This mini-mag is a companion to the Phase III magazine that Dawnbreaker has produced since 2008. We felt that another publication that shared information regarding the Small Business Innovation Research (SBIR) program would help those who aspire to Phase III commercialization success. As Commercialization is also a metric of success for organizations involved with technology transfer, topics of interest to universities and federal labs will also be included.

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**CURRENT SBIR SOLICITATIONS**

**NASA**
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
NASA SBIR 2018 Program Solicitation

**NASA**
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
NASA STTR 2018 Program Solicitation

**DOT**
DEPARTMENT OF TRANSPORTATION
FY18 DOT SBIR Solicitation

**NIST**
NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY
FY 2018 NIST SBIR Phase I Notice of Funding Opportunity (NOFO)
Across all agencies, successful SBIR (or STTR) proposals present top tier ideas. When proposing to mission-centric organizations such as the Department of Defense (DoD) there is another key aspect that comes into play. DoD funding categories subject to SBIR set asides are allocated among hundreds of programs and projects. A program may be developing a new command and control system, maintaining in-service turbines, or deploying robotic surgical teams to remote parts of the world. Not surprisingly, SBIR set asides that use particular program funding will be expected to improve R&D pertinent to that program. Typically, the same DoD scientists and engineers that work on program-pertinent R&D will also develop technical solicitation language and eventually select and manage external R&D projects, including SBIRs. Thus, for an SBIR proposal to be successful it will be necessary to demonstrate clear and sufficient understanding of underlying program requirements as it may pertain to the funded R&D and possibly beyond.
Program requirements are a very important part of the DoD program lifecycle management process. Requirements typically originate with current or future warfighter needs. Key stakeholders contribute to and work on these requirements and their embodiments. These include various working groups, integrated product teams, program analysts and others. Program requirements can be rather voluminous and detailed and their distribution or details may be limited due to classification and needs to know. Given these facts, how would a small business enterprise anticipating working with the DoD learn pertinent requirements? Turns out that while the DoD does naturally protect classified aspects of its work, it also provides a great deal of transparent and public reporting, as well.

When researching specific program requirements pertaining to a proposal topic contemplated by a small business enterprise, it is useful to become familiar with the requirements process in general. There is much information to be found at government sites such as at the Defense Acquisition University and private websites such as Acquisition Notes. DoD services and components also make available various strategic planning documents that outline their technological needs and requirements. For example, at various levels of detail and focus, the Department of the Navy provides such documents as the 2017 Navy Program Guide, lists of programs by acquisition command such as the 2017 SPAWAR List, Naval Science and Technology Strategy and a great many other strategic documents readily available at the Navy.mil site.

Similarly, other services make public their own documents, such as the Air Force’s Strategic Master Plan and a 2014 Technical Strategic Plan. A new long term S&T plan is being developed and the Army’s Research, Development and Engineering Command’s Strategic Plan and S&T 30 Year Plan.

The aforementioned documents make ample mention of DoD programs and projects, describing various technological desiderata of each. The same programs and projects or at least their general areas are also often referred to in SBIR and STTR topic descriptions. For example, the Navy topic N181-06 “S-Band Transmit/Receive Module for Airborne Navy Radars” explicitly states its acquisition sponsor program as (PMA 231) E-2/C-2 Airborne Tactical Data System. The Army topic A2018-003 “Optical Backbone Networks for Army Aviation” has a detailed discussion of backbone fiber optic and photonic network media, aboard in-service Army aviation platforms. While the actual specific program that has sponsored the SBIR is not mentioned explicitly, the following requirements-pertinent Q&A exchange is helpfully captured as well.

Indeed, PMs (Program Managers) and PEOs (Program Executive Offices – which aggregate PMs, e.g., US Army PEO Aviation) have their own program and project requirements. The aforementioned strategic documents present these requirements by program and at various levels of detail. To probe for more information specifically on an SBIR topic, a small business enterprise interested in the said topic may also inquire with the topic POC or FAQ venue as we just saw above.
Q1. Where can we find the hardware specifications for the current (legacy) system?

