coordinator links firms to incubator facilities and universities, provides technical assistance and business planning assistance, offers the assistance of a consultant in Washington to help target the proposals, and provides a number of services including workshops, newsletters and networking opportunities. Of the 75 companies that have been funded by the program, 74 are still in business and 25 of these didn't even exist the year before.

The program provides up to $40,000 for a total of $455,000 per year. Six companies have completed Phase II and have gone on to obtain Phase III financing. As of December 31, 1989, New Jersey assisted 200 projects leveraging more than $27.9 million in private funds through $2.1 million in state appropriations. The state's total SBIR awards increased from $1 million in 1985 to $12.9 million in 1989. The program director argues that it was an improved entrepreneurial climate in New Jersey that contributed to this success and that the state SBIR grants provided the bait that began to change this.

New Mexico has proposed an ambitious new program which would link the SBIR program more closely to Phase III. In a position similar to that of Maryland, New Mexico receives a healthy amount of SBIR awards. Unfortunately, the state is not realizing the commercial spin-off that is more valuable. Its proposed program would provide small proposal development grants (for a total of $100,000 per year) to encourage the firms that do not participate in the program to get involved. The state also plans to teach the local small business development centers about the program so it can encourage and assist new firms in utilizing the program. Finally, the state plans to offer pre-Phase III funding grants of up to $150,000 for a total state investment of $650,000 per year.

New Mexico technology development officials believe that SBIR awards will, in the future, depend more strongly on the ability of firms to commercialize their products. The grants would help the firms to leverage additional funds and develop an appropriate financial package. On a related note, the state is working with the federal laboratories in the state to re-orient their technology transfer programs and to identify new technology assessment areas for inclusion in the SBIR guidelines.

New York's matching grant program, the first in the country, aims to increase the number of federal awards to New York companies, leveraging significant federal R&D funds into the state's economy, and providing vital seed capital to over 130 high tech companies. Moving in the rank from 9th to 5th, New York estimates that its matching grant program, which automatically provides grants of up to $50,000 for a total of approximately $2 million per year to all Phase I completed projects, has kept approximately 25 percent of the firms alive. Additionally, the quality of proposal has improved: 60 percent of Phase I projects are awarded Phase II assistance.

In 1987-88, New York reported that sales among SBIR firms increased 200 percent, while employment increased by more than 10 percent. Among 70 projects, the following results have been estimated: 12 patent applications, seven joint venture or licensing arrangements, and a few initial sales of SBIR-related products. During 1987-88, three companies relocated to New York to take advantage of its program: one from California and two from the Washington, D.C. metropolitan area. In a previous year, New York reported that one firm relocated from Maryland.

According to one representative, the program is most effective in assisting the smallest firms of one to 12 employees. No matching funds or return on investment are required. As of December 31, 1988, the state spent $3.6 million and undertook 246 projects. New York recorded a 75 percent increase in SBIR awards after the first year of the program.

Ohio used to be tied for fourth place in the SBIR ranking but fell to 11th and believes that part of its fall was due to the development of SBIR programs in other states, namely New York. Home to the nation's third highest number of industrial researchers, Ohio receives less than four percent of SBIR funding. As a result, the state has developed a program which provides technical assistance grants to regional intermediaries to help market the program and provide assistance designed to increase both the number and quality of proposals. Additionally, a bridge grant program targeting $1 million in grants of up to $45,000 just passed the legislature and is expected to make its first award in July.

Oklahoma provides grants of up to $3,000 (representing no more than 50 percent of the cost) to be used towards preparing an SBIR application. Since its inception in 1988, the program has dispensed $161,131 for 79 proposals. The program has resulted in the formation of some new companies and a slight increase in the number of awards received.

Wisconsin provides bridge grants of up to $10,000 on a quarterly basis during the period in which the firm is waiting to hear about its Phase II award: Should the research result in a product or process that generates revenue for the firm, the state expects the grant to be paid back. Only two awards have been made, so far. Through its program, Wisconsin hopes to accomplish two things: 1) to encourage the private sector to undertake more research and development, and 2) to encourage firms to build ties with research institutions and universities in the state.

It is important to note that not all SBIR recipients are destined for entrepreneurship and, therefore, those state programs that seem to have the most impact require applicants to submit business plans or get plugged into the small business development network. Unless the goal of the state is to simply encourage more research (without the push for commercialization) automatic matching grant programs provide little incentive for commercialization. Bridge grant programs are most successful to the extent that they can provide a quick turnaround to financing (at least quarterly). Phase III financing will probably be most useful in the near future. Finally, the networking that occurs in the process of formalizing an SBIR program is critical to an emerging firm and its value should not be underestimated.

Maryland's Role

Currently, Maryland has no program specifically designed to either capitalize on its strength or overcome its weaknesses in the SBIR program. As with Massachusetts and California, the state has adopted the position that since its firms seem to do so well in competing for and receiving SBIR grants in raw numbers, it would do best to leave well enough alone. Such a policy is shortsighted for several reasons. To begin with, as noted above, other states are making a vigorous effort to get an increased share of SBIR grants. Since the pie is static, an increase in some states must mean a decrease in others. Maryland's inaction today could lead to a decline in the future.

