini photography:

2" x 2" 48mm slides from limited inventory 50¢

Color Prints

16 x 16	$30.00 ea.
10 x 10	$20.00 ea.
8 x 8	$12.00 ea.
5 x 7	$10.00 ea.
4 x 5	$ 8.00 ea.

Black and White Prints

16 x 16	$20.00 ea.
10 x 10	$12.00 ea.
8 x 8	$ 7.00 ea.
5 x 7	$ 6.00 ea.
4 x 5	$ 5.00 ea.

Color Transparencies

8 x 8	$26.00 ea.
5 x 7	$18.00 ea.
4 x 5	$13.00 ea.

Annotated Slide Sets $20.00 per set

Each set contains 20 35mm slides with annotations for each slide. Subjects are:

Full and Partial Earth	Mars/Viking
Space Shuttle	Launch Vehicles
Moon/Apollo	

A 15% postage and handling fee will be added to the cost of all photography orders.

CATALOGS	DOMESTIC	FOREIGN
Gemini	$3.00 ea.	$5.00 ea.
Apollo	$3.00 ea.	$5.00 ea.
Skylab 2	$5.00 ea.	$7.00 ea.
Skylab 3	$5.00 ea.	$7.00 ea.
Skylab 4	$7.00 ea.	$9.00 ea.
Apollo-Soyuz	$2.00 ea.	$4.00 ea.

Landsat Mosaics

Colorado 1:500,000 scale (color)	$10.00
New Mexico 1:1,000,000 scale (B&W)	$ 2.00

Map of Vegetation and Land Use in New Mexico (1:1,000,000) $ 2.00

Hard copies from microfiche—prices available upon request.
Series of technical reports—list and prices available upon request.

15 minute slide/tape presentations with cassette tape and audible advance

R100	Remote Sensing	$ 90.00 ppd.
R200	Food Watch by Satellite	$100.00 ppd.
R300	Prospecting by Satellite	$100.00 ppd.
R400	Hydrology by Satellite	$100.00 ppd.
R500	Forestry and Remote Sensing	$100.00 ppd.
R600	Remote Sensing and Economic Development	$120.00 ppd.
S100	Space Settlement One	$100.00 ppd.

To order the slide/tape shows, please send check or purchase order to:

AUDIO-VISUAL INSTITUTE
6839 GUADALUPE TRAIL NW
ALBUQUERQUE, NEW MEXICO 87107

TECHNOLOGY APPLICATION CENTER
UNIVERSITY OF NEW MEXICO
ALBUQUERQUE, NEW MEXICO 87131
(505) 277-3622

A Non-Profit NASA-Sponsored Industrial Applications Center

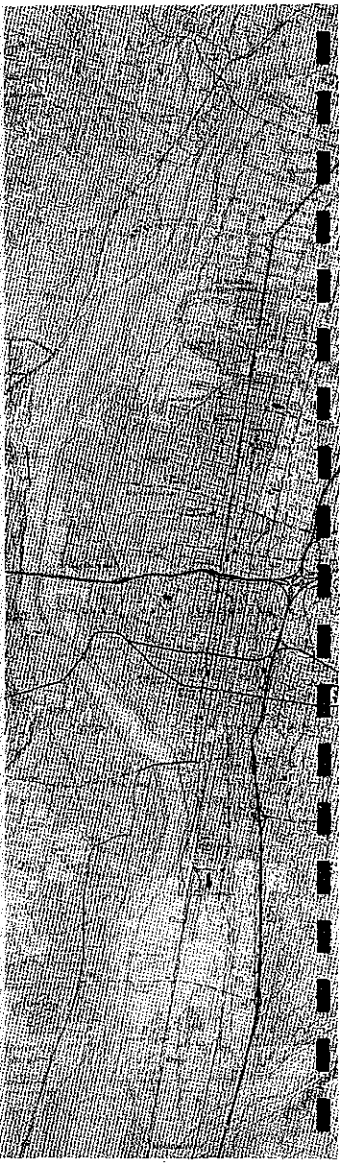


EXHIBIT C

TECHNOLOGY APPLICATION CENTER
THE UNIVERSITY OF NEW MEXICO
ALBUQUERQUE, NEW MEXICO 87131

••INFORMATION RESOURCES••

NASA
National Aeronautics and Space Administration

ENGINEERING/SCIENTIFIC

CINDAS	Center for Information and Numerical Data Analysis and Synthesis, Current
CLAIMS/GEM	Patents, General, Electrical, and Mechanical, 1975-present
COMPENDEX	Engineering Index, 1970-present
DOE RECON	DOE Energy File, 1970-present
ERD	Energy R&D Projects, 1973-1975
GAP	General and Practical Energy Information for Consumers, Current
INSPEC	I.E.E.E. Science Abstracts, 1969-present Physics Abstracts, 1969-present Electrical Engineering, 1969-present Computers and Control, 1969-present
ISMEC	Mechanical Engineering, 1973-present
ITT	Institute of Textile Technology, 1966-present
LIBCON/E	Library of Congress MARC Records - English
LIBCON/F	Library of Congress MARC Records - Foreign
MCIC	Metals and Ceramics Information Center, Current
METADEX	Metal Abstracts Index, 1966-present
MITTIS	MIT Textile Information Service, 1950-1967
NASA RECON	International Aerospace Abstracts, 1966-present Scientific and Technical Aerospace Reports, 1966-present
NCIC	National Cartographic Information Center, Current
NRC	National Referral Center - Library of Congress
NSA	Nuclear Science Abstracts, 1968-1975
NSIC	Nuclear Safety Information Center, Current
NSR	Nuclear Structure Reference File, 1977-present
NTIS	National Technical Information Services, 1964-present
PLASTIC	Plastics Technical Evaluation Center, Current
RAC	Reliability Analysis Center, Current
RIP	Research in Progress - DOE, Current
SAE ABSTRACTS	Society of Automotive Engineers, 1965-present
SCISEARCH	Science Citation Index, 1974-present
SPIN	Searchable Physics Information Abstracts, 1975-present
SSIE	Smithsonian Science Information Exchange, 1973-present
TEPIAC	Thermophysical and Electronic Properties IAC, Current
TITUS	French Textile Database, 1967-present
TTIS	Transportation Research Information Services, 1967-present
WAA	World Aluminum Abstracts, 1968-present
WTI	World Textile Index, 1970-present

BIOLOGICAL/CHEMICAL

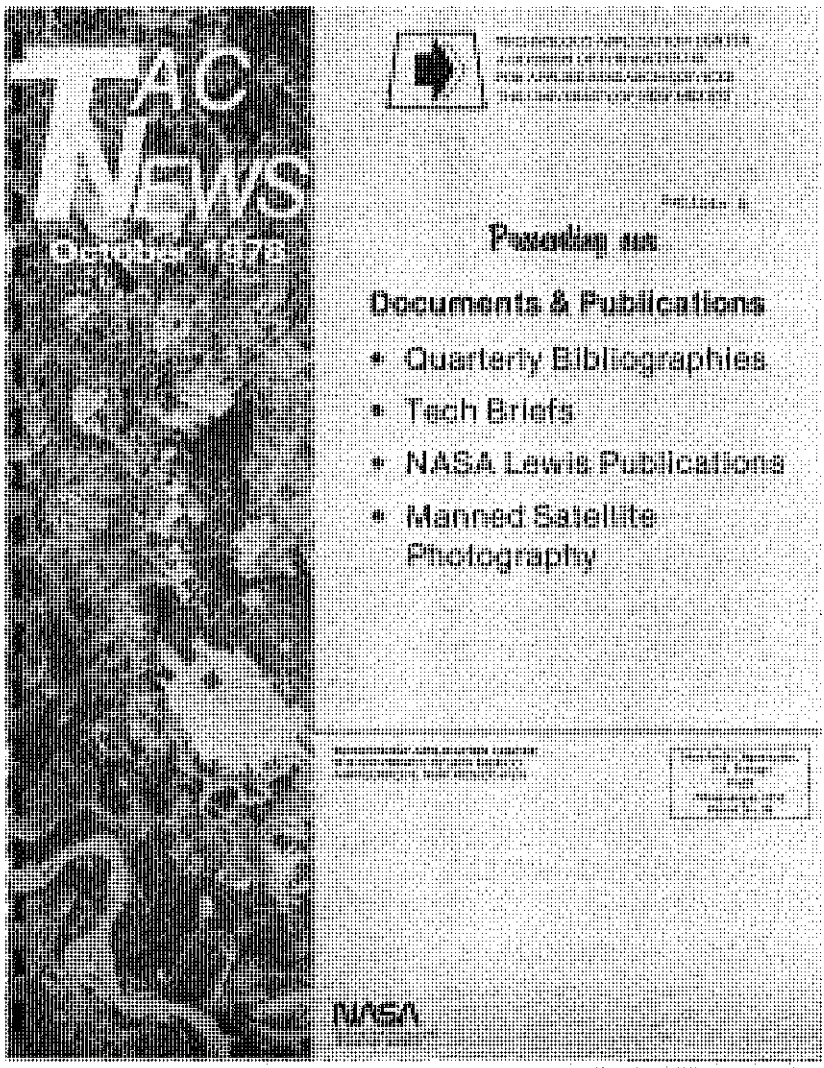
AGRICOLA	National Agriculture Cataloging and Indexing System, 1970-present
AQUACULTURE	Aquaculture File, 1972-present
AQUATIC	Aquatic Sciences and Fisheries Abstracts, 1975
BIOSIS	Biological Abstracts and Bio Research Index, 1972-present
BIRS	Biological Information Retrieval System-National Oceanographic Data Center, 1955-1974
CA CONDENS	Chemical Abstracts Condensates, 1970-present
CA PAT CONC	Chemical Patent Concordance, 1972-present
CAB ABS	Commonwealth Agricultural Bureaux, 1972-present
CASIA	Chemical Abstracts Subject Index Alert, Current
CDI	Comprehensive Dissertation Index, 1861-present
CHEMNAME	Chemical Abstracts Chemical Name Directory, 1972-present
CIN	Chemical Industry Notes, 1974-present
CIS INDEX	Congressional Information Services, 1970-present
CLAIMS/CHEM	IFI/Plenum Index to Chemical Patents, 1950-present
CLAIMS/CLASS	IFI/Plenum Index to Assignee Codes
CRECORD	Congressional Record, 1976-present
FSI	Foundation Grants Index, 1973-present
FSD DIRECTORY	Foundation Directory, Current
FSTA	Food Science and Technology Abstracts, 1970-present
FWRS	Fish and Wildlife Reference Service, 1965-present
GRANTS	Grants Index Prepared by Oryx Press, Current
LIBCON/E/F	Library of Congress Bibliographic Data Base, 1965-present
NTIS	National Technical Information Services, 1964-present
OCEANIC	Oceanic Abstracts, 1964-present
PAPER CHEM	Institute of Paper Chemistry, 1968-present
SCISEARCH	Science Citation Index, 1974-present
SSIE	Smithsonian Science Information Exchange, 1974-present
TSCA	Toxic Substances Control - Candidate List
USDA/CRIS	Current Research Information System in Agriculture, 1974-present
WPI	World Patent Index File, 1963-present
WRIS	Wildland Resource Information System, Current

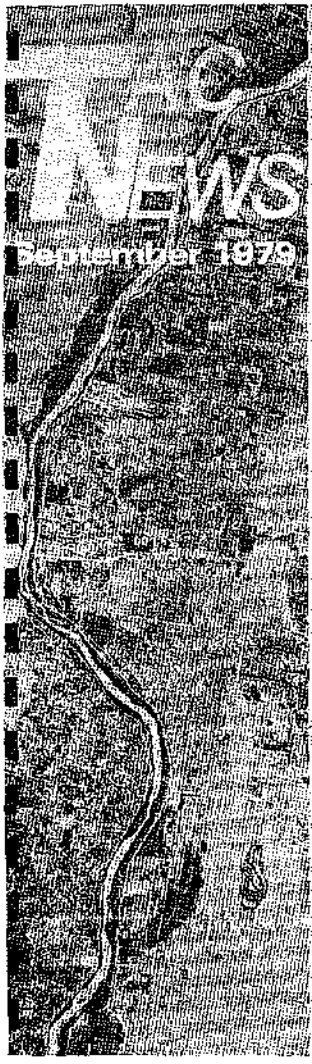
GEOLOGICAL AND MINERAL RESOURCES

APILIT	American Petroleum Institute Literature, 1964-present
APIPAT	Petroleum Patents - American Petroleum Institute, 1964-present
CRIB	USGS Mineral Resources Data System, 1969-present
GEOARCHIVES	Geoarchives England, 1974-present
GEOREF	American Geological Index, 1967-present
P/E NEWS	Petroleum/Energy Business News Index, 1975-present
RICIRS	Rare Earth Information Center - Ames
TULSA	Oil and Gas Exploration - University of Tulsa, 1965-present

BUSINESS/GOVERNMENT

ABI/INFORM	Abstracted Business Information, 1971-present
ACCOUNTANTS	Accountants Index, 1977-present
ASI	American Statistical Index, 1960-present
CA PAT CONC	Chemical Patent Concordance, 1972-present
CBPI	Canadian Business Periodicals Index, 1975-present
CDI	Comprehensive Dissertation Index, 1861-present
CIN	Chemical Industry Notes, 1974-present
CIS INDEX	Congressional Information Services, 1970-present
CLAIMS/CHEM	IFI/Plenum Index to Chemical Patents, 1950-present
CLAIMS/GEM	IFI/Plenum Index to General, Electrical, and Mechanical Patents, 1950-present
CNI	Canadian Newspaper Index, 1977-present
CONF	Conference Papers Index, 1973-present
CRECORD	Congressional Record, 1976-present
EIS NON MANFG	Economic Information Systems - Non Manufacturing, Current
EIS PLANTS	Economic Information Systems Industrial Plants, Current
FED INDEX	Predicasts Federal Index, 1977-present
FEDREG	Federal Register Abstracts, 1977-present


TAC NEWS
October 1978
Providing us
Documents & Publications
• Quarterly Bibliographies
• Tech Briefs
• NASA Lewis Publications
• Manned Satellite Photography
NASA



TECHNOLOGY APPLICATION CENTER
A DIVISION OF THE INSTITUTE
FOR APPLIED RESEARCH SERVICES
THE UNIVERSITY OF NEW MEXICO

The Remote Sensing-Natural Resources Division

Exhibit D

introduces

PHOTO SEARCH SERVICES

- Computerized Searching Techniques
- Manual Searches
- Photo Interpretation Services
- Photo Archive
- Manned Satellite Photography

A National Cartographic Information Center Affiliate

TECHNOLOGY APPLICATION CENTER
THE UNIVERSITY OF NEW MEXICO
ALBUQUERQUE, NEW MEXICO 87131

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NASA

with virtually all current international and domestic interest in Solar Thermal Energy Utilization. Our editions have grown from 900 citations a year to 1500 citations a *quarter*.

The bibliography is a three-volume set, available separately which covers the current research on three distinct topics: 1) Power Generation (such as Wind, Ocean or Concentrated Thermal Power), 2) Solar Components and Hardware (Collectors, Heat Exchangers, Irrigation Pumps), and 3) Heating and Cooling Systems (Thermal Storage, Architecture, Passive Solar). We believe these three divisions allow for comprehensive, yet concise, publications. Our abstracts are drawn from several computerized data files and represent well over 10,000 published sources of literature and research.

We have recently streamlined our format to make reading even easier and allow our subscribers to quickly examine abstracts of interest. Our staff in the Documents Department is prepared to order full-length reports upon request, making this a comprehensive and current overview of international solar research for all subscribers.

Remote Sensing



Remote Sensing consists of techniques for measuring the characteristics of an object without making actual physical contact with that object. The first form of remote sensing was the camera. This technology has since progressed with the development of sophisticated multi-camera systems, scanners, and radiometers. Modern devices are carried on aircraft and in both manned and unmanned spacecraft.

A fundamental feature of remote sensing is that the techniques allow objects to be viewed in wavelengths far removed from the visible. Images can now be made of objects and phenomena in the very short ultraviolet, visible, infrared, and longer microwave wavelengths.

Remote sensing has proven to be an important technological tool in such diverse fields as mineral exploration, land-use mapping, archeological studies, crop forecasting, pollution monitoring, and wildlife studies.

To help keep current on the state of this art, TAC publishes *Remote Sensing of Natural Resources: A Quarterly Literature Review*. This series provides the reader easy access to current applications and research in abstract form, supplemented by indexes of authors and title/subject terms. The *Review* is divided into seven broad subject areas:

- General Overview
- Geology and Hydrology
- Agriculture and Forestry
- Marine Sciences
- Urban Land-Use
- Instrumentation
- Image and Machine Processing

In addition, the *Review* contains a section devoted to up-to-date news releases and NASA *Tech Briefs*, as well as a calendar of events (conferences, short courses, seminars) of direct interest to the remote sensing community.

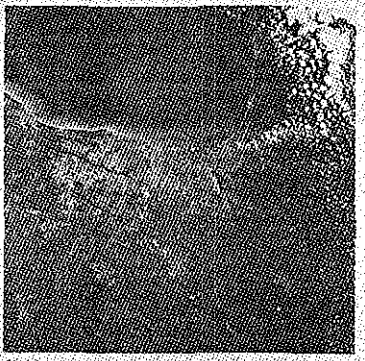
Tech Briefs

Tech Briefs is a quarterly publication containing short technical notes on NASA's latest innovations and is free to any U.S. citizen or organization. It is both a current-awareness medium and a problem-solving tool. Potential products . . . industrial processes . . . basic and applied research . . . shop and lab techniques . . . computer software . . . new sources of technical data . . . concepts . . . you will find them all in NASA *Tech Briefs*. The first section highlights a few of the potential new products contained in *Tech Briefs*. The remainder of the volume is organized by technical category to help you quickly review new developments in your areas of interest. Finally, a subject index makes each issue a convenient permanent reference file.

Although many articles are complete in themselves, others are backed up by *Technical Support Packages* (*TSP's*). *TSP's* are available without charge and may be ordered. Further information on some innovations is available for a nominal fee from other sources, as indicated at the ends of the articles.

NASA Lewis Publications

In addition to our own quarterlies, we are a major distribution center for NASA-sponsored solar and wind research now in progress at Lewis Research Center in Cleveland. By agreement with the Lewis Center, documents are made available well in advance of their release through other channels. At present our list of Lewis publications consists of over 100 articles on the latest solar and wind technology.



Skylab 3 photograph of Chicago. Similar photographs are available from TAC. (See back page)

TAC News is designed and edited by Amelia Komarek, Assistant to the Director, TAC.

INTERPRETATION SERVICES

In addition to our searching and ordering capabilities, we extend our services to photo interpretation, helping the customer identify relevant data on the images he has purchased. Our personnel have a combined history of over 40 years experience in satellite and aerial photo interpretation in virtually all research areas. Our expertise covers a wide variety of film types: black and white, color and color infrared aerial and satellite photography; aerial and satellite scanner data, thermal infrared and radar. Some of the types of interpretations we have performed are:

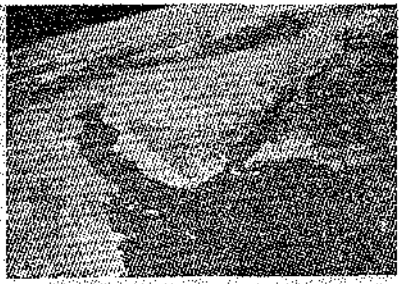
- Analysis of aerial scanner data for archaeological sites
- Coal surface mine monitoring utilizing Landsat satellite data
- Vegetation cover mapping from aerial photos
- Resource inventories for reservoir planning
- Analysis of temperature loss using an airborne thermal scanner
- Surface area measurements of reservoirs by Landsat
- Remote Sensing Short Courses
- Lineament mapping from aerial and satellite photography



ANNOTATED SLIDE SETS

TAC is pleased to introduce a new series of annotated slide sets. Each set contains 20 slides and a list of annotations and sells for $20.00 each. The Full and Partial Earth Set and the Moon/Apollo set contain some of the most popular and spectacular orbital photos of the earth and moon taken during the Apollo program. The Mars/Viking set has many orbital views of Mars as well as an excellent selection of slides of the Mars surface taken from the Viking landers. Through artist concepts and in-flight photos our new Space Shuttle set illustrates the many aspects and applications of America's newest space vehicle. Our launch vehicle set is a selection illustrating many of the important rocket boosters during the last 20 years of America's space program, including Saturn, Titan, Atlas, Delta, and many others.

Now available . . . Landsat color prints of selected areas over New Mexico. We have, in stock, 1:500,000 scale prints of highest quality over Albuquerque, the Jemez Craters, White Sands, the Sangre de Cristo Mountains, Elephant Butte Reservoir and the San Juan Basin. For further information, please write or call.



MANNED SATELLITE PHOTOGRAPHY

We are continuing to maintain our popular in-house collection of second-generation masters from Gemini, Apollo and Skylab manned missions. The masters are color, color infrared, black and white, and black and white infrared from which positive transparencies or prints can be made. Print ranges in size from 4 x 5 inches to 16 x 16 inches and transparencies range from 4 x 5 inches to 9 x 9 inches. Also available is a limited inventory of 46 mm. super slides from these missions.

To help identify and locate individual frames, we have developed a series of descriptive catalogs. Gemini, Apollo, and Apollo Soyuz photography are represented by one volume apiece. Skylab missions 2, 3, and 4 each have their own volume. These catalogs contain detailed information on individual frame coverage, quality, percent cloud cover, percent snow cover, and whether the format is oblique or vertical. The mission date, altitude, camera system and film type are also identified. The catalogs do not contain photographs. We recommend purchase of these volumes before ordering photographs.

IN-HOUSE ARCHIVAL LIBRARY

Our photo archive has expanded to more than 30,000 individual frames of black and white aerial photography over New Mexico. Contributors to this unique collection include the U.S. Geological Survey (USGS), Soil Conservation Service (SCS), Agricultural Stabilization and Conservation Service (ASCS), Forest Service, and the University of New Mexico Geology Department. Photos date from 1935 through the 1980's and vary in scale from 1:12,000 to 1:40,000. The collection also contains SCS 15 and 7½ minute controlled mosaics for most of New Mexico.

Our archival library includes over 6,000 black and white, color and color infrared NASA Aircraft photos. Most of the high altitude U-2 and RB-57 photography are on film rolls at a scale of 1:125,000 and are available for in-house use.

Access to the archive may be made by letter, telephone or appointment. A $10.00 per hour fee is charged to retrieve the photography.

Exhibit F

TECHNOLOGY APPLICATION CENTER
THE UNIVERSITY OF NEW MEXICO
ALBUQUERQUE, NEW MEXICO 87131

PUBLICATIONS AND PRICE LIST

NASA
National Aeronautics and Space Administration

HEAT PIPE TECHNOLOGY: A BIBLIOGRAPHY WITH ABSTRACTS*

This bibliographic series cites and abstracts the literature devoted to the heat pipe, a simple device first developed for NASA's aerospace program, which can transport thermal energy with little drop in temperature. The heat pipe has been used extensively on the Alyeska Pipeline Project in Alaska to protect the frozen tundra from the possibility of melting due to the high temperature of the crude oil being transported through the pipeline.

