



Where scientists and entrepreneurs meet to commercialize clean technologies

Memorandum on SBIR Program Successes & Limitations

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We have worked with a number of small businesses over the years that are active participants in the SBIR program, including with the Department of Energy. In that time we estimate we have spoken to well over a hundred firms who have won SBIR contracts. Included in this group is Lynntech, Inc., an R&D firm which is a strong participant in the SBIR program. We advised Lynntech for over two years on technology commercialization and partnerships with major industry players. We were the advisor to the spin-out and creation of Fideris, Inc. a venture funded spin-off company from Lynntech, Inc. in fuel cell and catalyst test & controls technology.

We have prepared a brief memo of insights from our experiences.

Strengths of the Program from an Outsider's Perspective:

SBIR Program Delivers Effective "Bang for the Buck"

SBIR Program has Facilitated the Movement of Small Business into the R&D Market

Law of Unintended Consequences

SBIR Program has Created a Facilitation of Inter-agency Funding Cooperation

SBIR Program has Fostered a Level of Collaborative Discipline

Issues with the Program from an Outsider's Perspective:

SBIR Program Suffers from Informal Structures in the Awarding Process

SBIR Program Suffers from Timing Issues with Contracts

SBIR Program Suffers from Cost vs. Benefit Incentives in Commercialization

Issues of SBIR Participant in Commercialization:

SBIR Participants Suffer from Lack of Resources for Commercialization

SBIR Firms Have Difficulty in Managing a Balance of Direct Investment, Profitability, Growth, & Capital Raising

SBIR Firms have Difficulty with Exit Issues Created by the Program

Hallmark of "Successful" SBIR Companies:

Strong SBIR Participants Tend to have Balanced Businesses

Strong SBIR Participants Tend to have Technology "Motifs"; but Diverse Applications

Strengths of the Program from an Outsider's Perspective:

SBIR Program Delivers Effective "Bang for the Buck" – Having worked with R&D groups in major companies, venture backed start-ups as well as industry cooperative groups, we have a broad perspective on the bang for the buck provided by the SBIR program. The c. \$75,000-\$100,000 Phase I and \$500,000-\$750,000 Phase II structure seems to have created a tremendous discipline in the market. We see SBIR firms running with extremely tight overheads and technology development budgets relative to the other groups. You can evaluate this by comparing the amount of capital employed, relative to the stage of a given technology, compared across venture capital funded firms, industry consortiums, and multi-nationals, and SBIR firms). In addition, the small amounts of discrete capital available through the SBIR program seem to have resulted in substantial short-term discipline, in that participants are very focused on achieving near results, and operate at a fairly high level of urgency for an R&D association.

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SBIR Program has Facilitated the Movement of Small Business into the R&D Market – The SBR program has been extremely valuable in allowing small businesses to enter into the R&D market, as a provider to multi-nationals. We believe the program has helped accelerate access to this market to small businesses, by giving them the wherewithal to develop enough internal R&D capabilities to compete with major industry players. In many cases this has allowed the US to bring new entrants into the technology export market to foreign multi-nationals. In addition, we believe this movement has helped accelerate the outsourcing of R&D from large firms to small firms.

SBIR Program has Increased Diversity of Players – The SBIR program has had a tremendous impact on the number of potential companies in the market to develop technology. We have witnessed an explosion in the number of small R&D firms under the SBIR program, in addition the diversity of firms increases every year, seemingly independent of geographical concentration in comparison to the impact of venture capital and multi-national backed R&D funding.

Law of Unintended Consequences – Because it is a highly diversified form of capital allocation compared to most other R&D funding allocation regimes, from time to time the SBIR program has the effect of creating unintended beneficial consequences in new technologies. For example, Fideris, the technology spin-off from Lynntech (see Case Study below), was a company formed and venture backed to commercialize fuel cell test & measurement technology. The Fideris technology was developed in large part under SBIRs won by Lynntech for its fuel cell stack and systems development. In this case the test & measurement technology was developed as ancillary to the primary goals of the fuel cell SBIRs that funded the development. In many cases this was because the test equipment required to complete Lynntech's SBIRs in fuel cells was not always available commercially off the shelf, and Lynntech had to develop proprietary technology itself to complete the SBIR requirements.

SBIR Program has Created a Facilitation of Inter-agency Funding Cooperation – While each proposal tends to stand alone as a technology funding source, successful SBIR participants are able to advance a broad technology platform across a series of grants for specific technologies. For example, many of the firms we see specialize in one or two major areas of technology development. They answer RFPs for specific applications or derivatives of those broad technology areas from a variety of funding agencies, for example DOE, DOD, EPA, each for different subsets of the technology area, generally over a period of years. The result is that the program has effectively created cross-agency funding cooperation to develop technology platforms, as participants string together a series of independent grants around a central technology area, and grow the platform with funding from many different program managers in multiple agencies, until the technology platform has reached the point where it is commercializable to industry.