A1. The best places to find information for current systems are with the aircraft OEM’s, other defense contractors, government PM’s and PEO’s, open source literature searches (AHS Forum proceedings, AAAA magazines, etc.) and other presentations. In addition, the aircraft operator manuals will have information as well.

Another potentially very good source of information with regard to sponsor program or project can be found in public budgetary description reports. DoD program funding is partitioned by component, nature of activity and program into Program Elements (PEs). A detailed discussion of PEs is beyond the scope of this brief article. However, PE-partitioned budget descriptions (or their unclassified portions thereof) are made available by the Defense Technical Information Center (DTIC). The DTIC budget search engine is available and is an extremely valuable tool. Searching for references to the Airborne Tactical Data System (the aforementioned Navy SBIR Topic’s sponsor program) in the Navy portion of the FY2018 budget, for example, yields a number of PE budget descriptions, which contain a good discussion of tactical data links and other details. The latter may in turn provide both a useful background with regard to plans and spending in this area, and a glimpse of how the Transmit/Receive capability desired by the aforementioned Navy SBIR topic N181-06 may fit in with the broader program plans.

Understanding pertinent sponsor program requirements is essential to delivering to the DoD useful products, under SBIR/STTR funding or any other funding. Learning about program requirements is important for all performers, small businesses included. There is no question that this learning process takes a substantial effort, especially for small organizations where every set of hands (and brains) is already quite busy, with not many to spare. However, to be successful in the DoD arena pertinent program requirements must be learned. While this brief article has merely scratched the surface, its intent is to provide some initial direction.

For more information
dawnbreakerdt.com
Today, batteries are used to power a broad array of products ranging from everyday personal electronics and medical devices to commercial and military electric vehicles, unmanned systems, and aviation engines.

BCC Research reports that the global large-and-advanced battery market totaled nearly $23.7 billion in 2014 and is projected to approach $30.9 billion by 2019, registering a compound annual growth rate (CAGR) of 5.5% through 2019. The global market for lithium batteries totaled $5.9 billion in 2010. The market should reach $10.6 billion in 2015 and $13.3 billion in 2020, demonstrating a compound annual growth rate (CAGR) of 4.5% from 2015 to 2020. The global market for advanced battery and fuel cell materials reached $22.7 billion in 2016. The market should reach $32.8 billion by 2022, growing at a compound annual growth rate (CAGR) of 7.6% from 2017 to 2022. Sodium-ion batteries have sodium-ion charge carriers.

MarketsandMarkets reports that growth in the lithium-ion battery market is driven by the increase in demand for electric vehicles, strict government mandates on fuel economy, growing demand for smart devices and other consumer electronics, and development toward enhancement of lithium ion batteries. They go on to note that the lithium ion battery ecosystem covers the manufacturing of components, manufacturing and assembly of cells, module and pack manufacturing, system designing, and distribution. The key players involved in the development of lithium ion battery systems include BYD Co. Ltd. (China), LG Chem Ltd. (South Korea), Panasonic Corporation (Japan), Samsung SDI Co., Ltd. (South Korea), and BAK Group (China), among others, as well as associations such as the International Battery Association and Energy Storage Association.

In terms of the future of battery technology, Frost & Sullivan reports that the three main issues that post lithium ion batteries must address are specific energy density, safety and cost. They go on to note that, theoretically, post lithium ion batteries have at least double the specific density compared to lithium ion batteries, and in terms of safety, the post lithium ion battery should have better safety due to less reactivity of its elements. BCC Research explores the future of battery technology in its coverage of sodium-ion batteries, which have recently gained commercialization status, with the market is expected to grow at a CAGR of 23.9% from $420 million in 2017 to $1.2 billion during the forecast period of 2017 to 2022. The sodium-ion battery market is segmented on the basis of technologies, including sodium-sulfur batteries, sodium-salt batteries, sodium-ion batteries and sodium-oxygen batteries.

