



SMALL BUSINESS INNOVATION DEVELOPMENT ACT

TENTH ANNUAL REPORT
1993



SBA

OFFICE OF INNOVATION, RESEARCH AND TECHNOLOGY

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

OFFICE OF THE ADMINISTRATOR

NOV 23 1993

The Honorable Dale L. Bumpers
Chairman, Committee on Small Business
United States Senate

The Honorable John J. LaFalce
Chairman, Committee on Small Business
House of Representatives

This report, prepared pursuant to Public Laws 102-564, 97-219 and 99-443, describes the tenth year results of the Small Business Innovation Development Act of 1982.

This report presents the accomplishments and progress of the participating federal agencies under the Small Business Innovation Research (SBIR) Program. It also details their achievement of small business goals in research and research and development acquisition and includes an update on the commercialization of SBIR efforts.

During fiscal year 1992 the eleven federal participating agencies awarded 3,475 SBIR funding agreements totaling over \$508 million. These figures are significantly greater than fiscal year 1991 totals.

We continue to depart from traditional fiscal reporting for awards. The report includes awards of procurements initiated in FY 1992, but which were made after the close of the fiscal year. This more accurately reflects the program's FY 1992 activity.

Copies of this report have been provided to the Office of Federal Procurement Policy and the General Accounting Office. The review and analysis were made by the Office of Innovation, Research and Technology of this Agency.

Sincerely,

Erskine B. Bowles
Administrator

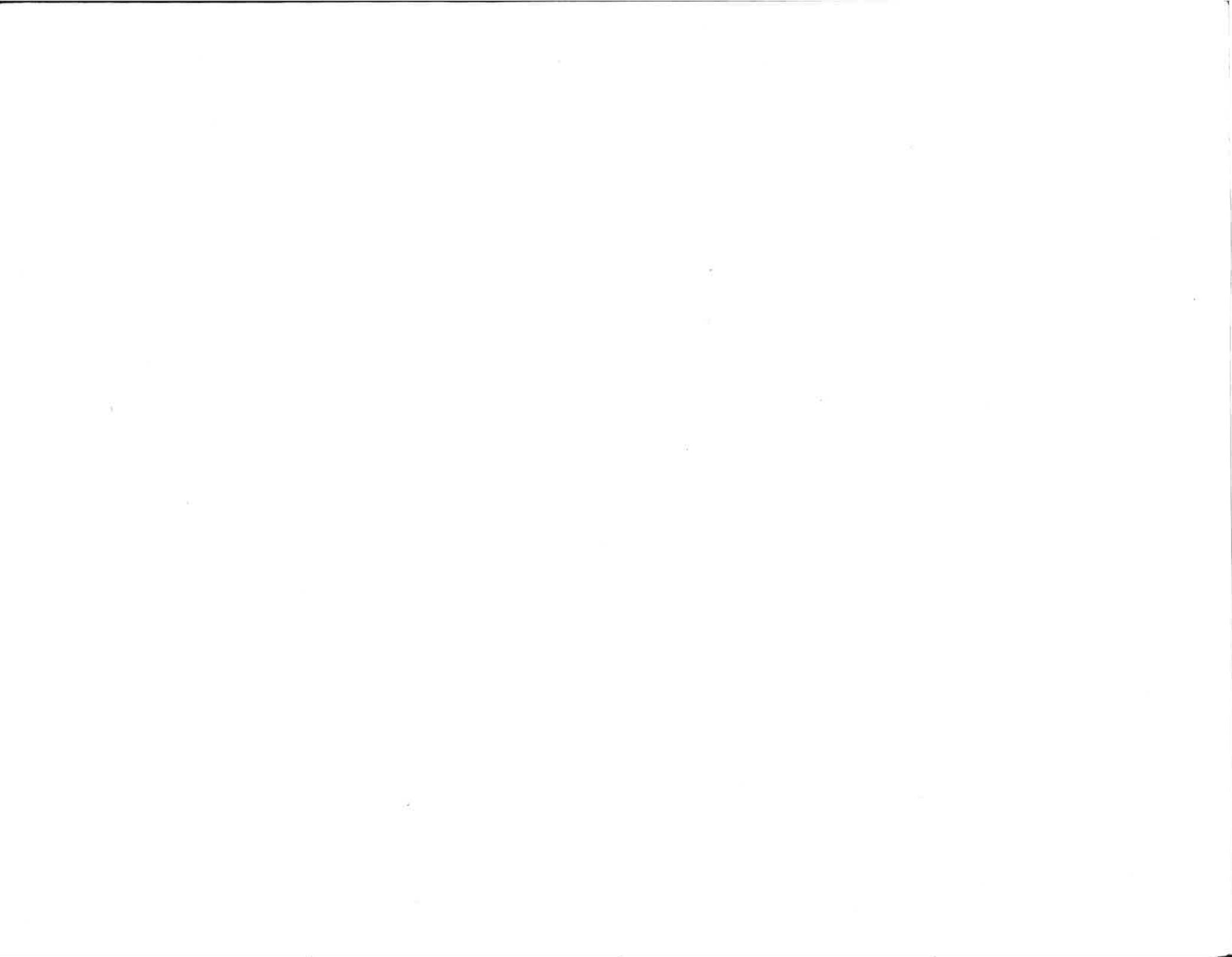




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SBIR AWARDS HELP WIDEN COMPUTER TECHNOLOGY

Communication Intelligence Corp. (CIC), a small hi-tech firm headquartered in Redwood Shores, CA, has used the SBIR Program to help it become a leader in one of the fastest-growing aspects of computer technology—a technology that uses pen, voice and image to communicate with computers. The company's successes have already led to almost \$3 million of Phase III follow-on commitment.

CIC says that despite many advances in computers, the way that most people interact with computers has changed very little. In fact, the company contends, many people still are afraid of computers and lack the training or technical background to use computers easily and effectively. CIC says its goal is to make computers more accommodating and provide the means for people to interact with computers in a more human-like way. In other words, rather than forcing people to adapt to the technology, make the technology smart enough to deal with people on their own terms.

A pen with handwriting recognition that replaces the computer keyboard and mouse is the first step, CIC contends. It makes it possible to point and enter data with a single device (a pen). It also adds new capabilities such as the ability to sketch and draw. Eventually, the company goes on, speech and imaging capability can be added.

CIC already is a leading supplier of pen computing products to hardware manufacturers around the world. The company is a world leader in on-line handwriting recognition technology as measured by PC market share under license. CIC's licensees and partners control more than 40 percent of the world personal computer market and 80 percent of the Japanese personal computer market. Major licensees and joint development partners include IBM, Intel, NCR/AT&T, NEC Corporation, Fujitsu Ltd., Seiko, Epson and Samsung Electronics. CIC's SBIR funding has come from the National Science Foundation.

CIC's first major innovation was development and commercialization of a Japanese language handwriting system. Written Japanese typically includes more than 3,000 ideographic symbols, which makes for difficult keyboard entry. CIC's technology enables users to enter Japanese



The MacHandwriter® tablet coupled with the Apple Macintosh® creates the first full capability pen input PC. You can communicate with your Macintosh® simply and naturally by pointing, writing, and drawing with a pen.

text in their own handwriting without the need for a keyboard. To solve the problem of recognizing more than 3,000 complex characters, CIC developed a proprietary technology incorporating elements of artificial intelligence. A commercial product based on this technology, the "MacHandwriter," is being distributed by Apple Computer in Japan.

CIC also has developed handwriting recognition for English and other Roman languages. The company's multilingual recognition system now offers a range of languages, including English, Japanese, German, French, Spanish and Italian. Options include recognition systems that are user independent, user trainable and user adaptive.



CIC has developed its own DOS-based operating system for pen computing, called PenDOS. Included are software tools for developing customized handwriting recognition applications. In 1992, the firm introduced a new version of its fast, memory-efficient pen operating environment for the U. S. European and Japanese markets, and reached an agreement with IBM under which IBM has the worldwide rights to use, resell and exclusively sublicense CIC's PenDOS and Handwriter Recognition Systems for PenDOS to end-users and computer manufacturers.

CIC's PenLABS program provides education and information about pen computing to end users, independent software vendors, and hardware manufacturers. PenLABS conducts seminars to help computer users and software developers learn to adapt existing and planned DOS programs for use on pen-based computers.

In commenting on its overall company objectives, CIC says that "we should be able to make computers that are friendly enough so that workers can learn to use them in productive jobs with only a little training and familiarity....Making computers easier to use and more accessible will open up the market to people who currently do not use computers. This is a huge untapped market that includes a large majority of people in the U. S. and worldwide."

John S. Ostrem, CIC's vice president for research and development, says

that SBIR "enabled CIC to begin an important high-risk research project that otherwise might have been significantly delayed or excluded altogether. The awards added credibility to CIC and its technology, and facilitated technology licensing and joint ventures."



Football coaches and assistants for top collegiate football programs adopt CIC's pen computing technology for the upcoming fall season to analyze game data and play statistics.



The Small Business Innovation Research (SBIR) Program in fiscal 1992 celebrated its 10th year of operation and continued to show that the nation's small hi-tech enterprises, with federal government help, can to a significant and important degree turn basic ideas and research into commercial products which add to the nation's productivity and help the U. S. maintain its competitive leadership in the international marketplace. The lesson of the SBIR Program is simple: It works!

In those 10 years, the SBIR Program directed nearly 25,000 awards worth more than \$3.2 billion to thousands of small hi-tech companies. As this report shows, small enterprises which turned their ideas and research into viable and profitable commercial successes are engaged in a wide variety of industries and technologies, from the mundane to the exotic.

On Oct. 28, 1992, the President signed legislation extending the SBIR Program to be in effect until Oct. 1, 2000 and increasing the percentage of research and development funds that must be directed to small hi-tech firms by the major agency participants. Congressional re-authorization of the program illustrated broad bipartisan support and reflected the program's continuing success.

There is no doubt about the talents and determination among entrepreneurs. But there also is no doubt that in many cases, small hi-tech companies could not have turned their ideas into profitable products without the assistance received from the SBIR Program. As this annual report for fiscal 1992 shows, through program statistics and stories of awardee successes, an ever-increasing number of SBIR Program participants are succeeding in commercializing their new products, processes and services—and in so doing are helping to boost our nation's competitiveness in world markets and improve our environment and physical well-being. Surveys by the Small Business Administration and the General Accounting Office show that at least one in four—and perhaps even more—SBIR participants have recorded commercial sales success within six years of receiving their Phase II awards.

- It also is encouraging that an increasing number of small firms headed by minorities are winning SBIR awards and proving their own technical and innovative talents.
- In administering and supervising the SBIR Program, the Small Business Administration and its Office of Innovation, Research and Technology continues efforts to encourage more and more small hi-tech enterprises to respond to agency award solicitations. It has been noted that a number of program participants are winning multiple awards; this is an understandable development in view of the firms' abilities and past successes. Such multiple award winners, along with their fellow small hi-tech managers, recognize the value of the time-old advisory, "innovate or stagnate."
- The SBIR Program began in fiscal 1983. In its 10 years, SBIR can list these highlights and accomplishments:
- In response to 130 solicitations, the 11 federal agencies involved in the program, have received 163,320 proposals from small hi-tech firms, resulting in 24,902 awards worth more than \$3,273.6 billion.
- In fiscal 1992, 3,475 awards were made, worth \$508.4 million.
- More than 50,000 names and addresses of small firms are now recorded on SBIR's fully automated outreach system mailing list, and thus receive current information on SBIR programs and policies and useful information on agency solicitations for proposals.
- The increasing number of commercial sales successes have come in a wide area of technologies and industries—everything (as the success stories in this report show) from superconductors, filter technology and automatic speech recognition to pharmaceuticals, gas purification and optics.
- The new products and new technologies resulting from SBIR awards are helping to maintain and improve America's world competitiveness and to improve the life of millions in our country and abroad.



INTRODUCTION

The basic purpose of the Small Business Innovation Development Act was to strengthen the role of small innovative enterprises in federally-funded research and development and thus help the nation develop a stronger base for technical innovation and wider commercialization of the ideas generated in the laboratories, research facilities and factory floors of small hi-tech companies.

The act, signed into law by the President on July 22, 1982, was re-authorized in fiscal 1986 and again in fiscal 1992, to be in effect until October 1, 2000.

The original statute, Public Law 97-219, also was enacted with the growing realization and appreciation that small businesses—especially small hi-tech businesses—are responsible for most of our new products, processes and technologies, and are particularly capable of turning research and development into commercial and profitable successes. In many cases, all these small innovators needed was an infusion of Small Business Innovation Research (SBIR) Program assistance. The small hi-tech businesses commercial successes to date, and those successes anticipated in the future, have created many new jobs, have added to the nation's tax base and have helped the country's economic viability and productivity.

This report is the tenth in a series of annual reports pursuant to the act and reflects and summarizes, among other things, SBIR Program results and activities during fiscal 1992 (the year ended September 30, 1992). The report is presented by the Small Business Administration (SBA), which is directed by the act to set program policy and to monitor, evaluate and report the progress of the SBIR Program.

Findings and Purposes of the Act

The President signed the Small Business Innovation Development act—the act that created the Small Business Innovation Research (SBIR) Program—on July 22, 1982. The act originally was set to expire on Oct. 1, 1988. During fiscal 1986, Congress enacted legislation extending the act through September 30, 1993, and in so doing said it found that technological innovation creates jobs, increases productivity and economic

growth, and serves as a valuable counterforce to inflation and the U. S. balance of payments deficit. Congress also noted that while small business is the nation's principal source of significant innovations, the vast majority of federally funded research and development had heretofore been conducted by large businesses, universities and government laboratories.

In 1992, Congress once again extended the life of the program, through enactment of the Small Business Research and Development Enhancement Act, Public Law 102-564. The extension is now set for expiration on October 1, 2000. The President signed this legislation on October 28, 1992. The extension increased, on an incremental basis, the percentage of research and development funds which the participating federal agencies must direct to small hi-tech firms—from 1.25 percent to 2.5 percent—and raised the thresholds of Phase I awards from \$50,000 to \$100,000 and Phase II awards from \$500,000 to \$750,000.

The purposes of the act are to:

1. Expand and improve the Small Business Innovation Research Program;
2. Emphasize increased private sector commercialization of technology developed through federal SBIR research and development;
3. Increase small business participation in federal research and development; and
4. Improve the federal government's dissemination of information concerning the SBIR Program with regard to participation by women-owned and socially and economically disadvantaged small business concerns.

Two Distinct Programs

The law created two distinct programs and directed that the programs be implemented by SBA. The primary program is the Small Business Innovation Research (SBIR) Program. The secondary program is the Research and Research and Development (R&R&D) Goaling Program.



Under the SBIR Program, each federal agency with an extramural budget for research or research and development in excess of \$100 million for fiscal 1982, or any fiscal year thereafter, must establish an SBIR Program. The program is funded by setting aside a set percentage of the participating agency's extramural research or research and development contracting dollars during each fiscal year. Each participating federal agency will expend with small business concerns not less than 1.5 percent of their R&D budget in fiscal years 1993 and 1994; not less than 2 percent in fiscal years 1995 and 1996 and not less than 2.5 percent thereafter.

There were 11 participating federal SBIR agencies during fiscal 1992:

Department of Agriculture
Department of Commerce
Department of Defense
Department of Education
Department of Health and Human Services
Department of Transportation
Environmental Protection Agency
National Aeronautics & Space Administration
Department of Energy
National Science Foundation
Nuclear Regulatory Commission

SBIR is a Three Phase Program

- Phase I: Phase I awards are funded for up to \$100,000 and are made for research projects to evaluate the scientific and technical merit and feasibility of an idea.
- Phase II: Phase I projects with the most potential are funded to further develop the proposed idea for one or two years. Most Phase II awards are funded for \$750,000 or less.
- Phase III: An innovation is brought to market by private sector investment and support. No SBIR funds may be used in Phase III. When appropriate, Phase III may involve follow-on production contracts with a federal agency for future use by the federal government.

The Goaling Program

The law requires federal agencies with a budget for research or research and development in excess of \$20 million for any fiscal year to establish small business goals for awarding research and research and development (R&R&D) funding agreements to small companies. The annual goal to be set cannot be less than an agency's achievement during the previous fiscal year. In addition to the 11 SBIR agencies, seven other agencies participate in the goaling program.