The Heat Pipe Bibliographic Series, the only one of its kind being published today, is produced jointly with the University of New Mexico's College of Engineering Heat Pipe Office, headed by Dr. K. T. Feldman, a widely recognized expert on the heat pipe. Each quarterly issue is divided into the broad areas of General Information; Heat Pipe Applications; Heat Pipe Theory; Design, Development, and Fabrication; and Testing and Operation. Author and Keyword/Title indexes are included, as well as a special index covering Patents.

	DOMESTIC	FOREIGN
Cumulative Volume (through 1972)	$ 30.00	$ 32.50
1973 Annual Supplement	15.00	17.50
1974 Annual Supplement	20.00	22.50
1975 Quarterly Update Service	60.00	70.00
1976 Quarterly Update Service	60.00	70.00
1977 Quarterly Update Service	75.00	85.00
1978 Quarterly Update Service	85.00	95.00
1979 Quarterly Update Service	95.00	105.00
1980 Quarterly Update Service	100.00	110.00

****

HYDROGEN ENERGY: A BIBLIOGRAPHY WITH ABSTRACTS*

Hydrogen is a pollution-free energy resource or carrier that may be produced from a variety of sources and transmitted over long distances. Its advantages lie in its safety, inexhaustible supply, clean qualities, and ease in transmission.

Our Hydrogen Energy Bibliographic Series cites and abstracts the literature devoted to hydrogen as a synthetic fuel and energy carrier. Both domestic and foreign literature are cited and abstracted into five major sections: General; Production; Utilization; Transmission, Distribution, and Storage; Safety; and Materials. Included at the end of each volume are Author and Keyword/Title indexes.

	DOMESTIC	FOREIGN
Cumulative Volume (through 1973)	$ 25.00	$ 27.50
1974 Annual Supplement	22.50	25.00
1975 Quarterly Update Service	60.00	70.00
1976 Quarterly Update Service	60.00	70.00
1977 Quarterly Update Service	75.00	85.00
1978 Quarterly Update Service	85.00	95.00
1979 Quarterly Update Service	95.00	105.00
1980 Quarterly Update Service	100.00	110.00

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SOLAR THERMAL ENERGY UTILIZATION: A BIBLIOGRAPHY WITH ABSTRACTS*

This bibliographic series cites and abstracts the literature devoted to the thermal application of solar energy. The cumulative, 1974 semiannual supplement, and the 1975 and 1976 quarterly update volumes are divided into seven broad categories: Development; Solar Radiation; Material Properties; Components; Space Heating and Cooling; Process Heat; and Power Generation. These volumes contain Author, Corporate Source, Title, and Keyword indexes.

The greatly increased activity in solar research and development in recent years has required us to expand, starting with the 1977 issues, the scope of the previous one-volume update into three non-overlapping, non-duplicative volumes: Solar Thermal Power Generation; Solar Thermal Components; and Solar Thermal Heating and Cooling. These volumes are indexed for Author and Keyword/Title.

	DOMESTIC	FOREIGN
Cumulative Volume (1957 through June, 1974; two-volume set) and Semiannual Supplement (July-December, 1974)	$ 50.00	$ 70.00
1975 Quarterly Update Service	60.00	70.00
1976 Quarterly Update Service	60.00	70.00
1977 Quarterly Update Service:		
Volume I: Solar Thermal Power Generation	75.00	85.00
Volume II: Solar Thermal Components	75.00	85.00
Volume III: Solar Thermal Heating and Cooling	75.00	85.00
Complete Three-Volume Set	200.00	230.00
1978 Quarterly Update Service:		
Volume I: Solar Thermal Power Generation	90.00	100.00
Volume II: Solar Thermal Components	90.00	100.00
Volume III: Solar Thermal Heating and Cooling	90.00	100.00
Complete Three-Volume Set	240.00	270.00
1979 Quarterly Update Service:		
Volume I: Solar Thermal Power Generation	100.00	110.00
Volume II: Solar Thermal Components	100.00	110.00
Volume III: Solar Thermal Heating and Cooling	100.00	110.00
Complete Three-Volume Set	270.00	300.00
1980 Quarterly Update Service:		
Volume I: Solar Thermal Power Generation	105.00	115.00
Volume II: Solar Thermal Components	105.00	115.00
Volume III: Solar Thermal Heating and Cooling	105.00	115.00
Complete Three-Volume Set	275.00	305.00

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Section 3

Documents and Publications

The Solar Thermal Bibliography

One of the most popular technical subjects today is the thermal application of solar energy. The Solar Thermal Bibliographies, published and updated quarterly by TAC, provide abstracts of articles concerning most of the areas of solar energy research and development.

TAC's Solar Thermal Bibliography is divided into the three major volumes of "Power Generation," "Solar Thermal Components," and "Heating and Cooling." These volumes contain author, subject, and keyword indexes.

"Power Generation" includes thermal, wind, and photovoltaic production of electricity, total energy systems, and solar energy overviews with national and international perspectives.

"Components" contains information concerning component development and production. It is not a catalog of products available to the solar industry. It does cover articles published on such subjects as solar collectors and their performance, heat pumps, heat exchangers, solar ponds, distillation, process heat, and pumps.

"Heating and Cooling" contains abstracts on design, construction, and maintenance considerations for solar heating and cooling. It lists national demonstration projects, individual design processes, and computer evaluations. This volume also includes special categories for the ever expanding field of passive solar energy systems.

Anyone interested in this excellent series of bibliographies may call or write for prices and additional details:

Technology Application Center
Documents and Publications Section
University of New Mexico
Albuquerque, NM 87131
(505) 277-3622

Section 4

Small Business Activities and Subscriber Benefits



TECHNOLOGY APPLICATION CENTER
UNIVERSITY OF NEW MEXICO ☐ 2500 CENTRAL AVENUE SE
ALBUQUERQUE, NEW MEXICO 87131 ☐ TELEPHONE: (505) 277-3622

The Technology Application Center (TAC) at the University of New Mexico is pleased to introduce its Business Information Assistance Service (BIAS).

BIAS is an information retrieval service offered by TAC to support any organization which fits the SBA definition of a small business. (TAC's capabilities are described in greater detail in the attached brochure.)

The benefits to be gained from BIAS are as varied as the interests of small businesses. Many users choose to apply the information to improve products and services in order to be more competitive. Others use it to develop new products and services.

TAC will provide one "Unevaluated Literature Search" (see brochure--average price $225.00) at no charge through its BIAS program. The client may also purchase additional services, if desired, at the same rate as other TAC industrial users.

If interested, simply fill in the attached card and return it to TAC. You may also call or drop by TAC at 2500 Central SE in Albuquerque, New Mexico. (telephone: 277-3622)

Quarterly Bibliographies

Our engineering staff is active in producing its own series of quarterly reviews on specialized topics. Over the past few years, our staff has recognized that energy information, in particular, is in the forefront of user needs. We have responded by routinely tapping all major sources to condense the vast amounts of new information into manageable, up-to-date volumes. Our information is accessed and printed off-line from mainframe suppliers across the United States. We then categorize, compile, sum, keyword and index the material for reprinting and distribution. Our most popular quarterly publications are in the fields of solar, hydrogen, heat pipe and remote sensing.

For information on subscription rates, please contact Mr. Eugene Burch, Manager of Energy Projects.

Hydrogen Energy



Hydrogen is a pollution-free energy carrier produced from a variety of sources. Since it is a carrier, and not an energy source, nuclear, wind or solar energy is needed to produce the hydrogen. Advantages of this energy carrier lie in its safety, inexhaustible supply, clean qualities, and long distance transmission.

Most of today's energy needs are met by fossil hydrocarbons that have finite reserves and are in short supply throughout the world. Hydrogen as an energy carrier may be one answer for meeting these growing needs. It appears to be feasible and practical in residential as well as commercial application, and is competitive with most of today's fuel requirements, making it potentially useful in industries which now utilize fossil fuels. It may also provide higher efficiencies in electrical power generation than presently possible in conventional generating plants.

Growing interest in H_2 as an energy carrier has established a need for complete, up-to-date information on this technology. To help meet this need, we have developed a *Hydrogen Energy Bibliography* using computerized and manual literature searching techniques. Updates to this bibliography, with citations and abstracts, is produced on a quarterly basis. Foreign as well as domestic publications are cited, abstracted and indexed.

Heat Pipe Technology



Heat pipes are high-performance heat transfer devices that perform like high conductance thermal conductors. They are self-contained, closed systems which can transport heat at high rates and over long distances from a source to a sink with a minimum drop in temperature. Heat is transferred to and away from the surfaces of the heat pipe by radiation, conduction and convection. Thermal energy from the heat source is absorbed in the heat pipe evaporator by the vaporization of an internal fluid. The energy is then transported axially by the fluid vapor to the heat pipe condenser where it condenses, giving up its thermal energy to the heat sink. The condensed vapor (liquid) then returns to the evaporator via a permeable wick to complete the cycle.

Typical heat pipe applications often involve the dissipation of heat from such sources as nuclear reactors or electronic equipment. Heat pipes have been successfully used as piling supports on the Alyeska pipeline where it was ecologically necessary to prevent the freeze/thaw cycle of the Alaskan permafrost. Today there is a growing number of heat pipe demonstrations in the areas of energy conservation and solar energy. For example, heat pipes can be effectively used to recover heat from boiler stacks where the energy would normally be lost to the atmosphere. Solar energy can be collected and stored using heat pipes as the heat transfer medium in solar collectors. One such design, currently being developed by the Bureau of Engineering Research at the University of New Mexico, uses a multi-heat pipe design to absorb focused solar radiation. Energy is transported by the heat pipe absorber to a water storage tank where the energy is stored and later utilized.

TAC is the world's recognized leader in heat pipe technology. Documents, conference proceedings, technical reports, and patents are collected on a continuous basis and organized into a bibliography with abstracts entitled, *Heat Pipe Technology*. Author and Title/Subject Term indexes, as well as patent indexes are also included. Each issue of the series is now arranged into the following general categories:

- —General Information, Reviews, Surveys
- —Heat Pipe Applications
- —Heat Pipe Theory
- —Design, Development, and Fabrication
- —Testing and Operation

Heat Pipe Technology is the only publication of its kind on the market today. It is produced jointly with the University of New Mexico's College of Engineering Heat Pipe Office. The office is headed by Dr. K. T. Feldman, a widely respected expert and consultant in this technology.

Solar Thermal Energy



Until the beginning of this decade, published research on solar energy was scattered and small. With the advent of an international concern for energy, a great deal of government and industrial attention has gone into all aspects of solar thermal energy utilization. This awakening of solar energy science has produced a rapidly growing information field and has made the need for some centralized research information index critical.

To help address this expanding body of documentation, TAC has been publishing quarterly updates of an original 1974 Solar Thermal Energy Bibliography to keep pace

Exhibit G

Case 1. Plumbing and Heating Firm, Farmington

Subject--Boiler Flushing and Maintenance

Information provided by TAC showed client how to improve boiler cleaning procedures and techniques. Both cleaning time and frequency of maintenance were reduced. First year savings in labor cost was $1,000.

Case 2. Construction Company, Albuquerque

Subject--Installation of Rebar in Hollow Core Masonry Walls

Information provided by TAC was implemented through several architectural firms and the construction firm. Construction cost savings was several thousand dollars.

Case 3. Home Finance Company, Roswell

Subject--Information on Residential Construction Costs

As a result of information provided by TAC, the finance company was able to reduce appraisal costs by anywhere from $35 to $60 *per* residence.

Case 4. Individual Entrepreneur, Roswell

Subject--Hydroponic Greenhouse Technology

Individual was interested in establishing a small scale commercial greenhouse operation as an addition to existing business activities. Using TAC information, he built a hydroponic greenhouse facility which grossed $8,000 in the first year of operation.

Case 5. Furniture Restoration Company, Deming

Subject--Fast Stripping of Furniture

Utilizing TAC-supplied information, this company grossed $5,000 the first year on the stripping process alone.

Case 6. Electronics Company, Albuquerque

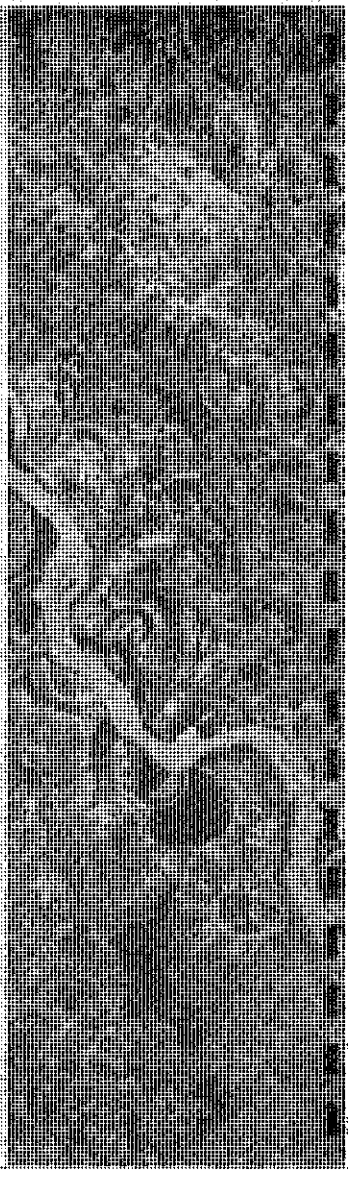
Subject--Metal Oxide Semiconductors

This is the largest identified TAC benefit in New Mexico. (Our largest overall benefit was a $100 million savings on the Alyeska pipeline). The company, working under contract to Kirtland Air Base used TAC information in two instances relating to their project. The manager of the company's Electronic Systems Department estimated the dollar benefit at more than $250,000.

Manned Satellite Photography

Upcoming Events . . .

TECHNOLOGY APPLICATION CENTER
UNIVERSITY OF NEW MEXICO



Rising construction costs concerns everyone. Bradbury & Stamm, a major southwestern construction company, is doing something about it.

Bradbury & Stamm
CONSTRUCTION COMPANY, INC.

You were able to give us some good information that provided us with background knowledge as to how we could construct masonry walls in a cheaper manner. We were able to implement this information with several Architects with the resultant savings of several thousands of dollars to Owners.

We will continue to review the various publications and information that you send us and will certainly call upon you any time we have a technical problem requiring outside assistance.

Very truly yours,

BRADBURY & STAMM CONSTRUCTION COMPANY, INC.

Robert J. Stamm
President

John D. Rupley, an Albuquerque architect, utilized a TAC bibliography on land use planning. Quoting from his letter to TAC:

RUPLEY & ASSOCIATES
ARCHITECT · PLANNER · LANDSCAPE ARCHITECT

The program was informative and obviously of a calibre which our organization could not have accomplished itself. The information from this program was utilized in later projects, although not of the same scale, and it allowed us to synthesize more planning information and to execute projects in a more professional manner.

In all, I feel that the information was quite useful and informative. I appreciated the opportunity to work with TAC in this regard. Because of the detail and the professional manner in which this project was undertaken by your organization, we hope to use TAC on future projects.

Sincerely,

John D. Rupley, AIA, AILA

Commenting on work done for the BDM Corporation, David R. Alexander writes:

2600 Yale Blvd. S.E., Albuquerque, NM 87106 - (505) 843-7570

THE BDM CORPORATION

We were well pleased with the performance of the survey, and the articles recovered were of major benefit in performing the required research.

As a result of our satisfaction with the original survey, we have used the TAC service on a modeling contract with the U. S. Army Harry Diamond Laboratories. The results of that survey were equally beneficial.

Thus far, programs utilizing the material derived from the two TAC surveys conducted for BDM exceed $250,000 in value. We consider the TAC services to be extremely valuable, and we routinely include them in proposed programs which require excensive literature reviews.

Very truly yours,

THE BDM CORPORATION
David R. Alexander
Manager, Electronic Systems Department

Tom Summers is a leading independent circuit design engineer contracting circuit design tasks for various public and private companies. TAC compiled an abstracted bibliography for Mr. Summers on Proton Precession magnetometers.

TOM SUMMERS
ELECTRONICS ENGINEER
SUMMERS ENGINEERING
912 BRYN MAWR DR NE
ALBUQUERQUE, N. M. 87106

As a result of the search, it was obvious that it would be cheaper to purchase a commercial unit and modify that unit as required.

The economics relative to the search are difficult to pin down; however, the $9000 that would have been spent on building a magnetometer was directed into other developments that proved profitable with regard to subsequent company business. I would estimate that my client has brought an additional income of approximately $100,000 into New Mexico as a direct result of the search.

Sincerely,

Tom Summers

QUARTERLY LITERATURE REVIEW OF THE REMOTE SENSING OF NATURAL RESOURCES*

This bibliographic series cites and abstracts the literature devoted to remote sensing theory and applications. The REVIEW has proven to be both a valuable aid and timely service for many who are working with remote sensing and satellite imagery in such diverse fields as mineral exploration, land-use mapping, crop forecasting, pollution monitoring, and wildlife studies.

Each quarterly issue is divided into six broad subject areas: General; Geology; Environmental Quality; Hydrology; Vegetation; Oceanography; Regional Planning and Land Use; Data Manipulation; and Instrumentation and Technology. In addition to the above, the REVIEW now carries a series of up-to-date news releases, NASA Tech Briefs, and a calendar of forthcoming events. The REVIEW includes an Author index for easy reader access. Issues prior to 1976 are available in limited supply. Prices sent upon request.

	DOMESTIC	FOREIGN
1976 Quarterly Update Service	$ 60.00	$ 70.00
1977 Quarterly Update Service	75.00	85.00
1978 Quarterly Update Service	85.00	95.00
1979 Quarterly Update Service	95.00	105.00
1980 Quarterly Update Service	100.00	110.00

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WIND ENERGY UTILIZATION: A BIBLIOGRAPHY WITH ABSTRACTS

This bibliography, produced by the Technology Application Center under the joint sponsorship of the National Aeronautics and Space Administration, the Energy Research and Development Administration, and the National Science Foundation, cites and annotates the literature devoted to the utilization of wind energy. The research period covered is 1944-1974. Among the subject areas covered are: Wind Utilization; Wind Power Plants; Wind Generators; Wind Machines; Wind Data and Properties; and Energy Storage. Included for easy reader access are indexes for Author, Corporate Source, Title, and Keyword.

	DOMESTIC	FOREIGN
Cumulative Volume (1944-1974)	$10.00	$12.50

****

NOISE POLLUTION RESOURCES COMPENDIUM

This bibliography cites and abstracts the literature devoted to the problem of noise pollution. Some of the areas covered are: Noise Sources; Noise Detection and Measurement; Noise Abatement and Control; Noise Regulations and Standards; Psychological and Physiological Effects of Noise; and Patents and Contracts.

The cumulative volume covers material through 1972, with the 1973 Quarterly Update Service covering material for 1973. The series was discontinued with the 1973 service. The volumes include a subject index.

	DOMESTIC	FOREIGN
Cumulative Volume	$30.00	$32.50
1973 Quarterly Update Service	50.00	60.00

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UTILIZATION OF WASTE GLASS

This two-volume set (also available separately) is a spinoff from the Symposium on the Utilization of Waste Glass in Secondary Products, held in Albuquerque, New Mexico January 24-25, 1973. One volume contains the proceedings of the Symposium. The other volume is a bibliography cumulative through June, 1973 which contains abstracts of pertinent literature, full-length articles and papers, and relevant NASA Tech Briefs. Indexed in three general subject areas: Glass Aggregate; Glass Waste; and Waste Glass Technology. Included is a Title/Subject index.

	DOMESTIC	FOREIGN
Cumulative Bibliography	$15.00	$17.50
Symposium Proceedings	10.00	12.50
Combined Two-Volume Set	20.00	23.00

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SYMPOSIUM ON ROLAMITE

The papers presented at the First Symposium on Rolamite, held in Albuquerque in 1969, are collected in this volume.

	DOMESTIC	FOREIGN
Symposium on Rolamite	$10.00	$12.50

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*All of these are published four times yearly to coincide with the end of each calendar quarter (March 31, June 30, September 30, December 31). Subscription prices include handling and shipment by U.S. Postal Service Fourth Class mail. Foreign shipments are via surface mail. Air shipment will be billed if requested.

The Technology Application Center (TAC) at the University of New Mexico in Albuquerque was established in 1965 by NASA as one of six facilities to transfer aerospace technology to the public/private sector. We now access over one hundred computerized data bases, as well as NASA's vast technical library, in order to provide technical assistance to researchers in any field. Services include customized literature searches, monthly or quarterly current awareness services, and highly specialized technical assistance, all designed as valuable, time-saving research tools. Further information on any of our products or services may be obtained by contacting TAC by mail or phone (505) 277-3622.

Mail to: TECHNOLOGY APPLICATION CENTER
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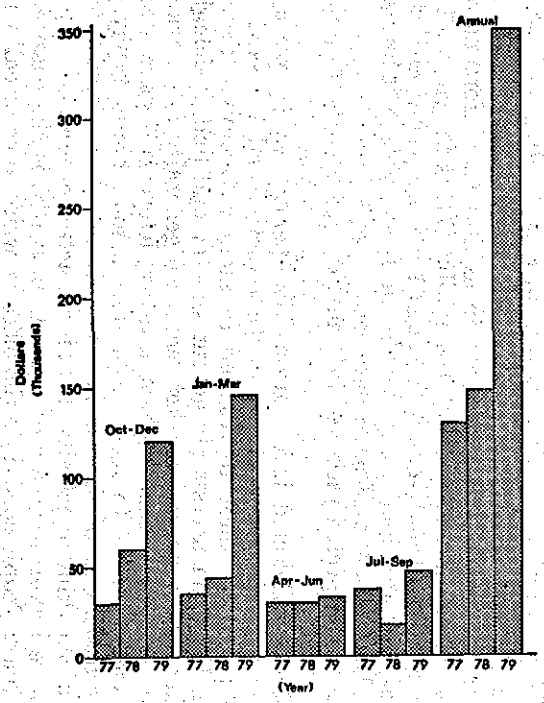
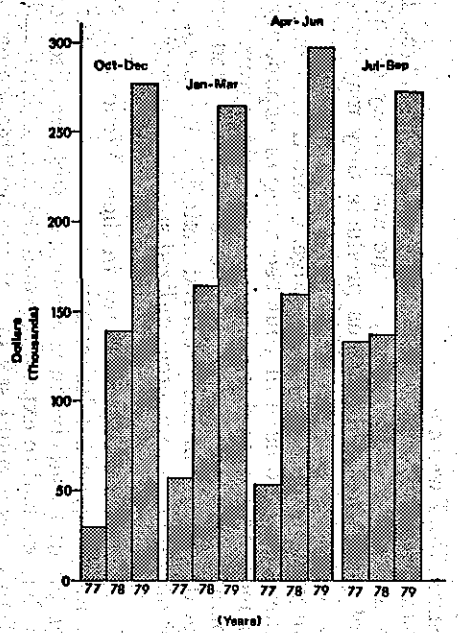
ALBUQUERQUE, NEW MEXICO 87131 USA



Cash Income



Value of Work in Progress

EXHIBIT J

Exhibit G

Case 1. Plumbing and Heating Firm, Farmington

Subject--Boiler Flushing and Maintenance

Information provided by TAC showed client how to improve boiler cleaning procedures and techniques. Both cleaning time and frequency of maintenance were reduced. First year savings in labor cost was $1,000.