The Department of Energy provides extensive information on battery technology, applications and initiatives and the Air Force, Navy, and Army are all actively working in this space. In September 2017 the Army Research Laboratory (ARL) introduced a new hydrophobic polymer gel coating that makes lithium-ion batteries safer. Other recent advancements include faster charging, increased capacity, and more environmentally-friendly materials. Be on the lookout for upcoming ways to network and learn more about opportunities in battery technology. The Battery Show is coming up in September 2018, and additional events are listed here.

For more information
dawnbreaker.com/mr.php
Growing a company and maturing a technology requires more than money, more than technology expertise. Growth requires the ability of company founders to embrace the challenge of personal change. Companies are ultimately a reflection of the founder; a mirror that accentuates both the strengths and weaknesses of the individual and/or team. For new entrepreneurs I hope this article will provide insight into the challenges that lay before you. For seasoned entrepreneurs there is often comfort in knowing that others have faced the same challenges and situations.

The term transformational entrepreneur is one which I use to describe the type of founder who can continually re-evaluate the situation, change their roles, and modify their perspective as critical situations arise. It is such individuals whose companies grow, whose companies become the gazelles of the future. Companies start in different ways – out of necessity, out of frustration, out of the promise of a new opportunity. The founder typically has a great capacity for work. Numerous studies have shown that entrepreneurs often need less sleep than most, which is beneficial given
the amount of work that lay before them. Founders are driven and provide an inordinate amount of time to their work and their vision. They invest sweat equity, a euphemism for investing time without pay. Many times other family members – whether a spouse, sibling, parent, or child – will also commit their time and energy to the company. The involvement of family members is often essential to the success of the start-up, as only a limited number of people will invest their time on speculation. The first couple of years are tenuous, with the founders rarely drawing a regular salary. This situation provides plenty of challenges – but the true challenge comes when you have to stop doing business in this fashion.

What often precipitates a change is a response from your customers – this may be either an opportunistic event, or a response to the marketing that you have carefully orchestrated. With SBIR funded firms, such marketing may consist of frequent proposal writing, frequent visits to program managers, discussions with topic authors, development of capabilities statements, and conference participation.

Expanding Your Staff
In response to your marketing efforts, at some point your firm receives a big order. For various reasons it is no longer feasible for you to use the approaches of the past – i.e. consultants or part-time staff. You have to hire new, full-time personnel. You are in essence hiring the first generation of full-time employees, post founders. The people that you need to hire are experienced; they benchmark their salary and benefits expectations against what they have been earning in mature, established industries. Their motivation for joining your company is not the same as yours – they want a good 40 hour per week job with a good salary. Imagine that at this point, you and your co-founders may still not be drawing a regular salary – yet you need to provide this level of stability to the next generation of employees – to employees who have not experienced the start-up phase with you; who have not sacrificed, as you have.

Some founders can’t make this leap. They decide that the responsibility of more full-time staff is something that they are reluctant to handle. They can’t see their way clear to be financially responsible on an ongoing basis. They don’t want to worry about personnel issues. They don’t want to pay others a full-time salary when they are not yet receiving a regular salary themselves. The transformational entrepreneur by contrast, after considering the vision of the company; after considering where they are in the growth cycle; after evaluating the stage of their relationship with potential customers, takes that leap and jumps into new territory – trusting that they will be able to provide for a growing business. The challenges of expanding staff are significant.

From a compliance perspective – you have to understand more about labor laws; about the differences between at-will employment and contract. You may have to redefine and expand your pay structure, develop job descriptions, think about career paths for the new staff that you are adding to your company. Perhaps the most difficult thing to accomplish is blending the two generations of employees – the founders and the next generation. New employees bring with them a perspective related to their employment experience. They come knowing very little about your firm, but they want to contribute. If they don’t quickly see your company’s direction, they will confuse their lack of knowledge with your lack of planning and forethought.

Therefore, as you add new staff – you must have a method of sharing your vision; sharing your corporate history, and integrating new employees into the fabric of what you are doing now and how it relates to the future you are building together. Regular company meetings is one way of doing this with the goal of showing your team the relationship between what they are doing and where you are going. A personal challenge for founders is to embrace new employees, to integrate them into the plans for the future and do all that you can to avoid a “them and us” culture. Expect that there will be growing pains, that there will be conflicts, that you will make mistakes in hiring, that you will need to let some people go.

