

Transition & Commercialization Strategy Development Guide

DARPA Small Business Programs Office

DARPA Small Business Programs Office
January 3, 2018
sbir@darpa.mil
Approved for Public Release, Distribution Unlimited

Table of Contents

1.0 Introduction to the Transition & Commercialization Support Program (TCSP)	2
What is Phase III?	2
What is the difference between Commercialization and Transition?	2
What to Expect from the Rest of this Guide	2
2.0 Transition & Commercialization Pathways	3
Pathway #1—Transition & the Government Market	3
Pathway #2—Commercial Market	4
3.0 Transition and Commercialization Strategy Development	5
Technological Need Assessment	5
Market Analysis	6
Business Readiness Planning	7
4.0 Best Practices and Summary	9
Appendix A - Transition and Commercialization Strategy Development Template	11
Appendix B - Commercial Readiness Level Scale	14
Appendix C – DoD Technology Readiness Levels	15

Introduction to the Transition & Commercialization Support Program (TCSP)

Welcome to the Defense Advanced Research Projects Agency (DARPA) SBIR/STTR program! We know that navigating your business to this point has been complicated, and that you and your team are probably focused on achieving technical success against the tasks you detailed in your proposal. However, Phase II contracts inevitably conclude, and your business must either have a product or service to sell, or find additional funding to continue development. It is never too early to start planning for the next step.

The Technology Transition and Commercialization Team (T2C Team) is contracted under DARPA's Small Business Programs Office (SBPO) to support DARPA-funded SBIR/STTR projects. We provide consulting services to program participants during their Phase II period of performance. This guide will help you with the most important technology transition and commercialization activity – coming up with a strategy. The Transition and Commercialization Strategy Development template included at Appendix A is a tool that can be used to baseline and refine the strategy.

The amount of effort you spend to create and execute your strategy is the strongest correlation with eventual business success.

What is Phase III?

The tagline of the SBIR/STTR program is “America’s Seed Fund”. Like any investor, the US Government wants to know that it is deploying its capital effectively. As a proxy for success, the government tracks how many dollars in capital SBIR/STTR companies obtain *after* they leave the program. The term “Phase III” in the [Small Business Administration \(SBA\) Policy Directive](#), often causes confusion since by definition, no dollars are coming from the SBIR/STTR Programs; and in most cases, the “Phase III” award is made by a different organization within the originating agency, or possibly a different agency altogether.

Another source of ambiguity is the connection between the technology requested by the SBIR/STTR topics, and the products and services that are eventually transitioned/commercialized. Technologies frequently require additional development, recombination with other technologies, or substantial modification before anything of value is created. Acknowledging this ambiguity, Phase III generally refers to any work that derives from, extends, or completes an effort made under prior SBIR/STTR funding agreements, as long as it is funded by sources other than the SBIR/STTR Program.

What is the difference between Commercialization and Transition?

In general, “transition” refers to selling products and services to the Government, especially when commercial markets would be inappropriate or do not exist (e.g., weapons systems). This generally includes additional R&D funding from non-SBIR/STTR Federal funding sources, particularly the military services. When these technologies are placed in the hands of warfighters, they are called “deployed” or “transitioned”. Commercialization refers to everything else, including for-profit knowledge creation, or “contracted research services”, as well as private capital investment that funds further development and joint ventures with other commercial entities.

What to Expect from the Rest of this Guide

This guide provides a transition and commercialization strategy development framework. It starts with a discussion of two different pathways for transitioning or commercializing SBIR/STTR technologies; followed by suggestions on how market, technology, and business factors enter into planning; and ends with a list of best practices gleaned by the DARPA T2C Team from SBIR/STTR awardees that participated in the TCSP, and obtained significant non-SBIR/STTR investment, (Phase III) dollars.

There are many approaches to the development of a transition and commercialization strategy, and you are encouraged to explore additional resources. Regardless of what methodology you use, both the SBA and T2C Team have found that the amount of effort you spend to create and execute your strategy is the strongest correlation with eventual business success.

Transition & Commercialization Pathways

The momentum for transition and commercialization of SBIR/STTR projects starts with a DARPA Program Manager (PM), who writes a technology topic that seeks to solve a challenging and significant national security problem. Your PM will work with you to align your approach and outputs with his or her vision. However, it is important to note that the technical deliverables detailed in the SBIR/STTR project may not directly correlate to transition and commercial opportunities. Some PMs write their topics with very specific transition opportunities in mind, and will match their topic objectives to those opportunities. Other PMs seek to create a brand-new market, or simply see a technical opportunity with no firm customer or user in mind. ***It is up to each SBIR/STTR awardee to translate the project deliverables into a product or service that may be deployed or sold successfully.***

Pathway #1—Transition & the Government Market

DARPA is not an acquisition agency, which means that it does not buy products or services for operational use; it only funds research and development. However, DARPA SBIR/STTR topics target game-changing capabilities, and are therefore widely applicable. DARPA SBIR/STTR efforts frequently transfer to a military service's Science and Technology (S&T) activity or SBIR/STTR effort as a first step in technology transition. In other cases, when technology is more mature, the first step often involves partnering with prime contractors or original equipment manufacturers (OEMs) who can integrate the technology into an existing system or product.