Department of Interior
Department of Justice
Department of Treasury
Department of Veteran Affairs
Agency for International Development
Smithsonian Institution
Tennessee Valley Authority

SBA Authorities and Responsibilities

The law designated SBA as the agency for program implementation, governing policy and monitoring and analysis. The SBA's authorities and responsibilities are:

1. Developing, coordinating, issuing and updating a policy directive for the federal government-wide conduct of the SBIR and goaling programs.
2. Developing and administering an SBIR Program information and outreach program.
3. Developing and maintaining a mailing list of interested small business concerns.
4. Developing, coordinating, publishing and disseminating SBIR Pre-Solicitation Announcements.
5. Surveying, monitoring and reporting on agency SBIR Programs.
6. Reporting at least annually to Congress on the two programs and on SBA monitoring activities.



7. Private sector coordination on the commercialization aspects of SBIR innovations.
8. Obtaining information on the current National Critical Technologies.

Agency SBIR Program Authorities and Responsibilities

The authorities and responsibilities of the participating agencies are to:

1. Determine categories of projects to be in the agency's SBIR Program.
2. Issue SBIR solicitations in accordance with a schedule determined cooperatively with SBA.
3. Unilaterally determine research topics within its SBIR solicitations giving special consideration to broad research topics and to topics that further one or more National Critical Technologies.
4. Receive and evaluate proposals resulting from SBIR solicitations.
5. Select awardees for SBIR funding agreements.
6. Each funding agreement under the SBIR Program shall include provisions setting forth respective rights of the United States and small business concerns with respect to intellectual property rights and any right to carry out follow-on research.
7. Administer an agency's SBIR funding agreements (or delegate such administration to another agency).
8. Make payments to SBIR award recipients on the basis of progress toward or completion of the funding agreement requirements.
9. Submit an annual report on the SBIR and goaling programs to SBA.



In setting SBIR Program policy and in monitoring and evaluating the program, SBA acts to keep contract award procedures simple and standardized, to keep paperwork to a minimum and to encourage small companies owned by minorities and the disadvantaged to participate in the program. SBA also conducts an ongoing national information and outreach campaign and makes sure the agencies conform with SBIR policy directives.

As required by law, the solicitation process minimized regulatory burdens and mandates timely receipt and review of proposals, peer review, proprietary information guidelines, selection of awardees, data rights retention, title to government property, cost sharing and cost principles.

Automated Outreach System

SBA, in carrying out a major responsibility, initiates programs and policies to make sure that all interested small businesses are provided with current program and solicitation information and opportunities available in the SBIR Program. Toward this end, SBA has developed a mailing list of those individuals and small firms that have requested to be included. This list was converted to a fully computerized process eight years ago.

In the last year, SBA worked to improve and update this informational mailing list, to insure the current interest of small firms represented—and thus the accuracy of the listing. Another SBA objective was to save taxpayer paperwork and mailing costs. The result was that at fiscal 1992's end, the automated outreach list contained 50,000 names and addresses, which are continuously updated to minimize expense and maximize outreach.

Pre-Solicitation Announcements

SBA's SBIR Pre-Solicitation Announcements to small businesses present basic program solicitation information in a succinct and understandable manner. Each publication provides complete information on all quarterly SBIR activity and eliminates the need for small businesses to track the activities of each participating agency.

The Pre-Solicitation Announcements are published and distributed prior to the time of agency solicitations. The announcements provide small businesses with a brief statement of each agency research topic, the opening and closing dates of each solicitation, an estimate of the number of awards to be made under each solicitation, who to contact for a copy of the agency solicitation and a master schedule of agency opening and closing dates. The response from the public to these Pre-Solicitation Announcements has been excellent.

During fiscal 1992, SBA published four Pre-Solicitation Announcements. For the 10 years of the program, over 2.5 million announcements have been distributed.

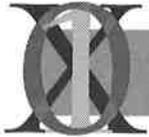
SBIR Seminars and Conferences

During fiscal 1992, SBA cooperated with numerous organizations that conducted SBIR seminars and conferences. This cooperation included providing information, materials and speakers. SBA field representatives and public and private organizations have become a significant part of the information dissemination process.

SBA continues to publish a special SBIR Program pamphlet which in addition to providing program information also serves as a mechanism for mailing list development. SBA field offices have been furnished a supply of the pamphlets for speakers throughout the country. SBA utilized an audio-visual program which presents a detailed explanation of the SBIR Program. The audio-visual program is available on video tape.

Another form of outreach used by SBA are briefings to officials of foreign governments. During fiscal 1992, foreign interest in the SBIR Program grew even stronger and SBA's staff briefed a number of foreign government officials. SBIR-type programs are in place in Europe and the United Kingdom.

The European Community has coordinated its R & D program through three multi-annual framework programs. The fourth program (Brite Euram II) is effective from 1991-94 and has a total funding of 660 million



ECU. (ECU is the European Currency Unit and currently equates to U. S. dollars at \$1.11 per ECU). The community's first program, 1985-88, was for 180 million ECU.

The community's program is open to industrial enterprises, universities, research institutes and other interested organizations. Small and medium-sized enterprises are particularly encouraged to participate.

SBIR PROGRAM DATA

Fiscal Year 1992 SBIR Agency Obligations Summary (Dollars in Thousands)

| | DOA | DOC | DOD | DOE | DOT | ED | EPA | HHS | NASA | NRC | NSF | Total |
|--------------------------------------|-----------|---------|------------|-----------|---------|---------|---------|------------|-----------|--------|-----------|------------|
| Agency Extramural Budget | \$450,200 | 128,828 | 19,347,481 | 3,411,520 | 168,259 | 160,956 | 328,945 | 8,019,607 | 6,352,000 | 97,490 | 1,862,960 | 40,328,246 |
| Agency SBIR Budget | \$5,627 | 1,610 | 241,844 | 42,644 | 2,102 | 2,012 | 4,112 | 100,245 | 79,400 | 1,219 | 23,287 | 504,102 |
| Dollars Obligated | \$5,627 | 2,001 | 241,844(a) | 42,917 | 3,390 | 2,461 | 4,291 | 101,886(b) | 79,015 | 1,491 | 23,480(c) | 508,403 |
| Percent of SBIR To Extramural Budget | 1.25% | 1.55% | 1.25% | 1.25% | 2.01% | 1.52% | 1.30% | 1.27% | 1.24% | 1.52% | 1.26% | 1.26% |
| Deficit/Surplus | 0 | +391 | 0 | +273 | +1,287 | +449 | +180 | +1,641 | -385 | +272 | +193 | +4,301 |

Fiscal Year 1992 Award Profile (Dollars in Thousands)

| | DOA | DOC | DOD | DOE | DOT | ED | EPA | HHS | NASA | NRC | NSF | Total |
|--|-------|-------|---------|--------|-------|-------|-------|--------|--------|-----|--------|---------|
| Total Phase I Awards | 44 | 19 | 1,064 | 198 | 29 | 23 | 41 | 619 | 301 | 17 | 204 | 2,559 |
| Minority/Disadvantaged Phase I Awards | 2 | 3 | 127 | 20 | 6 | 3 | 4 | 45 | 30 | 0 | 25 | 265 |
| Total Phase II Awards | 19 | 7 | 434 | 67 | 7 | 9 | 15 | 158 | 140 | 3 | 57 | 916 |
| Minority/Disadvantaged Phase II Awards | 0 | 1 | 65 | 11 | 0 | 4 | 1 | 8 | 15 | 0 | 1 | 106 |
| Total Phase I Dollars Awarded (\$) | 2,127 | 661 | 54,858 | 9,786 | 1,437 | 688 | 2,041 | 30,451 | 14,898 | 844 | 10,149 | 127,940 |
| Minority/Disadvantaged Phase I Dollars Awarded (\$) | 100 | 104 | 6,457 | 994 | 299 | 90 | 200 | 2,235 | 1,491 | 0 | 1,244 | 13,214 |
| Total Phase II Dollars Awarded (\$) | 3,500 | 1,340 | 179,558 | 32,858 | 1,953 | 1,773 | 2,250 | 69,875 | 64,117 | 647 | 13,279 | 371,150 |
| Minority/Disadvantaged Phase II Dollars Awarded (\$) | 0 | 200 | 29,774 | 5,260 | 0 | 797 | 150 | 3,737 | 6,829 | 0 | 252 | 46,999 |
| Average Amount for Phase I Awards (\$) | 48 | 35 | 52 | 49 | 50 | 30 | 50 | 49 | 49 | 50 | 50 | 50 |

Fiscal Year 1992 Agency Solicitation Profile

| | DOA | DOC | DOD | DOE | DOT | ED | EPA | HHS | NASA | NRC | NSF | Total |
|--|--------|-------|---------|--------|--------|-------|-------|--------|--------|-----|--------|---------|
| Number of Solicitations Released | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 13 |
| Number of Research Topics in Solicitations | 8 | 7 | 813 | 35 | 38 | 10 | 12 | 219 | 15 | 9 | 26 | 1,192 |
| Number of Copies Distributed | 14,000 | 8,000 | 100,000 | 30,000 | 17,000 | 2,000 | 5,000 | 24,924 | 25,000 | 600 | 50,000 | 276,524 |
| Number of Phase I Proposals Received | 346 | 201 | 9,414 | 1,534 | 502 | 269 | 427 | 2,517 | 2,535 | 94 | 1,740 | 19,579 |
| Number of Phase II Proposals Received | 30 | 14 | 1,216 | 159 | 39 | 21 | 27 | 430 | 258 | 3 | 114 | 2,311 |
| Number of Phase I Awards | 44 | 19 | 1,064 | 198 | 29 | 23 | 41 | 619 | 301 | 17 | 204 | 2,559 |
| Number of Phase II Awards | 19 | 7 | 434 | 67 | 7 | 9 | 15 | 158 | 140 | 3 | 57 | 916 |

(a) 1,115K modifications to non FY 92 Awards plus 6,311K total agency FY dollar amount set-aside for select proposals in negotiation, but not obligated.

(b) 1,560K modifications to non FY 92 Awards

(c) 52K in modifications to non FY 92 Awards



SBIR PROGRAM DATA

Commercialization Matching System

A major goal of the SBIR Program is to bring research and development results to the marketplace. The SBIR Program therefore not only encourages more research and development, but it also encourages commercialization by offering the possibility of economic reward for innovations successfully marketed by SBIR firms.

At each stage of a small firm's progress through this program, there are policies and incentives to promote research work with commercial potential and to encourage the availability of the completed research in the marketplace.

Recognizing that most small firms with innovative products have difficulty finding the financing required for the final development, manufacture, and marketing of their product, SBA has developed a Commercialization Matching System. The system maintains information on all SBIR awards including the company name and address, principal investigator, and information about the innovation to be commercialized. The system also includes information on financing sources that have requested inclusion and will provide information on the type of investment opportunities they are seeking.

From this data base, the Commercialization Matching System provides technical abstracts of SBIR projects to possible investors, and provides SBIR firms with information on sources of capital that might consider investing in their innovations. Matching selections from the data base are made on the basis of technology and industry preferences, geographic preferences, and dollar thresholds. Over 17,000 SBIR projects and nearly 500 capital sources are currently listed in the data base. In order to provide accurate information to SBIR awardees, the data on sources of capital were updated in fiscal 1992.

SBIR Reporting Requirements

Beginning with fiscal 1983, each agency establishing an SBIR Program set aside a set percentage of its extramural R&R&D budget for award to small businesses. Through a phased-in process over a four-year period, civilian agencies were required to increase the percentage of their set

asides, from 0.2 percent in fiscal 1983 to 1.25 percent in fiscal 1986. The Department of Defense was allowed five years to phase in the program and was required to set aside 0.01 percent in fiscal 1983 and reach 1.25 percent in fiscal 1987.

Each agency required by Sections 4(f) and 4(h) of Public Law 97-219 to establish an SBIR Program for research and research and development (R&R&D) was required to report annually to SBA on the number of grant, contract and cooperative agreement awards over \$10,000 and to report the dollar value of all such awards, identifying SBIR awards and comparing the number and amount of such awards with awards to other than small business.

To properly monitor and report on the participating agencies' SBIR Programs, SBA established a reporting base to compare against each agency's budget data. In determining extramural R&R&D obligations as a base for the size of the SBIR Programs, the act provided a definition of research and development identical to that in the Office of Management and Budget (OMB) Circular A-11 on the "Preparation and Submission of Budget Estimates."

Agencies submit to the National Science Foundation (NSF) breakdowns of their total R&R&D obligations into intramural and extramural R&R&D obligations, which are published in "Federal Funds for Research and Development."

For agencies with SBIR Programs, SBA reviews the NSF data and uses as an extramural base for SBIR that amount determined by the agency to be its extramural budget. A distinction between intramural and extramural is not made for agencies participating in the R&R&D goaling program, since the agency goal is based upon total R&R&D budget obligations.

Because of the three-year budget cycle in estimating extramural R&R&D obligations, and consequent changes in the SBIR bases, some differences between SBIR required expenditures and actual obligations are to be expected. Because of these obligations and the base reporting



arrangement, SBA uses a system of deficits and credits for adjusting future years. Thus SBIR agencies proceed on the best available estimates and ultimately, through adjustments, achieve the percentages specified by law.

SBIR Agency Total Obligation Summary

The number of proposals received from small hi-tech enterprises has increased steadily over the years—a trend which illustrates the past award successes and the ever-growing awareness and acceptance of the SBIR Program within the small business community. There also has been year-to-year increases in the dollar value of awards made.

In fiscal 1992, 21,890 Phase I and Phase II proposals were received. A record 3,475 awards were made. Since the program was first implemented, there have been 24,902 awards to qualified small businesses. The awards were worth more than \$3.2 billion.

During fiscal 1992, the 11 participating SBIR agencies awarded \$508.4 million through the SBIR Program; the total represented, a 5.2 percent increase over the approximately \$483.1 million obligated in fiscal 1991. Phase I awards were worth \$127.9 million in fiscal 1992. Phase II awards totaled \$371.2 million. The overall award dollar total includes \$9.0 million in modifications to non-1992 awards.

In awarding Phase II two-year funding agreements, agencies utilize various acquisition methods of obligation and funding. For purposes of consistency in our reporting, the acquisition data in this report reflect only actual obligations during fiscal 1992.

As in prior years, SBA continues to use a system of deficits and credits to evaluate agency SBIR budgets to actual amounts obligated. At the beginning of each fiscal year, SBA provides each agency with estimates (based upon NSF data) of the agency's extramural and SBIR budget. These estimates change during the year to reflect congressional action on a participating agency's R&R&D budget. Thus to ensure proper implementation, each agency establishes a budget and proceeds during the year on that budget. Adjustments may then be made in the following year.

SBIR AWARDS

| <i>Fiscal Year</i> | <i>Phase I</i> | <i>Phase II</i> | <i>Totals</i> |
|--------------------|----------------|-----------------|---------------|
| 83 | 686 | — | 686 |
| 84 | 999 | 338 | 1,337 |
| 85 | 1,397 | 407 | 1,804 |
| 86 | 1,945 | 564 | 2,509 |
| 87 | 2,189 | 768 | 2,957 |
| 88 | 2,013 | 711 | 2,724 |
| 89 | 2,137 | 749 | 2,886 |
| 90 | 2,346 | 837 | 3,183 |
| 91 | 2,553 | 788 | 3,341 |
| 92 | 2,559 | 916 | 2,475 |
| Total | 18,824 | 6,078 | 24,902 |

Solicitation Profile

Thirteen Phase I SBIR solicitations were released by the 11 participating agencies in fiscal 1992; DoD and HHS each released two solicitations; the other nine agencies released one each.

As a result of the solicitations, 19,579 Phase I proposals were received from small businesses. A total of 2,599 Phase I awards were made in fiscal 1992. Phase I awards represented 13 percent of proposals received.

During fiscal 1992, a total of 2,311 Phase II proposals were received and resulted in 916 new awards. The fiscal 1992 awards represented 40 percent of all Phase II proposals received.