Second, the SBIR firms in Maryland need assistance in order to remain competitive. Already, for Maryland firms, the conversion rate between Phases I and II is below the national average. While Maryland firms are receiving an above average number of Phase I SBIR awards, the majority of them are awarded to R&D firms (known professionally as "Beltway Bandits"), who have become skilled at applying for Phase I grants. Maryland firms receive a lower than average number of the more important Phase II awards. Additionally, the SBIR program is becoming more competitive, especially in the technology areas where Maryland has had an advantage. Clearly, Maryland firms need help in developing projects and/or proposals that meet the higher national standards. Any state effort designed to help companies overcome these and other obstacles to SBIR funding could potentially improve Maryland's competitive position and help to retain critical R&D dollars.

As federal dollars tighten and states are forced to develop more creative alternatives for improving their economies, they must look at their strengths and develop strategies that build upon them. Clearly, the SBIR program and the firms that so successfully compete for it represent just one strength that is readily available that Maryland can build upon.

Most importantly, the SBIR process is a very effective screen to surface ideas that can be commercialized and select those with promise. Maryland is being given, free of charge, the names of prospects plus funds to help those prospects prosper. It is hard to imagine a more fruitful opportunity for successful intervention by the state to increase the chances of these firms for success. As federal dollars tighten and states are forced to develop more creative alternatives for improving their economies, they have been forced to look at their strengths and develop strategies that build upon them. Clearly, the SBIR program and the firms that so successfully compete for it represent just one strength that Maryland has readily available.

And while Maryland can count among its strengths a proximity to federal research institutions and strong university research facilities, arguably, among its weaknesses are an underdeveloped entrepreneurial infrastructure and climate. With the exception of Montgomery County, which depends heavily on the entrepreneurial infrastructure and climate in the Washington, D.C. metropolitan area, many local economies in Maryland see a smaller concentration of research dollars resulting in few manufacturable products. And so while the SBIR program brings into the state a healthy amount of R&D capital, the region is not finding the amount of commercialization that would be expected.

While few can argue against the merits of a strong research base, many economic development officials would suggest that research dollars alone do little to contribute to the long-term economic vitality of a region. Indeed, some might argue that the reliance on federally-sponsored research can be a detriment to the long-term vitality of an economy if, in fact, that one critical source of revenue should one day dry up. Regardless, the benefit to the state arrives when the results of research are spun off into products that are manufacturable or processes that result in sales. While research, whether federally or industrially

sponsored, is a critical step in the process, it alone is not enough. Efforts must be made to improve the process that moves research results into manufacturable products or processes which create jobs, pay taxes, diversify the local economy and contribute to the entrepreneurial climate.

Maryland and its regional organizations have taken action to remedy this situation by designing programs that range from improving the linkage with higher education institutions to enhancing the capital available to small firms. Unfortunately, as the state has embarked on its effort to improve the entrepreneurial climate, it has neglected one very valuable resource: the SBIR program.

Many states across the country have not been so neglectful; they have used the SBIR program to help meet their dual goals of creating an entrepreneurial climate and helping businesses to succeed. Indeed, most of the state SBIR coordinators do not view an increase in awards as an end in itself, but instead as a means to accomplish a different goal or a measure of their state's success in encouraging firms to innovate. Specifically, each state SBIR program is designed to minimize a weakness, bridge a gap, or capitalize on a strength that is inherent within the state.

In Wisconsin, for example, the goal is to encourage more research dollars linked to the universities and, therefore, its program encourages firms to join universities in developing SBIR proposals. In New York, the goal is to induce firms to develop their capacity for R&D. For that reason, New York designed a matching grant program as an incentive for firms to submit proposals to the federal government. In Ohio, the goal is to encourage its vast resource of industrial researchers to leverage the federal dollars available through the SBIR program. By promoting the program through the regional technology centers and providing bridge grants, Ohio hopes to accomplish this. In New Jersey, the goal is to improve the commercialization of Phase II research efforts. Therefore, it uses the SBIR program to provide bridge grants which are tied to business assistance programs.

Maryland could benefit from a similar effort designed to use the SBIR program to enhance its economic development strategy and, in the process, learn more about the gaps facing the businesses participating in the program. In the short term, Maryland could provide technical assistance to SBIR firms or provide a network of SBIR awardees to encourage joint ventures and strategic alliances within the state. In the long term, the state could provide bridge grants to help firms survive through the critical Phase II process or assist grantees in obtaining phase III funding. While the solutions are varied, the first step would require an evaluation or assessment of the program to identify the state's strengths and weaknesses in the program and to determine whether or not further action should be taken.

Conclusion

In summary, today's innovators will fuel tomorrow's economy. Small businesses are recognized as playing a critical role in the economy by creating new jobs and developing the entrepreneurial infrastructure necessary to foster innovation. The SBIR program has played an important part in this process among small technology-oriented firms. In fact, many high tech entities use the SBIR program as de facto seed capital to fund new projects and often new firms. Recognizing the value of the program in helping to create a climate for entrepreneurship, many states have initiated strategies designed to leverage or complement the program. While each state program varies, most incorporate strategies designed to bring more research dollars to the state or link research efforts to business development strategies. Evidence indicates that most states that have developed an SBIR program have measured improvement.

Findings

A brief examination of Maryland's participation in the SBIR program finds the following:

- Maryland's performance in the SBIR program through the years has sometimes been better than the national average and sometimes worse. For example, in the national rankings, Maryland has gone from fifth place to fourth and then to fifth and finally to third where it has stayed for the past two years. In 1988, the state received a higher than average increase in SBIR funding but also a higher than average decrease in the number of awards.

- No formal mechanisms exist within the state to either maintain, increase or leverage the significant annual federal SBIR investment of $27 million.

- A regional disparity exists within the state with 70 percent of SBIR funds located in Montgomery and Prince George's counties.