As your company grows and you become more sophisticated with finance and with understanding the issues related to contract law, there will come a time when your rates are finally at the appropriate level for growth. The founders need to again change their perspective – recognizing that they are not poor any more. Now, you have the resources to do things that were not possible in the past – purchase new equipment; move into a larger facility; upgrade the office furniture; provide your staff with critical training; and hire more support. These are things that need to be done, but often times a founder is so accustomed to doing without that it’s difficult to recognize that there have been drastic changes that sweep you up to the next level of growth.

The transformational entrepreneur... after considering the vision of the company, after considering where they are in the growth cycle; after evaluating the stage of their relationship with potential customers, takes that leap and jumps into new territory – trusting that they will be able to provide for a growing business.
Delegation

As you grow your company and add staff, many worries seem to dissipate – you no longer fret about providing for so many – you don’t have time to worry, you just do it. Although your company has grown, your organizational structure may not have evolved. You may find yourself with too many direct reports and feel that every employee is a weight that pulls on you. Even though it’s obvious that the answer lies in delegation and reorganization – this is not easily done. To make an effective transition, soul searching by key members of the team is a prerequisite.

At the core of any growing enterprise are a handful of people who give themselves over completely to making the company a success. If you are growing the company well – that core will expand over time, you will have very little turnover, and key employees will internalize the vision of the firm. Instead of being your company, it will become their company.

Although the core of dedicated people will grow, the founder is still the one that provides the time, energy and direction. You’re still the leader of the band. Therefore, in redesigning or remaking a firm to deal with the issue of growth – that core group or key individual must ask themselves what makes them happy. Would the founder be happy just managing? The answer is usually no. Will the founder be happy only if they are doing R&D? What about doing R&D part time? Will they be happier retiring? Will they need to bring in another manager? Where is the balance and what are the implications?

The senior people in an entrepreneurial firm have shared experiences; have established relationships with customers and with one another; although they may not truly appreciate what makes the company work, they have substantial corporate history to draw upon. How do you clone that expertise? How do you develop the trust and confidence in someone new? In many advanced technology firms, the learning curve is steep and it may take at least a year to train a new person. During that time you lean heavily on your senior people and the exhaustion continues to mount, for you and for them. You try to screen well; you try to train as best you can; you look for initiative; you look for those who seem to share your vision and who treat customers in the same way. Bit by bit you delegate, dropping away those aspects of your role that you have decided to relinquish. You lop off parts of what you used to do and have it become part of another person’s job – perhaps program management, perhaps proposal writing, perhaps paying the bills, perhaps certain types of R&D. You stand on the sidelines and watch. If they drop the ball – you catch it. You catch it, because it’s your baby and you care. Over time, new, strong employees will emerge and opportunities to delegate will be realized. Every time you thoroughly train a new person and put them in a managerial role, you buy yourself time…

Taking Care of Your Team

You watch your team; you look for signs that they are doing too much; you tell them to take time off; you celebrate their successes, you weep with the tragedies that befall them. You are patient with those that try and have no sympathy for those whose personal agendas would destroy the fabric of what you have built. Through all of this, there needs to be an undercurrent of letting go. Even grieving, if you wish – because you must prepare others to tend to your baby. The company cannot grow if you cling to it too tightly. Growth comes from “leaps of faith” and trust – but wise, observant and considered trust. Increases must be earned and not “awarded.” Letting go becomes easier, as the capabilities of others grow and as you continually define your role.

Taking Care of Customers

Remember, if you don’t take care of your customers, your competitors will. Now, with a stronger organization in place, with individuals who you can rely on to do the tasks you have delegated, you increasingly turn to your customers. You are on the road, visiting first with existing customers and secondarily with new ones. You are on the road again, and again…

Taking Care of Yourself

Your plate is full – you are steering the company down a path, trying to meet your obligations while maintaining quality as you expand. Still working far too many hours…. But as your company becomes more robust and is recognized as an established entity, dis-
As your rate of growth continues to escalate, as the opportunities continue to present themselves, the only way to meet the demand may be to partner with others or to seek investment to fuel growth.