Minority/disadvantaged-owned firms received 265 Phase I awards in fiscal 1992, worth \$13.2 million, and 106 Phase II awards worth \$47.0 million. Since the program's inception, minority/disadvantaged-owned firms have received 2,713 awards, representing 10.9 percent of all SBIR awards; the value of these awards totaled \$319 million, representing 9.7 percent of all dollars awarded.

R&R&D Goaling Agencies

During fiscal 1983 and 1984, agencies required to submit annual R&R&D goaling reports often submitted inaccurate data or incomplete reports. As a result, the General Accounting Office recommended that SBA change reporting requirements to obtain additional data from reporting agencies; that all agencies be required to submit accurate or revised reports for fiscal 1983 and 1984, and that SBA change the due dates for R&R&D goaling reports to ensure that budget data were consistent with data reported to OMB. Consistent with these recommendations, SBA required all R&R&D goaling agency annual reports to include the following information:

1. Previous fiscal year's total R&R&D obligations.
2. Previous fiscal year's total R&R&D-obligated dollars to small businesses, minority and disadvantaged small businesses, and women-owned small businesses under funding agreements, and the percentage to the agency's total R&R&D obligations. (Women-owned small business data are not required by law to be collected by the agencies; therefore the data are incomplete.)
3. Current fiscal year's total R&R&D budget.
4. Current fiscal year's total R&R&D small business goal based on the percentage of obligations to small businesses made the previous fiscal year.
5. Current fiscal year achievement of the singular small business R&R&D goal and the dollars obligated through prime funding agreements by categories of small business, minority and disadvantaged small business and women-owned small business.

VALUE OF SBIR AWARDS

(in millions of dollars)

| Fiscal Year | Phase I | Phase II | Totals |
|--------------|----------------|------------------|--------------------|
| 83 | \$44.5 | \$ - | \$44.5 |
| 84 | 48.0 | 60.4 | 108.4 |
| 85 | 69.1 | 130.0 | 199.1 |
| 86 | 98.5 | 199.4 | 297.9 |
| 87 | 109.6 | 240.9 | 350.5 |
| 88 | 101.9 | 284.9 | 389.1* |
| 89 | 107.7 | 321.7 | 431.9* |
| 90 | 118.1 | 341.8 | 460.7* |
| 91 | 127.9 | 335.9 | 483.1* |
| 92 | 127.9 | 371.2 | 508.4* |
| Total | \$953.3 | \$2,286.2 | \$3,273.6** |

EST: Fiscal 93

\$650+

*includes awards modifications

**contains all \$ expended and/or obligated

6. The total number and dollar value of R&R&D awards to small business for contracts, grants and cooperative agreements over \$10,000 and a comparison of such awards to awards made to non-small businesses for the same categories.

To evaluate the agencies' R&R&D Goaling Program, SBA uses a final budget report from OMB entitled "Conduct of R&D by Agency." This report details the agencies' total R&R&D obligations for the reported fiscal year and provide R&D budget estimates for future years. SBA then computes the agencies' total R&R&D obligations to small business, as reported to SBA, to determine the actual percentage of the R&R&D obligations awarded to small business.



As in prior years, there was some difference between each agency's total R&R&D obligations reported to SBA as compared to data reported to OMB. Since SBA uses the OMB data as an actual base, the agency percent awards to small business may be higher or lower in this report compared to that percentage as reported by the agency to SBA.

In fiscal 1992, \$2.1 billion was awarded to small business under the R&R&D Goaling Program, representing 5 percent of the total R&D obligations for 18 reporting agencies.

R&R&D awards to minority/disadvantaged-owned firms totaled \$550 million in fiscal 1992, representing 27 percent of all agency R&R&D obligations to small businesses.

Cumulative Data

Since the SBIR Program's start, over \$3.2 billion has been awarded to small businesses; \$319 million was awarded to minority/disadvantaged-owned small businesses.

In accordance with the law, each participating agency will continue to award at least 1.5 percent in fiscal years 1993 and 1994; not less than 2.0 percent in fiscal years 1995 and 1996 and not less than 2.5 percent thereafter.

A total of 18,824 Phase I and 6,078 Phase II awards have been made since the program's beginning. The agencies received 148,755 Phase I proposals and 14,565 Phase II proposals responding to 117 SBIR solicitations. Several participating agencies have allocated more for this program than required by law. Awards have been made to firms in 50 states, Puerto Rico and the District of Columbia. The SBIR Program continues to receive national acceptance and international recognition for quality performance.

SBA requires, through its SBIR Policy Directive, that each participating agency list the number of Phase I awards made within six months, and beyond six months, of the closing date of the agency's solicitation announcement.

FISCAL YEAR 1992 PHASE I TIME FRAME

| <i>Agency</i> | <i>Total FY 92 Phase I Awards</i> | <i>Number Within Six Months of Solicitation Close</i> | <i>Number Over Six Months of Solicitation Close</i> |
|---------------|---|---|---|
| DOA | 44 | 0 | 44 |
| DOC | 19 | 19 | 0 |
| DOD | 1,064 | 397 | 667 |
| DOE | 198 | 198 | 0 |
| DOT | 29 | 13 | 16 |
| ED | 23 | 0 | 23 |
| EPA | 41 | 40 | 1 |
| HHS | 619 | 64 | 555 |
| NASA | 301 | 255 | 46 |
| NRC | 17 | 17 | 0 |
| NSF | 204 | 150 | 54 |
| Total | 2,559 | 1,153 | 1,406 |

RESEARCH GOALS

AGENCY RESEARCH AND RESEARCH AND DEVELOPMENT DATA

(dollars in thousands)

| <i>Agency</i> | <i>Agency % Goal FY '92</i> | <i>Total R&D Budget</i> | <i>\$ Goal</i> | <i>Agency Reported \$ To Small Business</i> | <i>% Awarded To Small Business</i> | <i>\$ Awarded To Minority/ Disadvantaged</i> | <i>% Awarded To Minority Disadvantaged</i> |
|---------------|-------------------------------------|-------------------------------------|--------------------|---|--|--|--|
| DOA | 0.0 | \$1,136,717 | NR | NR | NR | NR | NR |
| DOC | 0.2 | 562,700 | 1,125 | 5,628 | 1.0 | 2,909 | 0.5 |
| DOD | 4.0 | 38,116,000 | 1,518,000 | 1,700,000 | 4.5 | 435,000 | 1.5 |
| DOE | 1.4 | 6,216,700 | 85,790 | 85,790 | 1.4 | 19,298 | 0.3 |
| DOI | 0.3 | 615,200 | 1,846 | 1,350 | 0.2 | 0 | 0.0 |
| DOT | 28.0 | 462,500 | 129,500 | 62,184 | 13.0 | 37,404 | 8.0 |
| ED | 1.1 | 96,054 | 1,057 | 1,021 | 1.1 | 1,021 | 1.1 |
| EPA | 7.1 | 485,800 | 34,600 | 31,800 | 6.5 | 19,000 | 3.9 |
| HHS | 1.8 | 10,069,993 | 180,253 | 149,873 | 1.5 | 25,335 | 0.3 |
| NASA | NR | NR | NR | NR | NR | NR | NR |
| NSF | 1.1 | 1,873,660 | 21,360 | 21,740 | 1.2 | 6,870 | 0.4 |
| NRC | 3.1 | 97,490 | 3,022 | 1,927 | 2.0 | 437 | 0.4 |
| AID | 5.9 | 113,300 | 661 | 3,000 | 2.6 | 0 | 0.0 |
| DOJ | 15.4 | 39,597 | 6,098 | 6,653 | 16.8 | 1,694 | 0.4 |
| DVA | 0.5 | 274,006 | 1,315 | 1,496 | 0.5 | 252 | 0.9 |
| SI | 0.4 | 98,000 | 392 | 347 | 0.3 | 0 | 0.0 |
| TR | NR | NR | NR | NR | NR | NR | NR |
| TVA | 3.4 | 106,444 | 3,619 | 707 | 0.6 | 384 | 0.3 |
| Total | - | 60,364,161 | 1,988,638 | 2,073,516 | 3.4 | 549,604 | 0.9 |

NR = Not reported

RESEARCH GOALS

(dollars in thousands)

SMALL BUSINESS

NON-SMALL BUSINESS

| Agency | Number of Contracts Awarded | Dollar Amount Of Contracts | Number of Grants Awarded | Dollar Amount of Grants | Number of Co-op Agreements | Dollar Amount of Co-op | Number of Contracts Awarded | Dollar Amount of Contracts | Number of Grants Awarded | Dollar Amount of Grants | Number of Co-op Agreements | Dollar Amount of Co-op |
|--------|-----------------------------|----------------------------|--------------------------|-------------------------|----------------------------|------------------------|-----------------------------|----------------------------|--------------------------|-------------------------|----------------------------|------------------------|
| DOA | NR | NR | 63 | 5,628 | NR | NR | 54 | 3,885 | 669 | 411,979 | 1,591 | 63,038 |
| DOC | 97 | 5,629 | 3 | 153 | 18 | 14,929 | 125 | 16,253 | 521 | 110,507 | 399 | 143,892 |
| DOD | 21,779 | 1,941,000 | NU | NU | NU | NU | 17,553 | 17,089,000 | NR | NR | NR | NR |
| DOE | NR | 99,152 | NR | 39,000 | NR | NR | NR | 5,988,548 | NR | NR | NR | NR |
| DOI | 79 | 1,350 | NR | NR | NR | NR | 110 | 3,841 | NR | NR | NR | NR |
| DOT | 1,391 | 59,786 | NR | NR | NR | NR | 1,041 | 240,970 | 127 | 13,975 | 18 | 3,685 |
| ED | 44 | 3,482 | NR | NR | NR | NR | 111 | 11,872 | 860 | 182,465 | NR | NR |
| EPA | 178 | 31,800 | NR | NR | NR | NR | 137 | 108,300 | NR | NR | NR | NR |
| HHS | 639 | 117,710 | 924 | 112,421 | 28 | 11,715 | 2,509 | 632,759 | 30,393 | 6,559,098 | 2,972 | 891,099 |
| NASA | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR |
| NSF | 170 | 11,420 | 355 | 28,830 | NR | NR | 132 | 150,500 | 16,960 | 1,767,800 | NR | NR |
| NRC | 50 | 5,498 | 0 | 0 | 0 | 0 | 32 | 7,769 | 18 | 1,726 | 0 | 0 |
| AID | NR | NR | NR | NR | NR | NR | 144 | 81,000 | NR | NR | NR | NR |
| DOJ | 60 | 3,404 | 7 | 506 | 17 | 2,741 | 11 | 6,458 | 44 | 7,771 | 54 | 10,999 |
| DVA | 9 | 1,496 | NR | NR | NR | NR | 8 | 1,244 | NR | NR | NR | NR |
| SI | 7 | 347 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| TR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR |
| TVA | NR | NR | NR | 0 | NR | NR | NR | NR | 11 | 1,728,000 | NR | NR |

NR = Not reported

NU = Not used by reporting agency



SBIR COMMERCIALIZATION PROGRESS AND SUCCESS

Commercialization of SBIR technology is what distinguishes the SBIR Program from other federal research and development, and SBA continues to monitor activity in this area. Last year, we reported that our publication, "Results of Three-Year study of the SBIR Program," had been distributed to Administration officials and members of Congress. In fiscal 1992, we published a more detailed version of this study, "Commercialization Activities in the SBIR Program (Parts 1 and 2)," in the *Journal of Technology Transfer*.

In fiscal 1992, we also began a new study of multiple awardees in response to questions raised in congressional hearings. We surveyed companies with five or more Phase II SBIR awards to identify commercialization activity using procedures similar to those described in the three-year study.

In preliminary analyses, conducted jointly with SBA's Office of Advocacy, it was found that there was no drop-off in commercialization activity as companies win more Phase II awards. In fact, there was a small but significant increase in commercialization activity.

A second analysis, independent of commercialization, found that SBIR awards should not be considered concentrated among a relatively small number of companies. A measure used by the Department of Justice, which quantifies the degree of market concentration among competing businesses, was applied to SBIR companies (who compete for the "market" of SBIR awards). The measure was much smaller than the threshold value for distinguishing between concentrated and unconcentrated markets.

In the rest of this section, we present examples of SBIR program participants to illustrate the types of commercialization activity that is now underway.



SI DIAMOND TECHNOLOGY, INC.

Houston, TX



SI Diamond Technology has received 37 SBIR awards since its origin in 1987, most of them concentrated in the development of technology for manufactured diamonds for the enhancement of existing products that extend the life or improve the performance of a product or instrument. The company was started by Dr. Howard K. Schmidt, a Rice University graduate with degrees in electrical engineering and chemistry; he called his first enterprise Schmidt Instruments and changed the name shortly before a successful public stock offering in 1993.

The company's technology, along with a world-wide licensing agreement with the University of Texas-Dallas on amorphous diamond coating (ADC), enables SI Diamond Technology to apply ADC to substrates at room temperature. Previous man-made diamond coatings had to be applied under extreme heat, thus limiting the technology's application only to materials capable of accepting the excessive temperatures. Under the company's patented technology, nano-crystalline diamond coatings can be applied to an almost limitless variety of substrates, such as plastics, glass and aluminum. Products such as drill bits, auto parts, gears, ball bearings, valves and seals benefit from the coatings' durability and lubricity. The company says its diamond technology will revolutionize and improve the industrial tool industry and even enhance the tracking ability of heat-seeking missiles.

The company says its diamond technology will also be a big boost for semiconductors and flat panel displays. With SI Diamond's diamond-based field emitter technology, flat panel displays can be built which are brighter and utilize less energy than even the current Japanese alternatives—thus leading to construction of instrumentation and laptop computers which will be improved visually and have extended battery life.

Today, the company is moving to commercialize its diamond coatings for industrial applications. Experiments continue on the production of a single crystal diamond, one atomic layer at a time, to enable manufacture of a new age of semiconductors. SI Diamond Technology Inc. has won SBIR awards from five agencies, DOD, NASA, HHS, NSF and DOE.

STRATAGENE CLONING SYSTEMS

La Jolla, CA



Stratagene Cloning Systems, founded in 1984, used its first SBIR award to help successfully develop novel cloning systems which were recognized by the scientific community as providing a substantial breakthrough in standard cloning procedures and which were used by Stratagene customers in the cloning of genes such as the muscular dystrophy gene and the cystic fibrosis gene. Company President Jay M. Short says, "The commercial success of these vectors greatly diversified the company product line, a critical factor in assuring Stratagene's long term success."

Stratagene used another SBIR award to develop positive selection systems for the use of transgenic mice in mutagenicity/carcinogenicity testing. The transgenic system greatly reduces the number of animals required for testing, reduces the assay time to less than two weeks (down from up to two years) and permits the rapid screening and early elimination of dangerous compounds at 1/500 of the cost of the more lengthy screening assays. More than 70 institutions today are licensed for this test system. The company says system sales now exceed \$1 million a year.

Stratagene used funds from a further SBIR award to develop a complementary transgenic rat testing program in which the company was successful in generating the first transgenic rat model for mutagenicity testing.



SBIR SUCCESS STORIES

The company says that other areas of successful SBIR support include models such as the LacSwitch system which adapts bacterial gene regulatory systems to mammalian cells to permit controlled gene expression. The system, introduced early in 1993, already has been commercially successful. Stratagene says the vectors in this system have wide applicability for researchers using molecular biological techniques, including those in cell biology, immunology and neurobiology.

Stratagene has more than 250 employees and sales of more than \$30 million a year. The company has 30 overseas distributors and subsidiaries in England and Germany.

Dr. Short says, "The SBIR Program is clearly one of the most successful government programs and has played an important role in Stratagene's success....The SBIR Program provides one of the most important opportunities for American businesses. The program costs will no doubt be repaid through jobs generated by new industries which develop out of the discoveries supported by SBIR awards, Unlike many past programs, these discoveries are not easily lost to foreign enterprises because they are naturally protected and nurtured by the companies developing the products. Certainly the SBIR Program is a successful means of maintaining American technology leadership."

GUILD ASSOCIATES, INC.

Hilliard, OH

Since its founding in 1981, Guild Associates has received 10 Phase I awards and three Phase II SBIR awards which have helped the firm develop its unique electronics and chemical process technologies. Spurred by SBIR-supported successful efforts to develop a portable oxygen generator for battlefield medical support, Guild Associates won a multi-million dollar contract to develop an advanced oxygen generation system for field medical hospitals. The project is expected to include a year of low-intensity production followed by a five-year production run.