- While Maryland received the third highest amount of SBIR awards in the country in 1988, its conversion rate between Phases I and II during the first four years of the program was poorer than average. As a result, Maryland has a larger than average number of firms whose Phase II proposals are declined. Additionally, it has a larger than average number of firms ("Beltway Bandits") that only compete for the smaller (and less commercially significant) Phase I awards.

- Maryland's award rate, while slightly better than the nation as a whole, has been steadily slipping since its all-time high in 1985. While the national award rate has also been slipping, Maryland's has been slipping at a faster rate. The differential between Maryland and the nation decreased to 2.1 percent in 1988.

- Maryland has consistently increased its SBIR funding, though at a rate lower than the national average (except for a dramatic increase in 1988.) For example, in 1987, while SBIR funding for the nation as a whole increased 17.66 percent, for Maryland the increase was only 8.49 percent.

Conclusion

- A higher than average number of Maryland SBIR awards come from HHS, indicating a stronger than average biotech presence. However, all other areas of technological concentration were lower than average.

- The two most significant sources of SBIR dollars for Maryland firms are DOD and HHS, the two agencies most likely to face increased competition in the coming years.

- Increased competition has led to a favored status for proposals that contain a commitment for Phase III financing.

- A better than average participation among Maryland's minority firms may offer a competitive advantage in the stiffer competition for funding.

- Of the estimated 797 private technology companies in Maryland, 90 percent have under 500 employees, qualifying for SBIR, yet only 12.9 percent receive funding.

- The typical SBIR firm is small, growing, financially constrained, and at its earliest and most vulnerable stage of growth—precisely the type of firm that needs the most financial and technical assistance and provides the most opportunity.

- 84 percent of SBIR firms indicate that commercialization is likely, and among HHS awardees the number is greater. Maryland could be in an ideal position to capture the benefits of this commercialization as it occurs over the next few years if it improves linkages to the entrepreneurial infrastructure.

- Licensing is considered a significant choice for commercialization among SBIR firms. This puts Maryland at a disadvantage, because it has fewer headquarters of large technology-oriented firms that would buy and produce the technology. Unless Maryland helps firms to develop and produce their innovations locally, or to develop joint ventures with Maryland firms, potential jobs and revenues will be exported along with the ideas developed here.

- A large number of firms that received funding in the first years of the SBIR program are beginning to reach the critical Phase III phase that will require them to seek outside sources of funding in order to succeed.

- Historically, while Maryland universities have been more successful in developing their R&D base, they have a strikingly weak record of patents, commercialization, and new company spin-offs. One of Maryland's biggest challenges is the commercialization of research and building an entrepreneurial culture, precisely those elements critical to the long-term success of SBIR firms.

Merits of State SBIR Programs

While the jury is still out on the full impact of SBIR on firms and technology transfer, many states are willing to take a risk on investing in the program based on the following merits:

- SBIR helps states to meet the dual goals of creating a climate for entrepreneurship and assisting businesses to succeed.
- The SBIR program can be tied to other state efforts that also encourage innovation and technology transfer.
- By piggy-backing on the pre-screened SBIR projects, the state limits its risks and stretches its resources.
- The SBIR program can provide an opportunity to monitor and evaluate the state's small technology businesses.
- Time is a precious commodity in the R&D business, and the SBIR program is a fast and efficient way to reduce the otherwise time-consuming efforts often imposed in other financing programs.
- The research conducted by SBIR firms is of higher than average quality and, therefore, the program serves to reward excellence.
- The SBIR program provides a critical source of R&D not otherwise available to small, technology-oriented firms.

Recommendations

Unfortunately, Maryland has been delinquent in assessing its SBIR program and incorporating it into the broader economic development agenda of the state. Arguably, although it has been working to improve it, Maryland lacks the entrepreneurial climate that naturally encourages its talented researchers, scientists and engineers to turn their innovations into economic development opportunities. Additionally, the state prides itself on its strong research base. Beyond small business assistance, the state could take steps to further increase the level of research dollars, or at least ensure that the current level is sustained. A strong, world-class research base is an important element in the state's strategy to market itself internationally. If the state is unsuccessful at commercializing its research, at least it should ensure that a certain level will be maintained. For maximum impact, a Maryland-sponsored SBIR program should undertake the following:

Conclusion

- **Improve the approval rate for Phase II proposals.**

  This can be accomplished by focusing on improving applications, assisting businesses on a case by case basis, helping to reduce the delay between Phases I and II, assisting firms with business planning, and helping firms to secure Phase III financing.

- **Increase the commercialization of Phase II projects.**

  This can be accomplished through intensive technical assistance and aggressive bridge and/or Phase III financing programs that are tied to requirements that the firm develop a business plan, undertake patent research, investigate manufacturing and/or marketing alternatives, search for joint venture opportunities, attend seminars, talk with venture capitalists and, in general, develop the commercialization potential of their project. Commercialization should concentrate on growing firms in Maryland, either through joint venture arrangements (ideally with Maryland firms), contract arrangements or new business enterprises.

- **Maintain the current level of SBIR investment in the state.**

  This can be accomplished through a significant marketing and coordination program in addition to technical assistance for proposal writing. A designated state SBIR office and individual would assist in this effort and interface with the federal government to ensure that the program is funded beyond 1992.

- **Increase the current level of SBIR investment in the state.**

  This can be accomplished by identifying firms to target new SBIR growth areas, providing financial incentives for firms to apply, and coordinating more closely with regional technology centers and universities.