Case 2. Construction Company, Albuquerque

Subject--Installation of Rebar in Hollow Core Masonry Walls

Information provided by TAC was implemented through several architectural firms and the construction firm. Construction cost savings was several thousand dollars.

Case 3. Home Finance Company, Roswell

Subject--Information on Residential Construction Costs

As a result of information provided by TAC, the finance company was able to reduce appraisal costs by anywhere from $35 to $60 *per* residence.

Case 4. Individual Entrepreneur, Roswell

Subject--Hydroponic Greenhouse Technology

Individual was interested in establishing a small scale commercial greenhouse operation as an addition to existing business activities. Using TAC information, he built a hydroponic greenhouse facility which grossed $8,000 in the first year of operation.

Case 5. Furniture Restoration Company, Deming

Subject--Fast Stripping of Furniture

Utilizing TAC-supplied information, this company grossed $5,000 the first year on the stripping process alone.

Case 6. Electronics Company, Albuquerque

Subject--Metal Oxide Semiconductors

This is the largest identified TAC benefit in New Mexico. (Our largest overall benefit was a $100 million savings on the Alyeska pipeline). The company, working under contract to Kirtland Air Base Used TAC information in two instances relating to their project. The manager of the company's Electronic Systems Department estimated the dollar benefit at more than $250,000.

Mr. LUJAN. Would you have the answer to a question, such as I have got sufficient waste materials on my farm to be able to supply a small gasohol plant or alcohol fuels plant. Can you tell me, based on the material that I have, which is the best plant given this amount of material, how much alcohol could I get from it and who builds that plant? Could you solve that problem for me if I came to you?

Dr. MORAIN. Your use of the word "solve" is difficult for me.

Mr. LUJAN. I want you to tell me where to go to buy the plant, too.

Dr. MORAIN. We would be more than happy to work on that problem if you were to bring it to us, yes. The way we would normally operate is to retrieve all of the available information and then retain the services of experts in that area who would then prepare a document for you with recommendations. We are advised by NASA that we are not in the business to solve problems. We are in the business to supply information and make recommendations. We don't like to solve problems in that sense because we don't want to be in competition with the private sector.

Mr. LUJAN. How many technical centers are there across the conutry?

Dr. MORAIN. There are seven today sir.

Mr. LUJAN. So it could be regional?

Dr. MORAIN. It is now regionalized.

I might draw your attention to exhibit G, which is the loose page unbound in your document, because the one that is bound in your document has an error in it. This simply lists 11 cases for small business activities in the State of New Mexico. The university cost-shares the contract with NASA. The money that the university cost-shares, we have set this aside as a business assistance program in New Mexico so that small businesses can come to our facility and ask a question, a technical question, which we will then search and supply information on.

Mr. LUJAN. How much did it cost in case No. 1 to get the information from you so he could save $1,000?

Dr. MORAIN. Well, the cost, which we don't pass onto the client, it is a free service for small business enterprises in New Mexico.

Mr. LUJAN. That is the best kind.

Dr. MORAIN. You bet. We hope, of course, that having sampled our products and services that the firm will come back on a paying basis because we would like to be able to service as many small businesses in the State as we can. We also utilize on occasion people from SCORE in the SBA offices. To answer your question, I think the current price has an equivalent value of about $225.

Mr. LUJAN. Thank you.

STATEMENT OF LARRY KEHOE, ENERGY AND MINERALS DEPARTMENT, STATE OF NEW MEXICO

Mr. KEHOE. I would like to thank this committee for the opportunity to be here. I have submitted testimony, which I hope will be part of this record.

Mr. LLOYD. It will be accepted into the record without objection.

Mr. KEHOE. If I could, Mr. Chairman, I would like to make several comments about five specific points dealing with the problems the

EXHIBIT H

Subscriber Benefits

"Paths explored by few may have greater rewards than highways pounded by thousands"

The success of our programs can best be measured by subscriber attitudes towards our products, and that in turn, by the dollars or time we save them. We therefore have a major on-going activity to track the fate of information supplied to our subscribers. Since we deal with all sectors of private, corporate and governmental society, we find that the ultimate uses of our information are equally diverse . . . starting new businesses, resolving legal questions, reducing labor costs, assisting investment decisions, solving design problems, increasing efficiency, or just plain stimulating thought.

Our subscribers have expressed their reactions far better than we could, so we imposed mildly on their generosity and requested permission to quote some of them. We hope you enjoy reading the following excerpts as much as we enjoyed and appreciated receiving them.

Sleuths from TAC's Remote Sensing Program located a 1936 aerial photo of northeast Albuquerque. Skillfully using this photo and a 1974 photo of the same area TAC provided realtor Dave Rice with evidence used to settle, out-of-court, a litigation involving property within the pictured area. Mr. Rice comments:

RICE CO.
REALTORS

Just a short note of thanks for your conscientious and expeditious assistance in helping solve a major problem early this year, which in all probability could not have been achieved without the direct assistance of your Technology Application Center.

The result was an out of Court settlement, and the successful reconstruction of a $750,000 project.

Technology Application Center provided invaluable assistance and I seriously believe that without their service, no reasonable solution could have been achieved.

I wish there was some way to make the public sector more aware of the service Technology Application Center has to offer them.

Sincerely,

Dave Rice
Broker

For Yoder Enterprises, a major concern in southern New Mexico, TAC provided information on furniture stripping.

YODER ENTERPRISES
3120 Columbus Road
Route 1 Box 32
Deming, NM 88030
505-546-6405

We wish to express our appreciation of your fine services. You furnished information in regard to Furniture Stripping which we used to guide us into a new business.

Sincerely yours,

G. W. Yoder

Roswell farmer/businessman Clayton Stallings now produces tomatoes year-round. Says Mr. Stallings:

We were interested in establishing a commerical green house for growing hydroponic tomatoes. My brother-in-law and I were seeking information on this subject. Your office furnished us with some information.

Based on the information we were able to obtain, we did establish a 60 X 100 foot greenhouse. We will gross approximately $8,000 this first year of operation.

Sincerely,

Clayton Stallings

Sandia is doing some good things in that area. They have those sorts of seminars and classes to help them do those sorts of things. We need to do it at the State level.

One example, though, I think, was that we last year gave out $200,000 for grants in geothermal. BDM, I think, competed and won one of those grants. It took us to this month to get that proposal through DOE. A little State money, with BDM's expertise, it went to the feds, but by the time DOE finally got us their portion of the match, it took us close to a year. That process somehow has to be cut. We have to cut down on that process.

The third point is how do we assist the small businessman. Again, here in New Mexico, their competition is not so much the big firms, it is the universities. We need to put the small firm on the same footing with universities and large corporations. I think we as a State should help the small businesses. Unfortunately when you are dealing with national issues, it is not quite that easy because we as a small State, a little over a million people, we can develop processes a lot easier than we can develop things that are national in scope.

The fourth point, is how to get this information out to the average consumer. If we can get it out to the average consumer, we can talk about the benefits of doing something. He can see the tangible benefits as far as dollar amounts and costs to him. Once you get that information out to him, be it a farmer or a gasohol plant or a consumer looking at the advantages of a solar heating system for his house, you create the demand, you create the market. Someone has to have some credibility to go out there and say this is what you can gain. Without that credibility, the average citizen is going to be fearful. Government may not have that much credibility, but it has more than a salesman off the streets. I think that is a role that Government can play.

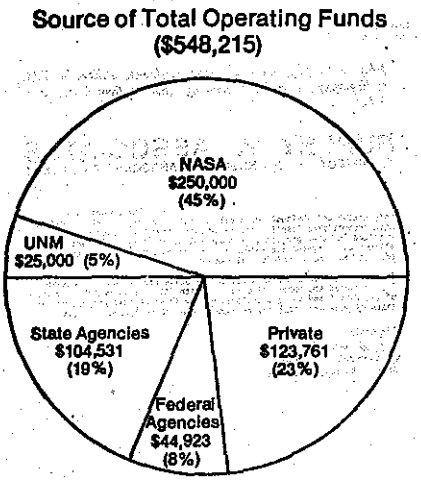
The fifth thing that I just want to mention is consumer confidence. It ties into this question of education and information. In 1977 we sat down and when we were working on our solar institute one of the things we put into that solar institute here in New Mexico was the necessity for developing standards to protect the consumer. What happens if New Mexico sits down and develops a set of standards for solar equipment without regard to what is going on in California or Florida or New Jersey or any place else, it is going to be very hard to make those standards stick. We will put small firms working in this State or selling products in this State at a disadvantage. We need some uniform standards that are applicable nationwide. We cannot do it as a State. We need someone else to take the lead.

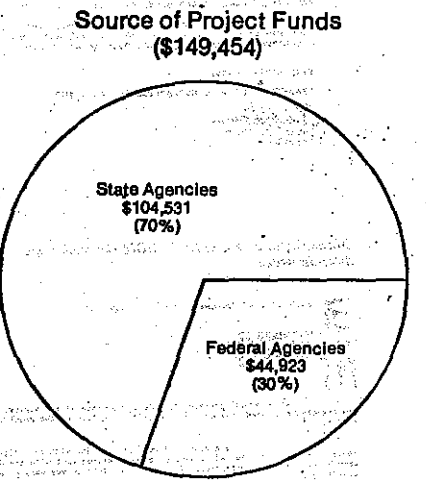
Many of the comments I am talking about are similar to what we are talking about, gasohol, solar, geothermal, across-the-board. The idea that was mentioned of the clearinghouse is a good one. It would have to be national in scope, it would have to be addressed to the particular issue we are talking about. A farmer is not going to feel comfortable going into, say, the SBA office and getting information. He is more familiar with dealing with the Cooperative Extension Service, Farmers Home, Production Credit Bank, those sorts of things that he knows about, is aware of, is familiar with them. Small businessmen could use SBA. Those things have to be geared toward the clientele.

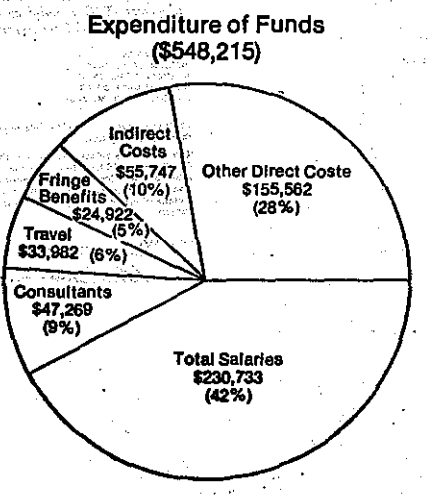
Section 5

Budget and Finance

EXHIBIT I







STATEMENT

OF

LARRY KEHOE, SECRETARY

ENERGY AND MINERALS DEPARTMENT

STATE OF NEW MEXICO

BEFORE THE

HOUSE SCIENCE AND TECHNOLOGY SUBCOMMITTEE

ON INVESTIGATIONS AND OVERSIGHT

MARCH 21, 1980

Mr. LLOYD. Mr. Lujan?

Mr. LUJAN. I don't mean to be asking all the question, but since I am familiar with the program, were you here when we had the gasohol panel?

Dr. MORAIN. No, I was not.

Mr. LUJAN. One of the problems when talking about the Technical Applications Center at that time, is the availability of information on gasohol plants and the various products they may have to turn into gasohol. Since that is not a NASA function now, I would imagine it is not in your warehouse of knowledge. Could that be on what kind of problems would we have in your becoming or expanding yourself for Department of Energy dissemination types of programs?

Dr. MORAIN. As a matter of fact, you have anticipated very nicely one of the documents in the prepared material. We discovered that we cannot operate as an undercapitalized small business within a university environment because we do have to charge a fee for our products and services in order to stay in there. We are not-for-profit, but we certainly are not-for-loss either.

In order for us to survive in this environment, we discovered some years ago that we had to expand beyond the initial NASA data base. In fact, I think you could say one of the best technology transfers that NASA has been able to effect has been the business of information retrieval. A number of commercial firms are now into that business and many of them got their start with the NASA data base, or working on the NASA data base.

One of the exhibits in the handout is, in fact, a rather awesome list of all of the data bases that we are now accessing and those data bases, for your information, sir, are in exhibit C. Unfortunately I have not paginated the document, but exhibit C lists for you well over 100 sources of information. Those range from the technical through biological, socio-economic, and we do, in fact, retrieve information from the Department of Energy data base.

Mr. LUJAN. Selected pieces of information or just general publications or what?

Dr. MORAIN. Selected information. We operate, we are perhaps a little confusing, but we operate in both an active and a passive way. We are primarily there to respond to users who have a technical question. We don't necessarily go out and try and find, although we do market in a very real market sense, we generally are marketing pieces of technology that we have already determined have a broad appeal, such as solar. In fact, we produce a solar bibliography on a quarterly basis. One of the previous witnesses has suggested that we do more of that kind of activity. That is our active program.

The more important piece of the action, really, is the passive role that we play. People come into the office or write to us or call us and say, hey, I have got a problem. I had a fellow the other day who has got a problem in Tucson. He needs to extrude 500 feet of hosing without any seams or connections and nobody has ever extruded 500 feet of anything apparently. The question is how do we go about solving that problem.

So we do both the selected, the very selected, and also the more general.

STEPPING UP THE DEVELOPMENT OF SYNTHETIC FUELS WILL NOT PROVIDE THE ANSWER. NEW MEXICO AND THE REST OF THE NATION MUST HAVE THE FLEXIBILITY OF A BROAD RANGE OF ENERGY CHOICES. FOR THIS REASON, TODAY'S CHALLENGE IS TO CREATE A WIDE VARIETY OF OPTIONS FOR THE FUTURE. AND, IN NEW MEXICO, WE ARE PROCEEDING WITH A PROGRAM, OUR RESEARCH AND DEVELOPMENT PROGRAM, WHICH HELPS PROMOTE BOTH INNOVATION AND TECHNOLOGY TRANSFER TO ACHIEVE THIS GOAL.

AS ONE STUDY ON TECHNOLOGY TRANSFER APTLY STATED, "RESEARCH AND DEVELOPMENT IS PART OF THE BOOMING 'KNOWLEDGE INDUSTRY' THAT IS BECOMING A MAJOR FORCE IN AMERICAN ENTERPRISE. IT IS AN INDUSTRY THAT FEEDS ON KNOWLEDGE IN ORDER TO CREATE MORE OF IT." PROVIDING KNOWLEDGE IN ENERGY R & D SO THAT PRIVATE INDUSTRY AND THE PUBLIC CAN BENEFIT FROM IT IS WHAT OUR R & D PROGRAM DOES.

SINCE 1974, THE NEW MEXICO STATE LEGISLATURE HAS ALLOCATED ALMOST $16 MILLION FOR THIS R & D PROGRAM. AND, A PRIMARY PURPOSE OF THE PROGRAM IS TO TRANSFER ENERGY-RELATED TECHNOLOGY DEVELOPED WITH PUBLIC FUNDS INTO PRODUCTION BY PRIVATE INDUSTRY FOR PUBLIC BENEFIT.

State government faces. I think in many cases they are fairly similar and typical to what the Federal Government is facing with this problem of energy technology transfer.

In sitting through this morning's hearings, it was very interesting to hear about some of the things that were talked about that were needed.

In my written testimony, I mentioned that New Mexico has an R. & D. program at the State level. This program has spent $16 million since its inception, which, for a State the size of New Mexico, is fairly substantial.

We have solar tax credits in New Mexico. We have solar rights legislation. We have a solar loan program. For the first time, this State has decided to get into the solar loan program. We are going to be putting out 5 percent money, which in this day and age is amazing for solar retrofits.

We have a Petroleum Recovery Institute in New Mexico dealing with how to get more oil out of the ground. We are attempting to start up a coal lab in New Mexico. We have three energy research centers in New Mexico dealing with conservation all the way through to nuclear power. We have got one solar energy institute that this year has an additional $100,000 in its budget for a total of $600,000. We have got Lee's Solar Development Corp., which was just talked about in the previous panel. We are doing things in geothermal. Last year we spent $200,000 in R. & D. money on geothermal research. This year we have an additional $600,000 for geothermal demonstration projects in New Mexico. There are a lot of things going on in this State, but we haven't solved the problems.

The five problems that I would like to discuss are similar to those that the Federal Government is facing. The first one is that in many cases the State governments don't know what problems are being faced by small business firms in the State. They don't know what type of information is needed. I think it is basically a situation of lack of communication, not so much from the standpoint of what those firms can do for this State, but how can the State help them in the promotion of their products, how can we help them in the promotion of the research that is necessary for the development of their products? These companies pay taxes to New Mexico. Some of the funds that we spend in R. & D. should be coming back to those firms. Somehow the State has to get better communications going with small high-tech firms and low-tech firms to help them in the development of their products for the benefit of our citizens.

In New Mexico the problem we have with this $16 million that we have spent so far in R. & D. is that our whole process is geared toward universities. That situation tends to keep out the small firms. They can't compete with the university. A university professor that sits down to write a proposal that is going to be judged by a peer group of professors, knows what to put down and knows how to put it down. The average small businessman does not, he puts down things that are important to him as a businessman. What we need to do at the State level, and I think the Federal Government has to do this too, is to address the problem, "How do we make the small businessman able to compete?"

TESTING, DEVELOPMENT OF STANDARDS. IN OTHER WORDS, THESE INSTITUTIONS CAN TURN THE KNOWLEDGE GAINED FROM AN R & D PROJECT INTO TERMS RELEVANT TO A NEED FOR THE TECHNOLOGY DEVELOPED AND ITS PRODUCTION CAPABILITY. FROM THIS POINT, NEW ADVANCES CAN BE RECOGNIZED, NEW TECHNOLOGIES DEVELOPED. AND, THESE INSTITUTES INTERACT WITH HUNDREDS OF COMPANIES EACH YEAR THROUGH EITHER INVOLVING THEM DIRECTLY IN A PROJECT OR MAKING ALL THE INFORMATION PERTAINING TO A PROJECT AVAILABLE TO INDUSTRY AS AVAILABLE KNOWLEDGE UPON WHICH TO DEVELOP MORE KNOWLEDGE AND IDEAS.

IN ADDITION TO THE ABOVE MENTIONED WORK OF THE R & D PROGRAM, AND ALTHOUGH STATE LAW PRESENTLY PRECLUDES ANYONE BUT INSTITUTIONS OF HIGHER EDUCATION OR NON-PROFIT RESEARCH ENTITIES FROM SUBMITTING APPLICATIONS FOR FUNDING A NUMBER OF SMALL, HIGH TECHNOLOGY FIRMS HAVE BEEN FUNDED FOR SUBCONTRACTUAL WORK ON MORE THAN 50 PROJECTS. IN ADDITION, THERE IS A POSSIBILITY THAT THE LEGISLATURE MAY CONSIDER OPENING THE PROGRAM UP NEXT YEAR TO PRIVATE FIRMS AS WELL AS TO UNIVERSITIES AND NON-PROFIT GROUPS. FURTHER-MORE, WHILE DIRECT FUNDING IS NOT AVAILABLE FIRMS

Here in this State, and we were looking at it just this week, how do you address the question of gasohol, how do you put a centralized clearinghouse together? We found out that no one department can do it. Our agency can't do it because we don't have the technical expertise to deal with such things as agricultural production. We don't have the background in financing that is necessary. How do you put the proposal together with the entrepeneur? It is very clear what we need to do. We need to put a combination of people together on a short-term basis to get some of these answers and then build it into an existing system.

One final example of how not to do it is how the Federal Government has set up the Energy Extension Service. There there was a perceived need that information was important to the consumer. Rightly so, but you just can't go out and set up a mechanism to give information out. Somebody can't go out on the street and hand out pamphlets. You have to go back four steps and find out where he is going to get that information. It is going to be important to tie in the information producers here in New Mexico, Sandia, Los Alamos, TAC, others. You have to bring those people that produce information, that have information, into the distribution system. You just can't hire people to go out and hand out pamphlets. That is not going to get it. We have to rethink that all the way back to the R. & D. portion of it, be it high tech or low tech, but build that into a system that feeds ultimately to the consumer and just not say, well, OK, we need somebody to hand out pamphlets or to sit there and man the phone because that won't do it. You need the whole thing all the way back to R. & D.

Mr. Chairman, I thank you. I didn't mean to go on.

[The prepared statement of Mr. Kehoe follows:]

PETROLEUM RECOVERY RESEARCH CENTER

IN AN EFFORT TO ASSIST THE STATE'S OIL PRODUCERS, THE LEGISLATURE HAS ESTABLISHED THE PETROLEUM RECOVERY RESEARCH CENTER AT NEW MEXICO INSTITUTE FOR TECHNOLOGY. THE CENTER, IN COORDINATION WITH THE ENERGY AND MINERALS DEPARTMENT, HAS HELPED A NUMBER OF NEW MEXICO PRODUCERS, PRIMARILY INDEPENDENTS, IN REGARD TO ENHANCED OIL RECOVERY.

THE CENTER HAS A FULL-TIME PROFESSIONAL STAFF AVAILABLE TO ASSIST ANY FIRM REGARDING ENHANCED OIL RECOVERY IN NEW MEXICO.

SOLAR ENERGY INSTITUTE

IN AN EFFORT TO ASSIST CITIZENS AND BUSINESSES INTERESTED IN SOLAR, WIND, AND BIOMASS, THE LEGISLATURE HAS PROVIDED THE NECESSARY FUNDING FOR THE NEW MEXICO SOLAR ENERGY INSTITUTE AT NEW MEXICO STATE UNIVERSITY. THE INSTITUTE, IN COORDINATION WITH THE ENERGY AND MINERALS DEPARTMENT, HAS INTERACTED WITH MORE THAN 200 HIGH TECHNOLOGY FIRMS SINCE IT WAS CREATED IN 1977. WORKING RELATIONSHIPS HAVE BEEN ESTABLISHED WITH MANY OF THESE COMPANIES. AT HOBBS, NEW MEXICO, FOR INSTANCE, TWO SUCH FIRMS ARE INVOLVED IN A HIGH TEMPERATURE PROCESS STEAM APPLICATION AT THE SOUTHERN UNION REFINING COMPANY.

66-228 O - 81 - 30

MR. CHAIRMAN,

I WANT TO THANK THE HOUSE SCIENCE AND TECHNOLOGY SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT FOR INVITING ME TO TESTIFY ON BEHALF OF THE STATE OF NEW MEXICO ON THE IMPORTANT ISSUE OF STATE INITIATIVES IN PROMOTING INNOVATION AND TECHNOLOGY TRANSFER TO SMALL, HIGH TECHNOLOGY FIRMS. THE SUBCOMMITTEE'S INTEREST IN THE PROSPECTS AND PROBLEMS IN THIS AREA IS CERTAINLY WORTHWHILE BECAUSE OF THE GREAT IMPORTANCE OF SUCH FIRMS TO PRODUCTIVITY AND THE NATIONAL ECONOMIC AND ENERGY SITUATIONS.