In another SBIR-supported development, Guild Associates is providing, under a multi-million dollar contract from the Army's Edgewood Research, Development and Engineering Center, design, equipment and testing support for a collective protection system which uses an advanced air filtration technology. This project supports the Army's program to develop the next generation collective protection system for armored vehicles.

Guild Associates also has been leveraging SBIR-assisted research into production with the commercial sector. The company, for example, is working with the pulp paper industry to commercialize two innovative chemical processes that were the focus of SBIR awards.

The company's successes in the competitive electronics and chemical process technologies illustrate the firm's credentials as a strong innovator and the value of the SBIR Program in boosting such efforts.

Guild Associates has secured awards from five different agencies, DOD, HHS, NSF, DOED and EPA.

ACCURATE AUTOMATION CORP.

Chattanooga, TN

Accurate Automation, Corp., which started in 1985, has been helped by 12 Phase I SBIR awards, 7 Phase II awards and multiple Phase III awards, in its successful efforts to commercialize neural network technology for robotics, control, fault diagnosis, sensor fusion and signal processing. The awards were from the Departments of Defense and Transportation, National Science Foundation and NASA. The firm's neural network product is an advanced computational technique that outperforms conventional computers in control and pattern recognition applications.

Accurate Automation's "Neural Network Toolbox" was developed for Silicon Graphics' IRIX Operating System as a result of a Phase II award.





SBIR SUCCESS STORIES

Containing 14 different neural software simulations with four learning modules, the "Neural Network Toolbox" assists users to integrate neural networks into their application programs.

Again with the help of SBIR awards, the company is developing a neural network computer and a VME board. Accurate Automation says this advanced computer will outperform today's commercial computers in solving problems like robotics, fault diagnosis and radar signal processing. The neural net board is being used on projects working with companies such as Lockheed, General Dynamics, UNISYS/Paramax and E-Systems. The firm's fault diagnosis system being developed for the National Aerospace Plane is intended to be used to monitor the fuel distribution for that aircraft. The system also can be used to monitor power supplies of large computer systems.

The SBIR awards have helped Accurate Automation grow from a two-person company working out of the basement of a Chattanooga hotel to an enterprise that employs 20 persons and occupies a 10,000 square foot office and laboratory. Revenues have grown from \$18,000 in 1987 to more than \$2 million in 1992. Those revenues are expected to top \$4 million in 1993.

Robert M. Pap, president of Accurate Automation, says, "The SBIR Program gave our corporation the opportunity to develop innovations to solve some of the critical technologies and, as a result, to help create a corporation that is profitable and now is a leader in neural network technology." Awards have been received from three agencies, DOD, DOT and NASA.

OMITRON, INC.

Greenbelt, MD

Omitron, founded in 1984 with the aim of providing a number of services and products for NASA, has used nine SBIR awards from NASA and the Coast Guard (a



Transportation Department agency) to expand into new business areas and to develop an enhanced technology base.

Omitron used its first SBIR award to develop a modular state-of-the-art spacecraft command and data handling system applicable to a range of space vehicles and capable of reducing wiring harness complexity. This development helped the firm establish a hardware development capability and significantly expanded Omitron's capability in spacecraft onboard computer software development.

Omitron now has successfully developed attitude control system onboard software for NASA's Extreme UltraViolet Explorer and Sampex missions and is providing onboard software support for the Earth Observing System. Specialized hardware development has expanded to include a parallel processor to provide a small "supercomputer" on a desktop, ground support equipment for instrument support within NASA's shuttle cargo bay and a vehicle state measurement system for understanding vehicle dynamics applied to automobile tire and suspension design.

Other SBIR awards are aimed at developing a supercomputer for migration to space flight and at developing a smart buoy system for the Coast Guard. The advanced system for the navigational buoys has an improved photovoltaic power system, position determination utilizing the Global Positioning System, and buoy health and safety monitoring. The company says its system significantly improves buoy maintenance and maritime safety and may be incorporated within a vessel traffic service. The Coast Guard sought such a system to better maintain and control buoys that blow away in storms, sink or run out of power.

Omitron, with the help of the SBIR awards, has grown steadily since its founding and now employs 40 workers and reports annual revenues of about \$3.5 million.

Omitron's chief executive, Dr. Frederick J. Hawkins, says the company "is currently pursuing commercial opportunities for its SBIR-developed technologies and capabilities and is looking forward to continuing and significant growth."



TRANSITIONS RESEARCH CORPORATION

Danbury, CT



TRC has used 13 SBIR awards to succeed in its basic aim to successfully develop and commercialize mobile robots to be used in the service sector. For example, the company's low cost, mobile robotic research base, called LABMATE, today is being sold throughout the world to robot, artificial intelligence and computer technology researchers. The company says this project "is a direct result of moving successfully from Phase I to Phase III under the Defense Department's SBIR awards Program."

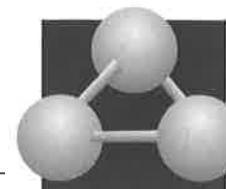
TRC says the drive system technology developed under this program also has been incorporated into other commercial products, such as HelpMate, a mobile robot courier designed to perform material transport tasks in hospitals and nursing homes, and Autoscript II, a robotic parapharmacist that works in mail order pharmaceutical operations.

Currently, thanks to other SBIR awards, the company is working on a variety of high technology projects that TRC thinks will lead to commercial applications of video image compression, virtual reality and true robot vision.

Company Chairman Joseph F. Engelberger says, "The SBIR Program has provided us with crucial research and development money to develop innovative techniques that we couldn't hope to find support for from private investors. The payoff has been a significant technology lead for us in autonomous, mobile robots for commercial cleaning, institutional material transport and robotic aides for the elderly and infirm. These are all huge commercial markets which we are successfully developing."

BORON BIOLOGICALS, INC.

Raleigh, NC



Boron Biologicals, inc. (BBI) was founded by Dr. Bernard Spielvogel on the scientific premise that new molecular structures fabricated from the element boron could provide a new and exciting drug discovery pipeline of compounds. BBI, which has received \$3 million in SBIR funding from the Energy Department and National Institutes of Health, is believed to be the nation's first enterprise to focus solely on the creation of boron chemicals to serve as the basis for new products with biomedical, pharmaceutical and other applications. Since 1986, BBI has invented more than 150 new "organic-like" biomolecules and compounds, resulting in more than 30 patents and patents pending.

As a result of the company's SBIR-assisted research, hundreds of boron analogues of amino acids, peptides, nucleic acids and boron compounds have been created in support of the Boron Neutron Capture Theory (BNCT) approach to cancer research. The company has undertaken collaborative preclinical studies with scientists at the University of North Carolina and North Carolina State University that shown the effectiveness of BBI compounds as therapeutic agents in osteoporosis, hyperlipidemia and analgesia.

The company says it has positioned itself to be the top supplier of boronated compounds for BNCT cancer research through the acquisition of a Callery Chemical subsidiary and the establishment of a worldwide distribution network using major biochemical firms. BBI also has signed a cooperative research and development agreement with the Brookhaven National Laboratory in the area of BNCT and has entered into a contract research and licensing agreement with a European pharmaceutical and medical products company in the area of radiopaque contrast media imaging.

G. Brooks Adams, BBI marketing and business development executive, says the company "owes a great deal to SBIR. Program funding of over \$3 million since our founding has contributed substantially to the development of our broad platform of technology."



APA OPTICS, INC.

Minneapolis, MN

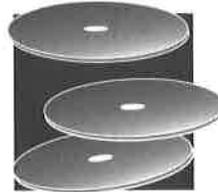
APA Optics, Inc., which develops and manufactures state-of-the-art components and systems in optics and optoelectronic technologies, has received 51 SBIR awards from NASA, the National Science Foundation and the Defense Department. It also has received two major private grants and four grants from the Greater Minnesota Corp. These awards have played a significant role in the company's evolution as a recognized leader in several optics technologies.

APA Optics has successfully developed a number of innovative products, including an integrated optic modulator, binary optic laser scanner, binary optic beam splitter, and interferometer for aspheric testing and computer-generated holograms, and now has established significant manufacturing facilities for its products. These products are currently being introduced to commercial markets. In addition, the company is developing new products based on its solid state ultraviolet detector technology.

The company offers a wide range of services to companies seeking assistance in optical design and fabrication. APA Optics designers have solved many unusual optical problems and have designed and built optical systems for use in high resolution inspection, optical disc readers, enlargement and photography, head-up displays, laser Doppler systems and helmet-mounted displays. APA Optics designs and fabricates entire optical systems, including hardware, mounts and custom optical coatings.

APA is a leader in optoelectronic technology, which links the fields of optics and electronics—essentially using photons instead of electrons to carry signals.

The company, which says it "has been very successful in the SBIR Program," also comments that it "is committed to turning its research and product development efforts into products ready for the market. We recently expanded facilities to increase production capabilities."



J. A. WOOLLAM CO.

Lincoln, NE

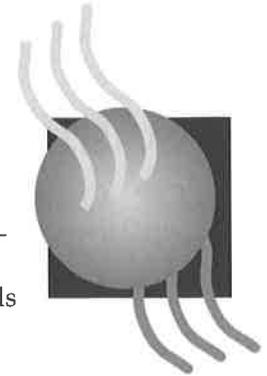
J. A. Woollam Co., which produces ellipsometers (devices that use polarized light to test semiconductors, glass coatings and films), has received 16 SBIR awards since 1988, and says these awards "helped development of a spectroscopic ellipsometer as well as ellipsometers for process control. Furthermore, these contracts helped develop the software, hardware and know-how for application of ellipsometry to a large number of important scientific and industrial problems."

Ellipsometer sales today total about \$1.5 million a year. The firm's revenues have jumped from \$110,000 in 1987 to more than \$1 million during the first half of 1993.

J. A. Woollam is a part of a consortium agreement with the Defense Department's ARPA and eight corporations in which the company will develop uses of ellipsometry for processing microelectronic materials. Corporate participants include Hughes Research and Texas Instruments. John Woolham, company founder, says that some of his products developed with the help of SBIR awards have been marketed to 3M, IBM, General Motors, Eastman Kodak, Ford Motor and numerous other major companies.

Before starting J. A. Woolham, John Woolham was a consultant to an Ohio firm that was active in the SBIR Program beginning with the program's inception in 1982.

John Woolham says that "we were helped enormously by the SBIR Program to start our company and develop a product. We continue to be helped by SBIR awards in perfecting the instrument and developing new versions and new applications."





ESSEX CORP.

Columbia, MD

Essex Corp., in explaining its operations, reminds that to err is human but that human error is a costly luxury, especially to business, industry and government. As a result, the company designs and markets products that improve human reliability in public and private sector enterprises.



Thanks in large part to six SBIR awards, Essex has developed a three-minute test taken by workers before a shift begins to assure their fitness for duty. The test, named Delta, detects impairment caused by fatigue, legal or illegal drugs, alcohol and illness. Essentially, Delta runs workers through a short battery of about three tests on a personal computer to determine reaction times, visual acuity and hand-eye coordination. Essex says Delta is "an easy-to-use, personal computer-based system that measures changes in individual performance on simple tests of coordination and thought processes. Delta compares workers only to themselves and, because it is non-invasive, respects workers' rights."

Among other things, the Essex product is an alternative to drug testing, and because it tests for actual performance ability rather than the presence of drugs, it is considered by civil libertarians to be less intrusive. Delta has been sold to American and foreign government agencies and private industries.

In commenting on his company's endeavors, Dr. Harry Letaw, Essex chairman and chief executive officer, told a House Government Operations Subcommittee that "very fundamental, relatively simple, cost-containing disciplines can sharply reduce exposure to loss from human error."

Dr. Letaw says that "Delta is inexpensive to operate and use, and reduces operating costs by improving human reliability in complex work places. Phase I and Phase II SBIR awards underpin expansion of this technology, first gained in NASA's SpaceLab, Trident submarine, armored vehicle, aircraft reconnaissance and highway trucking programs." Essex has won awards from three different agencies, DOD, NASA and DOT.



DISTRIBUTION OF SBIR AWARDS

The maps on the following pages show the distributions of fiscal 1992 SBIR awards (Phase I plus Phase II) by state. For a more detailed look at the geographical distribution of SBIR awards, the amount of funding by metropolitan area (as defined by the Census Bureau) is shown in Exhibit 1. The metropolitan areas are listed in order of their population in millions (column 1).

The next two columns show the SBIR funding (Phase I plus Phase II) for fiscal 1992 and for the program to date. A per capita funding rate is calculated by dividing the cumulative SBIR dollars by the population in millions. The last two columns show the running cumulative total and the cumulative percentage.

As reported last year, most SBIR awards in past years and also in fiscal 1992 go to large metropolitan areas. However, small towns and rural settings are by no means excluded from the SBIR Program. One hundred eighty-seven million dollars has been awarded to communities with populations under 125,000. As a group, these communities would be in the top five of all metropolitan areas in terms of total dollars per capita, and ahead of San Diego, Philadelphia and New York. In fiscal 1992, the following areas received their first SBIR awards: Bristol, Va.; Indianola, Miss.; Rosholt, S.D.; Fort Totten, N.D.; and Ogalala, Neb.

The metropolitan areas were also ranked by total SBIR funding, fiscal 1983–92. The top 50 areas are shown in Exhibit 2. Large metropolitan areas dominate the ranking: 17 of the first 25 have over one million population. The ranking is not very different from last year. The biggest gains were rendered by Colorado Springs, Colo. (from 37th place to 33rd place) and Elmira, N.Y. (44 to 40). Honolulu, Hawaii in 47th place was new to the list.

Lastly, the metropolitan areas were ranked by total dollars per capital (Exhibit 3). Now the ranking is dominated by smaller areas; 15 of the first 25 have populations under 500,000. In this ranking, the biggest gains were made by Charlottesville, Va. (37th place to 26th place), Colorado Springs, Colo. (26 to 20), and Madison, Wis. (44 to 38). New to the list were Nashua, N.H.; Lincoln, Neb.; and Fayetteville–Springdale, Ark. Many of these communities with large SBIR dollars per capita are located near major universities or government laboratories.

Technology investment policies followed by SBIR participating agencies are reflected in the amount of funding for awards made in various technology areas. Those areas are described and listed in Exhibit 4.

Exhibit 5 summarizes, by participating agency, the dollar amount of fiscal 1992 funding made in each technology area. The accompanying graph in Exhibit 6 illustrates the fiscal 1992 technology distribution for all agencies combined. Exhibits 7 and 8 show corresponding distributions for the entire program to date—that is, fiscal 1983–92.

In fiscal 1992, the Optical Devices/Lasers area has jumped from 4th place to 1st with 1992 SBIR funding exceeding \$65 million. This is followed by Information Processing, Biotechnology/Microbiology, Advanced Materials, all with over \$50 million. Two other areas each received more than \$40 million: Signal/Image Processing and Medical Instrumentation. With regard to the cumulative funding in Exhibit 7, the Information Processing area still maintains its lead over Optical Devices/Lasers.