- **Improve the regional disparity in the state.**

  This can be accomplished by coordinating the SBIR program with the regional technology centers and providing financial incentives.

Next Steps

Clearly, the SBIR program has benefited Maryland through the years by increasing the amount of R&D money for small firms. However, as the SBIR program becomes more competitive, it would be important to understand just what impact the program has on Maryland's economy and the small firms that utilize it. Additionally, as the state begins to refine its high technology strategy, it would be useful to determine how the program can complement and/or supplement Maryland's economic development strategies. The two states that precede Maryland in the state ranking have already begun to investigate the possibilities of developing programs to build upon their advantage in the SBIR program. If the first rule of thumb in economic development is to build on your assets, the time has come for Maryland to assess the value the SBIR program and develop a strategy that builds on its strength in it.

1. Survey the firms receiving SBIR awards in Maryland to identify the obstacles facing them.

The small firms receiving SBIR grants are an important resource to the state and may provide valuable insight into the entrepreneurial infrastructure now in place. By surveying the firms, the state could develop a database of SBIR grantees which may prove useful in the future. In the process, the state would learn about the obstacles facing these firms, the value of the SBIR program to their work, the opportunities associated with their research, and even more about the commercialization of SBIR research. Once these obstacles are discovered, the state would work with the firms to remove them.

2. Examine the impact of the SBIR program within Maryland.

While it is true that Maryland ranks third in the country in total SBIR awards, the value of the awards should be examined and assessed. Who benefits the most from the program and how? Who is left out and why? Who are the firms that participate in the program and in what technological areas do they concentrate? How do new or emerging companies fare? How are the research projects contributing to the local economy? Where does the program fall short of complementing the state's broader goals of creating a diversified and entrepreneurial economy? In what ways does the SBIR program contribute to other goals in the state? Given the concentration of research activities within the state, should Maryland be doing better at receiving SBIR dollars?

In the process of evaluating the impact of the program, the following questions should be addressed:

Phase I participants:

- Is the state getting the maximum amount and right mix of Phase I recipients?
- Is the state getting the maximum amount of Phase I applications (i.e. ,does it have enough businesses that qualify for SBIR funding, does everyone who qualifies for the program know about it, and does everyone who knows about it apply? Why not?)

- Is the state getting an average or better than average acceptance rate based on the number of applications it turns in (i.e., are its businesses turning in good proposals that meet the increasingly higher standards of the program)?
- Is the state getting the right mix of micro-, small-, and medium-sized small businesses to apply for and be accepted into the program (i.e. ,which type of small business in the area reaps the most benefits from this program)?
- Are there certain types of businesses that know/win more than others (i.e., biotech vs. defense related)?
- How many Phase I recipients are university-related and, therefore, qualify for MIPS?
- How do these numbers compare with other states and the national average?

Phase II participants:

- Is the state getting the right amount and mix of Phase II recipients?
- Is the Phase I failure rate average or better than average and do the Phase I failures do so for the right reasons (i.e., is there anything the state can do to help a Phase I grantee to complete its project successfully)?
- How much does lack of money have anything to do with a Phase I project failure?
- Are Phase I failures evenly distributed among business size and type?
- Of those that successfully complete Phase I, how many apply for Phase II?
- Of those that don't apply for Phase II, why not?
- How many that apply for Phase II win?
- How many Phase II grantees must wait for funding? How long? How many drop out or fall behind as a result?

Phase III participants:

- Is the state getting the right amount and mix of commercial products and processes from its SBIR phase II recipients?
- How many Phase II projects fail before completion? Why?
- Of those that successfully complete Phase II, how many have commercial products or processes?
- Of those with commercial products or processes, what happens next (i.e., are they able to get pre-seed or seed capital financing to help them with the next step or do they sell/license their product)?
- How many qualify for and obtain venture capital financing?
- How many stay in the state and how many move in order to continue or expand their business?

3. Identify Maryland's strengths and weaknesses in the SBIR program and evaluate various policy alternatives that would also complement or supplement the state's economic development strategies.

Once an assessment is made of the program's strengths and weaknesses, different policy alternatives can be evaluated and debated.

For example:

- Is the state satisfied with the geographic distribution of SBIR awards or with the size of the firms that receive the majority of the money or with the concentration of technology?
- Should other types of firms be targeted and assisted in developing proposals?
- Should the state concentrate its resources on attracting more research dollars or on transferring the technology to the workplace?

Special attention should be paid to those efforts that would complement or supplement other state strategies. Clear goals and objectives should be outlined.

4. Outline a strategy and identify programs that will accomplish the goals and objectives outlined in the policy evaluation.

Depending upon which policy alternatives are suggested for improving the state's role in the program, different routes are available to accomplish the goals set forth. Among the programs to consider are:

Marketing

- Develop literature describing the program and make it available at every event that may include potential SBIR recipients.
- Target certain groups of potential SBIR recipients that have been identified in the policy evaluation and inform them of the program.
- Hold conferences and workshops describing the program and invite key agency representatives, SBIR grantees and other critical persons to present and explain the programs. Such workshops could be targeted to different groups based on agency or technology concentration, or could be broad.
- Inform all state and local agencies and any private sector support networks that have any responsibility for entrepreneurship and high technology about the program through mailings, meetings, and presentations at conferences.
- Hire at least one full-time person to coordinate the program from the marketing and referral side. While other agencies at the state or local level may also play a role in the SBIR program, there should be at least one very visible name and number that most firms perceive as the central point of contact.
- Highlight excellence and congratulate winners through a strong press/public relations program.