Personal energy is a limited commodity. There’s only so much to give. Sometimes you will expend so much of your personal energy that you will feel like walking away from it all. In terms of the road traveled, you spent days at the outset, working exorbitant hours because you were resource-less. This was followed by years of working exorbitant hours due to growth. For although growth brings more human resources to your company, until you have enough good managers in place, the demands on your time remain high. So when you are really tired, take a break. Leave for the day, take a long week-end, go on a retreat, go on a vacation, restore yourself. When you feel like chucking it all – remember this is transient and the result of exhaustion.

Partnering

It may seem surprising that I haven’t mentioned financial challenges – the contract lost; the botched job, the technology that fails. Neither have I spoken about the challenges associated with adding new business functions such as manufacturing, marketing and sales, or with commercializing. Those challenges are significant and require the same kind of diligence by the founders. I omit those challenges from this discussion only for fear of making this article too hard to follow. But let me begin to address the latter in the following way. As your rate of growth continues to escalate, as the opportunities continue to present themselves, the only way to meet the demand may be to partner with others or to seek investment to fuel growth.

Finding a business partner has much in common with marriage. In this culture arranged marriages are rare, as is our tendency to jump into marriage after the first date. Yet finding an investor and/or partner is often approached in one of these two ways. Perhaps it’s naiveté, perhaps it’s the urgency of the moment – but rushing to the altar with a partner or investor is not the ideal way to develop a lasting relationship. Its far better to live in each other’s space for a period of time – be a subcontractor to a potential partner or have them as a subcontractor to you. Collaborate on R&D partnerships. Learn more about them from the inside before you make this profound step.

Letting Go

There are two sides to letting go, personal confidence (a pre-requisite for becoming a transformational entrepreneur) and knowing that there are others you can rely on. In order to let go, in order to be a transformational entrepreneur, you must first feel confident in your ability to carve out another future – otherwise, you will be unable to let go of this one. Like a good parent who nurtures strong, independent children who can stand on their own, your job as a transformational entrepreneur is to nurture a firm that can continue with your reduced involvement. You then have the delight of selecting your next great adventure.
According to a report prepared in 2008 by the National Academies of Science on Innovation, Diversity and the SBIR/STTR Programs, 65% of the total U.S. population consisted of women, Hispanics, African Americans, Native Americans, and people with disabilities, yet these groups constituted only 33% of science and engineering occupations.

Statistics for Native Americans and Alaska Natives

- **227K** firms owned by American Indians and Alaska Natives
- **15%** growth from 2007 – 2012
- **$398B** in annual income
- **208K** employees work at firms owned by American Indians and Alaska Natives
- **181K** of these are at small firms with fewer than 500 employees
- **150K** of these work at firms with fewer than 100 employees

Since 2008, a number of efforts have been made by the Department of Energy, the Department of Health and Human Services, the National Aeronautics and Space Administration and the National Science Foundation to address the recommendation to "focus on the pipeline of talented women and minorities to upgrade diversity performance."
In the most ideal of scenarios, the federal SBIR program would serve as a launch pad; rocketing a previously unknown small R&D firm into commercial success and national recognition, all while solving a critical government need. The product or technology would be well received and have a multitude of end users in various markets, and the company would no longer need any outside funding to thrive. This textbook, albeit rare definition of success mirrors the exact path forged by New Jersey-based Princeton Power Systems.

From working with Tesla, BMW and Nissan on the latest in electric vehicle charging, to assisting governments around the globe in bringing affordable electricity through microgrids and battery systems, Princeton Power is only just beginning to make a name for themselves. Although the company has come a long way since its Small Business Innovation Research (SBIR) days, President & Co-Founder Darren Hammell is never too busy to sit down and share his journey with other aspiring small technology firms.

“It’s hard to think back, but when we started this company, we were just a group of college kids, working out of our dorm rooms,” recalls Hammell, who began his SBIR journey with a Phase I and subsequent Phase II award from the Department of Defense.
The aim was to develop a system for future all-electric warships for NAVSEA, which would utilize compact power conversion equipment for a high conversion efficiency. The team at Princeton used AC-link power conversion technology and high-voltage silicon carbide switches that provided simplified ship design, improved ship efficiency, and improved electrical system control. The company’s first taste of success came when Northrup Grumman purchased the technology, although they continued to use these same elements throughout their future product lines.