GEOGRAPHIC DISTRIBUTION

FISCAL 1992 PHASE I AND PHASE II AWARDS
(value in thousands)



EXHIBIT ONE

DISTRIBUTION OF SBIR FUNDING BY METROPOLITAN AREAS

| <i>Metropolitan Area</i> | <i>Pop (M)</i> | <i>FY92 (\$K)</i> | <i>FY83-92 (\$K)</i> | <i>Total \$ Per Cap</i> | <i>Cum \$</i> | <i>Cum %</i> | <i>Metropolitan Area</i> | <i>Pop (M)</i> | <i>FY92 (\$K)</i> | <i>FY83-92 (\$K)</i> | <i>Total \$ Per Cap</i> | <i>Cum \$</i> | <i>Cum %</i> |
|------------------------------|--------------------|-----------------------|--------------------------|-----------------------------|-------------------|------------------|-------------------------------|--------------------|-----------------------|--------------------------|-----------------------------|-------------------|------------------|
| NEW YORK AREA | 15.529 | 18879 | 101008 | 6504 | 101008 | 3.2% | INDIANAPOLIS, IN | 1.213 | 561 | 3476 | 2867 | 2210798 | 69.2% |
| LOS ANGELES AREA | 13.075 | 48038 | 298707 | 22846 | 399715 | 12.5% | BUFFALO-NIAGRA AREA | 1.182 | 5221 | 26592 | 22505 | 2237390 | 70.1% |
| CHICAGO-LAKE COUNTY | 7.381 | 8774 | 46434 | 6291 | 446149 | 14.0% | JACKSONVILLE-DAYTONA, FL | 1.174 | 0 | 915 | 780 | 2056350 | 76.8% |
| BAY AREA (SF) | 5.534 | 46113 | 293129 | 52967 | 739278 | 23.2% | PORTLAND, OR | 1.153 | 1404 | 8490 | 7365 | 2154462 | 67.5% |
| PHILADELPHIA AREA | 5.697 | 15674 | 112039 | 19666 | 851317 | 26.7% | PROVIDENCE AREA, RI, MA | 1.109 | 2809 | 14689 | 13251 | 2252079 | 70.5% |
| DETROIT-ANN ARBOR, MI | 4.601 | 8673 | 42129 | 9157 | 893446 | 28.0% | CHARLOTTE AREA, NC, SC | 1.065 | 110 | 229 | 281 | 2252378 | 70.5% |
| BOSTON AREA | 4.056 | 83265 | 469485 | 115759 | 1362931 | 42.7% | SALT LAKE CITY-OGDEN, UT | 1.041 | 7867 | 45282 | 43482 | 2335069 | 73.1% |
| DALLAS-FT.WORTH AREA | 3.655 | 3287 | 24705 | 6759 | 1387636 | 43.5% | OKLAHOMA CITY, OK | 0.983 | 826 | 2009 | 2044 | 2337078 | 73.2% |
| HOUSTON, GALVESTON, TX | 3.634 | 4893 | 29669 | 8164 | 1417305 | 44.4% | ROCHESTER, NY | 0.980 | 2460 | 13371 | 13640 | 2350449 | 73.6% |
| WASHINGTON, DC-MD-VA | 3.565 | 37905 | 263827 | 74005 | 1681132 | 52.6% | HARTFORD AREA, CT | 0.967 | 7041 | 37409 | 38682 | 2289787 | 71.7% |
| MIAMI-FT.LAUDERDALE, FL | 2.912 | 230 | 3403 | 1169 | 1684535 | 52.8% | LOUISVILLE, KY-IN | 0.963 | 372 | 1665 | 1729 | 2352114 | 73.7% |
| CLEVELAND-AKRON AREA | 2.766 | 2671 | 13081 | 4730 | 1697616 | 53.2% | MEMPHIS, TN-AR-MS | 0.960 | 105 | 1662 | 1732 | 2353776 | 73.7% |
| ATLANTA, GA | 2.561 | 4678 | 18937 | 7396 | 1716553 | 53.8% | MIDDLESEX-SOMMERSSET AREA, NJ | 0.950 | 3425 | 18717 | 19700 | 2372493 | 74.3% |
| ST LOUIS, MO-IL | 2.438 | 663 | 6399 | 2625 | 1722952 | 54.0% | MONMOUTH-OCEAN, NJ | 0.935 | 238 | 4409 | 4714 | 2376902 | 74.4% |
| PITTSBURGH-BEAVER VALLEY, PA | 2.316 | 1597 | 21461 | 9266 | 1744413 | 54.6% | DAYTON-SPRINGFIELD, OH | 0.934 | 7748 | 45257 | 48481 | 2422159 | 75.8% |
| MINNEAPOLIS-ST PAUL, MN-WI | 2.295 | 6005 | 39669 | 17283 | 1784082 | 55.9% | NASHVILLE, TN | 0.931 | 669 | 3081 | 3310 | 2425240 | 75.9% |
| SEATTLE-TAKOMA AREA | 2.284 | 10095 | 66332 | 29037 | 1850414 | 57.9% | BIRMINGHAM, AL | 0.911 | 581 | 3085 | 3386 | 2428325 | 76.0% |
| BALTIMORE, MD | 2.280 | 4354 | 39583 | 17361 | 1889997 | 59.2% | GREENSBORO-WINSTON SALEM, NC | 0.900 | 1152 | 3064 | 3406 | 2431389 | 76.1% |
| SAN DIEGO, CA | 2.201 | 19613 | 142741 | 64844 | 2032738 | 63.7% | ORLANDO, FL | 0.898 | 2476 | 19601 | 21818 | 2450990 | 76.8% |
| TAMPA-ST PETE-CLEARWATER, FL | 1.914 | 826 | 3814 | 1992 | 2036552 | 63.8% | ALBANY-SCHENECTADY, NY | 0.844 | 3864 | 12012 | 14239 | 2463917 | 77.2% |
| PHOENIX, AZ | 1.900 | 1124 | 14684 | 7728 | 2051236 | 64.2% | HONOLULU, HI | 0.817 | 3936 | 10282 | 12590 | 2474199 | 77.5% |
| DENVER-BOULDER-LONGMONT, CO | 1.847 | 11126 | 80766 | 43719 | 2132002 | 66.8% | RICHMOND-PETERSBURG, VA | 0.810 | 99 | 1730 | 2135 | 2475929 | 77.5% |
| CINCINNATI AREA, OH, KY, IN | 1.690 | 1549 | 4894 | 2896 | 2136896 | 66.9% | WEST PALM BEACH AREA, FL | 0.756 | 1619 | 5931 | 7849 | 2481860 | 77.7% |
| MILWAUKEE-RACINE, WI | 1.552 | 1220 | 5918 | 3813 | 2142814 | 67.1% | STOCKTON-MODESTO, CA | 0.749 | 50 | 1256 | 1676 | 2483116 | 77.8% |
| KANSAS CITY, MO-KS | 1.518 | 669 | 3158 | 4655 | 2160674 | 67.2% | TULSA, OK | 0.734 | 250 | 5163 | 7039 | 2488279 | 77.9% |
| NEW ORLEANS, LA | 1.334 | 835 | 6212 | 4655 | 2160674 | 67.7% | AUSTIN, TX | 0.726 | 2703 | 21262 | 29270 | 2509541 | 78.6% |
| NORFOLK-VA BEACH AREA, VA | 1.310 | 799 | 9427 | 7199 | 2170101 | 68.0% | SCRANTON-WILKES-BARRE, PA | 0.726 | 0 | 609 | 839 | 2510150 | 78.6% |
| COLUMBUS, OH | 1.299 | 1685 | 15011 | 11552 | 2185112 | 68.4% | ALLENTOWN-BETHLEHEM, PA-NJ | 0.657 | 662 | 4053 | 6171 | 2514203 | 78.7% |
| SACRAMENTO, CA | 1.291 | 4408 | 12601 | 9758 | 2197713 | 68.8% | RALEIGH-DURHAM, NC | 0.651 | 4623 | 31594 | 48561 | 2545797 | 79.7% |
| SAN ANTONIO, TX | 1.276 | 842 | 9609 | 7528 | 2207322 | 69.1% | SYRACUSE, NY | 0.649 | 686 | 6353 | 9784 | 2552150 | 79.9% |

* per capita rate is obtained by dividing by the population in millions

EXHIBIT ONE

DISTRIBUTION OF SBIR FUNDING BY METROPOLITAN AREAS

| <i>Metropolitan Area</i> | <i>Pop (M)</i> | <i>FY92 (\$K)</i> | <i>FY83-92 (\$K)</i> | <i>Total \$ Per Cap</i> | <i>Cum \$</i> | <i>Cum %</i> | <i>Metropolitan Area</i> | <i>POP (M)</i> | <i>FY92 (\$K)</i> | <i>FY83-92 (\$K)</i> | <i>Total \$ Per Cap</i> | <i>CUM \$</i> | <i>CUM %</i> |
|------------------------------|----------------|-------------------|----------------------|-------------------------|---------------|--------------|------------------------------|----------------|-------------------|----------------------|-------------------------|---------------|--------------|
| GRAND RAPIDS, MI | 0.649 | 0 | 283 | 436 | 2552433 | 79.9% | SHREVEPORT, LA | 0.365 | 0 | 37 | 101 | 2764882 | 86.6% |
| OMAHA, NE-IA | 0.614 | 100 | 542 | 882 | 2552975 | 79.9% | CORPUS CHRISTI, TX | 0.363 | 0 | 49 | 135 | 2764931 | 86.6% |
| TOLEDO, OH | 0.611 | 2094 | 5150 | 8426 | 2558125 | 80.1% | MELBOURNE AREA, FL | 0.361 | 3451 | 23052 | 63821 | 2787983 | 87.3% |
| GREENVILLE-SPARTANBURG, SC | 0.606 | 0 | 705 | 1163 | 2558830 | 80.1% | SPOKANE, WA | 0.357 | 218 | 3169 | 8879 | 2791152 | 87.4% |
| TUCSON, AZ | 0.602 | 3455 | 19505 | 32379 | 2578335 | 80.7% | FORT WAYNE, IN | 0.356 | 0 | 345 | 969 | 2791497 | 87.4% |
| NEW HAVEN, CT | 0.597 | 6507 | 29476 | 49398 | 2649600 | 83.0% | MADISON, WI | 0.345 | 2336 | 8553 | 24798 | 2800050 | 87.7% |
| KNOXVILLE, TN | 0.591 | 3005 | 30793 | 52094 | 2609128 | 81.7% | SALINAS-SEASIDE-MONTEREY, CA | 0.340 | 0 | 2285 | 6727 | 2802335 | 87.8% |
| HARRISBURG AREA, PA | 0.577 | 99 | 405 | 702 | 2609533 | 81.7% | SANTA BARBARA, CA | 0.339 | 7942 | 27996 | 82487 | 2830331 | 88.6% |
| LAS VEGAS, NV | 0.570 | 1073 | 4093 | 7187 | 2613626 | 81.8% | PENSACOLA, FL | 0.337 | 48 | 2988 | 8864 | 2833319 | 88.7% |
| EL PASO, TX | 0.562 | 0 | 100 | 178 | 2613726 | 81.8% | LEXINGTON, KY | 0.332 | 167 | 1280 | 3855 | 2834599 | 88.8% |
| BATON ROUGE, LA | 0.546 | 100 | 884 | 1620 | 2614610 | 81.9% | READING, PA | 0.321 | 0 | 538 | 1676 | 2835137 | 88.8% |
| SPRINGFIELD, MA | 0.518 | 623 | 5514 | 10649 | 2620124 | 82.0% | UTICA-ROME, NY | 0.315 | 1538 | 2737 | 8678 | 2837874 | 88.9% |
| YOUNGSTOWN, OH | 0.510 | 0 | 99 | 194 | 2649699 | 83.0% | APPLETON-OSHKOSH-NEENAH, WI | 0.308 | 491 | 936 | 3044 | 2838810 | 88.9% |
| LITTLE ROCK AREA, AR | 0.506 | 0 | 1388 | 2745 | 2651087 | 83.0% | MONTGOMERY, AL | 0.299 | 0 | 50 | 167 | 2838860 | 88.9% |
| CHARLESTON, SC | 0.486 | 0 | 524 | 1079 | 2651611 | 83.0% | ATLANTIC CITY, NJ | 0.297 | 0 | 1402 | 4714 | 2840262 | 88.9% |
| ALBUQUERQUE, NM | 0.474 | 12723 | 51818 | 109228 | 2703429 | 84.7% | ROCKFORD, IL | 0.280 | 0 | 50 | 178 | 2840312 | 88.9% |
| WICHITA, KS | 0.470 | 0 | 297 | 632 | 2703726 | 84.7% | EUGENE-SPRINGFIELD, OR | 0.263 | 749 | 7707 | 29282 | 2848019 | 89.2% |
| COLUMBIA, SC | 0.445 | 0 | 508 | 1142 | 27042434 | 84.7% | SALEM, OR | 0.262 | 50 | 3362 | 12827 | 2851381 | 89.3% |
| FLINT, MI | 0.435 | 485 | 1109 | 2550 | 2705343 | 84.7% | BINGHAMTON, NY | 0.262 | 494 | 37700 | 14133 | 2855081 | 89.4% |
| CHATTANOOGA, TN-GA | 0.426 | 474 | 4950 | 11633 | 2710293 | 84.9% | NEW LONDON-NORWICH, CT-RI | 0.260 | 100 | 2961 | 11410 | 2858042 | 89.5% |
| LANSING-E LANSING, MI | 0.425 | 1747 | 4228 | 9953 | 2714521 | 85.0% | POUGHKEEPSIE, NY | 0.257 | 0 | 99 | 386 | 2858141 | 89.5% |
| WORCESTER, MA | 0.408 | 1670 | 14302 | 35071 | 2728823 | 85.5% | JOHNSTOWN, PA | 0.254 | 0 | 30 | 118 | 2858171 | 89.5% |
| SAGINAW-BAY CITY-MIDLAND, MI | 0.404 | 48 | 1217 | 3015 | 2730040 | 85.5% | DULUTH, MN-WI | 0.244 | 35 | 135 | 554 | 2858306 | 89.5% |
| CANTON, OH | 0.400 | 0 | 482 | 1204 | 2730522 | 85.5% | SOUTH BEND-MISHAWAKA, IN | 0.241 | 83 | 135 | 6674 | 2859917 | 89.6% |
| YORK, PA | 0.398 | 0 | 225 | 566 | 2730747 | 85.5% | PROVO-OREM, UT | 0.241 | 542 | 3060 | 12723 | 2862977 | 89.7% |
| LANCASTER, PA | 0.394 | 1952 | 12958 | 32930 | 2743705 | 85.9% | SAVANNAH, GA | 0.240 | 0 | 50 | 209 | 2863027 | 89.7% |
| JACKSON, MS | 0.392 | 49 | 276 | 704 | 2743981 | 85.9% | ANCHORAGE, AK | 0.235 | 0 | 140 | 596 | 2388638 | 89.7% |
| AUGUSTA, GA-SC | 0.390 | 0 | 50 | 128 | 2744031 | 85.9% | HUNTSVILLE, AL | 0.234 | 9129 | 46559 | 199226 | 2910219 | 91.1% |
| DES MOINES, IA | 0.381 | 637 | 2551 | 6690 | 2746582 | 86.0% | ROANOKE, VA | 0.225 | 1508 | 18121 | 80574 | 2928340 | 91.7% |
| COLORADO SPRINGS, CO | 0.380 | 5412 | 18263 | 48010 | 2764845 | 86.6% | LUBBOCK, TX | 0.225 | 0 | 50 | 222 | 2928390 | 91.7% |