Technical Assistance

- Hire a full-time, experienced person to help businesses prepare proposals or train other intermediaries to help businesses.
- Develop a referral system of consultants able to help businesses prepare proposals.
- Hold workshops on proposal development.
- Initiate a network of SBIR grantees through workshops, meetings, newsletters, conferences, etc.
- Encourage partnerships and joint ventures with academic, government, and business research entities.
- Assist with business and commercialization plan development.
- Link and refer firms to other effective federal, state, local, and private programs or support networks (i.e., incubators, venture capital, legal assistance, business development, technical assistance, etc.)
- Encourage professional services (legal, accounting, etc.) to take more interest in SBIR-type firms.
- Initiate a demonstration/pilot project taking defense-related SBIR projects, etc., and help them to identify other nondefense-related uses and resources.
- Keep a database of projects that remain uncommercialized and link them with entrepreneurs who are willing to turn them into commercializable products or processes.
- Offer internships with small growth-oriented SBIR firms to encourage a new generation of high tech entrepreneurs.

Financing

- Offer financial assistance for proposal writing.
- Identify Phase III financing and refer or assist firms in obtaining.
- Provide Phase III financing.
- Expand existing financing programs (MIPS, Challenge Grants, State Venture Fund, etc.) to include or target SBIR firms.
- Offer commitment letters for state Phase III financing so that proposals will have an advantage.
- Provide bridge grants to those firms with promising projects that may face serious obstacles in the delay between Phase I and II.

Federal Involvement

- Maintain a presence at the federal level to ensure that the SBIR program is funded past 1992.
- Join together with other states to limit the time and delay between Phase I and II.

Conclusion

The time has come for Maryland to evaluate and measure the impact of the SBIR program on its economy and to develop an action strategy. Limited fiscal capacity has forced the state to look hard at its strengths and develop ways to build on them to ensure a future diversified economy. Technology transfer is not a natural process; it requires incentives and linkages every step of the way. States across the country are contributing to this process by leveraging the innovation found in the SBIR program. Like incubators, the goal of these programs is not to create jobs now, but to create jobs later. The objectives are to help firms to survive and to lower the risks of failure. As in many economic development programs, a short-term investment may result in a long-term reward of a stable, diversified economy.

Appendix

State Grant Programs Oriented to Phase III

Beyond the grant programs specifically designated for SBIR, many states have other forms of technology oriented R&D or seed capital grant programs. Usually, these programs encourage applied research though some permit basic research. Some are linked only to university-related research (such as MIPS) and others have broader goals (such as Michigan). SBIR grantees may or may not be eligible for these programs depending on whether they meet the established criteria.

Examples of broader programs which include SBIR grantees among the list of eligible recipients are outlined below. The information comes from a June 1989 publication by the National Governors Association, State Competitive Research Grant Programs. On average, these state programs provided $3.3 million in FY88 initiating, on average, 43 projects. Together, these programs provided more than $132,847,431 to initiate over 1,500 projects in 1988.

Alabama

The Institutional Challenge Grant Program is administered through the Alabama Research Institute, and the Research Projects Grants is administered through the Department of Economic and Community Affairs. Both programs are geared to colleges and universities for basic and applied research. For the Challenge Grant program maximum grants of $150,000 are awarded; all require a 1:1 match. The Research Projects Grant program allows maximum grants of $50,000 with no match but a limited time frame. Patent rights are owned by the university. Funding for the programs comes from the interest generated by an $11.5 million trust fund. As of 1988, Alabama anticipated awarding approximately $250,000 for research project grants and $450,000 for institutional challenge grants in 1989.

Arkansas

Both the Applied Research Grant Program and the Basic Research Grant Program are administered by the Arkansas Science and Technology Authority. Both programs are geared to colleges and universities who own the patent rights. No minimum or maximum amounts are specified. The applied grant program requires a 1:1 match, while the basic program match requirement is 2:3. For the applied program, a 1988 state appropriation of $178,000 initiated seven projects. For the basic program, $238,000 state appropriation went towards six projects.

California

The California Competitive Technology Program administered through the Department of Commerce provides grants (no minimum or maximum) to technology transfer projects. There are no eligibility requirements, though a 4:1 match is required. In 1988, the program was established and appropriated $6,580,000. Another grant program, the Systemwide Biotechnology Research and Education Program is administered through the University of California. The program, initiated in 1985, requires university affiliation, though no match. Maximum awards are $400,000. As of December 31, 1988, $6,000,000 had been appropriated, initiating 30 projects all focused on biotechnology.

Connecticut

Connecticut Seed Ventures, Limited Partnership provides seed and early stage financing for high-potential technology oriented companies. Initiated in 1987, there are relatively no requirements for the program. As of December 31, 1988, $5 million was appropriated by the state and five projects were initiated. The Cooperative High Technology Research and Development Grant Program, administered through the Department of Higher Education, provides basic and applied research grants to universities. Maximum awards are $200,000; a 1:1 match is required. A 1988 state appropriation of $2 million assisted 15 projects.

Florida

The Applied Research Grants Program administered through the Florida High Technology and Industry Council provides minimum grants of $20,000 to college and university faculty. A 1:1 match is required. In 1988, $4.6 million in state money initiated 58 projects. Since its inception in 1985, as of December 31, 1988 $13.7 million initiated 135 projects.