“One of the company’s most famous microgrid projects, located on the historic Alcatraz Island, showed the world what Princeton was capable of in terms of eliminating dangerous carbon emissions and reliance on foreign fossil fuels. After all, so many islands, even in the U.S. alone could emulate the model of Alcatraz, by using solar arrays and a battery bank. Princeton was soon approached by Lockheed Martin, to build and deliver its latest generation of 100 kW grid-tied inverters to an energy storage system in Boothbay, Maine in order to avoid a costly upgrade to the system.

The energy storage project was part of a program to study the use of non-transmission alternatives to avoid this costly, but necessary upgrade in order to connect to Maine’s broader electricity grid. Absent Princeton’s technology, that electricity would have cost five times more for similar reliability benefits. Nearby in Cuttyhunk Island, off the coast of Massachusetts, Princeton Power remedied a similar situation. Too costly to connect to the mainland grid, a microgrid system was built 14 miles out to sea in order to provide electricity to the island’s 75 year-round residents. With Princeton’s system, sunlight and battery now provide over 50 percent of the island’s electricity.

“As distributed energy storage performance has improved, and costs have come down, it is becoming a viable solution to a wide variety of efficiency and reliability concerns on the electric grid,” explained Hammell. “Advanced power electronics and controls software are critical pieces of a highly-functional energy storage solution.”

There is also the emerging market of electric vehicle charging, which Princeton Power got in on long before it was trending. While charging stations several years ago were slow and somewhat sparse, today’s systems has fewer parts and can be installed on a much broader scale. Newer technology allows the car charger to charge itself, and the lithium ion batteries are bigger and more powerful than ever, enabling a full charge in just minutes. Princeton has worked with Tesla, BMW and Nissan on its charging capabilities, as well as the Department of Defense on installing stations at the Los Angeles Air Force Base. Princeton continues to work with various businesses and commercial partners to implement its EV charging technology.

“There is so much happening with electric vehicles, there are more models on the road, and we’re installing new charging stations that take just 20 minutes to fully charge a car,” says Hammell. “It’s the electrification of transportation and infrastructure and to be a part of this evolution is very exciting.”
DAWNBREAKER®, INC.

Dawnbreaker specializes in providing commercialization assistance to small advanced technology firms and their investors. Since 1990, we have worked with over 2,500 firms that have received funding from the Small Business Innovation Research (SBIR) program, the Small Business Technology Transfer (STTR) program, the Advanced Technology Program (ATP), and others. Dawnbreaker's depth is in understanding the intent, method and objectives of the SBIR and STTR programs. Having worked within large corporations and small businesses, our staff understands the perspective and financial imperatives of both and is uniquely well-prepared to assist companies in planning for and succeeding in transitioning to Phase III (Commercial phase).

MARKET RESEARCH

OVERVIEW

Good information about a market opportunity can save you revenue and countless hours that would be forever lost by pursuing weak, rather than rich opportunities. It's hard to come back from investing too much money on a hunch – if your intuition has been wrong. Market research helps you to avoid making painful mistakes. Dawnbreaker's market research team has the requisite skills and experience to make a difference to your organization's growth. With over a dozen market researchers on staff - all with advanced degrees, all with experience researching advanced technologies, and all with access to numerous subscription databases – this team adds value. The information gathered using primary and secondary sources is current, clearly referenced, and focused on specific business objectives.

VALUE

There are countless decisions that you make every day that could benefit from market research: Which company would make the best licensee? How much money do I need to invest in marketing my product to effectively compete with established players? What do my potential customers really think about this technology? How large is the opportunity for this product or component? Where are the potential sources of funding for the next round of investment? What are the barriers to entry? In providing answers to these and other questions – we use a team approach which combines the ability of our market research team with our business coaches/engineers. The result is that we effectively address your business objectives.