EXHIBIT ONE

DISTRIBUTION OF SBIR FUNDING BY METROPOLITAN AREAS

| Metropolitan Area | Pop (M) | FY92 (\$K) | FY83-92 (\$K) | Total \$ Per Cap | Cum \$ | Cum % | Metropolitan Area | Pop (M) | FY92 (\$K) | FY83-92 (\$K) | Total \$ Per Cap | Cum \$ | Cum % |
|------------------------------|---------|------------|---------------|------------------|---------|-------|-----------------------------|---------|------------|---------------|------------------|---------|--------|
| RENO, NV | 0.225 | 1304 | 6941 | 30904 | 2935331 | 91.9% | LAFAYETTE-W LAFAYETTE, IN | 0.124 | 0 | 4800 | 38585 | 3011207 | 94.3% |
| TALLAHASSEE, FL | 0.218 | 0 | 295 | 1353 | 2935626 | 91.9% | LAS CRUCES, NM | 0.123 | 791 | 7388 | 60065 | 3018595 | 94.5% |
| KALAMAZOO, MI | 0.218 | 96 | 849 | 3900 | 2936475 | 92.0% | BLOOMINGTON-NORMAL, IL | 0.123 | 146 | 196 | 1597 | 3018791 | 94.5% |
| PORTSMOUTH AREA, NH, ME | 0.215 | 430 | 3087 | 14358 | 2939562 | 92.1% | CHARLOTTESVILLE, VA | 0.121 | 2064 | 4952 | 40791 | 3023743 | 94.7% |
| WATERBURY, CT | 0.212 | 4055 | 17023 | 80335 | 2956585 | 92.6% | MUNCIE, IN | 0.121 | 0 | 96 | 794 | 3023839 | 94.7% |
| LINCOLN, NE | 0.206 | 1242 | 4029 | 19549 | 2960614 | 92.7% | BRYAN-COLLEGE STATION, TX | 0.121 | 1651 | 6628 | 56523 | 3030667 | 94.9% |
| PORTLAND, ME | 0.206 | 6117 | 6939 | 33734 | 2967553 | 92.9% | LAWTON, OK | 0.121 | 99 | 3021 | 25029 | 3033688 | 95.0% |
| GAINESVILLE, FL | 0.200 | 1950 | 9627 | 48183 | 2977180 | 93.2% | STATE COLLEGE, PA | 0.115 | 227 | 2660 | 23211 | 3036348 | 95.1% |
| WACO, TX | 0.188 | 50 | 148 | 789 | 2977328 | 93.2% | BELLINGHAM, WA | 0.114 | 50 | 1189 | 10457 | 3037537 | 95.1% |
| YAKIMA, WA | 0.183 | 200 | 250 | 1365 | 2977578 | 93.2% | GLENS FALLS, NY | 0.112 | 0 | 52 | 463 | 3037589 | 95.1% |
| CHAMPAIGN-URBANA-RANTOUL, IL | 0.171 | 1189 | 8019 | 46867 | 2985597 | 93.5% | MIDLAND, TX | 0.111 | 0 | 547 | 4915 | 3038136 | 95.1% |
| ASHEVILLE, NC | 0.170 | 50 | 499 | 2935 | 2986096 | 93.5% | FAYETTEVILLE-SPRINGDALE, AR | 0.107 | 600 | 1994 | 18566 | 3040130 | 95.2% |
| CEDAR RAPIDS, IA | 0.169 | 0 | 2286 | 13543 | 2988382 | 93.6% | SANTA FE, NM | 0.106 | 1349 | 11575 | 108992 | 3051705 | 95.6% |
| NASHUA, NH | 0.163 | 2409 | 4008 | 24544 | 2992390 | 93.7% | BLOOMINGTON, IN | 0.102 | 703 | 4368 | 42950 | 3056073 | 95.7% |
| TOPEKA, KS | 0.161 | 0 | 1392 | 8657 | 2993782 | 93.8% | KOKOMO, IN | 0.101 | 0 | 50 | 493 | 3056123 | 95.7% |
| WATERLOO-CEDAR FALLS, IA | 0.152 | 0 | 605 | 3993 | 2994387 | 93.8% | ROCHESTER, MN | 0.098 | 0 | 245 | 2500 | 3056368 | 95.7% |
| OLYMPIA, WA | 0.147 | 432 | 1770 | 12074 | 2496906 | 93.8% | FITCHBURG-LEOMINSTER, MA | 0.096 | 98 | 2306 | 23946 | 3058674 | 95.8% |
| FARGO-MOOREHEAD, ND-MN | 0.145 | 50 | 1820 | 12415 | 2996207 | 93.8% | LA CROSSE, WI | 0.094 | 0 | 39 | 414 | 3058713 | 95.8% |
| MANCHESTER, NH | 0.145 | 300 | 1452 | 10007 | 2997709 | 93.9% | ELMIRA, NY | 0.091 | 3441 | 13391 | 147967 | 3072104 | 96.2% |
| JACKSON, MI | 0.144 | 50 | 200 | 1385 | 2997909 | 93.9% | BISMARCK, ND | 0.086 | 0 | 100 | 1163 | 3072204 | 96.2% |
| ATHENS, GA | 0.142 | 215 | 2569 | 18155 | 3000478 | 94.0% | BANGOR, ME | 0.083 | 0 | 271 | 3249 | 3072475 | 96.2% |
| MEDFORD, OR | 0.140 | 0 | 50 | 357 | 3000528 | 94.0% | PITTSFIELD, MA | 0.081 | 248 | 535 | 6613 | 3073010 | 96.2% |
| REDDING, CA | 0.133 | 49 | 49 | 368 | 3000577 | 94.0% | RAPID CITY, SD | 0.077 | 0 | 206 | 2679 | 3073216 | 96.2% |
| PASCAGOULA, MS | 0.128 | 49 | 396 | 3089 | 3000973 | 94.0% | VICTORIA, TX | 0.076 | 0 | 407 | 5355 | 3073623 | 96.3% |
| WICHITA FALLS, TX | 0.127 | 0 | 49 | 386 | 3001022 | 94.0% | CASPER, WY | 0.071 | 33 | 83 | 1169 | 3073706 | 96.3% |
| ABILENE, TX | 0.126 | 0 | 100 | 794 | 3001122 | 94.0% | GRAND FORKS, ND | 0.069 | 90 | 1182 | 17032 | 3074888 | 96.3% |
| BURLINGTON, VT | 0.125 | 245 | 5285 | 42416 | 3006407 | 94.1% | NOT IN Metropolitan Area | | 21783 | 118473 | | 3193361 | 100.0% |

* per capita rate is obtained by dividing by the population in millions

EXHIBIT TWO

SBIR AWARDS BY METROPOLITAN AREAS (ordered by total dollars, Fiscal 83-92)

| <i>Metropolitan Area</i> | <i>Pop (M)</i> | <i>FY92 (\$K)</i> | <i>FY83-92 (\$K)</i> | <i>Total \$ Per Cap</i> | <i>Metropolitan Area</i> | <i>Pop (M)</i> | <i>FY92 (\$K)</i> | <i>FY83-92 (\$K)</i> | <i>Total \$ Per Cap</i> |
|-----------------------------|--------------------|-----------------------|--------------------------|-----------------------------|------------------------------|--------------------|-----------------------|--------------------------|-----------------------------|
| BOSTON AREA | 4.056 | 83265 | 469485 | 115759 | MELBOURNE AREA, FL | 0.361 | 3451 | 23052 | 63821 |
| LOS ANGELES AREA | 13.075 | 48038 | 298707 | 22846 | PITTSBURGH-BEAVER VALLEY, PA | 2.316 | 1597 | 21461 | 9266 |
| BAY AREA (SF) | 5.534 | 46113 | 293129 | 52967 | AUSTIN, TX | 0.726 | 2703 | 21262 | 29270 |
| WASHINGTON, DC-MD-VA | 3.565 | 37905 | 263827 | 74005 | ORLANDO, FL | 0.898 | 2476 | 19601 | 21818 |
| SAN DIEGO, CA | 2.201 | 19613 | 142741 | 64844 | TUCSON, AZ | 0.602 | 3455 | 19505 | 32379 |
| PHILADELPHIA AREA | 5.697 | 15674 | 112039 | 19666 | ATLANTA, GA | 2.561 | 4678 | 18937 | 7396 |
| NEW YORK AREA | 15.529 | 18879 | 101008 | 6504 | MIDDLESEX-SOMMERSET AREA, NJ | 0.950 | 3425 | 18717 | 19700 |
| DENVER-BOULDER-LONGMONT, CO | 1.847 | 11126 | 80766 | 43719 | COLORADO SPRINGS, CO | 0.380 | 5412 | 18263 | 48010 |
| SEATTLE-TAKOMA AREA | 2.284 | 10095 | 66332 | 29037 | ROANOKE, VA | 0.225 | 1508 | 18121 | 80574 |
| ALBUQUERQUE, NM | 0.474 | 12723 | 51818 | 109228 | WATERBURY, CT | 0.212 | 4055 | 17023 | 80335 |
| HUNTSVILLE, AL | 0.234 | 9129 | 46559 | 199226 | COLUMBUS, OH | 1.299 | 1685 | 15011 | 11552 |
| CHICAGO-LAKE COUNTY | 7.381 | 8774 | 46434 | 6291 | PROVIDENCE AREA, RI, MA | 1.109 | 2809 | 14689 | 13251 |
| SALT LAKE CITY-OGDEN, UT | 1.041 | 7867 | 45282 | 43482 | PHOENIX, AZ | 1.900 | 1124 | 14684 | 7728 |
| DAYTON-SPRINGFIELD, OH | 0.934 | 7748 | 45257 | 48481 | WORCESTER, MA | 0.408 | 1670 | 14302 | 35071 |
| DETROIT-ANN ARBOR, MI | 4.601 | 8673 | 42129 | 9157 | ELMIRA, NY | 0.091 | 3441 | 13391 | 147967 |
| MINNEAPOLIS-ST PAUL, MN-WI | 2.295 | 6005 | 39669 | 17283 | ROCHESTER, NY | 0.980 | 2460 | 13371 | 13640 |
| BALTIMORE, MD | 2.280 | 4354 | 39583 | 17361 | CLEVELAND-AKRON AREA | 2.766 | 2671 | 13081 | 4730 |
| HARTFORD AREA, CT | 0.967 | 7041 | 37409 | 38682 | LANCASTER, PA | 0.394 | 1952 | 12958 | 32930 |
| RALEIGH-DURHAM, NC | 0.651 | 4623 | 31594 | 48561 | SACRAMENTO, CA | 1.291 | 4408 | 12601 | 9758 |
| KNOXVILLE, TN | 0.591 | 3005 | 30793 | 52094 | ALBANY-SCHENECTADY, NY | 0.844 | 3864 | 12012 | 14239 |
| HOUSTON, GALVESTON, TX | 3.634 | 4893 | 29669 | 8164 | SANTA FE, NM | 0.106 | 1349 | 11575 | 108992 |
| NEW HAVEN, CT | 0.597 | 6507 | 29476 | 49398 | HONOLULU, HI | 0.817 | 3936 | 10282 | 12590 |
| SANTA BARBARA, CA | 0.339 | 7942 | 27996 | 82487 | GAINESVILLE, FL | 0.200 | 1950 | 9627 | 48183 |
| BUFFALO-NIAGRA AREA | 1.182 | 5221 | 26592 | 22505 | SAN ANTONIO, TX | 1.276 | 842 | 9609 | 7528 |
| DALLAS-FT. WORTH AREA | 3.655 | 3287 | 24705 | 6759 | NORFOLK-VA BEACH AREA, VA | 1.310 | 799 | 9427 | 7199 |

* per capital rate is obtained by dividing by the population in millions.

EXHIBIT THREE

SBIR AWARDS BY METROPOLITAN AREAS (ordered by total dollars per capita)

| <i>Metropolitan Area</i> | <i>POP (M)</i> | <i>FY92 (\$K)</i> | <i>FY83-92 (\$K)</i> | <i>Total \$ Per Cap</i> | <i>Metropolitan Area</i> | <i>POP (M)</i> | <i>FY92 (\$K)</i> | <i>FY83-92 (\$K)</i> | <i>Total \$ Per Cap</i> |
|------------------------------|--------------------|-----------------------|--------------------------|-----------------------------|------------------------------|--------------------|-----------------------|--------------------------|-----------------------------|
| HUNTSVILLE, AL | 0.234 | 9129 | 46559 | 199226 | CHARLOTTESVILLE, VA | 0.121 | 2064 | 4952 | 40791 |
| ELMIRA, NY | 0.091 | 3441 | 13391 | 147967 | HARTFORD AREA, CT | 0.967 | 7041 | 37409 | 38682 |
| BOSTON AREA | 4.056 | 83265 | 469485 | 115759 | LAFAYETTE-W LAFAYETTE, IN | 0.124 | 0 | 4800 | 38585 |
| ALBUQUERQUE, NM | 0.474 | 12723 | 51818 | 109228 | WORCESTER, MA | 0.408 | 1670 | 14302 | 35071 |
| SANTA FE, NM | 0.106 | 1349 | 11575 | 108992 | PORTLAND, ME | 0.206 | 617 | 6939 | 33734 |
| SANTA BARBARA, CA | 0.339 | 7942 | 27996 | 82487 | LANCASTER, PA | 0.394 | 1952 | 12958 | 32930 |
| ROANOKE, VA | 0.225 | 1508 | 18121 | 80574 | TUCSON, AZ | 0.602 | 3455 | 19505 | 32379 |
| WATERBURY, CT | 0.212 | 4055 | 17023 | 80335 | RENO, NV | 0.225 | 1304 | 6941 | 30904 |
| WASHINGTON, DC-MD-VA | 3.565 | 37905 | 263817 | 74005 | EUGENE-SPRINGFIELD, OR | 0.263 | 749 | 7707 | 29282 |
| SAN DIEGO, CA | 2.201 | 19613 | 142741 | 64844 | AUSTIN, TX | 0.726 | 2703 | 21262 | 29270 |
| MELBOURNE AREA, FL | 0.361 | 3451 | 23052 | 63821 | SEATTLE-TAKOMA AREA | 2.284 | 10095 | 66332 | 29037 |
| LAS CRUCES, NM | 0.123 | 791 | 7388 | 60065 | LAWTON, OK | 0.121 | 99 | 3021 | 25029 |
| BRYAN-COLLEGE STATION, TX | 0.121 | 1651 | 6828 | 56523 | MADISON, WI | 0.345 | 2366 | 8553 | 24798 |
| BAY AREA (SF) | 5.534 | 46113 | 293129 | 52967 | NASHUA, NH | 0.163 | 2409 | 4008 | 24544 |
| KNOXVILLE, TN | 0.591 | 3005 | 30793 | 52094 | FITCHBURG-LEOMINSTER, MA | 0.096 | 98 | 2306 | 23946 |
| NEW HAVEN, CT | 0.597 | 6507 | 29476 | 49398 | STATE COLLEGE, PA | 0.115 | 227 | 2660 | 23211 |
| RALEIGH-DURHAM, NC | 0.651 | 4623 | 31594 | 48561 | LOS ANGELES AREA | 13.075 | 48038 | 298707 | 22846 |
| DAYTON-SPRINGFIELD, OH | 0.934 | 7748 | 45257 | 48481 | BUFFALO-NIAGRA AREA | 1.182 | 5221 | 26592 | 22505 |
| GAINESVILLE, FL | 0.200 | 1950 | 9627 | 48183 | ORLANDO, FL | 0.898 | 2476 | 19601 | 21818 |
| COLORADO SPRINGS, CO | 0.380 | 5412 | 18263 | 48010 | MIDDLESEX-SOMMERSET AREA, NJ | 0.950 | 3425 | 18717 | 19700 |
| CHAMPAIGN-URBANA-RANTOUL, IL | 0.171 | 1189 | 8019 | 46867 | PHILADELPHIA AREA | 5.697 | 15674 | 112039 | 19666 |
| DENVER-BOULDER-LONGMONT, CO | 1.847 | 11126 | 80766 | 43719 | LINCOLN, NE | 0.206 | 1242 | 4029 | 19549 |
| SALT LAKE CITY-OGDEN, UT | 1.041 | 7867 | 45282 | 43482 | FAYETTEVILLE-SPRINGDALE, AR | 0.107 | 600 | 1994 | 18566 |
| BLOOMINGTON, IN | 0.102 | 703 | 4368 | 42950 | ATHENS, GA | 0.142 | 215 | 2569 | 18155 |
| BURLINGTON, VT | 0.125 | 245 | 5285 | 42416 | BALTIMORE, MD | 2.280 | 4354 | 39583 | 17361 |

*per capita rate is obtained by dividing by the population in millions

EXHIBIT FOUR

TECHNOLOGY AREAS

1000 COMPUTER, INFORMATION PROCESSING, ANALYSIS

1100 Computer and communication systems

- 1110 Computer systems technology
- 1120 Communication and control systems
- 1130 Networks and architectures
- 1140 Computer security

1200 Information processing and management

- 1210 Data and information processing
- 1220 Artificial intelligence
- 1230 Computer software
- 1240 Robotics and automation
- 1250 Man machine interface

1300 Signal and image processing

- 1310 Signal processing
- 1320 Image processing
- 1330 Navigation, guidance, positioning

1400 Systems studies

- 1410 General studies
- 1420 Operations and systems analysis
- 1430 Safety systems, health and risk analysis

1500 Mathematical sciences

- 1510 Math fundamentals
- 1520 Numerical modeling
- 1530 Math modeling

2000 ELECTRONICS

2100 Microelectronics

- 2110 Microelectronics:materials, concepts, processing
- 2120 Compound semiconductors
- 2130 Photovoltaics
- 2140 Optoelectronics