Illinois

The Technology Commercialization Center Program provides grants and seed capital for almost every phase of technology development from basic research to implementation and operation. Maximum awards are $25,000 and all require a match of 3:2. $3 million in state appropriations in FY88 helped to initiate 170 projects. Eligibility is flexible; a return on investment in the form of a royalty is required.

Indiana

The R&D Investment Program, administered by the Indiana Corporation for Science and Technology, provides very early stage R&D support through completion of prototype. Matching funds are not required, though a return on investment in the form of royalty is. A $10 million appropriation from the state in FY88 assisted 24 projects. Eligibility is flexible.

Iowa

The Economic and R&D Grant Program is administered through the Iowa Department of Economic Development. The program provides grants of any size to colleges and universities for basic and applied research. A 1:1 match is required. In FY88, $7 million was appropriated.

Kansas

The Research Matching Grant Program, administered by the Kansas Technology Enterprise Corporation, was established in 1983 to provide grants for applied research in advanced technological fields. A 2:3 match is required on the grants, though no minimum or maximum amounts are specified. In FY88, $810,000 was appropriated, initiating 20 projects. As of 1988, $4.5 million had been appropriated.

Maine

The Technological Innovation Program, administered by the Maine Science and Technology Board, was established in 1985 to provide basic and applied research grants to colleges, universities and joint ventures. A 1:1 match is required, though no minimum or maximum amounts are specified. In FY88, $100,600 was appropriated, initiating five projects.

require a 1:1 match and a return on investment in the form of a royalty. In FY88, a $1.8 million state appropriation initiated 25 projects. Total appropriations as of December 31, 1988 (since 1984) amounted to $9.1 million, which assisted 108 projects.

New Mexico

Through its Seed Capital for Entrepreneurial Technology Development program, administered through the NM R&D Institute, New Mexico provides seed money to companies, including SBIR grantees. Maximum awards of $500,000 require no matching funds and a return on investment in the form of royalty. As of December 31, 1988, the program received $5.5 million in state appropriations and $5 million in matching funds which initiated 27 projects. The FY88 appropriation of $1.35 million initiated three projects. Also, the Institute has a Cost-Shared Applied R&D Program which provides applied research grants to colleges or universities. No minimum or maximum amount is specified, though a 1:1 match is required. FY88 appropriation of $596,570 initiated three projects. As of December 31, 1988, $1 million in state appropriations assisted 10 projects.

New York

Through its Corporation for Innovation Development program, New York provides venture capital for working capital and requires a 3:1 matching investment. Equity and long-term debt investments range from $50,000-150,000. Several CID participants have won Phase II awards. Also, through the Research and Development Grant Program administered through the New York State Science and Technology Foundation, applied research grants are awarded to universities and colleges. No minimum is specified; maximum awards are $50,000. No matching funds or return is required. In FY88, appropriation of $1 million initiated 30 projects.

North Carolina

The North Carolina Innovation Research Fund, administered through the Technological Development Authority, provides seed capital awards not exceeding $100,000. The program requires a match (1:1) and a return on investment in the form of equity, royalty and/or stock. As of December 31, 1988, the program had received total state appropriations of $2.5 million and matching funds of $8 million and initiated 50 projects. The FY88 appropriation of $1 million initiated 10 projects. Eligibility requirements are flexible. Through the Science and Engineering Development Awards Program administered by the Board of Science and Technology, basic and applied research grants are awarded to universities and colleges. Maximum grants of $45,000 require a 1:1 match. In FY88, $300,000 was appropriated, initiating 12 projects.

Ohio

Ohio's Edison Seed Development Fund provides applied research seed capital to eligible SBIR grantees. Awards of up to $300,000 require matching funds (1:1) and a return on investment in the form of royalty and license fee. Since its inception in 1983, the program has received $10.7 million in state appropriations and $15 million in matching funds which assisted 113 projects. The program, which is geared to universities and colleges, received

Maryland

The Maryland Industrial Partnerships Program, administered through the University of Maryland Engineering Research Center, was established in 1987 to provide matching funds for applied research to industry/university research partnerships. Minimum grants of $5,000 and maximum grants of $50,000 require a match and a return on the investment in the form of royalty. FY88 appropriation of $663,000 assisted 28 projects; as of 1988, $1.8 million in state funds initiated 73 projects.

Massachusetts

The Research and Development Grants program, administered by the Massachusetts Center of Excellence Corporation, provides maximum grants of $75,000 (minimum $20,000) for almost every phase of technology development from basic research to implementation and operation. Matching funds of 1:1 and a return on investment are required for these grants geared toward joint university/business ventures. FY88 appropriation of $3.34 million initiated 20 projects. As of December 31, 1988, $7.8 million in state appropriations and $13.2 million in matching funds had assisted 51 projects.

Michigan

The State Research Fund, administered through the Michigan Department of Commerce, was established in 1982 to provide applied research grants for proof of concept and pre-prototype projects. Eligibility requirements are flexible and no minimum or maximum is required. A match of 3:1 is required.

Minnesota

The Technology Research Grant Program through the Greater Minnesota Corporation supports applied research and development with an emphasis on early commercialization. Maximum grants of $200,000 (minimum $25,000) require matching funds and a return on investment in the form of royalty. The new program had not yet received state appropriation. Eligibility requirements are flexible.

Montana

The Montana R&D Financing Program, administered through the Science and Technology Alliance, provides financing for a range of technology development and commercialization uses. Maximum grants of $350,000 require matching funds (1:1) and a return on investment in the form of royalty. As of December 31, 1988, $2.2 million in state funds and $1.3 million in matching funds assisted 29 projects. Through its Seed Capital Financing Program, Montana provides awards of up to $350,000 as a source of risk capital. A 1:1 match is required, as is a return on investment. As of December 31, 1988, $720,000 in state appropriations and $1.3 million in matching funds assisted seven projects.