TECHNOLOGY IS AT THE CORE OF OUR INTERACTIONS WITH OUR ENVIRONMENT. PERSONS AND FIRMS DEALING IN INNOVATION AND TECHNOLOGY ARE DEALING IN THE "PROBLEM-SOLVING" OF THIS INTERACTION. AND, THERE IS PROBABLY NO AREA OF GREATER NATIONAL IMPACT TODAY WHICH DESPERATELY NEEDS PROBLEM-SOLVING THROUGH INNOVATION AND EXCHANGE OF IDEAS AND TECHNOLOGY THAN THE FIELD IN WHICH I WORK -- THAT IS, ENERGY. OUR DEPENDENCE UPON FOREIGN AND NON-RENEWABLE RESOURCES HAS WRECKED HAVOC UPON OUR NATIONS'S ECONOMY AS WELL AS THE SUPPLIES OF ENERGY AVAILABLE TO MEET OUR DEMANDS. THE SOLUTION TO THESE ILLS WILL NOT BE SIMPLE AND, FOR EXAMPLE, JUST

WITH THE NEED AND INCENTIVES FOR PROMOTING ADDITIONAL INNOVATION AND TECHNOLOGY TRANSFER -- WOULD BE OF GREAT BENEFIT TO NEW MEXICO.

ENERGY EXTENSION SERVICE AND WESTSUN

AS MR. LEE ALHORN TESTIFIED EARLIER THIS MORNING, NEW MEXICO HAS QUITE AN EFFORT UNDERWAY THROUGH THE RECENTLY-FORMED NEW MEXICO SOLAR ENERGY INDUSTRY DEVELOPMENT CORPORATION TO PROMOTE INNOVATION AND TECHNOLOGY TRANSFER FOR FIRMS IN THE AREA OF SOLAR ENERGY. IN ADDITION TO THE EFFORTS MADE THROUGH THE CORPORATION, OTHER AVENUES ARE AVAILABLE.

NEW MEXICO WILL BE ESTABLISHING A STATE SOLAR OFFICE IN CONJUNCTION WITH WESTSUN, THE WESTERN SOLAR UTILIZATION NETWORK, THE REGIONAL SOLAR OFFICE FOR THIS AREA. IN ADDITION TO SERVICES SUCH AS WORKSHOPS AND TRAINING AND EDUCATION, THE MAJOR FOCUS OF THIS OFFICE WILL BE ON THE PROMOTION OF SOLAR ENERGY UTILIZATION PRACTICES, THE COMMERCIALIZATION OF SOLAR ENERGY TECHNIQUES AND SUPPORT OF PROGRAMS DESIGNED TO COMMERCIALIZE MARKET-READY SOLAR AND OTHER RENEWABLE TECHNOLOGIES. SMALL, HIGH TECHNOLOGY FIRMS CAN CERTAINLY BENEFIT FROM THE WORK WE ACCOMPLISH THROUGH THIS PROGRAM.

MUCH OF THE WORK IS DONE BY OUR FOUR ENERGY INSTITUTES WHICH ARE DIVIDED UP TO COVER THE NON-RENEWABLE AND RENEWABLE ENERGY RESOURCES. THE TECHNIQUES BEING IMPLEMENTED INCLUDE THE WORKING KNOWLEDGE OF COMMERCIALIZATION PROCESSES, FACTORS, BARRIERS AND MECHANISMS; IDENTIFICATION OF SYNERGISTIC PROGRAM DEVELOPMENTS; IDENTIFICATION OF NEW ENERGY-RELATED CONCEPTS; AND THE IDENTIFICATION OF STATE ACTIONS OR INCENTIVES THAT MAY BE REQUIRED FOR THE ACCEPTANCE OF A NEW TECHNOLOGY. THE RANGE OF PROJECTS UNDERTAKEN SO FAR IS VAST -- FROM, FOR EXAMPLE, A PROJECT ON DESIGN AND CONSTRUCTION OF A PROTOTYPE SULFUR MONITORING SYSTEM TO A PROJECT ON DEVELOPMENT OF A LOW-COST, NON-TRACKING HEAT PIPE CONCENTRATING COLLECTOR.

SINCE TECHNOLOGICAL PROGRESS AND EVEN INNOVATION DEPEND ON THE ACCUMULATION OF ADVANCES IN THE "STATE OF THE ACT" AND CAN BE MOTIVATED BY THE AVAILABILITY OF CURRENT TECHNOLOGY, THE "SPIN-OFF" BENEFITS FROM OUR R & D PROGRAM FOR FIRMS ARE GREAT. THE INSTITUTIONS WE DEAL WITH THROUGH THIS PROGRAM, MAINLY OUR ENERGY INSTITUTES, NOT ONLY CONDUCT WORKSHOPS, CONFERENCES AND UTILIZE OTHER MEANS OF DISSEMINATING THE KNOWLEDGE UPON WHICH FIRMS CAN FEED ON BUT ALSO DO MARKET RESEARCH,

THROUGH THIS DEPARTMENT'S ECONOMIC DEVELOPMENT DIVISION, DIRECT CONTACT IS BEING MADE WITH HIGH TECHNOLOGY FIRMS TO ATTRACT THEM TO THIS STATE. ALL AVENUES OF FUNDING ASSISTANCE ARE INVESTIGATED FOR PERSONS AND OR FIRMS WITH INNOVATIVE IDEAS BY THIS DIVISION. IN ADDITION, THE ECONOMIC DEVELOPMENT DIVISION MAKES EVERY EFFORT TO HELP SUCH FIRMS UTILIZE THE STATE'S EMPLOYEE TRAINING PROGRAM -- NOTED AS ONE OF THE BEST TRAINING PROGRAMS IN NEW MEXICO. ACTUALLY, ONE COULD THINK OF THIS PROGRAM AS A FORM OF "TECHNOLOGY TRANSFER." BECAUSE NEW MEXICO DOES NOT HAVE A LARGE POOL OF LABORERS TRAINED IN HIGH TECHNOLOGY AREAS, THE STATE IS WILLING TO SHARE IN THE COSTS OF TRAINING RESIDENTS FOR FIRMS NEEDING PERSONS WITH TECHNOLOGICAL OR OTHER EXPERTISE.

IN ADDITION TO ASSISTING FIRMS WITH THE TRAINING PROGRAM, THE COMMERCE AND INDUSTRY DEPARTMENT MAKES EVERY EFFORT TO ENCOURAGE AND PROMOTE INNOVATION. ALTHOUGH THE DEPARTMENT DOES NOT HAVE A FULL-TIME STAFF ASSIGNED TO MARKET RESEARCH, THE STAFF OF THIS AGENCY WILL MAKE EVERY REASONABLE EFFORT TO DO SOME PRELIMINARY MARKET RESEARCH FOR SMALL FIRMS WHICH DESIRE TO IMPLEMENT

IN ADDITION, THE INSTITUTE HAS TARGETED SPECIFIC GROUPS SUCH AS ARCHITECTS, REALTORS AND OTHER FIRMS OFFERING THEM PROGRAMS IN EDUCATION, INFORMATION AND TRAINING.

URANIUM PROCESSING FACILITIES

IN AN EFFORT TO STUDY THE FEASIBILITY OF ATTRACTING URANIUM PROCESSING FACILITIES TO NEW MEXICO, THE ENERGY AND MINERALS DEPARTMENT AND THE UNIVERSITY OF NEW MEXICO INITIATED A PROJECT TWO YEARS AGO TO EVALUATE THIS SUBJECT. THE FINAL REPORT IS NOW IN THE FINAL STAGES OF PREPARATION AND COMCLUDED THAT OPPORTUNITIES EXIST FOR NEW MEXICO TO OBTAIN URANIUM PROCESSING FACILITIES.

IF THE STATE DECIDES TO PURSUE THESE OPPORTUNITIES AND IS SUCCESSFUL, IT COULD HAVE A SIGNIFICANT IMPACT ON SMALL, HIGH TECHNOLOGY FIRMS IN NEW MEXICO. PAST EXPERIENCE HAS INDICATED THAT THE ESTABLISHMENT OF A SCIENTIFIC FACILITY USUALLY RESULTS IN THE CREATION OF A NUMBER OF SMALL, HIGH TECHNOLOGY COMPANIES NEAR THE FACILITY. IN THE CASE OF ALBUQUERQUE, FOR EXAMPLE, THIS SPIN-OFF ACTIVITY HAS BEEN TREMENDOUS. AND, LOCATION OF SUCH FIRMS --

Mr. LLOYD. You did very well there. I am most pleased with your presentation.

Let me ask you this question. You obviously find some fault with the Federal Government and the Department of Energy. In your interface with the Department of Energy, do you really think we are getting a handle on a solution to this problem or are we still wandering around out there in the woods?

Mr. KEHOE. I think in many cases we get some very good services from the DOE, but it is like anything else, it is a very big organization, there are portions of it that have problems and there are portions that are very good. I think the lab structure at DOE, we need more interface with them. They are doing a good job. I don't envy the job of DOE. There are some things they are doing good. There are others that I think they could take a lead from what some of the States are doing, what some of the labs are doing already to set up systems.

Mr. LLOYD. Do you feel that the interface relationship between DOE and your area of interest, is adequate? Are they really just going off over here piecemealing the problem?

Mr. KEHOE. I think the comprehensive approach, the coordination that needs to take place, has not happened in some areas. It is something that DOE by itself cannot do. Gasohol is the perfect example. DOE cannot lead gasohol.

You have to have the Department of Agriculture in it, you have to have the research organization in it, you have to have engineering firms in it. What we have to do is, I think, get away from saying energy has to be all solved by DOE and they can build an empire out of it. We have got to spread the glory and credit out to others and get them involved in the process. I think it is unfortunate. Conservation is one area of DOE that has been so fractured and broken down into departments, they have got little pieces all over the Department of Energy, and I think it is unfortunate. I think we need to pull those together and come up with some consistent uniform approach. Otherwise everybody is going off in 16 different directions. There is no real looking at what the goals are. It is always by program and unfortunately some of those programs are not talking to each other. Conservation just goes in four or five different directions.

Mr. LUJAN. There is one thing thatI am beginning to see. I was set to go out and charge on this gasohol thing that we were talking about this morning, to have the information available to TAC and then the proposal writing perhaps, then NEDA who does that for SBA to have the capability of preparing the proposals for people; but you don't think that is the way to go, I gather, from what you are telling me. More appropriately would be to do it through the land-grant universities existing in all the States now and can take the production, agriculture production, into account, so that is probably the place to put it rather than two different places?

Mr. KEHOE. Gasohol, I think, maybe the lead function should be at one of the land-grant universities or the State department of agriculture, whatever promotion board States have. Each State is different. I think it is going to take the expertise of TAC and others to be able to get the input into that. You are going to need the cooperative extension services who have an outreach function and are going to be

OUR STATE ALSO HAS AN ENERGY EXTENSION SERVICE PROGRAM, PATTERNED SOMEWHAT AFTER THE AGRICULTURAL EXTENSION SERVICE AS A GOOD TOOL FOR DISSEMINATING SPECIALIZED INFORMATION. FOR BOTH RENEWABLE RESOURCES AND ENERGY CONSERVATION TECHNIQUES AND TECHNOLOGIES, OUR PROGRAM HAS TARGETED SEVERAL GROUPS FOR INFORMATION AND TECHNOLOGY TRANSFER AND DEVELOPMENT OF INNOVATIVE IDEAS. ONE OF OUR TARGET GROUPS IS SMALL BUSINESS, AND THROUGHOUT THIS YEAR WE EXPECT TO FURTHER OUR EFFORTS AT REACHING THIS TARGET AUDIENCE TO FURTHER PROMOTE THE EXCHANGE OF IDEAS AND TECHNOLOGY IN THESE ENERGY AREAS.

SINCE I AM TESTIFYING ON BEHALF OF THE STATE OF NEW MEXICO, I WOULD ALSO LIKE TO POINT OUT TO THE COMMITTEE THE WORK OF ANOTHER VERY IMPORTANT DEPARTMENT WITHIN STATE GOVERNMENT WHICH DOES SOME WORK IN THIS PROMOTION OF INNOVATION AND TECHNOLOGY TRANSFER BUT WHICH IS ALSO RESPONSIBLE FOR THE ROLE OF THE STATE OF NEW MEXICO IN THE PROMOTION AND LOCATION OF SMALL, HIGH TECHNOLOGY FIRMS WITHIN THE STATE. THE DEPARTMENT I AM REFERRING TO IS THE NEW MEXICO COMMERCE AND INDUSTRY DEPARTMENT.

SMALL, HIGH TECHNOLOGY FIRMS AND INNOVATION

THURSDAY, APRIL 10, 1980

U.S. HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE AND TECHNOLOGY,
SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT,
Pomona, Calif.

The subcommittee met, pursuant to notice, at 9:40 a.m., in the Student Union Building of the California State Polytechnic University, Pomona, Calif., Hon. Jim Lloyd, presiding.

Mr. LLOYD. Dr. La Bounty, why don't you come up. We already have a panel up here, and we will be underway; when you are ready, we will start.

Dr. La Bounty, we appreciate your coming today. I would also like to acknowledge my two colleagues. On my left is Manuel Lujan from New Mexico, and we would like to welcome you to this part of California. We held hearings over in New Mexico not too long ago and had a very, very fine reception there by Manny. We appreciate it.

My colleague on my right is George Brown, who is well known in the areas of science and technology, and has been a Congressman from the State of California over a long period of time. He has been associated with these kinds of hearings over a long period of time and brings an expertise which is almost unique in the Congress, and we welcome you today, George, and thank you for being with us.

Dr. La Bounty, I would like to turn the microphone over to you, but before I do I want to thank you for the hospitality which you have extended to this committee and the cooperation which you have given us while we have been here. We appreciate very much being at this outstanding institution of learning, and I take great pride in the fact that it just seems to grow every year and fare better, and we just thank you very much.

STATEMENT OF DR. G. LA BOUNTY

Dr. LA BOUNTY. Congressman Lloyd, on behalf of our 15,000 students, 800 faculty, 800 staff, we will welcome the committee to Cal-Poly, Pomona.

We have more than a passing interest in the subject of your concern, innovation, declining innovation. Our university, as its name connotes, is deeply committed to science and technology and innovation.

We hope that your meeting here will be informative and that if there is any service that we can perform to that end you have but to ask us.

I would like to introduce several of my colleagues who have been of great assistance to the university and the committee in establishing

INTERESTED IN THIS AREA MAY BE ELIGIBLE FOR A NUMBER OF PROGRAMS AND, ALMOST ON A DAILY BASIS, MEMBERS OF THE R & D STAFF ARE ASKED TO SEARCH FOR SUCH ALTERNATIVE FUNDING SOURCES. WE ENCOURAGE BUSINESSES TO CONTINUE TO CONTACT US FOR THIS SERVICE, FOR WE REALIZE THAT HELPING TO SEEK FUNDING FOR AN INNOVATION IN ENERGY R & D WHICH PROVES FEASIBLE FURTHER ENHANCES OUR DEVELOPMENT OF THOSE NEEDED ENERGY OPTIONS.

ANYONE INTERESTED IN OBTAINING FURTHER INFORMATION REGARDING THE STATE'S R & D PROGRAM IS WELCOME TO CONTACT THE ENERGY AND MINERALS DEPARTMENT OR ANY OF THE ENERGY INSTITUTES AT THE UNIVERSITY OF NEW MEXICO, NEW MEXICO STATE UNIVERSITY OR NEW MEXICO INSTITUTE OF TECHNOLOGY.

THE ENERGY AND MINERALS DEPARTMENT IS ALSO MANDATED TO FURTHER FACILITATE COOPERATION BETWEEN GOVERNMENT AND BUSINESS IN THE DEVELOPMENT AND COMMERCIALIZATION OF NEW AND IMPROVED ENERGY TECHNOLOGIES. AND, IN ADDITION TO THE R & D PROGRAM, I HAVE ALREADY MENTIONED, THE STATE HAS INITIATED A NUMBER OF OTHER PROGRAMS. THE FOLLOWING IS A BRIEF SUMMARY OF EACH OF THEM:

Mr. Chairman, Members of the Committee,

It is a pleasure to be here to testify concerning the plight of small, high technology firms and their impact on innovation and productivity on our national economy.

Innovators, inventors, and their associated small businesses have been mainstays in the economic history of the United States. The first patent was issued to the Colonies in 1641, one hundred and thirty-five years before the Declaration of Independence.

Inventions and innovations have shaped American life styles. The development of this country has been molded by such inventions as the steamboat, the locomotive, hybrid seeds, the cotton gin, the lightbulb, the radio, the photocopying machine, and the printed circuit. All of these inventions have a common characteristic: each is the product of an individual or small business. The names of Jefferson, Franklin, Whitney, Ford, Edison, and more recently, Land of Polaroid fame, are etched into America's history. They represent the creativity and plain old Yankee ingenuity that is still an important resource available in this country today. Innovation has and always will be a part of American life, creating new products, improving existing systems, and replacing those that have ceased to serve the country's needs.

From the conception of an idea to its commercial application is normally a long and arduous process. More often than not the road is lined with hazards and roadblocks totally unexpected by the entrepreneur. Once an idea is formulated it must be evaluated in terms of technical and commercial feasibility. Providing it passes these tests, the next step is often protecting the idea through the patent process followed by the development of a prototype and finally a plan for commercialization.

NEW AND INNOVATIVE TECHNOLOGIES IN OUR STATE.

IN CLOSING, MR. CHAIRMAN, I WOULD LIKE TO STATE THAT THE STATE OF NEW MEXICO MOST DEFINITELY REALIZES AND APPRECIATES THE NEED FOR PROMOTING INNOVATION AND TECHNOLOGY TRANSFER FOR SMALL, HIGH TECHNOLOGY FIRMS. ALTHOUGH SUCH FIRMS MAY BE SMALL IN SIZE, WE REALIZE THEIR IMPACT ON ENERGY AND SCIENTIFIC DEVELOPMENTS HAS BEEN SUBSTANTIAL. IT IS OUR HOPE THAT, THROUGH HEARINGS SUCH AS THE ONES CONDUCTED BY THIS SUBCOMMITTEE, FURTHER AWARENESS OF THE IMPORTANT CONTRIBUTION THESE FIRMS CAN MAKE FOR OUR NATIONS'S BENEFIT WILL BE RECOGNIZED.

surrounding communities, including Riverside, San Bernardino, Fontana, Corona, Ontario, Upland, Chino, Pomona, West Covina, La Verne, Hacienda Heights, Pico Rivera, and El Monte. Program content varies from such basic subjects as record-keeping, advertising techniques and financial planning to the more advanced subjects such as tax planning, industrial relations, and small business computers. In all cases the programs are conducted by an appropriate faculty member or an eminently qualified member of the business community.

The SBDC also provides assistance in less direct ways. Our highly acclaimed newsletter features advice and information on topics directed expressly at the small business community. The newsletter also contains information regarding future training programs. It is distributed monthly and has a circulation of approximately 8,000.

Other sources of assistance include the National Technical Information Service and the U. S. Patent Office. Inventor's organizations also exist across the U. S.

Given the wide variety of programs in existence and sources of information available, it is regrettable that this activity is so fractured, not fully visible to the public, nor cooperative among the participating organizations.

Thank you.

facing the farmer on a day-to-day basis. He is looking for answers to questions. The whole system has to be built. It is not a simple one. It has to be complex and there has to be lots of coordination and working together. Otherwise we will all go off on our own directions.

Mr. LUJAN. It has got to be simple to the guy that wants to put a gasohol plant together.

Mr. KEHOE. He wants an answer that is short, sweet and to the point. The only time you can get a simple answer like that is if you do lots of homework beforehand. He is going to go and get 16 different simple answers, but all saying different things.

Mr. LUJAN. Mr. Roth?

Mr. ROTH. I want to again thank you for coming here.

I want to thank Congressman Lujan for the testimony we have heard this day. It has been excellent. I must say I am very surprised because you have some very sophisticated people here in New Mexico. [Laughter.]

Mr. LLOYD. Thank you very much.

We appreciate your presentations here today. Thank you for your time and interest.

We thank the audience that has joined us here today.

I declare this hearing adjourned.

[Whereupon, at 12:17 p.m., the hearing was closed.]

if you wish to paraphrase or make any changes in your presentation you may do so.

Mr. King?

Mr. KING. Thank you.

Mr. LLOYD. Excuse me. I am sorry. I believe I am leaving George out. He has a statement to make.

Mr. BROWN. Mr. Chairman, if you don't object, I will have my statement inserted in the record.

[Prepared statement of Mr. Brown follows:]

this environment, and more than that some of them are the academic leaders of programs of interest to this committee.

First is Dr. Beaumont Davis, the dean of our school of engineering right here.

Mr. LLOYD. Welcome.

Dr. LA BOUNTY. Second, Dr. Ralph Ames, who is the dean of our school of science.

Mr. LLOYD. Dr. Ames. Welcome.

Dr. LA BOUNTY. Next to Dr. Ames is Dr. David Foley, the dean of our school of business right here.

Mr. LLOYD. Good morning.

Dr. LA BOUNTY. I would hasten to add one of our colleagues is sitting across from you, Dr. Wayne Williams, is a director of our small business development center. Wayne is right here.

Mr. LLOYD. Dr. Williams. Welcome.

Dr. LA BOUNTY. The vice president for academic affairs, who makes so many of these things, Dr. Paul Weller.

And last but not least the fellow who really did all the work and gave us leadership in setting the meeting up, Dr. Niel Gerard.

Mr. LLOYD. Thank you, Niel. Appreciate it.

Dr. LA BOUNTY. Again we appreciate deeply the opportunity to host this hearing, and we look forward to working with you throughout the day. Jim, have a nice meeting.

[The prepared statement of Dr. La Bounty follows:]

HIGH-TECHNOLOGY SMALL BUSINESSES HAVE BEEN KEY IN OUR SUCCESS AND HAVE CONTRIBUTED A DISPROPORTIONATELY LARGE SHARE OF INNOVATIVE IDEAS. A STUDY BY THE NATIONAL SCIENCE FOUNDATION, FOR EXAMPLE CONCLUDED THAT OF THE 319 INNOVATIONS PRODUCED BY UNITED STATES INDUSTRIES BETWEEN 1953 AND 1973, 24% WERE PRODUCED BY COMPANIES WITH LESS THAN 100 EMPLOYEES, AND ANOTHER 24% WERE PRODUCED BY COMPANIES WITH 100 - 999 EMPLOYEES. * UNFORTUNATELY, THE FEDERAL GOVERNMENT HAS NOT ADEQUATELY NURTURED HIGH-TECHNOLOGY SMALL BUSINESS.

A STRIKING DISPARITY APPEARS TO EXIST BETWEEN THE CAPABILITIES OF HIGH-TECHNOLOGY SMALL BUSINESSES AND THEIR UTILIZATION BY FEDERAL AGENCIES. SMALL BUSINESSES RECEIVE A RELATIVELY MINOR AND DECLINING PROPORTION OF FEDERAL R & D FUNDS -- ONLY THREE PERCENT, WHILE 64 PERCENT OF GOVERNMENT R & D FUNDS GO FOR DEVELOPMENT NORMALLY INVOLVING LARGE INDUSTRIAL FIRMS.

FEDERAL PROCUREMENT PROCEDURES ALSO RESTRICT THE USE OF HIGH-TECHNOLOGY SMALL FIRMS IN CARRYING OUT FEDERAL AGENCY MISSION R & D REQUIREMENTS. FOR EXAMPLE,

- FINDING OUT WHAT THE GOVERNMENT WANTS AND PREPARING PROPOSALS IS EXPENSIVE AND TIME-CONSUMING TO A POINT FREQUENTLY EXCEEDING THE CAPABILITIES OF SMALL FIRMS.