2200 Electronics device performance

- 2210 Electronic device performance, packaging, reliability
- 2220 Radiation damage and hardening
- 2230 Testability

2300 Electronic equipment and instrumentation

- 2310 Electronic equipment and systems
- 2320 Data and information processing equipment
- 2330 Sensors, transducers, instrumentation

2400 Electromagnetic radiation/propagation

- 2410 RF technology
- 2420 Electronic warfare
- 2430 Target detection
- 2440 Metal and mine detection

2500 Microwave and millimeter wave electronics

- 2510 Microwave electronics
- 2520 Millimeter wave electronics

2600 Optical devices and lasers

- 2610 Optical and IR sensors, components
- 2620 Optical fiber technology
- 2630 Laser technology
- 2640 Higher frequency EM radiation

TECHNOLOGY AREAS

3000 MATERIALS

- 3100 Advanced materials
 - 3110 Metallic, magnetic, highT, conducting & superconducting materials
 - 3120 Polymers
 - 3130 Ceramics
 - 3140 Composites and lightweight materials
 - 3150 Construction materials
 - 3160 Fire, fabric, and insulation materials
 - 3170 EM transparent materials
 - 3180 Biomaterials

- 3200 Materials processing and manufacturing
 - 3210 Materials processing
 - 3220 Manufacturing methods
 - 3230 Joining and welding technology
 - 3240 Separation/characterization of multiphases

- 3300 Coatings, corrosion and surface phenomena
 - 3310 Corrosion
 - 3320 Coatings
 - 3330 Thin films and surfaces

- 3400 Materials performance
 - 3410 Failure, fracture, fatigue
 - 3420 Lubrication, wear and seals
 - 3430 Repair
 - 3440 Non-destructive evaluation

- 3500 Fundamentals and instrumentation
 - 3510 Materials fundamentals/general
 - 3520 Instrumentation

4000 MECHANICAL PERFORMANCE OF VEHICLES, WEAPONS, FACILITIES

- 4100 Hydrodynamics
 - 4110 Hydrodynamics
 - 4120 Watercraft

- 4200 Aerodynamics
 - 4210 Fundamental aerodynamics
 - 4220 Aerodynamic performance
 - 4230 Aerodynamic facilities, instrumentation

- 4300 Acoustics
 - 4310 Underwater acoustic detection and communication
 - 4320 Vibration related acoustics

- 4400 Mechanical performance of structures and equipment
 - 4410 Shock vibration and structural performance of vehicles, facilities, equipment
 - 4420 New structural concepts
 - 4430 Performance of engine, equipment, mechanical components
 - 4440 Weapons performance and effects

- 4500 Control
 - 4510 Control concepts
 - 4520 Vehicle/weapon motion control
 - 4530 Structural controls

- 4600 Mechanical measurements
 - 4610 Mechanical measurements (pressure, velocity, etc.)

TECHNOLOGY AREAS

5000 ENERGY CONVERSION AND USE

5100 Transport sciences

- 5110 Fluid mechanics
- 5120 Flow/fluid measurement and enhancement
- 5130 Heat transfer
- 5140 Refrigeration/cryogenics

5200 Propulsion/combustion technology

- 5210 Propulsion systems
- 5220 Propellants, fuels, explosives
- 5230 Combustion
- 5240 Fire detection
- 5250 Exhaust gases & gas analysis

5300 Large scale energy usage

- 5310 Industrial energy processes and utilization
- 5320 Physics, nuclear physics, fusion and plasma
- 5330 Energy use in buildings

5400 Energy conversion/electric power

- 5410 Batteries, fuel cells, electrochemistry, energy storage
- 5420 Alternative energy conversion
- 5430 Electric power technology

6000 ENVIRONMENT & NATURAL RESOURCES

6100 Ocean science

- 6110 Ocean science and instrumentation

6200 Atmospheric sciences

- 6210 Atmospheric science and monitoring
- 6220 Remote sensing
- 6230 Chemical and biological measurement
- 6240 Particulates and aerosols
- 6250 Pollution abatement and environment control

6300 Water management

- 6310 Water monitoring and characterization
- 6320 Water treatment
- 6330 Water management and utilization
- 6340 Ice, snow, frost detection

6400 Earth sciences

- 6410 Earth sciences
- 6420 Soil measurement and manipulation

6500 Environment protection

- 6510 Nuclear, chemical, biological waste management
- 6520 CBR defense

TECHNOLOGY AREAS

7000 LIFE SCIENCES

7100 Medical instrumentation

- 7110 Medical measurements
- 7120 Measurements/techniques for radiation/imagery
- 7130 Medical devices
- 7140 Devices/systems for physically impaired

7200 Biotechnology and microbiology

- 7210 Biotechnology and genetic engineering
- 7220 Cellular biology
- 7230 Drugs, vaccines, toxicity, immunology,
therapeutic agents
- 7240 Disease detection and screening

7300 Behavioral sciences

- 7310 Behavior, human factors, cognition
- 7320 Training, testing, simulation
- 7330 Social studies

7400 Physiology and miscellaneous

- 7410 Physiological mechanisms, injury, miscellaneous
- 7420 Dental
- 7430 Food, nutrition, agriculture
- 7440 Biotic resources
- 7450 Animal models and veterinary medicine
- 7460 Plant physiology

EXHIBIT FIVE

FISCAL 1992 PHASE I AND II AWARDS BY TECHNOLOGY AREA AND AGENCY

(dollars in thousands)

| | DOD | DOE | NASA | HHS | NSF | DOT | EPA | NRC | ED | DOA | DOC | TOTAL |
|---|-------|------|-------|------|------|------|-----|-----|-----|-----|-----|-------|
| 1000 COMPUTER, INFORMATION, ANALYSIS | | | | | | | | | | | | |
| 1100 COMPUTER, COMMUNICATION | 17860 | 1400 | 4445 | 2604 | 749 | 393 | 0 | 0 | 524 | 49 | 140 | 28164 |
| 1200 INFORMATION PROCESSING | 25308 | 2493 | 14794 | 6983 | 2317 | 150 | 0 | 0 | 554 | 328 | 272 | 53199 |
| 1300 SIGNAL/IMAGE PROCESSING | 31525 | 1849 | 3907 | 1300 | 1348 | 1240 | 0 | 0 | 0 | 100 | 338 | 41607 |
| 1400 SYSTEMS STUDIES | 9585 | 1000 | 2564 | 2864 | 299 | 99 | 0 | 525 | 90 | 249 | 0 | 17275 |
| 1500 MATH MODELLING | 7276 | 700 | 5657 | 2175 | 1198 | 0 | 0 | 100 | 0 | 229 | 70 | 17405 |
| 2000 ELECTRONICS | | | | | | | | | | | | |
| 2100 MICROELECTRONICS | 20515 | 1698 | 3104 | 0 | 2445 | 0 | 0 | 0 | 0 | 0 | 35 | 27797 |
| 2200 DEVICE PERFORMANCE | 4027 | 650 | 295 | 0 | 0 | 0 | 0 | 50 | 0 | 0 | 0 | 5022 |
| 2300 EQUIPMENT/INSTRUMENTATION | 21150 | 3791 | 6399 | 1849 | 848 | 295 | 150 | 297 | 262 | 149 | 35 | 35225 |
| 2400 EM RADIATION/PROPAGATION | 28657 | 600 | 1184 | 0 | 352 | 197 | 0 | 0 | 0 | 0 | 199 | 31189 |
| 2500 MICROWAVE/MM WAVE | 9733 | 150 | 2178 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12061 |
| 2600 OPTICAL/LASER | 43780 | 5654 | 9670 | 3915 | 2662 | 99 | 50 | 347 | 0 | 49 | 669 | 66895 |
| 3000 MATERIALS | | | | | | | | | | | | |
| 3100 ADVANCED MATERIALS | 28327 | 6402 | 8600 | 3877 | 2328 | 499 | 250 | 0 | 0 | 255 | 70 | 50608 |
| 3200 PROCESSING/MANUFACTURING | 11214 | 5028 | 6120 | 2020 | 2284 | 49 | 694 | 0 | 0 | 83 | 105 | 27597 |
| 3300 COATINGS/CORROSION | 14769 | 2890 | 4725 | 4041 | 2631 | 199 | 345 | 50 | 0 | 0 | 0 | 29650 |
| 3400 PERFORMANCE/FATIGUE | 9888 | 100 | 3356 | 50 | 1259 | 299 | 50 | 150 | 0 | 200 | 200 | 15552 |
| 3500 FUNDAMENTALS/INSTRUMENTS | 1543 | 898 | 688 | 4604 | 2155 | 150 | 50 | 48 | 0 | 50 | 200 | 10386 |

*multiple technology areas assigned to awards

EXHIBIT FIVE

FISCAL 1992 PHASE I AND II AWARDS BY TECHNOLOGY AREA AND AGENCY

(dollars in thousands)

| | DOD | DOE | NASA | HHS | NSF | DOT | EPA | NRC | ED | DOA | DOC | TOTAL |
|---|-------|------|-------|-------|------|-----|------|-----|------|------|-----|-------|
| 4000 MECHANICS OF VEHICLES, FACILITIES | | | | | | | | | | | | |
| 4100 HYDRODYNAMICS | 150 | 550 | 125 | 0 | 0 | 97 | 0 | 0 | 0 | 0 | 0 | 922 |
| 4200 AERODYNAMICS | 6666 | 0 | 5139 | 0 | 0 | 50 | 0 | 0 | 0 | 0 | 0 | 11855 |
| 4300 ACOUSTICS | 4490 | 50 | 698 | 50 | 0 | 0 | 0 | 50 | 30 | 0 | 35 | 5403 |
| 4400 STRUCTURAL PERFORMANCE | 11836 | 50 | 1940 | 150 | 629 | 300 | 0 | 0 | 0 | 0 | 0 | 14905 |
| 4500 CONTROL | 4543 | 400 | 4759 | 50 | 50 | 0 | 0 | 50 | 0 | 0 | 0 | 9852 |
| 4600 MEASUREMENTS | 2551 | 0 | 845 | 100 | 97 | 100 | 0 | 0 | 0 | 0 | 0 | 3693 |
| 5000 ENERGY CONSERVATION AND USE | | | | | | | | | | | | |
| 5100 TRANSPORT SCIENCES | 13844 | 3846 | 11350 | 1142 | 818 | 0 | 0 | 150 | 0 | 364 | 0 | 31514 |
| 5200 PROPULSION/COMBUSTION | 13506 | 3799 | 5482 | 1099 | 314 | 298 | 150 | 0 | 0 | 100 | 0 | 24748 |
| 5300 LARGE SCALE USES | 2891 | 9285 | 499 | 50 | 650 | 0 | 0 | 0 | 0 | 50 | 235 | 13660 |
| 5400 ELECTRIC POWER | 6311 | 3398 | 3637 | 248 | 800 | 0 | 400 | 0 | 0 | 245 | 0 | 15039 |
| 6000 ENVIRONMENT AND NATURAL RESOURCES | | | | | | | | | | | | |
| 6100 OCEAN SCIENCE | 106 | 547 | 1037 | 0 | 288 | 0 | 0 | 0 | 0 | 0 | 50 | 2028 |
| 6200 ATMOSPHERIC SCIENCE | 12397 | 5340 | 5443 | 1705 | 1875 | 548 | 2000 | 0 | 0 | 425 | 493 | 30226 |
| 6300 WATER MANAGEMENT | 1499 | 100 | 1749 | 436 | 679 | 0 | 394 | 0 | 0 | 395 | 173 | 5425 |
| 6400 EARTH SCIENCES | 2007 | 3750 | 494 | 0 | 912 | 50 | 200 | 50 | 0 | 150 | 0 | 7613 |
| 6500 ENVIRONMENT PROTECTION | 4183 | 800 | 643 | 0 | 500 | 0 | 2047 | 148 | 0 | 149 | 0 | 8470 |
| 7000 LIFE SCIENCES | | | | | | | | | | | | |
| 7100 MEDICAL INSTRUMENTATION | 2128 | 1200 | 2602 | 31772 | 611 | 0 | 0 | 0 | 1347 | 365 | 0 | 40025 |
| 7200 BIOTECHNOLOGY/MICROBIOLOGY | 5654 | 1300 | 150 | 41838 | 2368 | 0 | 144 | 50 | 0 | 1229 | 0 | 52733 |
| 7300 BEHAVIORAL SCIENCES | 5802 | 0 | 1197 | 12373 | 1988 | 343 | 0 | 150 | 1514 | 625 | 0 | 23992 |
| 7400 PHYSIOLOGY AND MISC. | 853 | 0 | 597 | 5625 | 1974 | 391 | 0 | 0 | 30 | 3677 | 340 | 13487 |

*multiple technology areas assigned to awards

EXHIBIT SIX

DISTRIBUTION OF FISCAL 1992 PHASE I AND II AWARDS AMONG TECHNOLOGY AREAS (multiple technology areas assigned to awards)

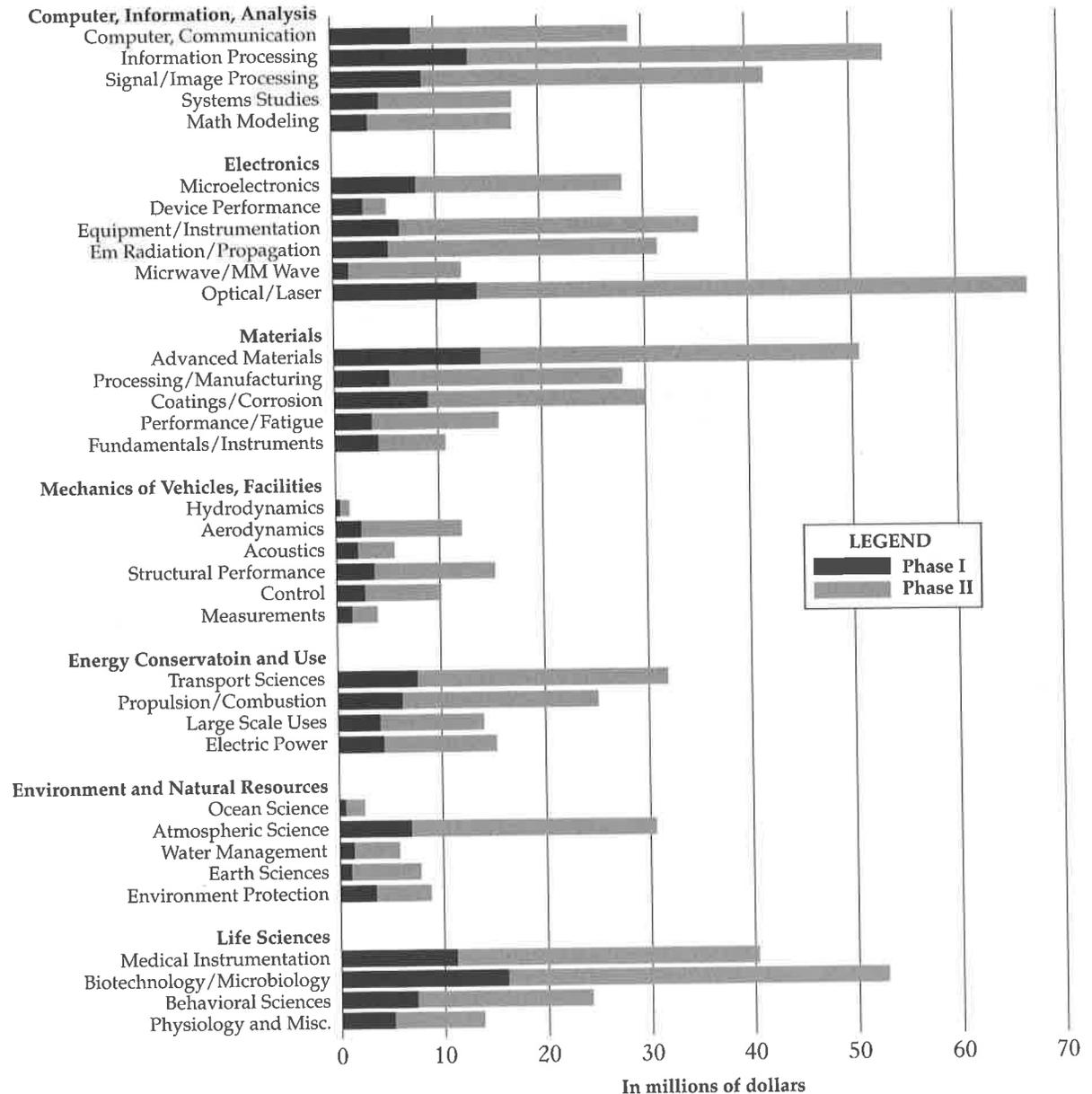


EXHIBIT SEVEN

FISCAL 1983-92 PHASE I AND II AWARDS BY TECHNOLOGY AREA AND AGENCY

(dollars in thousands)