The DoD acquisition process is famously complex; as an example, Figure 1 illustrates the Defense Acquisition Management System's phases, and identifies where new technologies developed under SBIR/STTR funding are considered for transition. Fortunately, the Defense Department is well aware of the barriers this complexity creates for small businesses, and devotes significant resources to describing its technology needs.

In fact, DoD actively seeks new and innovative technologies from the SBIR/STTR program via the policies presented in [Interim DoD Instruction 5000.02](#):

"Program managers will establish goals for applying SBIR and STTR technologies in programs of record (i.e., large acquisition programs) and incentivize primes (i.e., large defense contractors) to meet those goals. For contracts with a value at or above \$100 million, program managers will establish goals for the transition of Phase III technologies in subcontracting plans and require primes to report the number and dollar amount of Phase III SBIR or STTR contracts.¹"

These requirements exert substantial pressure on the prime contractors to work with small businesses. Therefore, it is vital for you to understand that stakeholders will include individuals from both government and industry communities – such as program managers, lead engineers, and existing or potential prime contractors and sub-contractors. You will need to find these stakeholders and engage them early and often, both those managing existing programs, and those developing new ones.

SBIR/STTR-developed technologies may also be of interest to other Federal agencies, such as Department of Health and Human Services, Department of Homeland Security, Department of Energy; and state and local entities, such as first responders. Similar acquisition processes exist within these organizations, though each process is tailored to the agency's unique needs. Understanding these needs and engaging all stakeholders early is a key factor to success.

¹ Interim DoD Instruction 5000.02, Operation of the Defense Acquisition System, pg.48