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

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Today there are virtually no programs to assist the innovator through the entire process. There are, however, several government/university partnerships which provide varying degrees of assistance. The University of Oregon has developed a computer analysis to assess the feasibility of new ideas. Utah's Innovation Center is under edict to develop a "Small Business Start-up" program. They will take a project from start to finish, but have very restrictive eligibility requirements. The Carnegie Mellon University Program is aimed at stimulating and promoting faculty and graduate student ideas coming from research and lab discoveries. M.I.T.'s Innovation Center retains its thrust of "teaching the method of invention."

These are examples of programs which exist today and are designed to assist the innovator during the developmental stages. Here at Cal Poly the Small Business Development Center has the capability of assisting the entrepreneur during the commercialization and operation stages of the business.

Founded in December, 1976 the Small Business Development Center offers free consulting services and training programs to all small business persons.

During the course of a year this center provides consulting services to more than 1,000 individuals seeking assistance in starting a small business or in solving a problem in an already established small business.

The assistance requested ranges from advice regarding the licenses required, and the process to be followed when starting a new business to the development of an entirely new marketing plan or the installation of a small computer. In responding to these requests, the SBDC utilizes a small internal staff, the faculty, senior-level business administration students and members of a local volunteer organization (Service Corps of Retired Executives). Naturally the resource used depends on the nature of the problem.

In addition, the SBDC conducts approximately 100 training programs involving about 3,000 attendees. The programs are conducted in nearly all the

SUBCOMMITTEE IS ACTIVE, AS YOU CAN SEE FROM TODAY'S HEARING, AND THE SCIENCE, RESEARCH AND TECHNOLOGY SUBCOMMITTEE, WHICH I CHAIR, HAS ALSO BEEN WORKING TO PROMOTE SMALL BUSINESS.

I WOULD LIKE TO TELL YOU BRIEFLY ABOUT WHAT MY SUBCOMMITTEE IS DOING IN INNOVATION AND PRODUCTIVITY, AND WHAT SPECIFICALLY WE ARE DOING THAT WILL HELP SMALL BUSINESS. IN THE LAST YEAR THE SUBCOMMITTEE HAS HELD OVER 20 SESSIONS OF INNOVATION AND PRODUCTIVITY HEARINGS ON TOPICS INCLUDING PATENT POLICY, UNIVERSITY-INDUSTRY RELATIONS, FDA NEW DRUG REGULATION, FEDERAL LABORATORY UTILIZATION AND OTHERS.

THE SUBCOMMITTEE HAS LEGISLATIVE JURISDICTION OVER THE NATIONAL SCIENCE FOUNDATION. LAST MONTH WE REPORTED A NSF AUTHORIZATION BILL WHICH INCLUDES A $10 MILLION INCREASE OVER LAST YEAR IN THE SMALL BUSINESS INNOVATION PROGRAM, AND A NEW $5 MILLION PROGRAM TO ESTABLISH A CENTER FOR INNOVATION DEVELOPMENT. THE FUNCTIONS OF THE CENTER WOULD INCLUDE: (1) DIRECT EQUITY FUNDING FOR THE START-UP OF FIRMS WISHING TO DEVELOP AND BRING TO MARKET A PROMISING INNOVATION, (2) GUIDANCE TO SMALL BUSINESS IN UTILIZING FEDERAL ASSISTANCE PROGRAMS, AND (3) MANAGERIAL AND TECHNICAL ASSISTANCE TO FIRMS THAT ARE FUNDED.

THE SUBCOMMITTEE ALSO HAS LEGISLATIVE JURISDICTION OVER FEDERAL PATENT POLICY, AND ON THE FIRST OF THIS MONTH WE REPORTED H.R. 5715, A PATENT POLICY BILL THAT HAS AS A BASIC

Mr. LLOYD. Thank you very much, Dr. La Bounty. We appreciate all the help that we have received from you. With that we will get the meeting underway.

I am very pleased to be here in Pomona, my home district. I welcome all of you this morning to discuss a very important subject—small, high technology firms and innovation.

I have already welcomed my colleagues, and I would like to say only this, that I think this is a very important field that we are involved in, and I think that the testimony that we will hear today will be of great value in hopefully solving some of the problems which will manifest themselves as the witnesses make presentations.

I think that we must take steps to meet the financial needs of small businesses and to modify Federal policies that tend to favor big business over small business, and, of course, it begs the question of why is this so important.

Simply stated, small business contributes so much. In the 1969–77 period small businesses were responsible for 96 percent of the new jobs or the jobs that were created in the private sector. In contrast the top 1,000 industrial corporations provided approximately 4 percent of the jobs created in the period.

During the 1953 to 1973 period small business accounted for one-half of the U.S. major innovations. Added to these impressive statistics small business produced 24 times as many innovations per research and development dollar as do large businesses, yet they receive only 3½ percent of the Federal research and development dollars. As a former small businessman, I am concerned about this situation and will do all I can to promote Federal policies that encourage innovation and increased productivity. As a matter of fact, I think this is a major weakness in our economy today. We have not stimulated the growth the way we ought to have, and I am in no way shirking the responsibilities that do indeed lie in Washington.

I am very pleased to have the first panel, Radford King, Mr. Stam, and, of course, Wayne Williams, and I would like to take this opportunity to welcome the three of you. Again it is my pleasure to welcome today my colleagues, Mr. Brown, George Brown, of California, and Mr. Lujan of New Mexico, and at this point we will start with the first witness. Rad, since you are on the left, you get to start first.

Is that all right?

Mr. KING. That's all right, Congressman. Thank you.

Mr. LLOYD. Could I interrupt. You do not have a written statement, is that right?

Mr. KING. Not at this time.

Mr. LLOYD. All right. Nor do you have, is that right, Mr. Williams?

Mr. WILLIAMS. I do have, yes, sir.

Mr. LLOYD. You have one?

Mr. WILLIAMS. Yes.

Mr. LLOYD. I have you having a written statement, do you have any copies?

Mr. WILLIAMS. Absolutely.

Mr. LLOYD. If you have, I would remind those who are testifying today if you have any statement, the Chair would be most pleased to accept that without objection on the part of the other members, and

Mr. LLOYD. Without objection so ordered.
Now you are recognized, Mr. King.

STATEMENT OF RADFORD G. KING

Mr. KING. Fine. Thank you, Mr. Chairman.

I would like to say I welcome this opportuntiy to discuss small business and its role in innovation and technology, and I would like to preface my remarks by quoting from the testimony of William H. Mock, Jr., Deputy Administrator of the Small Business Administration to the Committee on Small Business, House of Representatives, March 4, 1980.

> We must meet the challenge of renewing innovation in order to insure America's continued viability, increased productivity, strength in our competitive society, most importantly improve the quality of life for every American. The committee in approving small business's position is bolstered by a recent National Science Foundation study which indicated since World War II firms with less than 1,000 employees have accounted for one-half of the most significant innovations, and small businesses have accounted for more innovation per dollar of research than the large firms. We therefore must identify mechanisms to encourage small firms to seek Federal or R. & D. contracts, make it as easy as possible for an individual to follow through, develop an idea, which indeed may have a tremendous potential. We must make it possible for that person to follow through over a period of time with that idea in an independent manner so that his only option will not be one of selling his product to a major corporation and collecting dividends and royalties.

I would like to say that I wholeheartedly support those comments and also am extremely pleased to see the type of activity that has been occurring during the past year basically represented by the White House Conference on Small Business, the currently pending Government Patent Policy Act of 1980, the President's position on industrial innovation initiatives, the small business innovation report, and the current House bills, H.R. 5607, H.R. 5126, H.R. 5330, and H.R. 5702, and I would like to at this time comment totally support the positions that are taken in each of these various activities, as such will limit my remarks today to those areas that I feel are not covered within the positions that are represented by those various bills at this time.

As a little background information I am the director of the Western Research Applications Center, University of Southern California, and within our programs includes the NASA Industrial Applications Center.

We are part of a network of six industrial applications centers and three State technology application centers across the country.

The system has been operating since about 1967. We have been located at the university since 1969.

That center is predominantly involved in computerized information retrieval especially as it pertains to the technological areas and function in a technology transfer mode.

At the current time we are handling over 1,500 problem statements a year and conducting over 5,000 searches a year working with approximately 500 individual companies per year.

A part of that program also includes a NASA-Small Business Administration joint project in which we deal with small firms, pre-

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

APRIL 10, 1980

POMONA, CALIFORNIA

STATEMENT BY HON. GEORGE E. BROWN, JR.

CHAIRMAN, SUBCOMMITTEE ON SCIENCE, RESEARCH AND TECHNOLOGY

U.S. HOUSE OF REPRESENTATIVES

MR. CHAIRMAN, I WANT TO THANK YOU AND MY OTHER COLLEAGUES ON THE SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT FOR THIS OPPORTUNITY TO COOPERATE ON INNOVATION AND HIGH-TECHNOLOGY SMALL BUSINESS. MY SUBCOMMITTEE ON SCIENCE, RESEARCH AND TECHNOLOGY, HAS BEEN CONCERNED WITH ALL ASPECTS OF INNOVATION AND PRODUCTIVITY, AND YOUR FOCUS ON HIGH-TECHNOLOGY SMALL BUSINESS IS A WELCOME COMPLEMENT TO OUR ACTIVITIES.

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

I would like to preface that statement or qualify that statement by saying that we consistently see the major cause of the failure is a lack of management competency.

Many times this just comes as a startling remark, but I think we have got to recognize that the major difference between the small business firm and the large business firm is the large firm is able to spread staff capabilities in almost every area of legal services, advertising, whatever else it is across its overhead base, and the small firm normally does not have the same type of capability.

As such I think that the support from the Federal sector as it relates to providing sophisticated, effective, efficient management and technical assistance to the small business sector is very important.

The other area, is the area of information services. We find that this is a rapidly growing field, that the cost-benefit return that is now being demonstrated by using sophisticated information service in small business planning, problem solving is creating a very sizeable return.

These areas that type of system needs to be developed, and it is important to a much greater extent. At the current time less than 1 percent of the firms that we are dealing with have ever used information retrieval as a consistent part of their business activities, and that is a staggering thing.

That area to give another example a small manufacturing could involved in making nozzles, bottles, caps, closure predominantly for the hair spray industry recognized the problem coming about due to the ban on aerosols, and it developed a nonpressurized container, was having a problem on designing the nozzle. Women today and men do not like to have hair spray that spits and comes out in globs. As such the nozzle design is very critical, spent 6 months attempting to design the nozzle unsuccessfully.

Through the NASA program we ran a problem search for him on that, identified a hundred different citations. Two of those showed him exactly how to design the nozzle. In 30 days he had working prototypes. The last time I talked to him his sales were going very, very well. He was quite pleased.

In the area of financing and especially as it relates to the program, et cetera, I am very much a proponent from the standpoint that we need the financing programs to replace the lack of venture money, especially as we see in our current market and as it relates to R. & D.

At the same time I would place caution on the fact that we consistently report numbers, and it is easy to say look how many dollars I have loaned, how many dollars new companies that I have loaned money to. We have a tendency to look at how many of them failed, how many of them defaulted on their loans, and to look at what is the cause for this, how come that is happening.

I think that we would find that through the provision of sophisticated systems and feasibility analysis prior to loan especially as it relates in the technical areas that the default rate and the success stories can change rapidly, that there is a requirement for providing an ongoing management-technical assistance to companies during their growth phase until they reach a point of stability.

In the area of patents, and I will keep my comments very short on this because we have one of the leading experts sitting right next to

- MOREOVER, FUNDING FOR FEDERAL R & D WORK FREQUENTLY LACKS STABILITY. THIS STRAINS THE FINANCIAL CAPABILITIES OF SMALL FIRMS.

I HAVE BEEN CONCERNED WITH THESE AND OTHER FEDERAL POLICIES ADVERSELY AFFECTING SMALL INNOVATIVE BUSINESSES SUCH AS TAX, PENSION FUND AND SECURITY POLICIES WHICH MAKE IT HARD FOR SMALL R & D FIRMS TO ACQUIRE CAPITAL; GOVERNMENT REGULATIONS PLACING DISPROPORTIONATE AND DISCRIMINATORY COMPLIANCE BURDENS UPON SMALL BUSINESSES; FEDERAL PATENT POLICIES PROVIDING INADEQUATE PROTECTION TO SMALL R & D FIRMS, AND THE ELIMINATION OF QUALIFIED STOCK OPTION PLANS, WHICH ELIMINATED AN IMPORTANT INCENTIVE FOR TOP SMALL BUSINESS EXECUTIVES.

FORTUNATELY, THE FEDERAL GOVERNMENT APPEARS TO BE WAKING UP TO THE IMPORTANCE OF HIGH-TECHNOLOGY SMALL BUSINESS. THE PRESIDENT PLACED EMPHASIS ON SMALL BUSINESS IN THE INDUSTRIAL INNOVATION INITIATIVES HE ANNOUNCED LAST FALL. THE HOUSE AND SENATE SMALL BUSINESS COMMITTEES ARE ACTIVELY WORKING ON LEGISLATION TO PROMOTE SMALL BUSINESS, AND THE SMALL BUSINESS ADMINISTRATION IS STARTING TO REORIENT ITSELF TOWARDS HIGH TECHNOLOGY.

THE FULL COMMITTEE ON SCIENCE AND TECHNOLOGY PARTICIPATED IN JOINT HEARINGS WITH THE HOUSE AND SENATE SMALL BUSINESS COMMITTEES LAST NOVEMBER. THE INVESTIGATIONS AND OVERSIGHT

guess, and they all need further development before they reach the marketplace. But we are dedicated to the proposition of acquiring title, and we feel that we can transfer the technology better than Government. So a good deal of my time is spent in working with the existing legislation and agency regulations to acquire title to inventions so we can do it.

In agreement with Mr. King we have found that you need an exclusive license to protect the private risk capital necessary to cross the bridge between the research laboratory and a commercial product. Essentially the whole licensing effort is to assure ourselves that the product we are trying to get on the market is feasible and is commercially viable and then to find the right businessman and convince him that necessary investment ought to be made and can be protected.

Now, we have found that we can grant exclusive licenses and we consummate about four or five per year. They are subject to difficulties in acquiring title, and they are subject to reservations that the Government makes in granting title to us. What I would like to go into is first to explain that in a licensing program one possible answer to all this might be to vest title in the Government, you know. Then, theoretically, the royalties that are collected would go back into the public coffers and it would be made available to everyone. However, this doesn't work very well because the Government patent licensing program is so extremely large as to be unmanageable. It has to be passive. NASA, for example, has almost 4,000 patents in its portfolio, it publishes them in a large book, without delineating the dross from the good ones. This makes it almost impossible for anyone to find commercially feasible inventions.

By contradistinction, any small business or university has a small portfolio which can be actively, personally, and aggressively promoted on a personal man-to-man basis. The scientists who created the invention are generally still available and interested in helping promote it because at most universities, a percentage of the royalty income is paid to the inventor. So, for a variety of reasons the Government patent licensing program has not worked as well as private programs.

I saw some statistics which indicate that NASA, owning 3,750 patents, had 8 exclusive licenses. But at Cal-Tech, with a portfolio of about 250 patents, we have about 20 products on the market. We license 4 or 5 new inventions a year out of maybe 20 or so recent acquisitions. At any rate, we are strongly dedicated to the proposition that the private approach and the small portfolio is the best way to transfer the technology.

Now, for some reason or other, and I am going to expound on those, it is difficult for universities to acquire title, one large problem being the lack of uniformity in the Government patent policy.

Despite several Presidential messages which purported to give standards, it develops that each agency, either by virtue of its notion of its function or sometimes by legislative fiat, as in the case of DOE and NASA, feels compelled to write its own regulations and to interpret the regulations and the Presidential message, differently from the others. Accordingly, we have a different patent policy from every agency.

The Health, Education, and Welfare group, which has changed its name recently and NSF have what they call institutional patent agree-

UNDERPINNING THE PROVISION THAT FULL TITLE TO INVENTIONS DEVELOPED UNDER FEDERAL R & D CONTRACT SHOULD GO TO THE CONTRACTOR -- SMALL BUSINESS INCLUDED.

ON MARCH 25 I INTRODUCED H.R. 6910, THE "NATIONAL TECHNOLOGY FOUNDATION ACT." THIS ACT WOULD ESTABLISH AN INDEPENDENT AGENCY TO FURTHER TECHNOLOGY FOR THE NATIONAL WELFARE. ONE OF THE MAIN BRANCHES OF THE AGENCY WOULD BE DEVOTED TO FOSTERING HIGH-TECHNOLOGY SMALL BUSINESS. WE INTEND TO HOLD HEARINGS ON THAT BILL LATER THIS YEAR.

THE IMPORTANCE OF INNOVATIVE SMALL BUSINESSES IN MAINTAINING OUR ECONOMIC VITALITY, IN IMPROVING OUR SOCIAL WELFARE, AND IN ASSURING OUR NATIONAL SECURITY CANNOT BE UNDERSTATED. MR. LLOYD IS TO BE CONGRATULATED FOR HIS FORESIGHT AND LEADERSHIP IN HIGHLIGHTING SMALL BUSINESS. I LOOK FORWARD TO CONTINUED COOPERATION BETWEEN OUR SUBCOMMITTEES IN THIS AREA. THANK YOU.

At any rate, as a result, we have the lack of uniformity which I think comes from this fear of criticism. As a further result, we have contract terms and conditions when we accept research projects from the Government, varying in restrictiveness, and including an awful lot of red tape put into them to protect values which may not exist. It is sort of like a 16-inch gun being used in a flyswatter situation and it makes it difficult to deal with Government.

I have made a short list of things that trouble me and will trouble small businesses when they accept Government research projects. First, we are forced to disclose too quickly; forced to tell whether or not we want to acquire title. We are compelled to report inventions within 6 months of conception or reduction to practice. Well, most inventions probably don't reach a place where you want to tell anybody about them until sometimes years after an inventor may have had a rough idea. This is extremely difficult to cope with.

At Cal-Tech we have an extraordinary record. We have licensed about 40 percent, just slightly under 40 percent, of the patent properties we have acquired. The other 60 percent are quite often cases in which we were compelled to take a patent position too quickly. It strikes me, for one thing, that this requirement for premature reporting of unproven concepts ought to be changed to allow time to determine feasibility and value, and more time before being compelled to make decisions and make reports.

The second factor that I want to talk about is the reservation of rights in Government as a condition of little transfer to a contractor. These vary from agency to agency and have become more and more restrictive. These can make it difficult to license and can make it difficult for small business to make use of the results of Government research. In the beginning there was a standard reservation of a royalty free license to the U.S. Government for use for governmental purposes. Well, that is great. I think that is the way it ought to be if the Government funds research, and it is really all the Government needs. Then somebody got to thinking about it. They added all municipalities, State, and county governments and just about any kind of civic organization. What I run across in trying to license is that my licensees say, "How am I going to know which of these people is entitled to that royalty free license." We require that they charge all of this large class of "governmental" agencies a lesser price by the amount of the royalty and that no royalty be paid. The thing is that it is difficult to administer. It was probably not intended to be burdensome but it is an extension of the governmental reservation which is distasteful to the people that have to deal with it. I don't feel all that strongly on this point except for the difficutly of administration which I think frightens some of the business people I deal with.

Third, the Government, in protecting patent rights, the value of which I sometimes question, sometimes insists on a procedure called prepublication review that is troublesome to universities. Universities are dedicated to early publication and dissemination of information. Therefore, most researchers wish to publish the results of their research quickly. Under prepublication review procedures this may be impossible.

The problem arose as Government agencies sought to protect the illusory extremely great value of the foreign rights in inventions. Now,

dominantly small manufacturing firms, advising them for services on a for-free basis at one time to not only function in a problem solve mode but also to function in an educational mode.

I quite often refer to a situation that occurred to me about 2 years ago in which I was having lunch, was introduced to the director of a very sizable R. & D. firm and had asked him at that time if he had ever utilized resources of computerized information retrieval, and he said no.

He said that isn't necessary. He said all the work we are doing is at state of the art, and he said as such the majority of the information that is going into the various data bases is provided by us. We really don't have a need.

I suggested to him that he accept an invitation to go over and see a demonstration of what can be done.

He submitted a particular problem statement to our information specialist, and approximately a 15-minute period she had conducted the search, and I suggested that she print out approximately 10 of the citations that were identified.

The gentleman reached down, ripped off the printout sheet, and he says my God, you just saved me $100,000, and I said how come?

He said, well, the problem statement I gave to you I just budgeted $100,000 to find the answer to, and the answer is already right here.

We find that this is happening on a constant basis, and I will not go any further into the concepts that we often hear, don't reinvent the wheel and search before research.

Another center that we operate at the university is the Urban University Center.

This program is funded by the Economic Development Administration, and we work in a business assistance mode also in local economic development programs within the county of Los Angeles.

That program is relatively similar to the small business development center program that Wayne Williams will be discussing I think a little later.

We also have a third center, which is the Trade Adjustment Assistance Center.

This program is legislatively mandated under the Trade Act of 1974, is supported by the Economic Development Administration. We handle 10 Western States, including Alaska, Washington, Idaho, Montana, Utah. Oregon, California, Arizona, and Hawaii, in providing both management technical assistance and financial assistance to manufacturing companies that are being adversely impacted by imports.

The combination of these programs has provided us with a staffing capability and an awareness of the types of problems that exist I think all the way from the small R. & D. firm to the relatively large manufacturing companies in a competitive sense, also from the standpoint of their financing problems, and their management problems.

I would like to preface that statement or qualify that statement significant needs in and to state some of our thoughts.

One is in the area of requirements of management and technical assistance.

We consistently hear that the major problem of cause and failures is a lack of capitalization.

grants and contracts have an inordinate portion of the overall terms and conditions devoted to patents. These are included in every grant or contract without regard to its nature, and often involve heavy administrative duties and reporting requirements relating to patents. It strikes me, that a place like Cal-Tech, where we do basic research—and I am sure it is true of other universities it could be agreed in—some cases that patent provisions are not necessary and that the public would best be served by early publication of results. One of the things I'd like to see done is for somebody to look into the possibility of changing the procurement regulations to include some sort of an appraisal of the nature of the work to be done and a means for eliminating unnecessary patent requirements when such action is appropriate. Thank you very much.

Mr. LLOYD. Thank you very much.

[The prepared statement of Mr. Stam follows:]

me, in that area my one comment is that there is a need for providing exclusive licensing capabilities on federally owned patents. At the existing time we have a system that makes it almost impossible to create exclusive licensing opportunity.

I do not see in the existing legislation on the patent area that that has been taken into consideration. I would highly recommend that.

Thank you.

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

Mr. Stam?

Excuse me. Would you like to ask questions now or after?

Mr. BROWN. No. After.

Mr. LLOYD. That's fine.

Mr. Stam.

STATEMENT OF T. LEE STAM

Mr. STAM. I am in the patent field, and specifically I am going to zero in on just one facet of the overall subject matter of this group, namely, the use of patents, the transfer of technology. It works out that the majority of the patent licenses that I am responsible for relate to patents acquired by Cal-Tech and the nature of the technology is such that the opportunities are greater for small business than for large companies because most of our inventions are in high technology. They represent small potential cash flow opportunities, and it develops that if you deal with a major corporation it won't look at a new product that doesn't have a tens of millions cash flow sales potential, whereas for small business sometimes the creation of a new product having maybe a $100,000 annual cash flow potential can be good for its growth.