| | DOD | DOE | NASA | HHS | NSF | DOT | EPA | NRC | ED | DOA | DOC | TOTAL | |
|-------------|--|--------|-------|-------|-------|-------|------|------|------|------|------|-------|--------|
| 1000 | COMPUTER, INFORMATION, ANALYSIS | | | | | | | | | | | | |
| 1100 | COMPUTER, COMMUNICATION | 119472 | 12566 | 26044 | 23680 | 6710 | 3399 | 0 | 560 | 3266 | 574 | 504 | 196775 |
| 1200 | INFORMATION PROCESSING | 203473 | 29293 | 72509 | 56451 | 16222 | 3664 | 200 | 1091 | 6979 | 1716 | 879 | 383477 |
| 1300 | SIGNAL/IMAGE PROCESSING | 152545 | 9204 | 36129 | 19840 | 8458 | 4753 | 0 | 480 | 502 | 350 | 1588 | 233849 |
| 1400 | SYSTEMS STUDIES | 70937 | 6203 | 6440 | 14175 | 2394 | 1992 | 199 | 2956 | 894 | 2060 | 0 | 108250 |
| 1500 | MATH MODELLING | 70340 | 3329 | 43379 | 11691 | 8738 | 643 | 198 | 2188 | 230 | 279 | 130 | 141145 |
| 2000 | ELECTRONICS | | | | | | | | | | | | |
| 2100 | MICROELECTRONICS | 125211 | 14168 | 23947 | 588 | 13722 | 99 | 0 | 242 | 0 | 50 | 35 | 178062 |
| 2200 | DEVICE PERFORMANCE | 38662 | 3477 | 4269 | 4856 | 705 | 449 | 0 | 543 | 0 | 0 | 0 | 52961 |
| 2300 | EQUIPMENT/INSTRUMENTATION | 125221 | 34616 | 39876 | 21723 | 9748 | 3954 | 1970 | 1255 | 1842 | 2404 | 803 | 243412 |
| 2400 | EM RADIATION/PROPAGATION | 164918 | 2090 | 5400 | 1913 | 1307 | 1523 | 397 | 49 | 30 | 0 | 648 | 178275 |
| 2500 | MICROWAVE/MM WAVE | 48315 | 4709 | 11808 | 590 | 401 | 49 | 49 | 0 | 30 | 0 | 226 | 66177 |
| 2600 | OPTICAL/LASER | 206342 | 41894 | 60251 | 33105 | 15513 | 2984 | 1050 | 1214 | 86 | 992 | 1603 | 365034 |
| 3000 | MATERIALS | | | | | | | | | | | | |
| 3100 | ADVANCED MATERIALS | 182709 | 50983 | 46971 | 16745 | 17445 | 5789 | 1542 | 118 | 30 | 3225 | 334 | 325891 |
| 3200 | PROCESSING/MANUFACTURING | 54217 | 34604 | 24777 | 9765 | 15033 | 1056 | 3765 | 348 | 30 | 1588 | 365 | 145548 |
| 3300 | COATINGS/CORROSION | 98676 | 24526 | 24008 | 13052 | 14118 | 635 | 2333 | 100 | 0 | 619 | 34 | 178101 |
| 3400 | PERFORMANCE/FATIGUE | 68598 | 14474 | 16613 | 761 | 10213 | 4948 | 274 | 1084 | 0 | 1367 | 235 | 118567 |
| 3500 | FUNDAMENTALS/INSTRUMENTS | 14235 | 6732 | 8765 | 18608 | 7385 | 150 | 1087 | 48 | 0 | 242 | 728 | 57980 |

*multiple technology areas assigned to awards

EXHIBIT SEVEN

FISCAL 1983-92 PHASE I AND II AWARDS BY TECHNOLOGY AREA AND AGENCY

(dollars in thousands)

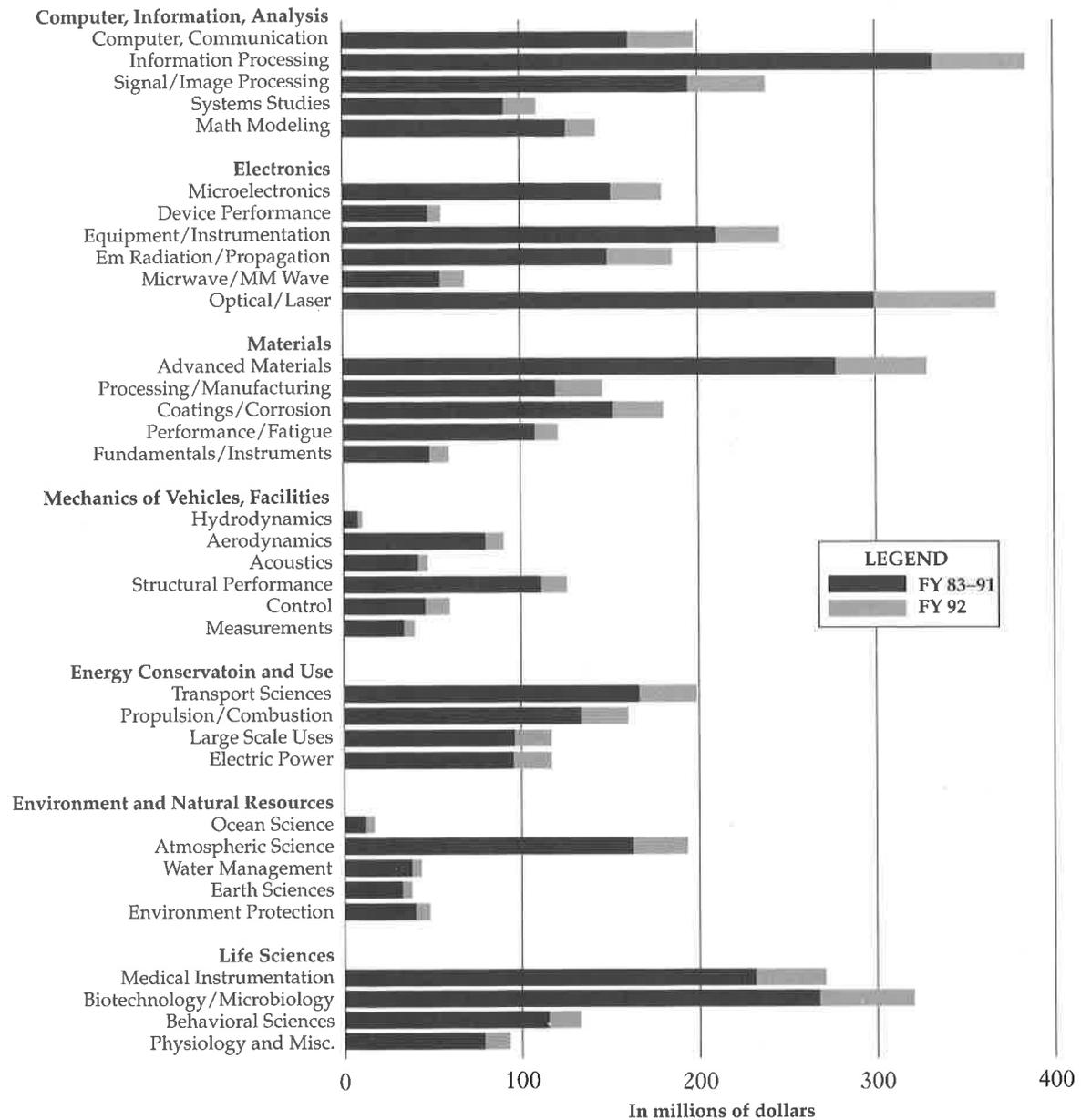
| | DOD | DOE | NASA | HHS | NSF | DOT | EPA | NRC | ED | DOA | DOC | TOTAL |
|---|-------|-------|-------|--------|-------|------|-------|------|------|-------|------|--------|
| 4000 MECHANICS OF VEHICLES, FACILITIES | | | | | | | | | | | | |
| 4100 HYDRODYNAMICS | 7076 | 599 | 718 | 0 | 327 | 97 | 0 | 0 | 0 | 0 | 259 | 9076 |
| 4200 AERODYNAMICS | 42776 | 587 | 42791 | 0 | 1316 | 1293 | 0 | 0 | 0 | 0 | 34 | 88797 |
| 4300 ACOUSTICS | 37404 | 2196 | 4425 | 662 | 215 | 399 | 0 | 50 | 528 | 0 | 565 | 46444 |
| 4400 STRUCTURAL PERFORMANCE | 96959 | 2463 | 13944 | 2344 | 4085 | 2273 | 0 | 200 | 29 | 291 | 23 | 122611 |
| 4500 CONTROL | 25009 | 6931 | 17488 | 1580 | 1896 | 1170 | 0 | 200 | 0 | 240 | 0 | 54514 |
| 4600 MEASUREMENTS | 21822 | 3108 | 7683 | 781 | 1602 | 1176 | 0 | 149 | 0 | 0 | 57 | 36378 |
| 5000 ENERGY CONSERVATION AND USE | | | | | | | | | | | | |
| 5100 TRANSPORT SCIENCES | 78973 | 28045 | 62176 | 16092 | 6033 | 447 | 743 | 1257 | 0 | 1509 | 0 | 195275 |
| 5200 PROPULSION/COMBUSTION | 80495 | 32051 | 30995 | 2260 | 4992 | 1734 | 2832 | 50 | 0 | 550 | 30 | 155986 |
| 5300 LARGE SCALE USES | 15597 | 82781 | 4493 | 3157 | 4321 | 396 | 360 | 474 | 0 | 607 | 291 | 112477 |
| 5400 ELECTRIC POWER | 56049 | 24605 | 17403 | 5557 | 7232 | 100 | 687 | 0 | 0 | 867 | 0 | 112500 |
| 6000 ENVIRONMENT AND NATURAL RESOURCES | | | | | | | | | | | | |
| 6100 OCEAN SCIENCE | 8134 | 2393 | 2302 | 0 | 1850 | 50 | 0 | 0 | 0 | 0 | 2128 | 16857 |
| 6200 ATMOSPHERIC SCIENCE | 63914 | 32281 | 37353 | 27839 | 12022 | 3138 | 11113 | 98 | 0 | 2326 | 3002 | 193086 |
| 6300 WATER MANAGEMENT | 13868 | 2786 | 10911 | 1813 | 5118 | 899 | 4747 | 288 | 0 | 2619 | 236 | 43285 |
| 6400 EARTH SCIENCES | 13204 | 15093 | 1839 | 0 | 7046 | 397 | 420 | 438 | 0 | 1694 | 225 | 40356 |
| 6500 ENVIRONMENT PROTECTION | 18999 | 9784 | 1810 | 269 | 3860 | 886 | 11926 | 478 | 0 | 544 | 0 | 48556 |
| 7000 LIFE SCIENCES | | | | | | | | | | | | |
| 7100 MEDICAL INSTRUMENTATION | 18023 | 5698 | 8482 | 223082 | 4096 | 1252 | 0 | 100 | 9375 | 830 | 30 | 270968 |
| 7200 BIOTECHNOLOGY/MICROBIOLOGY | 20297 | 13526 | 3523 | 258553 | 14926 | 348 | 1072 | 50 | 347 | 7451 | 154 | 320247 |
| 7300 BEHAVIORAL SCIENCES | 44045 | 0 | 7374 | 62458 | 3978 | 3569 | 0 | 200 | 7782 | 2595 | 0 | 132001 |
| 7400 PHYSIOLOGY AND MISC. | 6494 | 3396 | 9095 | 36737 | 10601 | 790 | 324 | 0 | 90 | 23866 | 1485 | 92878 |

*multiple technology areas assigned to awards

EXHIBIT EIGHT

DISTRIBUTION OF FISCAL 1983-92 PHASE I AND II AWARDS AMONG TECHNOLOGY AREAS

(multiple technology areas assigned to awards)





During fiscal 1992, the Office of Innovation, Research and Technology undertook a number of activities to assist and support congressional consideration to reauthorize the SBIR Program. On October 28, 1992, Public Law 102-564 did reauthorize, widen and modify the program. The reauthorization provided that the SBIR Program remain in effect until October 1, 2000.

The reauthorization mandated a number of significant changes in the program:

- Expenditures by participating federal agencies, which always were based on a percentage of annual agency extramural R&D budgets, were incrementally increased from the previous maximum of 1.25 percent, to 1.5 percent in fiscal 1993 and 1994, 2 percent in fiscal 1995 and 1996 and 2.5 percent thereafter.
- The maximum amount of Phase I awards was increased from \$50,000 to \$100,000 and the maximum for Phase II awards was increased from \$500,000 to \$750,000.
- Data rights for participating firms were protected for four years following completion of Phase II activities.
- Continued use of government equipment by participating firms was encouraged to extend two years following Phase II completion.
- Participating federal agencies were encouraged to enter into non-SBIR follow-on funding with participating small businesses after Phase II completion.
- Participating agencies were urged to direct SBIR awards to firms engaged in critical technologies.
- Provisions were included in the reauthorization to provide technical assistance to program awardees.

Authorization of the Small Business Technology Transfer Pilot Program
Public Law 102-564 also authorized a new program, the Small Business Technology Transfer (STTR) Pilot Program. This program has parallels to the SBIR Program and is designed to take advantage of SBIR Program results and successes.

Major provisions of the STTR Program include:

- Only small businesses conducting joint R&D with qualified research institutions are eligible.
- Federal agencies with annual extramural R&D budgets exceeding \$1 billion were authorized to take part in STTR. These agencies were authorized to spend not less than 0.05 percent of their annual extramural R&D budgets on STTR awards in fiscal 1994, 0.10 percent in fiscal 1995 and 0.15 percent in fiscal 1996.
- STTR participants are eligible to receive a one-year Phase I award of up to \$100,000 and a two-year Phase II award of up to \$500,000.
- Participating small firms must undertake at least 40 percent of the award work themselves. The involved research institutions must perform at least 30 percent of the work.

General Information

Administrative efforts were begun in fiscal 1992 to minimize operating expenses and to increase program efficiency. Those efforts will continue in fiscal 1993. Newer and more sophisticated data processing procedures have enabled the Office of Innovation, Research and Technology to reduce program contracts and to reduce operating expenses. Some contracts and expenses have already been eliminated. Operational changes will reduce award processing and analytical procedures.

National SBIR Conferences

SBIR Conferences sponsored by the Department of Defense and the National Science Foundation were held in San Diego, Detroit and Atlanta during fiscal 1992, and were very successful. Attendances were at



record levels. Three such conferences are scheduled in fiscal 1993. The locations will be Washington, D. C., Phoenix and Minneapolis.

Goaling Program

Repeated attempts to acquire and report fiscal 1992 procurement activity at NASA and the Department of Treasury were unsuccessful.

Tenth Anniversary of the SBIR Program

The Office of Innovation, Research and Technology is proud to report the completion of 10 successful and mutually rewarding years of the SBIR Program, which was originally seen as an opportunity for small businesses to demonstrate their competence and entrepreneurial potential and spirit.

In fact, the SBIR Program has exceeded early expectations. Awards in the first year of operation totaled \$44.5 million; the 10-year total now shows a total funding of almost \$3.3 billion. Studies by the Small Business Administration and General Accounting Office indicate that successful commercialization of proposals originating with Phase I awards and then continuing in Phase II awards exceeds 25 percent after conclusions of Phase II progress.

In the 10 years, almost 25,000 awards have been made, more than fulfilling the expectations of SBIR Program managers and the expectations of small businesses. The SBIR Program also has exceeded expectations in meeting federal research and development goals and needs.

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