New Jersey

The Innovation Partnerships Grants Program, administered through the New Jersey Commission on Science and Technology, provides applied research grants and seed capital to universities and colleges. Minimum grants of $25,000 and maximum grants of $250,000

a FY88 appropriation of $2.58 million, initiating 27 projects. Additionally, Research Challenge Grants, through the Ohio Board of Regents, provide money for basic and applied research to universities based on a percentage of total R&D expenditures. There are relatively few requirements. In FY88, $11.47 million was made available.

Oklahoma

Four programs administered through the Oklahoma Center for the Advancement of Science and Technology provide grants for applied and basic research. The Applied Research Program has almost no requirements. In FY88, $910,000 was appropriated. The Centers of Excellence Program provides grants of up to $500,000 for joint academic/private ventures. Maximum awards are $500,000; a 4:1 match is required. In FY88, $4.9 million was appropriated. The Most Research Equipment Program provides challenge funding to help universities and colleges purchase state-of-the-art research equipment. Minimum awards are $10,000; all require a 1:1 match. In FY88, $294,000 went to three projects. The Oklahoma Health Research Program provides basic and applied research grants for biomedical research to any eligible organization. Maximum awards of $100,000; none require a match. In FY88, $1.9 million initiated 40 projects.

Oregon

The Applied Research Contract Fund, administered by the Oregon Resource and Technology Development Corporation ,provides awards of up to $100,000 to serve as a catalyst between laboratory research and commercial development. Matching funds are required (1:1) as is a return on investment in the form of royalty or warrant. As of December 31, 1988, $1.5 million in state appropriations and $500,000 in matching funds assisted four projects. In FY88, a $300,000 appropriation initiated two projects. Also provided is the Seed Capital Fund which provides early-stage investments in Oregon traded-sector enterprises. Maximum awards are $500,000; a return on investment is required in the form of warrants, royalties and convertible debt. In FY88, a $2.4 million appropriation initiated 10 projects.

Pennsylvania

The Small Business Seed Grants Program, administered by the Office of Technology Development, provides awards of up to $35,000 to help small businesses perform high quality applied research. No matching funds or return on investment is required. As of December 31, 1988, $4.9 million in state appropriations initiated 153 projects. $1.5 million in FY88 initiated 44 projects. The Challenge Grants for Technology Innovation Program provides matching grants to advanced technology centers which are for joint academic/private ventures. A 1:1 match is required. In FY88, $28.4 million was appropriated by the state initiating 500 projects.

Rhode Island

The Applied Research Grant Program, administered through the Rhode Island Partnership for Science & Technology, provides funds for joint academic/private applied research projects. Minimum grants of $200,000 require a match of 3:2 and a return on investment in the form of a royalty. In FY88, $125,000 was appropriated, initiating three projects.

Texas

Through the Higher Education Coordinating Board, Texas administers two programs: the Advanced Research Program and the Advanced Technology Program. Both provide grants to colleges and universities, with virtually no requirements, for basic and applied research, respectively. In FY88, the Advanced Research Program was appropriated $9.9 million and the Advanced Technology Program was appropriated $19.9 million which assisted 195 projects.

Virginia

The Research Grant Program, administered through the Center for Innovative Technology provides grants for basic and applied research to colleges and universities. A 1:1 match is required. In FY88, $6.4 million was appropriated, initiating 78 projects.

Wisconsin

The Development Fund, administered through the Wisconsin Department of Development, provides applied research grants and seed capital for joint academic/private ventures. Matching funds of 3:1 and a return on investment in the form of a royalty is required. In FY88, $2.2 million in state appropriations resulted in 15 projects.

SBIR Update
Results of the 1989 SBIR Awards

• **Number of Awards.** Maryland fell in the state SBIR ranking from third place in 1988 to fifth place in 1989. Virginia and New York surpassed Maryland. The number of awards received by Maryland firms also decreased from a total of 151 in 1988 to 146 in 1989.

• **Phase I and II ratios.** Maryland received more Phase I awards in 1989 (111) than it did in 1988 (93). However, the larger and more important Phase II awards decreased by 40% from 58 in 1988 to 35 in 1989. Again, this testifies to Maryland's poor commercialization efforts.

• **Amount of Awards.** Maryland also fell in the state ranking of dollars received from third place to fourth place, while Virginia edged ahead. SBIR brought $27 million into Maryland in 1988 and $20 million in 1989. Of the top ten states, California (1), Massachusetts (2), Virginia (3), New York (5), Texas (7), and Ohio (8) each earned more SBIR money in 1989, while Maryland (4), Pennsylvania (6), Colorado (8) and New Jersey (10) actually lost money. Maryland lost the most money with $7 million, in addition to $3 million which it would have gained had it been able to keep up with the 11% growth of the SBIR program in 1989.

• **Metropolitan Areas.** The D.C. Metro Area fell from 3rd to 4th place in 1989 in total SBIR dollars received. Actual dollars also fell from $38.2 million in 1988 to $37.6 million in 1989. Baltimore fell from 11th to 15th place reflecting the loss of $2.2 million in SBIR awards--from $6.4 million in 1988 to $4.2 million in 1989.