So, our relationship to the small business area is that, to the extent that our patents are used to induce people to invest in completing the development, marketing them to small business is a key factor.

In order to tell you where we come from, I guess I ought to explain to you Cal-Tech's policies and history in this regard. Way back in the 1930's Cal-Tech recognized that patents were a means of transferring technology and could be used to induce private risk capital input to placing new products on the market.

By policy, even though they said "we will make no money on patents," the stated policy was that they would acquire patents and seek to license them. It developed that this could become embarrassing, because in order to pay for the program they had to charge a royalty on the things they did license, and if they ever hit a block-buster they were going to be in breach of their own policy. So the policy was changed. It now says that we recognize that the primary function is to transfer the technology, but if we make any money we will spend it only on fostering education and research.

Now, Cal-Tech in this regard is a very small, and prestigious, I think, educational institution of about one-tenth the size of Cal Poly. We have just 1,500 students. But we operate Jet Propulsion Laboratory. We are in the space program. We do between a quarter of a billion and a third of a billion in research annually. It is all highly basic research on the campus and space-oriented research at JPL. So, the inventions we have are high technology, except for a few exceptions I

would therefore never be in a position where they might knowingly contribute to suppression of the development of a new product in favor of a prior established commercial position.

With these unique aspects in mind, I would like to discuss the legal aspects of university conducted funded research, including the legal aspects and the problems involved in technology transfer by patent licensing. In recent years, Congress and the agencies have taken notice of the special position of universities and non-profit research laboratories and have, in fact, made concessions to the differences between them and industrial contractors. However, there are still uncertainties and problem areas, the greatest of which is the lack of uniformity of policy amongst the various agencies concerning the disposition of title to inventions created in the performance of research funded by Government. Thus, despite a succession of Presidential messages, which sought to standardize the Government's policy on the granting of rights to contractors, and in spite of the evolution of a GSA standard on the subject, there is a good deal of variation in the application of such guidelines so that, in fact, each agency appears to have an individual policy differing from that of many other agencies.

DOE, DOD and NASA all have programs for consideration of waiver of title to the contractors, with differing results, based on subjective decisions of the persons or groups who make these decisions for the various agencies.

NSF and DHEW agencies have Institutional Patent Agreements with many universities which permit the university rather than the agency to decide whether it will take title or not.

These variations in policy and the varying degree of uncertainty as to whether or not a university will actually acquire title to patent properties can result in a good deal of delay relative to efforts to transfer technology to the private sector so that the public may benefit from the use thereof. The Bayh-Dole Bill (S414), if it becomes law, will standardize Government patent policy insofar as it applies to universities and small business and, by leaving title with such entities, create a much healthier atmosphere for possible early use of new technology by the public. Otherwise stated, if universities and small business knew immediately that they had the right to do so, they could begin to seek manufacturing licensees at an earlier date and could deal with such licensees with a firm understanding that they had the right to do so. At the present time, in order to expedite the introduction of new products, Caltech often begins to seek licensees for inventions of DOE, DOD and NASA origin, even before it knows that it will acquire title to patent properties, gambling on the possibility or probability

ments, which are granted to qualified universities and which allow the university to decide whether or not it wants title and feels it can transfer technology.

DOE, NASA, and more recently, DOD, have fairly restrictive requirements, sometimes in their enabling legislation, which require them to take title, and under which they may waive title back to the contractor. Small business runs into the same things as universities do in contracting with the Government, and are subject to these variations in how the Government agencies apply the same rules.

DOE and the agencies from which it evolved have traditionally been extremely tough. You just can't easily and quickly get title to an invention. Given the same set of circumstances NASA is much more liberal. DOD is in a state of flux. They rewrote the DOD regulations, a few years ago to make them more difficult than they had been.

There is no uniformity. We have to deal on a different basis with each one of the Government agencies.

We hope the Bayh-Dole bill—Senate 414—will be passed, because it will resolve these difficulties, and we will be in a position from the very beginning, when we become aware that there is an invention, to go out and try to get somebody to put it on the market and create jobs and help the economy.

At any rate, in connection with all of this, there is, at present, a lack of uniformity. It is probably caused by what I will call a sort of paranoia, if you will.

There is strong sentiment throughout the country, in consumer advocate groups, and in some congressional quarters that inventions which are funded in part or in whole by Federal Government should be, one way or another, in the public domain and available to anyone. People holding this opinion believe that, if a royalty is paid, the public somehow pays twice for an invention and that this is inappropriate and shouldn't be.

Well, the fact remains that if you know anything about patents you must disagree. In the first place, I think these people don't understand how patents can operate to assist the national economy. Second, I think they place an out-of-proportion value on inventions of the type created in the performance of basic research or aerospace research. Patents operate, through the protection of an exclusive license, to convince people to make the investment necessary to create a commercial product out of a project, and I think that the people who advocate simply putting inventions into the public domain don't understand that at all.

Moreover, and for the same reason, there appears to be a tendency to give great value to these unfinished inventions. The way I look at it I think there is a bridge that has to be crossed to move an invention from the laboratory to the marketplace and these people are overlooking the fact that the bridge is there. Accordingly, they attach great value to these inventions. These highly vocal people, have, I think, created a kind of fear within the agencies that they are going to have to explain and justify to such people if they give title to one of these inventions to anyone. I think this is counterproductive, and I think it needs to be fought. I would hope a majority could come to understand the business requirements and the realities of what patents can do in moving innovation into the marketplace.

1. The inclusion of difficult, complex and restrictive patent clauses in substantially every grant and contract without appropriate regard to the nature of the work to be performed.

2. Reporting requirements which lead to premature filing of patent applications.

3. Pre-occupation with preservation of rights in foreign patents.

As to the concept that the Government is buying inventions rather than research when it funds a basic research project, this is a fallacy. Inventions, if there are any, are incidental fall-out. What the public paid for was the research and not the invention. What is most important is that a new and improved product may have been made available. If the charge of a reasonable royalty is necessary to support the patent program (or help support a University, for that matter) the public benefits.

There appears to be a basic misconception concerning the value of the patents involved. Except in rare instances, inventions resulting from Government funded research are not market ready. A manufacturer seeking to commercialize is normally faced with some or all of the problems relating to redesign for the commercial market, tooling, development of manufacturing procedures, debugging, market surveys, etc. Accordingly, very few of the patent properties involved represent "give-aways." Although they may present opportunities, they generally are high risk investments. The problem in technology transfer is to understand the size and nature of the private risk capital investment necessary to move the technology to the marketplace and to convince industry that the rewards of a successful commercialization make such expenditures good investments. There are seldom any "give-aways."

It follows from the preceding paragraph that it may be a gross misconception to consider that patents created in the course of Government funded research should be "made available to everyone." This view does not take into account the risks involved in moving technology (particularly high technology) from the research laboratories to the marketplace. In the absence of some protection, as in the form of a period of exclusivity under a patent, the investment necessary to bring about commercialization will simply not be made by anyone. The groups advocating procedures which would place such patents in the public domain fail to recognize the significance of patent

in the United States we have a 1 year grace period in which you can file a valid U.S. patent 1 year after publication, public use or sale. In most foreign countries, the important ones, if you publish 1 day before the filing in any one of the countries that operates under the Geneva Convention you can't get a valid patent. So in order to protect these foreign rights we are compelled by certain agencies to permit the agency to conduct a review of every proposed publication before release. This sometimes takes a long time.

Now, the review itself wouldn't be bad if they would let it be done by the contractor, since we could give our people a 1 day turn around and thus quickly release any proposed publication not containing patentable subject matter. If there is something potentially patentable in a proposed publication without regard to values or without regard to whether anybody would waste the large amounts of money required to get foreign patents we still would have to hold up that publication until somebody takes patent action.

We had one case in which one agency withheld the right to publish for 1½ years, trying to make up its mind as to whether or not it was going to file an application. In order to obtain a release and permit the poor researcher to publish the results of his work, we finally took some of Cal-Tech's own money, and filed a patent application ourselves.

The real answer to all of this, as I look at it, is that, in publications involving basic research, and the kind of research some small business performs, in looking at 100 potential publications, might find perhaps 1 that has a reportable invention in it. Of the reportable inventions found, there are probably less than 10 percent which would warrant foreign filing. So it develops that we are delaying publication of 1,000 publications on the small possibility that 1 or 2 might warrant foreign patent action. Somehow the cost of administering this prepublication review program, in agencies such as DOE when they insist proposed publications be sent to them seems unjustified. They have to have a large bureaucracy and people who ought to be doing more important things administer all this, and I really wonder just how much money is being wasted on the protection of very small values.

If I were to make any recommendations based on those things I have said I guess I would recommend, first that efforts be made to develop truly uniform and mandatory patent policies. GSA came out with standard regulations that favor most of our points of view and suggested they be uniformly adoted, but they are voluntary. I don't know of a single agency that adopted them.

Second, Government should ease requirements for the early reporting of concepts and maybe develop new standards as to when an invention should be reported and when decisions have to be made. Currently, and awful lot of time and money is being wasted on the attention given to unproven concepts and on the filing of worthless patent applications.

And third, there ought to be a provision that certain types of research should not require publication review because the nature of the research is such that the possibility of an invention and/or the possibility of foreign filings is remote. This would cut down a good deal of cost and a good deal of aggravation. In this connection, there ought to be a simplified prepublication review requirement.

And, as a last recommendation, I'd suggest that terms and conditions for basic research grants and contracts be simplified. Many of our

As a result of the views held in some quarters concerning what I have alluded to as "misconceptions" there have been pressures on administrative agencies and the Legislature to evolve highly restrictive rights in data and patent rights clauses. Such restrictive and difficult provisions and all of the administrative requirements thereof do not appear to be justified in the majority of the cases in which they are applied and it would appear that the amount of expense and difficulty involved in the administration of such contract provisions are totally out of proportion, in many respects, with the values sought to be protected.

It is a fact that a vast majority of basic research grants and contracts are extremely unlikely to result in patentable inventions. Moreover, it could probably be accepted in advance that if inventions were created in connection with such projects they could hardly be of commercial significance or warrant concern about protecting foreign rights. Some examples of such projects which come to mind might be (1) the conduct of a survey of population growth trends, air pollution or the like; (2) the monitoring of seismographic information on pre-existing instrument installations; (3) the development of mathematical theories or models, etc. It is entirely out of perspective for projects such as these to be encumbered with the full boilerplate relating to patents and with the administrative and reporting duties attendant to patent administration. It would appear that the greatest benefit to the public would accrue from a simple publication of the results of such projects.

A second difficulty with the patent clauses resulting from fear of losing rights are reporting requirements which contractually obligate the contractor to report inventions within six months of conception or reduction to practice and which force the contractor to make almost immediate decisions concerning whether or not to seek title to the inventions and/or to file patent applications. The fact is that it is almost impossible in most cases, to evaluate or even sensibly report an invention within six months of conception. The result of being compelled to try to do so is that important and expensive decisions must necessarily be made before the true merit of the invention is recognizable. Moreover, the Government, and in our case, sometimes the university, is left open to embarrassment by premature publication of such concepts in those instances where they turn out to be not feasible.

A further out-of-proportion effort on the part of Government which is forced upon contractors is the preoccupation of Government with the protection of foreign rights in

T. L. STAM
PATENT OFFICER

CALIFORNIA INSTITUTE OF TECHNOLOGY

LEGAL ASPECTS OF GOVERNMENT PATENT POLICY AND THEIR RELATIONSHIP TO THE UNIVERSITY COMMUNITY AND TO SMALL BUSINESS

Any overview of the Government's role in the support of research must be concerned with the ultimate benefits of such research. The primary and direct result of basic research is the advancement of man's knowledge and the increase of his ability to understand and utilize natural phenomena. However, of increasing importance is the question of how the results of such research and of the advances made can become useful to the general public in the form of the availability of new and improved products; in the benefits to be derived by the public in using such products; and in the economic advantage in employment and profits derived from their manufacture. The process of moving new technology discovered in the course of research into the public and economic sectors has been termed technology transfer. Such transfer and ultimate use by the public may be brought about, at times, simply by dissemination of the results of the research. However, where private risk capital investment is necessary for the completion of development and marketing, the protection offered by patents becomes an essential ingredient. I intend to limit this paper to a discussion of that portion of the technology transfer function which relates to patentable inventions; the disposition of title thereto, and the utilization of such inventions in making new products available in the marketplace.

While many of the factors to be discussed relate in a general sense to all Government administration of patent matters, I intend to emphasize the university position and role in this function, based on my experiences as Patent Officer of California Institute of Technology, and to discuss the involvement of small business. It is my intention to look at the question of technology transfer from the point of view of the university community and to point out some of the problems I think exist in the present policies, regulations and attitudes of the various Government agencies in connection with the technology transfer process.

It should be understood that universities are unique in their relationships with Government in the areas of performance of funded research and the transfer of technology to the business sector, respectively. In contrast with industry, universities are dedicated to the free and early publication of the results of research rather than the suppression thereof for profit purposes. Universities differ also in the area of technology transfer (by patent licensing) in that licenses are normally geared to insuring appearance of new products on the market; to fostering competition; and to guarding the public interest. Insofar as new product development is concerned, universities are not in commercial competition and accordingly, are not concerned with competitive aspects such as might exist in industry and

STATEMENT OF WAYNE WILLIAMS

Mr. WILLIAMS. I will try and make my remarks short and to the point.

It is a pleasure to be here to testify concerning the plight of small, high technology firms and their impact on innovation and productivity on our national economy.

The problems that we see most often, as Mr. King has mentioned, is the lack of managerial capability, the lack of understanding on the part of the inventor or innovator of the entire process going from development to commercialization, and the lack of capital available to these individuals.

I wish I had answers to them.

Mr. LLOYD. Well, we are going to be asking some questions. We are very pleased to have this panel of persons, obviously capable and understanding of the problem. I think that we may even have some answers up here. I know that there is some legislation which Congressman Brown will address himself to, and we will begin with questions from Mr. Lujan.

Mr. LUJAN. Thank you, Mr. Chairman.

I only have one question as to how, what you gentlemen feel would be the best way to go. At our hearings the last time we addressed an alcohol fuels program. It seems like it is a program where the technologies people can build alcohol fuel plants, but the fellows that have the raw materials, one, don't have the information as to where to go, what kind of a plant is the best one, and, second, although we have from the Department of Agriculture a loan, $100 million in loans, for that purpose, only $1 million has been lent out.

So the problem is, of course, No. 1, of getting the information, No. 2, the men that have the raw materials, and second, some vehicle for him to find out about the financing.

Maybe the two of you on the end, Mr. King and Mr. Williams, can address each side of it, one, the technology end of it, how we could get it to that farmer we will say, and, second, how we get this information, financing information, to him.

Mr. KING. I would, one, would like to raise the financing end, and because we have seen similar situations right in that particular area.

Of course, right now one of the problems is the interest rate.

Even with the guarantee programs we are now seeing that the various agencies are only allowing a half over prime.

Automatically the banks say hey, we don't deal with a half over prime, and the businessman is looking at it from the side how can I afford to pay 21, 22 percent, especially where in a number of the funding situations for pilot situations are relatively small. They are small grants.

Funding for an economic and viable operation that is going to create a return then there is an equity requirement that exists from the standpoint of the investor, the developer, that many times carries with it the requirement of continuing guarantees, the individual is being required to put up everything that he has, and what this does is it creates a stigma of failure that we have in the form of our bank-

that the Government will waive title. It is our understanding that most research organizations do not do so and may delay even the filing of a patent application until after the question of title disposition is resolved. If the Bayh-Dole bill should become law, existing problems relating to title disposition will be alleviated. However, the Bayh-Dole bill is not yet law, and it is likely that many of the present attitudes and practices will continue even if it is signed into law. Accordingly, the following discussion attempts to analyze the reasons for the difficulties involved in the administration of Government patent properties and some of the factors which have caused the uncertainties which presently exist and which may continue to be a problem even if S414 should become law.

Uncertainties as to the disposition of title are apparently due to what might be termed a lack of perspective in some quarters concerning the values involved and concerning how best the public may be served by bringing about utilization of the fruits of the Government supported research. These are reflected in what appear to be out-of-perspective concern with patents in the contracting for research to be performed for the Government and in failure to properly understand how patents should be used. I would like to expound on those areas on which I think the policies, regulations and administration of patents resulting from Government sponsored research are based upon inappropriate concepts and are counterproductive in result. Some of the factors tending to cause out of perspective handling of patents seem to be:

1. Misconception concerning the purpose of Government funded basic research.

2. Misconception concerning the value of the patents involved.

3. Failure to recognize or accept the fact that making patents available to all may have a negative effect on the transfer process.

4. Failure to accept as a fact the difficulties involved in Government operated licensing programs.

These factors, and the resulting pressures on administrative agencies have resulted in regulations and contract terms and conditions which are out of perspective with reality and which, in many instances pose difficult and impractical requirements on both Government and the contractors. Some of these requirements are:

trend in the economy and inflation, and all of these can be related in some way to the inadequacy of the patent law, and we are moving toward some legislation in this area.

The Science and Technology Committee will consider legislation in the next couple of weeks. The subcommittee has already reported out a bill.

The hangup stems from that attitude of paranoia that you mentioned on the part of some other parts of the Government, including I think to some degree in the Judiciary Committee, which also will have to review any major changes in the patent legislation, and we are trying to work with them to overcome this paranoia and focus on the real economic significance of what we can do here to improve the system, and one of the things that I would like to ask you is whether you or others with the same type of a concrete experience might be able to testify before the Judiciary Committee after our committee has acted favorably on this legislation and perhaps give a little extra impetus to getting some action in that forum in the Congress.

Mr. STAM. Yes, sir.

Mr. BROWN. Mr. King, I have been interested in the operation that you have for a number of years. I guess it stems from the technology utilization program at NASA.

Mr. KING. Had its beginning, yes.

Mr. BROWN. Can you give me some indication of how your funding has progressed over the years and whether you have competence or the resources to engage in any what you might call extension type work? Are you able to provide competent personnel, field personnel, to work with small business and to utilize the information that you generate in your system there?

Mr. KING. OK; not from a standpoint directly of the NASA Industrial Application Center.

However, what we are doing is in our university center, which works on a one-on-one basis with the small businessman, and also the same thing within our Trade Adjustment Assistance Center, we establish a line item in those centers whereby they then can use the services out of the NASA Center, and it is on a funded basis.

The fact we have been suggesting to NASA and to Commerce, to the SBDC programs, the technology commercialization center program, the business development center program that each of these programs should have a line item within their contract to utilize the informational services that are available from the NASA sector, because they are the one that is dealing on a one-on-one basis with the client.

The biggest cost in most of the assistance programs is the cost of outreach, the cost of identifying people who do something for, and the administrative cost, and we have to look at instead of creating a lot more of small centers of centralizing resources and having local representation that then identifies the needs, and you have got the resources in the centralized, efficient basis that they can relate to. Unfortunately we see that doesn't happen. Each agency wants to do its own thing.

Mr. BROWN. Well, I have been recalling more often recently the Federal Government's first experience with technology transfer sys-

protection in bringing about the availability of new and improved products on the marketplace.

Related to the questions of the value of patents and the availability of exclusive licenses is the role which can be played by small business in the entire technology transfer process. It must be realized that insofar as the development of new products is concerned, large corporations seldom have interest in new products having sales potential or cash flow potential less than millions of dollars annually. The nature of most of the inventions resulting from basic or space research are such that such potential markets are seldom, if ever, involved. However, when an invention of apparent merit is recognized as having market potential as low as $100,000 per year or even less, the development of and marketing of such inventions may be of major importance to small and moderate sized businesses. At Caltech most of our inventions are of this nature and most of our license agreements have been with small or moderate sized business, resulting in useful growth for the business establishments and in the appearance of new high technology products in the marketplace. It is considered that this is a very significant facet of the technology transfer process and that greater importance should be given to it.

There is a misconception or lack of perspective concerning the relative merits of Government versus University programs in the licensing of new technology. It could be argued that retention of title by the Government and licensing by the Government could achieve all of the advantages of licensing by the University and have the further advantage that management of such licensing might be more in the public interest if managed by Government employees. The fact remains that Government efforts at licensing spin-off inventions has been totally unsuccessful for a variety of reasons. I do not know the degree of success Government has had, but I do know that at Caltech, for example, we have succeeded in effecting license agreements involving almost 40% of the patent properties to which we have acquired title. I am certain, from what information I can derive of the Government effort, that its percentage is much lower. The reasons for this are that the Government portfolio is so large as to be unmanageable, whereas individual university portfolios are quite small. What is more important, the large Government portfolio must necessarily be handled on a passive basis whereas smaller portfolios may be personally and aggressively promoted. Moreover, at most universities the inventors may become involved in both finding a licensee and assisting him in his efforts and are motivated to do so because it is the practice at most universities to give the inventor a portion of any royalty income developed.

Have you any comment that you might offer on something of that sort?

Mr. KING. I understand that there has been some pilot programs and that have dealt with satellite use as it relates to the transmittal of the printed material itself.

Mr. BROWN. Yes.

Mr. KING. Now, that would be of major advantage. From the standpoint of a comparative use of satellite as compared to telephone lines, et cetera, I really have not looked at it from what are the cost relationships standpoints.

Right now it is so fast, anyway, you really wonder as to what the improvement would be.

Mr. BROWN. Well, I don't think it would improve the speed. It might improve the cost if there was a sufficient volume of similar type information.

Thank you.

Mr. LLOYD. Thank you very much, and I thank the panel for being with us this morning.

We will take a 10-minute break.

[Recess.]

Mr. LLOYD. I am sorry. We have been a little slow. I hope we can make up the time.

Mr. LUJAN. We can keep the questions short.

Mr. LLOYD. Oh, no. Not at all. I want to hear from everyone.

As soon as she sits down, the Chair will recognize Elaine Donaldson, and we say welcome to all of you. I am very pleased to see you here today, and I thank you for joining us.

I know that Elaine has some comments to make. As I remember, she was a participant in the Small Business Conference back in Washington, D.C., as were others I believe. Phil Schlosser, who will be testifying, was also back there, you may begin.

STATEMENT OF ELAINE DONALDSON

Mrs. DONALDSON. Thank you, Congressman Lloyd, and may I say to you gentlemen welcome to California, and I am delighted you have been going around the country and particularly pleased that you came to our area.

I think my real value in appearing before you today lies not in my expertise in the area of science or technology but rather I believe in my involvement over the past 18 years in the growing of the small business from scratch and the other side of the coin 16 years of serving in a local elected capacity, 4 of them as city councilwoman and 2 of them as mayor of this city of Covina.

My husband and I started our own industrial supply business in 1962 with $5,000 and 400 square feet of building space and 2 employees, my husband and I. We now have 17 employees and 4,000 square feet of building space, and the last fiscal year we grossed $2 million.

Now, that is not really a big deal in the business world, but we are proud of it, especially that we have created jobs for 17 people.

ruptcy and from the standpoint of social actions, and yet every time a loan that is made we require these continuing guarantees, includes their homes, all their assets, everything that they have.