SBIR Program has Fostered a Level of Collaborative Discipline - The program has also benefited the fostering of for-profit business collaborations with universities and accelerating the access of university funded research to commercialization. Small businesses have a much easier time integrating with university research 1) they tend to be more flexible. The nature of the “letter of support” and need for commercialization capital has also tended to force a discipline on small companies in involving large firms in their work at a fairly early stage, and by providing a going concern business base for the participant, the SBIR program has helped participants improve their negotiating position vis a vis potential partners, investors, and licensors, as it is much more likely for these companies to secure partnerships and collaborations when they do not have to ask for operating and capital as well as technology development capital. As for cost shares, it has been our experience that SBIR participants as a general rule find it very difficult to secure cost share funding, either from their own capital base, outside investors, or collaboration partners.

Issues with the Program from an Outsider's Perspective:

SBIR Program Suffers from Informal Structures in the Awarding Process – The program seems to have an internal bias in the review and award process towards participants with strong relationships with a particular program manager

or reviewer, as opposed to applicants with the newest or most advanced proposed technology. This has created a perception of “an old boys club” among possible new participants. One aspect of this is participants’ touting their “success rate” in winning contracts instead of their successes in commercialization when marketing their firm. In addition, many participants feel that the reviewers have no check on their prejudices, and often read proposals in a very casual manner. There is a strong perception among participants that some reviewers tend retreat behind their own prior assumptions and biases in the evaluation process, as opposed to looking for new ideas.

SBIR Program Suffers from Timing Issues with Contracts – The time lags in winning contracts and subsequently receiving the funding is a real concern. There is a perception among potential applicants that the process is often too long to easily accelerate a new technology development. Keep in mind that companies effectively have to build this cost of capital, and the cost of administration of the contracts, into their overhead structures, so the funding agency at the end of the day pays for it. The process needs to be streamlined if at all possible to maximize the impact on small businesses and minimize the transaction costs.

SBIR Program Suffers from Cost vs. Benefit Incentives in Commercialization – One incentive of the current structure, especially among firms with a strong track record of winning grants within specific program, is to focus on winning new SBIRs instead of putting resources into commercialization. It almost creates a disincentive to make the technology work and commercialize it, as given their level of internal resources, the participant may view the task of securing capital, finding partners developing products, and marketing them, to be more daunting than trying to win another SBIR for another technology (see Resources for Commercialization below).

Possible policy implementations could include 1) more detailed disclosure or even publication of reasons for rejection and acceptance of awards; 2) process for customer satisfaction rating of reviewers by applicants, and 3) reducing the administrative burden on both the applicants and funding agencies add more simplicity, stability, standardization in contract awards, review, timing, and process.

Issues of SBIR Participant in Commercialization:

Below we detail some of the key commercialization issues facing the many SBIR participants, as well as thoughts on policy or resource areas the funding agencies or policymakers might be able to address to improve the level of commercialization seen from technically successful funded technologies.

SBIR Participants Suffer from Lack of Resources for Commercialization – SBIR companies tend to be very small, with very limited resources for technology commercialization. For example, the limitations on contract size and profit margin leave very limited resources for activities including intellectual property development, design for manufacturing, market assessment, and business development, let alone fundraising, which are key to commercialization. This situation is lessened as the participants grow in absolute size, and increase their diversification outside of the program, but is true even in the businesses which have achieved upwards of \$10-\$20 mm in revenues, and good balance. We find that most participants in the program have fewer than 2, and many have no individuals dedicated to business development or commercialization exercises. Even the larger firms tend to be very limited in the number of technologies they can actively seek to commercialize at one time.

Another key issue here is management talent. The talent and skills that enable an entrepreneur to build a successful R&D company and SBIR participant are often not the skills required to fundraise, build or manage a high growth technology products business. However, the 2 to 3 person management and operations team required to adequately develop and execute a commercialization plan are often well beyond the resources of the typical participant.