• **Growth Areas.** The metropolitan areas with the largest growth rates in SBIR awards are: Olympia, WA (77%); Toledo, OH (68%); Eugene, OR (59%); Norfolk, VA (50%); Champaign/Urbana, IL (44%); Syracuse, NY (43%); Waterbury, CT (42%); Pensacola, FL (41%); Cleveland, OH (36%); Phoenix, AZ (35%); and Dallas/Ft. Worth (35%).

• **Technology Areas.** Advanced materials continues to receive the most Phase I support while information processing received the most Phase II support. In total SBIR dollars, information processing continued to lead followed by optical devices/lasers and biotechnology (both of which passed last year's second place category--advanced materials.) Fifth place was medical instrumentation, followed closely by signal/image processing which jumped dramatically from 12th place.

SBIR Update

In 1990 the Abell Foundation published a report which analyzed Maryland's performance in the federal SBIR program. In 1988 (the most recent data available at the time of the study), the major findings were:

- Maryland received $27.2 million in SBIR awards for 153 projects
- This represented 9.5% of total SBIR dollars available
- Maryland ranked 3rd behind California and Massachusetts in SBIR dollars received
- Firms in Montgomery and Prince George's Counties received 70% of the state awards
- The primary source of SBIR grants for Maryland firms came from DOD (48.7%) which was lower than the national average of 53% (a difference of 5%).
- HHS provided the second largest source of dollars (33.5%), a rate higher than the national average of 19%.
- The dollars received per company was $274,652
- Phase II grants represented 79% of all SBIR dollars in Maryland compared to 73% nationally. Although the state outperformed the national average in this category during 1988, a study of the four year period concluded that Maryland's rate of converting Phase I grants to Phase II was poor.

The report concluded that Maryland firms needed assistance in obtaining the more lucrative Phase II dollars.

Follow-up

During the period between 1989 and 1992, Maryland's performance declined despite a period of modest increases in the program nationwide. In 1992, Maryland's performance was as follows:

- Maryland received $22.9 million in SBIR dollars for 182 projects.
- This represented 4.5% of the total SBIR dollars.
- Maryland ranked 5th behind California, Massachusetts, New York and Virginia.

- Firms in Montgomery and Prince George's Counties received 74% of the state SBIR dollars.
- The largest source of dollars came from HHS (34%) at a rate exceeding the national average of 19%.
- DOD represented only 32% of the dollars, compared to 48% nationally (a 16% difference), which means that Maryland firms were less successful than their counterparts in other states in obtaining SBIR dollars from DOD.
- Maryland outperformed the nation in obtaining grants from NASA and NSF, which together accounted for 23% of SBIR dollars, compared to 20% nationally.
- Phase II grants represented 21.5 % of the funding in the state compared to 26.4% nationally (a variance of 4.9%). Again, Maryland was less successful than the nation as a whole in obtaining Phase II awards.
- The dollar received per company was $269,437.

In 1993, Maryland's performance improved considerably. The total SBIR dollars increased 48% from the previous year. However, national funding also increased, by 37%. On a relative basis, Maryland's improvement was more modest. However, the following describes Maryland's status in 1993:

- Maryland received $33.9 million in SBIR awards for 225 projects.
- This represented 4.8% of total SBIR dollars.
- Maryland ranked 4th behind California, Massachusetts and New York.
- Firms in Montgomery and Prince George's Counties received 70% of the funds.
- The largest source of funding came from DOD (40%), although behind the national average of 55%.
- HHS provided the next largest source of funds (32%) at a rate higher than the national average of 18%.
- Funding from NASA and NSF lost ground in absolute numbers and in the share of total Maryland SBIR dollars (15.5%), compared to the national average at 16.5%.
- Phase II grants represented 23.5% of all SBIR dollars, an improvement from 1992 but still lower than the national average of 28.3% (a variance of 4.8%).

- The dollar per company dropped to $150,666.

State Programs

The SBIR study identified 17 states that provided direct financial assistance to SBIR applicants or winners. Primarily, the financial assistance consisted of one or more of the following:

1. Proposal preparation loans/grants
2. Matching grants/loans
3. Bridge grants/loans.

Between 1990 and 1994 nine of these programs were dropped (Connecticut, Illinois, New Mexico, New York, Ohio, Louisiana, Maine, Rhode Island, and Texas.) However, another fourteen were added. Now, 21 states offer financial assistance as indicated below:

- **Proposal preparation loans/grants**: Arizona, Kansas, Maryland, North Dakota, Oklahoma, Oregon.

- **Matching grants/loans**: Hawaii, Virginia, West Virginia

- **Bridge loans/grants**: Alabama, Arizona, Delaware, Indiana, Iowa, Kansas, Kentucky, Michigan, New Jersey, North Carolina (biotech), Oklahoma, South Dakota, Wisconsin.

- **Phase III commercialization**: Connecticut, Massachusetts

All fifty states provide some level of technical assistance or referrals to SBIR firms.

Conclusion

Overall, Maryland's performance in the SBIR program is above average. However, considering its proximity to federal labs and its rich R&D base, its performance is disappointing. On a per capita basis, Maryland ranked sixth in SBIR funding behind New Mexico, Massachusetts, Hawaii, Alabama, and Virginia.

Maryland still lags behind the nation in Phase II awards as a percentage of total SBIR dollars, a disappointment considering that Phase II awards are for larger amounts and make-up nearly three-quarters of all SBIR funds. SBIR dollars represent a significant source of free capital for emerging technology companies.

Maryland firms are particularly good at obtaining grants from HHS but fall below average in the percentage of grants received from DOD, NSF, and NASA.