Now, I think this is especially critical as it relates to R. & D.

Mr. LUJAN. Well, that is the problem. You are stating the problem.

What I want to know from you is in your center do you have the capability of punching a button and telling the farmer this is the kind of a plan that you need because you have waste or you have something else. That is what I was trying to find out.

Mr. KING. From a technical standpoint we have the capability of being able to provide to the individual where the information is, how it can be gotten. We can get it for him in a printed format if it is available from that standpoint.

We can identify who the people are who are knowledgeable and provide them with the list of names.

So from that standpoint, yes.

Mr. LUJAN. Do all these other centers have that capability?

Mr. KING. I would say in most cases. Now, they all will from the standpoint of the computer information side. We have also what we call a tech coordinator system. In our case it is Dr. Goldbrand at Ames Research Center. His task is in identifying the information that does not exist in a published or printed format. Phone interviewing, he has a list of experts all over the country, be it within NASA Research Centers themselves or the Bureau of Standards or other Federal agencies, private companies, universities, et cetera.

So, yes, we have both sides.

Mr. WILLIAMS. The SBDC's working through the SBA do have the capability of taking this a step further into the operational stages, helping the individual set up these things.

Technically we don't have the types of background from—from the business standpoint we do have the background. We have one problem in the way SBDC's are funded. It is a set amount per State. Nevada would receive the same amount that California would regardless of the impact. From the SBA's standpoint they don't differentiate between a shoe store or a deli and a high technology manufacturing firm.

There is also a problem in getting into a firm on a long-term basis. Unfortunately SBA's—or SBDC's are pretty much a direct reflection of the SBA, and I have a lot of respect for these people naturally, but direct reflection of the SBA; the type of work that the SBA gets into is oftentimes very superficial. They expect SBDC's to do the same type of thing.

It is very difficult to get into long-term relationships that are really the type of work that is necessary in these areas.

Mr. LUJAN. Thank you.

Mr. LLOYD. Mr. Brown?

Mr. BROWN. Yes.

Let me comment briefly about the patent situation, and then I want to say that I very much appreciate the testimony of Mr. Stam and the comments based upon his actual experience.

The time seems to be ripe for some changes in the patent situation, primarily because of our concern with the productivity and down-

Today, however, it is becoming more and more clear to more and more people that the American economy has not exhausted its capacity for growth, that in fact we are probably a largely underdeveloped country, and even more important there is a gathering realization that public policy basically designed in a desperate time to deal with the set of bewildering and unprecedented short-time circumstances and in the long run produced the very conditions that they set out to correct.

I believe that today after 50 long years of deep changes occurring and that finally a pro enterprise revolution is gathering momentum. We seem to be talking about revolution this morning.

We had some remarks a while ago about the information revolution. I believe that we have a pro enterprise revolution.

Let me tell you why I believe that. As my husband and I gradually came through those early years of struggle I became a champion of an advocate for the small business owner, the enterpreneur, if you will. I have worn many hats. In 1976 as mayor of my city and as a member of the advisory board of the business department of this university I was invited to a luncheon on campus and had the good fortune of meeting Midge Koblinsky, who was then Director of the Small Business Administration. As a result of that meeting a few weeks later I was appointed by Mrs. Koblinsky under President Ford to the National Advisory Council of the SBA as a member at large.

I have been reaffirmed three times by Vernon Weaver and the present administration. My present term extends to October 1 of this year.

A few months later as a result of my Washington involvement I was asked to serve on the newly formed U.S. Chamber of Commerce Small Business Council. I am still an active member of that 60-man group, and I served as chairman of their committee for the White House Conference on Small Business in January of this year.

I was also a delegate to that conference appointed by Vernon Weaver. Arthur Leavitt, Chairman on the Commission on the White House Conference, asked me to serve on the seven man task force on inflation, one of eight task forces that prepared option papers for the White House Conference.

I made three trips to Washington with that hardworking group. During July of last year I was invited to the Rose Garden by President Carter to witness the signing of his new Executive order concerning the express needs of women in business, an action a long time in coming and much of it is still to be implemented.

All in all I made eight trips to Washington last year, including the White House Conference.

It made me decide I never want to run for Congress from the State of California. It isn't all that glamorous.

The action and the enthusiasm there to bring new life to the small business community was unmistakable. Trade organizations, such as the National Association of Wholesaler Distributors and business groups such as the NFIB are becoming increasingly active in the advocacy ground as well for small business, and I am sure you probably heard at different times that in the State of California the State chamber of commerce has initiated a small business committee, of which I am a member. All over the State they are promoting and selling the idea of local small business councils.

In the beginning I am afraid we had more guts than know-how, and now we have more know-how than guts, primarily because the years have taken their toll.

I can talk blithely about the beginning and happily about the present, but the years in between, particularly the early years, were sometimes tolerable and at the worst sheer torture, lack of capital, burdensome Government regulations, Government employees at all levels who were at the best uncooperative and at the worst downright rude.

Now we are in the more successful years we face mounting inflation and unbelievable interest rates and the constant threat to product liability even though we only sell industrial supplies. We don't manufacture them.

Incidentally, as I look through all the background material, I didn't see product liability mentioned at all, and I do think it has something to do when you are developing your products.

As the mayor of my city I became acutely aware of the strong need in our American society to undergird the efforts of our business communities, particularly small business, and a continuing effort to keep our tax base strong and viable and to be less and less dependent upon State and Federal funds.

This indeed should be your thrust for small business. Guide us. Don't regulate us. Give less government, not more. Listen to us. Don't preach to us. We have been through it. We have coped with taxes and OSHA and more and more Government forms that cost us an arm and a leg in time and money.

You have heard this before, I am sure, and I noticed in the background material that my good friend George, who gets abalone at Monterey talked to you and testified when you had your first meeting in Washington, and then you also have heard from Mel Stewart, also my good friend, who is a friend of all small business. Both of them I think are completely dedicated to the basic American premise that small business is indeed basic to our U.S. economy.

Let me go back in history for a few moments and relate an incident I think you might find interesting that was told to me by Arthur Leavitt, chairman of the board of the American Stock Exchange.

In the autumn of 1932 a Presidential candidate stood before an audience and presented a far-reaching analysis of America's economic plight.

America's era of growth he said was over. Our task now he said flatly is not discovered or exploitation of natural resources or producing more goods. It is the sober business of administering the resources and plants that we already have at hand. More growth he continued could be dangerous. The American economy, which in 50 years has lifted a whole nation of immigrants from poverty had finally reached the winter of maturity. Our headlong pursuit of production had gone too far. Now he said the problem was something new and unfamiliar, something called underconsumption.

That speaker's name was Franklin D. Roosevelt. Less than 6 weeks later he was elected to the Presidency, and what he told that original audience in 1932 became the basis of nearly a half century of public policy. It was in a sense a declaration of a curious 50 years war on the enterprise system.

Elaine W. Donaldson
966-0671

Subcommittee on Investigations and Oversight

My real value in appearing before you today lies not in my expertise in the area of Science and/or Technology, but rather, I believe, in my involvement over the past 18 years in growing a small business from scratch and the other side of the coin--16 years of serving in a local elected capacity four of them as a City Councilwoman and two of them as Mayor of the City of Covina.

My husband and I started our own industrial supply business in 1962 with $5000, 400 square ft. of bldg. space, and two employees, He and I. We now have 17 employees, 4000 square feet of bldg. space and last fiscal year we grossed two million.

Now that's not really a big deal in the business world--but we are proud of it--especially that we have created jobs for 17 people. In the beginning I'm afraid we had more guts than know-how. Now we have more know-how than guts--primarily because the years have taken there toll. I can talk blithely about the beginning and happily about the present--but the years in between--particularly the early years--were at the best tolerable and at the worst--sheer torture! Lack of capital, burdensome government regulations, government employees at <u>all</u> levels who were at the best uncooperative and at the worst--downright rude. Now, in our more successful years we

Product liability law reform, which as I stated before I think is of particular importance to you gentlemen, is of particular concern to the small business owner. I am vice chairman of the California product liability task force, and we are working this year to limit seller liability wherever possible, is a real problem for those in my type of business, and as I said, certainly should be of concern to you.

The kinds of organizations that are becoming interested in that last point I might say I spoke to the Los Angeles Industrial Distributors Association regarding the new laws that are being promoted not only at State level but at the national level, and that organization alone represented $126 million in gross sales in Los Angeles area, and it is something that they are tremendously concerned about, and I think it is a rising tide.

Yes, I find in final terms a pro enterprise revolution has come to pass. People and legislators are beginning to see that growth, be it in innovation or technology or small business in general, is not something that can be legislated or contrived. We cannot produce innovation the way we produce sausages. It is then not the product of a plum but of an attitude, a climate tolerable of enterprise and innovation. Growth begins when people are free to find new paths. That is my basic message to you this morning.

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

But more than that the Federal Government must listen to the mounting roar from the small business community. Every Federal agency should be aware of the 60 options that came out of the White House Conference on Small Business. After almost 2 years of meeting all over our country and groups that involved all together 30,000 small business people. I am sure that those 60 options are very available to all of the gentlemen on your subcommittee. Some of them point directly to innovation and technology. A lot of them point to capital formation retention, which I think also goes along very much with what you are trying to promote, and last but definitely not least make the risk and the hard years of work in becoming an entrepreneur worth the effort by enacting legislation that will help and encourage small business by eliminated regulations that strangle us. Our economy depends upon it.

Thank you.

[The prepared statement of Ms. Donaldson follows:]

of 1932, a Presidential candidate stood before an audience and presented a far-reaching analysis of America's deepening economic plight.

America's great era of growth, he said, was over. "Our task now," he said flatly, "is not discovery or exploitation of natural resources or ... producing more goods. It is the soberer, less dramatic business of administering resources and plants already at hand." More growth, he continued, could be dangerous. The American economy, which in fifty years had lifted a whole nation of immigrants from poverty, had finally reached the winter of its maturity.

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The speaker's name was Franklin D. Roosevelt. Less than six weeks later he was elected to the Presidency. And what he told that original audience in 1932 became the basis of nearly half a century of public policy. It was, in a sense, the declaration of a curious fifty-years war on enterprise.

Today, however, it is becoming more and more clear to more and more people that the American economy has not exhausted its capacity for growth--that, in fact, we are probably still a largely underdeveloped country. And, even

more important, there is a gathering realization that public policies hastily designed in a desperate time to deal with a set of bewildering and unprecedented short-term circumstances have in the long run produced the very conditions they set out to correct. I believe, that today, after fifty long years, a deep change is occurring and that finally a pro-enterprise revolution is gathering momentum.

Let me tell you why I believe this. As my husband and I gradually came through those early years of struggle, I became a champion of and an advocate for the small business owner--the entrepreneur--if you will.

I have worn many different hats. In 1976, as Mayor of my city, and as a member of the Advisory Board of the Business Dept. of this very University, I was invited to a luncheon on campus and had the good fortune of meeting Mitch Kobelinski, who was then Director of the Small Business Administration. As the result of that meeting, a few weeks later, I was appointed by Mr. Kobelinski, under President Ford, to the National Advisory Council of the S.B.A. as a member at large. I have been reaffirmed three times by Vernon Weaver and the present administration. My present term extends to October 1st, of this year.

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All in all, I made eight trips to Washington last year including the White House Conference. The action and enthusiasm there to bring new life to the small business community was unmistakable. Trade organizations such as

the National Association of Wholesaler Distributors and business groups such as N.F.I.B. are becoming increasingly active in the advocacy groundswell for small business.

In the State of California the State Chamber of Commerce has initiated a Small Business Committee, of which I am a member. All over the state they are promoting and selling the idea of local small business councils.

Product Liability law reform is of particular concern to the small business owner. I am Vice Chairman of the California Product Liability Task Force and we are working this year to eliminate seller liability wherever possible--a real problem for those in my type of business.

Yes, finally, a pro-enterprise revolution has come to pass. People--and legislators are beginning to see that growth--be it in innovation or technology--or small business in general, is not something that can be legislated or contrived. We cannot produce innovation the way we produce sausages. It is not the product of a plum but of an attitude--a climate tolerant of enterprise and innovation. Growth begins when people are free to find new paths.

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 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."

But more than that, the Federal government must listen to the mounting roar from the Small Business Community. Every Federal Agency should be aware of the sixty options that came out of the White House Conference on Small Business after almost two years of meetings all over our country and that involved 30,000 small business people.

And last, but definately not least, make the risk and years of hard work in becoming an entrepreneur worth the effort by enacting legislation that will help and encourage small business and by eliminating regulations that strangle us. Our economy depends on it.

Mr. LLOYD. Thank you very much, Mrs. Donaldson.

Dave, I believe you have someone with you who will speak for you.

Mr. ORMISTON. I would like to present Earl Kieselhorse to speak for the Chamber this morning.

Earl?

STATEMENT OF EARL KIESELHORSE

Mr. KIESELHORSE. I want to concentrate this morning on a very serious problem of the small businessman which has been made more acute as a result of today's credit crunch, and that is the inability of the small businessman to get capital, to get loan funds, or to earn sufficient profits to reinvest in the business.

Cecil Bird, vice president of the Bank of America, in charge of urban affairs, advises the small entrepreneurs to cut back, to streamline their operation, to be cognizant of the high costs of money today and to use any kind of cash that can be generated internally.

The Bank of America will not cut back on its small business loan program. Last year the bank made 467 loans in the amount of $52.3 million. The goal this year is 490 loans in the amount of $60.2. In other words, they are going to increase the average loan for the small businessman from $112,000 to $122,000 this year.

Of course, not every business is going to be able to borrow. It is only going to be the most liquid and viable businesses.

Some businessmen are not even going to make small business loans. The Bank of America is going to concentrate on their existing customers.

William Mauk, the Deputy Administrator for the Small Business Administration, said that they are making a move to keep up with inflation by asking Congress to increase the top limit, on the average loan, from $500,000 to $750,000.

Now, I think that is the wrong approach. It seems to me instead of raising the ceiling on loans like the Bank of America is doing or the Small Business Administration is asking Congress to do we should lower the floor on loans.

Now, of course, theoretically there is no floor. The only floor is one that the banks have imposed themselves.

Very rarely do you see a bank lending under $100,000. Most of the loans are above that figure, yet the critical area in business is the man who needs $50 or $60,000.

One reason for this high figure on loans is the result of the Small Business Administration's definition of a small business itself.

Now, here are the size standards for a small business according to the SBA. A small service business is one who has annual receipts not exceeding from $2 to $8 million a year. A small retailer is one who has receipts of not exceeding $2 to $7½ million. The small wholesaler is one who has receipts not exceeding $9½ to $22 million, and as for manufacturers they don't use dollar figures. They say the small manufacturer will have from 250 to 1,500 employees.

Despite the multimillion dollar limits on small business, let's see how small, small business really is in the United States.

Consider this, that only 2 percent of all businesses in the United States do over $1 million a year; 93 percent of all proprietorships and

77 percent of all partnerships do less than $100,000 a year; and 45.2 percent of all corporations do less than a $100,000 a year.

Now let's take retailing. Ninety-six percent of all retailers do less than a $1 million a year. Actually 59 percent of all retailers do less than a $100,000, and 81 percent of the retailers in the country employ less than 8 people.

So you see business is really quite small. When it comes to wholesalers remember that limit was annual receipts of from $9½ to $22 million. Actually only 1.4 percent of all wholesalers do more than $10 million a year, and as for manufacturers 33 percent of all firms in the country employ less than 50 individuals.

So it seems to me we want to greatly reduce the size of the definition of what really is a small business. I am in hopes that this will help to channel funds down to the very, very small business person who is unable to get loan funds today.

When you consider the cost of paperwork and servicing of any loan is about the same, you can understand the banks' preference for the larger loans. So if the banks do not want to go below the $100,000 level it seems to me that the Small Business Administration is going to have to seek more direct loan funds for this purpose.

Today the SBA is into the 7th month of its fiscal year, yet no more direct loan funds are available for the rest of the year. That is how critical it is for the very small business.

I just got word the day before yesterday that the Small Business Administration is planning to revise the size standards and the definition of small business. It is a very complex affair. They are attempting to classify business into three categories: one, industries that are competitive; another group of industries that are concentrated, that is, the industries where maybe four businesses dominate the entire industry; and then, a third category, a mixed group, where you don't have any businesses dominating the industry, but still with quite a large number of sizable businesses. Instead of using dollar figures the SBA plans to use the number of employees as the guide to what constitutes a small business instead of dollar amounts.

They will be starting hearings next month in Philadelphia, and the hearing on the coast will be in San Francisco on May 20.

I do hope those hearings will succeed in reducing the limits as to what constitutes "small business."

The benefits of preserving the health of small business were very ably stated by Stahrl W. Edmunds, dean of the graduate school of administration at the University of California in Riverside at the hearing of the Senate Select Committee on Small Business November 6, 1979. He made some very good points on what can be done to help small business.

One thing is to eliminate unfair competition, get rid of discriminatory taxation, and reduce the burden of Government regulation and paperwork.

Milton Stewart of the Small Business Administration stated that taking total taxes as a percentage of net worth that 30 percent will be for the small business doing less than $100,000, and this burden declines to the point where it is only 11 percent for businesses that are doing over a $1 billion—a very unfair tax burden on the small enterprise.

Time doesn't permit me to go into the details of his report, but he has granted permission to submit his report as part of these proceedings. I want to commend you gentlemen for your interests in attempting to provide a wholesome climate for small business, and thank you for enabling us to appear before you today.

Mr. LLOYD. Thank you, Mr. Kieselhorse.

Do you have any other comments, Dave?

Mr. ORMISTON. That covers them. Thank you.

Mr. LLOYD. Mr. Gardner?

STATEMENT OF JOHN GARDNER

Mr. GARDNER. Yes; thank you very much for asking me to testify here today.

I appreciate the thought, although I had a little wondering going through my mind when you first asked, and when I first heard you were asking for expert witnesses, and although I have been out of business for sometime, I have spent almost 30 years in business as a private small businessman before I retired to this 80-hour-a-week job as chief executive, in other words, as the executive vice president of the Covina Chamber of Commerce, that job where it doesn't put me in the category of a small businessman any more, but it does permit me to speak on their behalf.

I know in talking to them today in regards to today's subject one of the things they wanted to cover immediately as to actually part of the need and it soon developed if small business has produced about one-half of the U.S. inventions since World War II and have been far more economical in doing so, then surely they deserve better consideration than just 4 percent of the financial development help, considering they pay almost one-half of the taxes paid by business.

It would appear that small business represents a great potential for producing of new technical innovations and high economic productivity. Certainly there is a need for a program of encouragement.

In our Covina area we have been blessed with a substantial number of small businesses, many which are in the high technology category.

In our good line of communication we have with business here plus some additional requests for input on small business problems of productivity and innovations one basic problem was almost unanimous in their concern. It was simple and understandable.

In large firms, agencies, nonprofit organizations and educational institutions, one or more employees, even whole departments were staffed with personnel having the expertise necessary and whose sole functions were to obtain grants and contracts, both private and public, for the use of research and development. No way could a small business with 1, 10, or 100 employees compete except in the most limited way against these skilled personnel. The only conclusion the small business person had with the unfamiliar forms and regulations was that it was redtape, redtape, redtape.

To add to this problem the small business person had another large deterrent that was due to the inability to have access to the library of knowledge stored in computers containing technology advice and conclusions developed and paid for by public funds. This access seems

to be restricted to the "in" crowd, who have been the most successful in obtaining grants and contracts through the years.

There are other problems such as slow government payments or even greater problems concerning not allowed or nonrecoverable costs that are really part of the development and production. There have been times when this has happened in Covina.

In our conversations with high technology members of the Covina Chamber of Commerce and others we asked not only their problems but also as to their thoughts on improvements. We did arrive at some positive conclusions in our opinion.

One: Help small business to help themselves by:

(*a*) Setting up regional advisory committees made up with knowledgeable business people to be assisted by some in authority in government who have the direct contact with decisionmakers. This objective would enable conclusions with the minimum of redtape for the small business person lacking the expertise in forms, procedures, and regulations.

(*b*) Make available to the library of already developed technology to enable the small business person to further develop a project on service in a given area.

Two: Set up in computer form a listing by various technological categories the small business firms and their capabilities of productivity. This would enable prime contractors to become more knowledgeable of all the firms available to improve technology and productivity rather than just their firms who have been blessed with the personnel to make themselves known.

Three: Set up in a given geographical area where there are sufficient small businesses of the high technological nature and are in a somewhat concentrated area like Covina a pilot program that would utilize these firms and recommendations set forth. This would enable us to work out and refine the programs and then when possible expand to other areas in the Nation.

Four: We recommend that this Subcommittee on Investigation and Oversight pursue the recommendations of the White House Conference on Small Business in regards to innovation and technology. They are recommending the following:

(*a*) Support and urge passage of S. 1860, the Small Business Innovation Act of 1979, and companion bill H.R. 5607, as presently drafted with flexibility for minor future amendments covering: Small business research and development set-asides, small business innovation and research programs, as already encompassed by H.R. 5126 and S. 1074, patents, retentions, amendments to the Internal Revenue Code, and regulatory flexibility.

(*b*) Existing Federal research and development procurement assistance, and tax laws and policies must be modified and new laws enacted to: First, eliminate unfair advantages enjoyed by Government agencies, nonprofit organizations and educational institutions which compete with innovative small business in providing goods and services; second, mandate statutorily a national policy of reliance on small business; third, prevent the Federal Government from disseminating proprietary information; and fourth, prevent the Federal Government, through the use of its own personnel including Federal research centers, from competing with small business.

(*c*) Increase the amount of Federal research and development prime contracts awarded through small business set-asides by 1 percent per year of each agency's research and development budget, until the dollar value of the set-asides reached at least 10 percent of that agency's total annul research and development budget.

(*d*) Clarify the "prudent man rule" to broaden it and insure that securities of small issuers are not excluded from those securities eligible for purchase by funds subject to ERISA, and exempt those securities from planned asset regulation issued by the Department of Labor.

(*e*) Institute specialized capital gains treatment for generative capital invested in technology based firms starting with 25 percent in the first year, decreasing by 5 percent per year to 0 after 5 years and, further, defer taxation on such gains whenever the proceeds from sale of investments is reinvested into a small business within the next 12 months.

We believe the goals you are seeking are obtainable. We believe that with your help the small businesses of this Nation will stand up and be counted.

In an effort to help, the Covina Chamber of Commerce is now in the formation stage of a small business council, wide in nature to free itself of the competition that exists among local chambers of commerce in their economic development programs, yet in a positive step for small business to help themselves, to help this Nation maintain its freedom which has as its base the free enterprise system. Thank you.

[The prepared statement of Mr. Gardner follows:]

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IMPROVING THE CLIMATE FOR INNOVATION BY SMALL, HIGH TECHNOLOGY BUSINESS

IS THERE A NEED

If Small Business has produced about one half of the U.S. Inventions since World War II and have been far more economical in doing so, then surely they deserve better consideration than just 4% of the financial development help, considering they pay almost one half of the taxes paid by business. It would appear that Small Business represents a great potential for producing of new technical innovations and high economic productivity. Certainly there is a need for a program of encouragement.

IDENTIFYING THE PROBLEMS

In our Covina area, we have been blessed with a substantial number of small businesses, many are in the high technology catagory.