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SBIR Firms Have Difficulty in Managing a Balance of Direct Investment, Profitability, Growth, & Capital Raising – SBIR participants themselves tend to achieve a fairly low rate of direct investment to fund commercialization from what one would expect given the mature state of the technologies often developed (see also Exit Issues below). They often rely more on spin-outs to a strategic partner of venture capital firms, instead of direct investment themselves. While this strategy certainly has success, the costs and resources of spinning-out and arranging financing for a venture are quite draining on the participant. A common complaint we hear is participant executives lamenting that if they only had a small amount of capital to invest in their most promising technologies that may never see the light of day because they can't afford to fund the marketing, or product development, or business development, or fundraising. We see the core reasons for this lack of direct investment into participants as follows: 1) Low profit margins on the core R&D/SBIR business (and "long" government receivables) often preclude debt capital (exacerbated by a finance industry that views government receivables as poor collateral); 2) The more successful participants growing their R&D business are often viewed as fairly "slow" growth for the venture capital market, and without the management track record to accelerate that; 3) These participants often have a fairly diversified technology portfolio and find it difficult to accept valuations on their entire company when the venture capital or strategic investors typically want to see their capital employed in only 1 or 2 high growth products or technologies. The periodic debate about ending the SBIR program as well as limiting SBIR participation in venture capital funded companies is constant cloud over the direct investment climate as well.

One policy recommendation is to consider increasing the allowable profit margin, or add into the allowable costs commercialization items like intellectual property, design for manufacturing, market assessment, and business development. Or permit allowable costs to include a 1 year grace period on business development hires. Another recommendation is to increase support and facilitation activities for the service sectors to the R&D firms. Another recommendation could be to lengthen the term of contracts and/or provide interest /penalties on late receivables, and work to increase the credit quality of the participants.

SBIR Firms have Difficulty with Exit Issues Created by the Program – Because of the size limits on eligibility for SBIR contracts, combined with the small size of each SBIR contract, and limited profitability on each contract, founders of SBIR firms have difficulty in selling their businesses, as they tend to find few buyers with adequate capital to effect and exit who would still meet the eligibility criteria. This situation tends to be exacerbated for the firms that secure larger amounts of SBIR capital. This has a major limitation for the funding agencies in commercialization of the technologies they fund, as it limits the capital creation that flows into the R&D sector. The limitation comes from a couple of areas: 1) it limits the creation of serial entrepreneurs who sell out one business and put their own capital into the next; 2) it limits the availability of strategic investors to put their money into the SBIR companies to co-invest alongside the funding agency; 3) it limits the appetite of institutional venture capital firms.

One possible solution would be to put a grace period of 2-4 years on the size limitation for SBIR contracts following a change of control, to give the acquiror an opportunity to more slowly migrate the business away from SBIRs, or even eliminate the size requirements all together. Another option would be to put a premium in the award process on balance, e.g., a company with <50% of its revenues from the SBIR program has a higher score than one with >50%.

Hallmark of "Successful" SBIR Companies:

We have found that many of the successful SBIR participants, both in winning of awards and in commercialization, tend to have two broadly defined business disciplines running through their companies.

Strong SBIR Participants Tend to have Balanced Businesses – Most of the larger successful participants have a well-balanced business. This is typical of what one would expect in well-run businesses of any type. Balance for this concept is measured in several different ways: 1) balance in funding sources and customers, funding from a range

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many agencies, good balance in percentage of revenues from government and non-government sources, good balance in SBIR vs. non SBIR government funding; good balance in type of revenues, R&D contract, license royalty, product revenues, etc. 2) balance in technical talent, no one principal investigator with over 50% of the contract wins; 3) balance in mix of technology products/applications; 4) balance in contract size and duration.

Strong SBIR Participants Tend to have Technology “Motifs”; but Diverse Applications – The successful companies generally have one or two technology areas that they focus in to the exclusion of all others (a technology motif), for example, electrochemistry in the case of Lynntech, or high voltage RF, or permeable membranes, or deposition techniques, or surface chemistry, or optics. Despite this, the companies tend to be extremely diverse in the applications they pursue, both for funding and commercialization. In fact, many of the most successful companies are quite technology and application agnostic, and will adjust the specific areas of focus of their businesses rapidly as the market needs of the funding agencies and customers adjust, as long as they do not stray too far a field from the core technology motif.

We believe that these disciplines are two that the funding agencies should seek to promote when possible. Possible policy initiatives could include: awards weighted to historical success in the core technology area rather than the specific application or system area; weight to diversity of funding sources; weighting preference for new PIs in the award process, continued weight on prior “commercialization successes”.

Overall we would characterize the program as successful and very economic in fostering R&D growth and innovation in the US. We expect that with stable support and periodic assessment of the economic incentives the program parameters create, the program can increase the level of technology commercializations for its investment dollar.