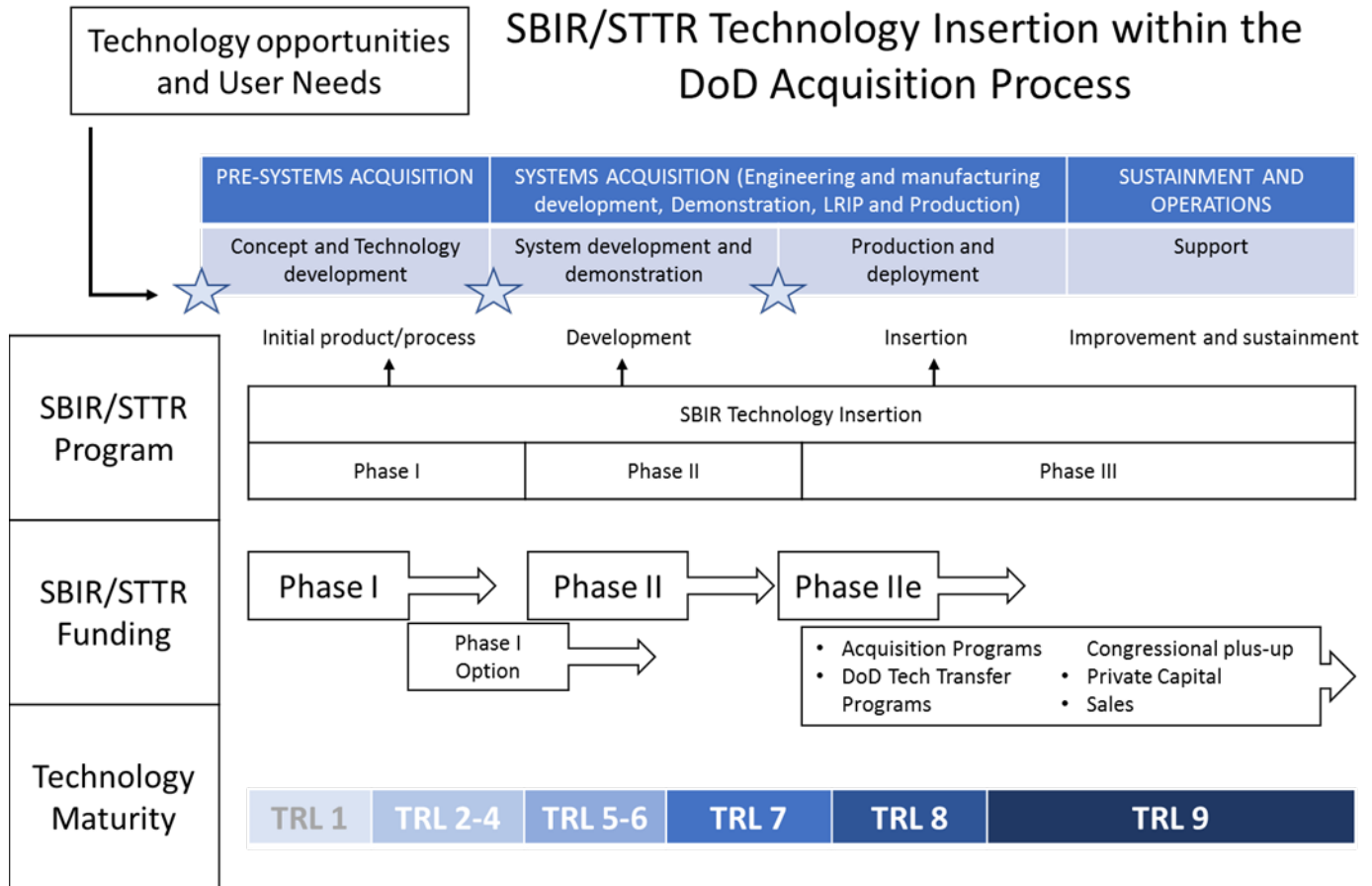


Figure 1: SBIR/STTR Technology Insertion within the DoD Acquisition Process

Pathway #2—Commercial Market

Many SBIR/STTR technologies are dual-use, or have uniquely commercial applications – although many key issues are the same. For example, an SBIR/STTR awardee still needs to identify the product to be developed, the target market, the value proposition for the user, the business model to be employed, and how to enter and reach the market, including identification and engagement of partnering and collaboration entities. All of these activities are required to create and sustain a profitable business, regardless of the targeted pathway.

However, commercially oriented business strategy and tactics are usually less specialized to a large, unique customer. Margins, price sensitivities, product and service requirements, and accounting practices can all be different in the private sector. These differences can be further exacerbated if a financing decision dilutes ownership and changes the dynamics of management and control.

A major difference can arise from the pressure in commercial markets to “get big fast”. External financing may be needed to rapidly and strategically address and/or create opportunities in the commercial market. The company must be prepared to meet the standard due diligence performed by each different source of funding. Much has been written about this process, and many organizations can provide advice on alternative financing options, to include the T2C Team.

There are many models to consider for commercializing government technologies into the private sector, with no single model being standard. As before, the most important thing is to plan and engage early, recognizing the tight interplay between your technology, business, and market.

Transition and Commercialization Strategy Development

Conducting innovative research and achieving development milestones is not enough for success. The technology must have practical applications for specific markets and customers. The business realities of product/service delivery and sustaining a profitable business must be addressed. Developing a detailed plan is instrumental to successful technology transition and commercialization.

These steps are perhaps even more necessary when targeting further R&D funding from other DoD components, such as the service S&T organizations. These organizations tend to favor well defined technology development paths that are tailored to User needs and requirements and they will place a much larger emphasis on a strong transition and commercialization plan when evaluating your proposal.

A robust plan incorporates inter-relationships between these factors:

- Technological need assessment – define product to be sold that meets a need, manage developmental progression to operational/marketable state
- Market analysis – market assessment, competition, risk assessment and mitigation
- Business readiness planning – revenue, financing and potential partners to bring technology to market

While you were working on your Phase I tasks, you should have been following the transition and commercialization strategy you outlined in your Phase I proposal. In your Phase II proposal's Commercialization Strategy section, you were asked to refine your business concept.

However, this planning is not static, but a work-in-progress that needs to be re-defined and augmented during each project's lifecycle to

Research & development must lead to practical applications for specific markets, customers and end-users.

best meet the evolving needs and requirements of the government and commercial markets. So while the plan should detail a specific set of tasks, milestones, schedule, and resources needed, it should evolve in parallel with iterations of market analysis and a comprehensive business strategy.

The following sections discuss an approach for each of these factors, and resources that could be of assistance. You should develop a customized plan that is best suited for your company's unique overall objectives and the technology under development. The DARPA T2C Team works collaboratively with each SBIR/STTR awardee to explore the project and company-specific perspectives in order to arrive at a focused plan.

Technological Need Assessment

The premise behind technological needs assessment is simple: people have problems that can be solved with technology. However, the answers – who these people are, and what their problems are, and how your technology can solve them – should be constantly reassessed. This isn't to suggest that you should undermine your own premises or become mired in "analysis paralysis", only that you regularly reexamine your conclusions about the best marketable application of your technology in order to place them on the firmest possible footing.