In our good line of communication we have with business here, plus some additional requests for input on small business problems of productivity and innovations, one basic problem was almost unanimous in their concern. It was simple and understandable. In large firms, agencies, non-profit organizations and educational institutions, one or more employees; even whole departments were staffed with personnel having the expertise necessary and whose sole functions were to obtain grants and contracts, both private and public, for the use of research and development. No way could a small business with one, ten, or one hundred employees compete, except in the most limited way against these skilled personnel. The only conclusion the small business person had with the unfamiliar forms and regulations was that it was red tape..red tape...red tape.

To add to this problem, the small business person had another large deterent that was due to the inability to have access to the library of knowledge stored in computors containing technology advise and conclusions developed and paid for by public funds. This access seems to be restricted to the "in" crowd, who have been the most successful in obtaining grants and contracts through the years.

There are other problems such as slow government payments; or even greater problems concerning not allowed or non-recoverable costs that are really part of the development and production. There have been times when this has happened in Covina.

RECOMMENDATIONS

In our conversations with high technology members of the Covina Chamber and others, we asked not only about their problems, but also as to their thoughts on improvements. We did arrive at some positive conclusions, in our opinion.

1. Help Small Business to help themselves by:
   a. Setting up regional advisory committees made up with knowledgeable business people to be assisted by some in authority of government who have the direct contact with decision makers. This objective would enable conclusions with the minimum of red tape for the small business person lacking the expertise in forms, procedures and regulations.
   b. Make available to the library of already developed technology to enable the small business person to further develop a project on service in a given area.
2. Set up in a computer form a listing by various technological catagories the small business firms and their capabilities of productivity. This would enable prime contractors to become more knowledgeable of all the firms available to improve technology and productivity rather than just their firms who have been blessed with the personnel to make themselves known.

3. Set up in a given geographical area, where there are sufficient small businesses of the high technological nature and are in a somewhat concentrated area like Covina. A pilot program that would utilize these firms and recommendations set forth. This would enable us to work out and refine the program and then, when possible expand to other areas in the nation.

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e. Institute specialized capital gains treatment for generative capital invested in technology based firms starting with 25% in the first year, decreasing by 5% per year to zero after five years and, further, defer taxation on such gains whenever the proceeds from sale of investments is reinvested into a small business within the next twelve months.

SUMMARY

We believe the goals you are seeking are obtainable. We believe that with your help, the Small Businesses of this nation will stand up and be counted.

In an effort to help, the Covina Chamber of Commerce is now in the formation stage of a Small Business Council wide in nature, to free itself of the competition that exists between local Chambers of Commerce in their economic development programs, yet in a positive step for Small Business to help themselves; to help this nation maintain its freedom which has as its base, the free enterprise system.

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

Mr. Lujan?

Mr. LUJAN. Thank you, Mr. Chairman.

I think all of the statements were excellent.

I might say, Mrs. Donaldson, that—I was in the insurance business before I went to Congress. I am familiar with the whole product liability thing—and we did pass through the House a bill allowing groups to self-insure without——

Mrs. DONALDSON. Uniform product liability. Has that passed through the Senate yet?

Mr. LUJAN. I don't believe it has passed through the Senate, but it has gone through the House already.

I am not sure that that is really the answer, to allow self-insure——

Mrs. DONALDSON. No, no; it offers an option.

Mr. LUJAN. It is a step in the right direction.

As to the deregulation that all of you talk about, it sounds fine, but when you do start it, it has been started in the trucking industry now, and now all of a sudden in the trucking industry it is a very unpopular word.

We face that going into the radio stations, communications media, and all those sorts of things.

So while we all say get the Government off our back when we do start to get the Government off people's back there is a rebellion, just get them off as far as the forms are concerned, but don't touch my turf; don't let anybody else come into my area.

So it is kind of difficult to get it done. It sounds like a good idea, and it is a good idea, as a matter of fact. We are dedicated to doing that and as much of it as we can.

Mr. LLOYD. I thank you, Mr. Lujan. I was going to ask Mrs. Donaldson, who has really had tremendous experience, and is a prime example not only of a small business person but also of someone who has begun to understand the complexity of the labyrinth of government, and I know this because I have watched the progress that you have made with great interest in the area of small business, and you have certainly exemplified yourself as being one of the people who is really trying to communicate. My question then is with the understanding that you have regarding government, we will say Federal Government in this case—State and local government is another problem, and it is a problem—but with your understanding of the Federal Government how can we communicate with people going into business or small businessmen who are already there the problems that may exist for them in the development of their products or the development of their business area. I know that we can cut down on the paperwork and I cosponsored bills which are supposed to accomplish that, and I know that Manny has done the same thing.

We came up with the idea it was time we did indeed talk to the small businessman to try to communicate that indeed, there is somebody back there in Washington who is interested, but when you use that term back in Washington oftentimes the people don't understand the separation of powers, the difference, for instance, between Jim Lloyd as a Congressman who is responsible supposedly to his own constituency, to his district, and the head of the Small Business Administration or

the head of OSHA or ERISA or the Department of Energy and the conflicting orders that might result.

I have found that most people in business unlike yourself really don't understand what areas I can be somewhat effective in—I would like to be more than I am—as compared to the areas over which I have no control. I can't make the Small Business Administration grant a loan. I just cannot do that.

How do I communicate that? By the way, any of you are welcome to answer this question.

Mrs. DONALDSON. I think that, Congressman Lloyd, the first thing that came to mind as you talked about it was the word education, and I think that basically our educational system has got to do a lot more from the aspect of teaching this to students as they go through school and to get it back to the direction of yes, there is a free enterprise system out there. You don't have to go out and work for somebody else. You can work for small business and then look to something better.

Now, that is an area that I feel very strongly about and one of the reasons that I am very interested in the new Department of Education to see if they are going to introduce anything at all in that area.

I think that Wayne Williams and his Small Business Development Center offers an excellent opportunity of getting information to people on a local basis. I watched that center develop. It has been a controversial issue, and that I know. Even on the National Advisory Council there are those who feel strongly that "academia" cannot teach small business people, that they have to get it in other ways.

I don't happen to agree with that premise, and I don't know what I would do without the SBDC here at Cal-Poly, because I get so many questions from people in the community who are concerned about problems, who want to know where they can find the answer, and I am constantly referring them to Wayne.

Those two things come to mind, and I think that you have touched on a problem that is one that is far reaching and one that a lot of things can be done about it, but it is difficult I am sure from your level in Washington to get that information to people.

But there are ways, and I wouldn't overlook the chamber of commerce. They have ways and means of getting these, this kind of information, to people.

I have purchased, or our company has, because I am interested in this whole field a new film that was put out by the U.S. Chamber called Small Business Keeps America Working.

I have been showing this to the various school districts in the area and education councils in the hopes that they will utilize movies like that not only at the high school level but at the college level.

There are I think lots of areas in the realm of education that could be improved.

Mr. LLOYD. Yes, sir.

Mr. KIESELHORSE. With the score ace program the chapters throughout the country are doing a marvelous job of educating small businessmen in sound business practices, and one of the problems we are running into and one of the tragedies of our present inflation I think is the fact that we see too many families being pressured into getting a

second breadwinner in order to keep up with inflation, and they, in desperation, decide to open up a small retail business or a restaurant, and they get themselves committed with an onerous lease agreement, and then when they begin to lose their shirts they come in for counselling.

So we are trying to develop publicity and some way to reach people before they get into business to realize some of the marketing, planning, the financial planning, and the controls that they have to exercise in operating a business successfully.

Mr. LLOYD. Well, Mr. Gardner, and Elaine mentioned the chambers of commerce, and Dave, you are making major changes, and I know that John is. You are trying to be more responsive. You are trying to encourage the business community, but one of the problems we do have is that of educating the community as to what cannot be done by certain Federal entities, the Congressmen for instance versus the Administration, and we are not one and the same by any matter of means.

How can you communicate that to your people?

Mr. GARDNER. I think actually what we are doing, as you know, Congressman Lloyd, we are setting up a Small Business Council, and we did really take some pains to be sure we did not confine it to our normal marketing area, because we wanted to have it be for the benefit of the small business, not get a division or a part of the community chamber of commerce. The idea, intent of that is simply to set up an education process to take and have them have a forum to come with their particular problems and see what can be done collectively. In other words, this is to help them help themselves to formulate and concentrate on their ideas.

We think that also in turn that putting up a computer imprint that is available to the larger firms, the prime contractors, where they can say hey, we need this particular item, a base for a microphone, whatever the case may be, and set it up in their particular manner and they can then out of that computer come to have the information that those firms that are capable of producing that or making changes or development this way, rather than leaving it—let's put it this way—the people in the past, the small business person in the past, when he looked at what he had to do to get this on the market development or something he gave up when he saw the long line of things that he had to do.

True. He hit a problem. He called Congressman Lloyd. You have got a beautiful reputation of helping people, no question about it, but he may call, but there is a limitation to their knowledge there. It may not have been the thing that could have gone through your office and could have been something they could have developed for themselves if there was a forum to help them, encourage them.

It is a matter of education. I think it has to be a two-way street, not small business going to Government only. The Government has to come back and help them a little bit in some form rather than just say do it this way, and they look at a stack of forms to fill out.

Mr. ORMISTON. Once we find out the problems, what they are, and once they come to us, we can use expertise like Earle's, retired business people, to start chanelling those problems to specific departments that can help them.

I think that is what we are trying to do through the chapter.

Mrs. DONALDSON. I would be remiss if I didn't mention the Department of Advocacy through the SBDC through Mel Stewart.

I think that is a fine area to work through from the Federal area level. I think he is doing one bangup job.

I was concerned from the time I was on the Advisory Council that there wasn't more being done on the basis of advocacy. That was one of the mandates originally of SBA.

It is my understanding that Mel Stewart is responsible more to Congress than he is to the administration, and I like that, and I think that he works under that premise, and he is doing a great job. I think he needs more help in that area, and I think that would be a good place to start.

Mr. LLOYD. Well, do you think, for instance, here in your regional areas. I would use Kellogg Hill, as an example, that has always been a very difficult problem not only for business but also, you know, for me and my operation. Maybe we should have some sort of a regional data bank coordinated with the business people here at Cal-Poly for basic information?

For instance, someone decides, as you mentioned, Mr. Kieselhorst, the mom and pop operation, people leap out, and, you know, you issue a business license in the city, which costs you X number of dollars. You put an ad in the local paper doing business as and you are in business, nothing more than that.

Maybe we should have more restrictive covenants in the issuance of business licenses and that there should be an input from, knowledgeable business people who can accurately say how much money is needed to capitalize this business. For example, they might say $50,000, and the person doesn't have $5,000. They are in trouble before they start. You know it, and I know it, and they walk in, and they say I am going to go into business, but you say, well, who is your banker. Really, I don't have a banker. I guess I will go down and talk to the Bank of America.

You know automatically they are in trouble. If they don't know who their banker is by name and reputation, there is no way you can be in business unless you can call up Joe at UCB and say hey, Joe, I have got to have a $1,000 or $5,000 or $10,000 or whatever it may be, he says OK, and he already has your financial statement, and all of those that have been in business know those things. How can we communicate that?

Mr. KIESELHORST. The trouble with the $5,000 and $10,000 it is not available. They are up to $100,000. That is the point I am making.

We have got to get banks willing to come down and lower their sights on loans to help these business people.

Mr. ORMISTON. I think that is the system we are trying to create where Cal-Poly becomes the master cog and the chamber of commerce becomes the front door to small business within the communities, and then we can begin to coordinate the different sectors, the financial sector, the governmental sector with the problems of the small businessman.

Mr. LLOYD. I get people who call me up and say if I would only intercede with the SBA and help them get this loan I would solve their

problem, and I ask questions such as, well, who is your banker? Well, I don't really have a banker.

Now, you know they are not going to get an SBA loan unless they have a bank who is willing to loan the money. They assume that somehow I or Manny or people like us are going to wave that magic wand that we have in our office.

This is one of the toughest of all things to communicate to people who are leaping into business, and, as was aleady pointed out for us, inevitably they show up on my doorstep having a problem with an SBA loan when they may have defaulted on the loan or whatever it may be, and I am now supposed to pick up the pieces and put it back together for them.

One, in all fairness I don't think I am that good a businessman in the first place. Second, it is tough to look somebody in the eye and say I just don't think there is a solution for your problem. I would love to send them here to Cal-Poly. I would love to send them to John Gardner in Covina or Dave Ormiston over in Pomona or whoever it may be in one of the other cities that are in the district and say have you really checked with these poeple.

I would love to have that kind of cooperation, because, you know, I am a visible point, and they come to me not understanding what my limitations or capabilities may be, and you people who deal in this area need to—maybe we don't communicate enough. Have I failed in that area?

Mr. ORMISTON. I think we have a successful program in the Pomona area. Earl is dealing with over 600 businesses a year in counseling, being coordinated through Wayne Williams at Cal-Poly.

There is a need to get more communication. There is a need to get the story out more than we are doing, and we at the same time need to be able to duplicate the services that we are offering in the Pomona Valley elsewhere to begin to reach more than 600 business people, and I think that is the key really in the system, duplicating the system. I think we demonstrated locally the work being done.

Mr. LLOYD. Go ahead.

Mrs. DONALDSON. I might point out it occurred to me a little bit ago that during the years I was Mayor of Covina I was also president of the San Gabriel Association of Cities, 21 cities, and I had two or three meetings out here at the time that was in order to get the mayors together to help them to understand what was offered here in the way of counseling for small business people, because in my way of thinking a mayor who doesn't realize the importance of the basic economics of the city and the fact that the success of small business is important to him is making a big mistake.

I think working through you you are in a position certainly to get this kind of information to them, to the local government officials, who perhaps can assist in some manner.

Mr. LLOYD. I will take that to heart.

Yes. Did you have something?

Mr. VILTER. I would like to make a statement to the committee.

My name is John Vilter. I am a small businessman in Covina, have a firm, management consultant, called Executives.

I am currently vice president of governmental affairs for the Covina

Chamber of Commerce, and I am hopefully one of those who is instrumental in starting this Covina Valley Small Business Council.

I am concurrently the chairman of the southern California section of the American Chemical Society, and looking at what I believe is the heart of this whole discussion that to have high technology industry and innovation is not a matter of just simply a small business but having access for the small business person to employ high technology specialists.

This afternoon over at Mount San Antonio College they are having an Edison conference for high school students in business to inform the student in high school about the problems of small business. Last night I had the honor of presenting the southern California section's highest award of achievement at Cal-Tech to Dr. Harry Gray for the work that he is doing there, and in the process of meeting with rather prominent scientists there and from throughout the country and Europe to discuss this problem.

I have spoken with his staff on this area of the employment of the technically competent people, and one of the things that we do find is that in trying to set up some sort of an access to governmental agencies or to high technology large corporations it is difficult for an individual unless they have a track record to even have access to information or to be considered as on a bidder's list, and when you are looking at this, we tried during the last crunch in 1969 to 1971 in setting up individuals who had credentials, they had degrees, and they were with prestigious companies one day handling multibillion dollar contracts, and, Congressman, and I have talked on this in detail, and one day the pink slip arrives, and they do not have access to Government funding, and yet the day before they controlled it, and because of the manipulation that is being done by industry, by education, and by the Government.

It is difficult, extremely difficult, for people who get together like the starting of the Rand Corp. or starting of TRW or any of these with a group of people who had the technical competence and the brilliance to do something to bid, to make an effort, because they are no longer there. They don't represent anyone, and they also had nothing that they can do.

In a small business council it should not be considered a competition. I seem to understand from Pomona that we are looking for a small business council, and it is not one that we are looking to or assistance to come into the Small Business Administration, because that is done very well.

In my committee in the Covina Chamber we are very interested in governmental affairs and in seeing that those things that are important to small business are acted upon or brought to your attention, and these are the things that we do.

As far as access to information there is no doubt that the conference here—and when Reed Powell was here and setting up the center here, it was the intent to make it accessible to everyone, and so this is all to let others know about it, but there are other concerns that small business people have that has to be acted upon in a concerted effort, and that is the one Elaine is addressing in the product liability. The Small Business Council would do this, but the other aspect that we have not addressed and the one thing that we are very,

very conscious of in the scientific community, and I have been following these statistics since 1969, specifically since I am involved in southern California and also nationally on the transient nature of employment in high technology areas, because once the person has received an advance degree in left-handed navigational systems, all of a sudden the Federal Government makes it a right-handed navigational system, and he is out of a job. He is too old to go back to be trained.

In fact right here we had tried for a master's program in environmental engineering, and we were screening people in 1969 through 1971 to fill these fields to get them proper applicants to take part in this program, and we made a very tight screen with a Ph. D. After the people had gone into the crash program for 1 year they came out and were looking for jobs, because no one had ever heard of a master's degree in environmental engineering.

So the reaction and action seems to be in the wrong way.

It is always a fact that we are looking for someone to take an action part rather than a reaction part, and what we do need now is access within the Federal Government to bidding on high technology programs by individuals who are very, very competent. We try. We ourselves in the southern California section had set up a legal entity so that we could receive funds in the eight basic areas we were to look at in conjunction with NASA. Solid waste management was one we had in California. Sea technology was active in San Diego. We developed the eight areas, heart research, and we had people eminently qualified, and we could not get any one large company or government agency to let funds to us because we did not have a track record, and this is happening again and again.

Mr. LLOYD. John, could I get you to finish. We have another panel.

Mr. VILTER. Oh. That is my question, or I would be very happy to answer any questions about these, but there is work being done. There are people qualified for innovation if we only had some way to approach it.

Mr. LLOYD. Thank you. We will have the next panel, and thank you very much. Appreciate it.

[Recess.]

Mr. LLOYD. Are we ready to go? I guess we will start with the other end this time, start with Mr. Petker. Is that all right?

Mr. PETKER. Yes.

Mr. LLOYD. All right. I have your statement, and without objection that will be included in the record. Feel free to paraphrase or go forward with it, and we are running out of time. The last panel always has less time. You realize that.

But we will go forward right away on it. Go ahead, Mr. Petker.

STATEMENT OF IRA PETKER

Mr. PETKER. I guess really this is an aside, but I believe very strongly that the way to learn about, you know, the nature of innovation and high technology comes directly I think from a study of those companies and the experience of people, you know, as they live it within and what happened through the years.

In a sense it is unfortunate this panel is last, because I think there is a lot probably that has to be said, but I have been a technologist

for about 30 years now, and practically all of that time has been in the aerospace industry, which means that in a sense I have always worked with and for the Government, and I certainly have a lot of experience in the nature of Government contracting and also the kinds of people, you know, many, many Government people through the years and literally I say there are hundreds that I have associated with, some that I got friendly with, many I have gotten to know very well, and I have found at least a sector of the people that I have dealt with, you know, and they have tended to be engineers, they tend to be scientists, technical people themselves, that as a group, you know, my experience has been that their integrity is as high as that of industry. Many of them work as hard and work harder, you know, than counterparts in industry. I could quote really a good variety of, you know, good experiences rather than a poor one.

I think the Government, you know, just like companies it is difficult to get individualized. Every company is different and has different problems. Every technology has different problems in its evolution.

What I can talk about, you know, what I can speak from is my own experience as a technologist and as a businessman, which has been something over 5 years now, and it just so happens that my becoming a businessman was an evolution. It wasn't something that I figured 20 years ago that is what I wanted to be, you know, and then I would be it some day.

The evolution really grew out of the experiences I had as a worker, as an engineer, as a technologist, in aerospace companies, and it also happened that the problem of innovation and the creation of technology was one that I developed an interest in a long time ago, and the issue of productivity, you know, for people also happened to be one that developed within me a long time ago. It is something I was very interested in, and the formation of my company really grew out as much from those considerations and my ideas and thoughts about how to create more technology for less, how to get more productivity, because I believe people want to be productive.

The issue really, you know, it takes a couple or three things. The one thing that unfortunately enough attention is not given to is the people who are involved, you know. Innovation is created by people. Creativity is one of the unique things about human beings. We want to understand innovation then I think we have to understand more about the people who innovate. I think we ought to understand something more about the environment, because it is a combination of people, enivornment and resources that either leads to more or less of anything in innovation or productivity.

So in a sense, you know, the intent of my company was really to explore some of these kinds of things to be involved in the context of my technology, which is composite material.

I have been a worker in composite materials for about 23 years. The technology is about 30 years. So it means that I have been around and part of it for a long time. I know an awful lot about composites.

Composites are a class of lightweight materials that can be used for almost all the things that metals are used for. Those are their basic characteristics.

Certain classes of composite materials which are the ones that we specialize in called advanced composites have the potential of building

an airplane at half the weight, same size, with the potential of building an automobile at a third of the weight, same size, and all the same ability, and what it means is that the fuel costs and the energy costs and potentialization are dramatic.

Composites are potentially, you know, the technology field that will touch everybody if they are successful, then if they do prove themselves out ultimately.

It is also a technology that many large companies became interested in quite early, because it was obvious, for example, to an airplane company that if composites are going to be used on airplanes, if they are going to change the nature and the weight and the efficiency of an airplane, then they sure had better develop a capability.

It is also a technology that the Government has had a very strong interest in and has supported in a variety of ways, because there are a host of things, a host of applications of composites in a whole variety of defense systems, almost any vehicle starting with airplanes.

Now, we chose a path with the company which was one that in essence eliminated early, you know, equity money coming into the company. The opportunity for financial resources was limited to begin with, true for any small company. Because of the nature of the technology, where it was and the nature of the company the only real interest in equity money would be coming from capital and companies who had an interest in the technology, and we decided very early that we didn't want that kind of money, because we didn't want the influence. We started a company as a result of experiences in industry, and we thought we could do better, something more productive, and essentially we had to follow an independent path, and it is very, very difficult.

The nature of our problems, at least looking at Government support, Government funding of composite technology, as I said, it has been pretty widespread, the tendency has been for the major funding to go to the companies who the Government feels will be utilizing the technology rather early, and that means that the technology is going to be used on airplanes, then the heaviest funding will go to an airplane company, but if it happens that the airplane company has an aggressive interest in the technology and sees use for it in the future, they will, as they did in composites, start to build up in-house capability, and what has happened through the years is that the major money that has come down has stopped essentially at the prime contractor level. Very little is trickled down into small companies, and even though, you know, we have proven time and time again that we can build composite structure of higher quality at lesser cost at better efficiency that many of our, you know, large competitors the ability, you know, to have at least a fair share in the funding that comes down is very, very limited.

The ability to obtain financing, you know, lending money has also been very limited again from the nature of the company. A small, high technology company when it is young is a risky thing, and I myself who professionally work within my company take risks, and they take risks, not simply because they anticipate financial benefits. They take risks because they get to work in a manner, they work on things in a way in which they can believe in what they are doing. The fact that risk is high means that financial resources are limited, and the higher the risk appears the less there is availability for money.

I suspect that one of these things that the Government might consider a bit is the whole idea of risk and whether or not because the nature of high technology companies—little ones are risky, and it is risk they are worried about, because the payoffs can be very big for the investment, and I don't believe there are many mechanisms really in Government funding in which, you know, risk can be accepted in a natural way, and it might be a whole issue that maybe some attention should be put to.

There really are a lot of things I have to say. I think I would rather stop maybe right here. And let the other guys say something.

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