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Authors & Contributors:

Neal M. Dikeman is founder and chairman of Cleantech.org, and was a founding partner at Jane Capital Partners LLC, a specialty advisory firm providing buy-side M&A and strategic advisory services, primarily in the information and energy-related technology sectors and with an emphasis on cross-border transactions. Jane Capital represents Macquarie Bank's Technology group in the US. Macquarie is Australia's largest investment bank, and maintains an active cross-border technology investment arm. Mr. Dikeman is the head of Jane Capital's leading energy technology practice. His recent credits at Jane Capital include advising on the fuel cell commercialization activities of Lynntech, Inc., (including the spin-off of Fideris, Inc.), the sale of @Pos to Symbol Technologies; and the management and migration of two Australian emerging technology companies to the US, one in superconductors and the other in point of sale software technology.

Mr. Dikeman's previous experience includes private equity and investment banking. Prior to co-founding Jane Capital, he served as Director, Business Development for Globalgate, a software technology holding company backed by strategic investors in the US and Asia, whose business included acquiring and commercializing ecommerce technologies. Globalgate's assets included Annuncio Software (acquired by PeopleSoft) and Yellowpages.com (recently acquired by an SBC/Bellsouth joint venture). Prior to that, Mr. Dikeman worked for Doyle & Boissiere, a private equity fund backed by Calpers, focused investing in under-performing middle market companies, and whose portfolio companies included Ocean Pacific. Mr. Dikeman began his career in investment banking in the energy & power group of BT. Alex. Brown/Bankers Trust (now Deutsche Bank), working on M&A, high yield, leveraged lending and IPOs for oil & gas firms and service & supply companies. He holds a B.A. from Texas A&M University, and has served on boards of a number of early stage technology companies. He is a speaker at numerous conference events.

William M. Salathiel, PhD, MBA is Associate Director and Energy Program Lead at Cleantech.org. He is a technical and financial expert in the energy & power sectors, with experience in oil & gas, power generation, and environmental remediation, and is well connected in the energy research & engineering community. He is currently President of Optimal Resources, a technical consulting firm providing business development, financial modeling, management consulting, and technical recruiting in energy & environmental technology for over 15 years, working with the Jane Capital team for a large portion of that time on numerous projects.

- He has provided technical consultation in numerous areas, including: high temperature materials, plastics applications, fluid behavior, and surface/colloid science. Past projects include advising developers of international power projects, assisting in M&A activities for several environmental businesses, and business planning and technical advice for numerous technology startups in the energy and environmental field.
- Dr. Salathiel was a scientist with Exxon Corp on both upstream oil & gas and chemical projects as a Research Associate with Exxon Production Research, and prior to that a Senior Research Scientist at Exxon Chemical Company. His work there included enhanced oil recovery, well completion & workover, well operations, and specialty production chemicals for oil & gas, refining, and remediation operations.

He has served as an international lecturer in Exxon schools, and has 12 US patents and numerous other publications and foreign patents to his name. Dr. Salathiel has an MBA from University of Houston and a PhD in Physical Chemistry from Rice University.



Jane Capital Advisory to Lynntech, Inc.

On its 2Q04 Spin-Out of Fideris, an emerging capital equipment provider to the Fuel Cell Industry

Lynntech, Inc. is a leading electrochemical R&D company in Texas. Founded in 1990, Lynntech is privately held, and the recipient of over 300 R&D contracts and grants totaling over \$70 million in R&D funding from every major US government research agency and numerous commercial customers. Lynntech develops technology in the areas of energy conversion and storage, environmental remediation, water disinfectants, bioengineering, materials sciences, and electronics, and holds over 150 US patents issued and pending.

In 3Q02 Lynntech hired Jane Capital Partners to advise it on commercializing technology commercialization, focusing on its fuel cell technology. Working closely with Lynntech senior management, in 4Q02 Jane Capital began preparing the strategic options for Lynntech's emerging fuel cell test technology business, a non-core asset with significant promise, at the time \$1.5 mm in revenue, and with the only patented technology in the sector. The business however, had no dedicated management or defined strategy.

Lynntech focused its efforts on retaining upside in the business, but securing adequate financing to fund growth. Jane Capital approached the process from a two-pronged approach to maximize value for Lynntech: prepare for a spin-off and arrange venture capital funding, and initiate discussions with potential strategic partners and merger candidates.

Over the course of 15 months, Jane Capital developed a business plan; arranged strategic customer meetings; recruited as CEO the founder of a leading fuel cell company, Arthur D. Little's fuel reformer spin-out, Epyx, (now Nuvera Fuel Cells); initiated discussions with merger partners; and formally took out a financing round in 3Q03. The result was a \$5.5 mm Series A Financing led by Chrysalix Energy and Braemar Energy Ventures, along with Altira Group that closed in 2Q04. Jane Capital closed the round with two of the first five investors introduced to the company. All three are leading venture capital firms in the energy technology sector. Fideris was the first spin-out and venture funded start-up from Lynntech.

Jane Capital structured the deal providing Lynntech with a minority preferred stock position pari passu with the investors.