This reassessment is necessary because of the sensitivity of your transition/commercialization plan to new information. New information can come from anywhere, including your own research; it is very common for a strong plan to be invalidated by surprising lab results. New information can come from discussions with potential customers and stakeholders; a particular application may be infeasible due to unforeseen operational constraints of the users. And assumptions about integration requirements can be fatal; it is

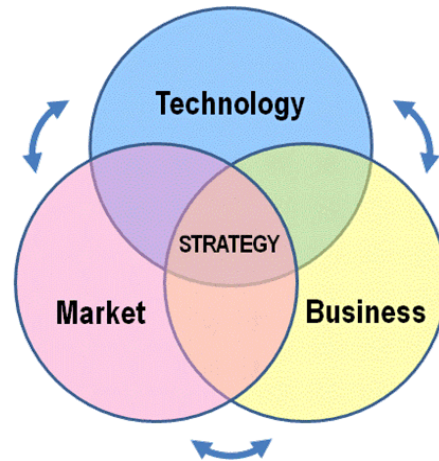


Figure 2. Elements of a Strategy

essential that you verify the technical feasibility of incorporating your technology into the user's systems and processes. You should actively seek new information, and consider contingency plans for results and hypotheses that are not yet validated. Be vigilant in increasing the maturity of the technological solution, but remain agile to unforeseen changes and opportunistic about exploring new applications.

Many of the large government primes publish their technology needs on their websites, along with contact information for their Small Business Liaison (SBL). Several also provide small business portals for companies to create corporate profiles in their databases. These are used by the primes for data mining for potential teaming opportunities. The T2C Team maintains relationships with major primes and periodically reviews the DARPA TCSP portfolio to determine interest in potential collaboration with SBIR/STTR companies. Similarly, the DoD and other Federal agencies publish research needs and technology development plans that describe current technology needs. The T2C Team works with the S&T, acquisitions, and SBIR/STTR program representatives of various government agencies to promote interest in TCSP portfolio projects based on your interests, technology relevance, and maturity.

Both government and commercial entities are interested in your technology's state of development and the timeline to operational maturity. They use this information to make planning, partnering, and investment decisions across a portfolio of technologies, and frequently use various scales to evaluate maturity with a common metric.

Technology Readiness Level (TRL) is a common metric used by DoD and other Federal agencies to measure technology maturity when making funding and/or procurement decisions. The [DoD Technology Readiness Assessment \(TRA\)](#) guidance defines Level 1 as the point when scientific research begins to be translated into application. Level 9, the highest, is when the technology in its final form is implemented in an operational environment. Non-DoD agencies use versions of the TRL terminology that can differ in minor ways.

TRL 6 is a key milestone that supports transition.

SBIR/STTR awardees engaged in software development should apply and advertise the use of proven software development processes. Government (and increasingly) commercial contracts for software often require companies to have certified software maturity models in place, such as the [Capability Maturity Model Integration \(CMMI\)](#). These reassure customers that steps have been taken to reduce risk and deliver a high quality product.

As you reduce your technological uncertainties, your marketing and business efforts should mature, and more focus should be placed on internal resources and infra-structure build-up, budget, intellectual property protection (patents, copyrights and trademarks), etc.

In general, readiness for "demonstrating a prototype in a relevant environment" is the threshold where additional funding opportunities are most likely to occur in both government and commercial markets. For government procurement, this is the TRL 6 milestone. The [DoD annual Rapid Innovation Fund \(RIF\)](#) solicitation, for example, supports maturation of TRL 5-6 technologies, targeting TRL 7-9 for exit. Similarly, the commercial market, IP licensors, and private investors are more likely to engage when a tested prototype is available. Technologies at TRL 5 or less will likely target further R&D opportunities with Federal S&T communities or commercial companies' research groups, and may be of interest to the military Commercialization Readiness programs (CRPs), as well as early-venture or angel funding for private-sector applications.

Market Analysis

A comprehensive market analysis should include a description of government and private sector customers; the commercial opportunity and its size; market trends and technology evolution trends; and the key reasons potential customers would consider procuring the technology. There are many sources of market data, from commercial reports to open-source research. The most compelling marketing data often comes from individuals with direct experience. As with technology needs assessment, market analysis should be a continuing effort, so that your plan is as robust as possible.

Reviewing current and past DoD and Federal agency announcements and funding opportunities can provide valuable insight into conducting business in the government sector, and help identify transition agencies and potential collaborators. The official databases, [Beta.SAM.gov](https://beta.sam.gov) and [Grants.gov](https://grants.gov), should be mined routinely to identify funding opportunities. The T2C Team provides an excerpted list of opportunities on a weekly basis to TCSP participants.

You may also consider pursuing contracting vehicles such as General Service Administration (GSA) schedules, which streamline the government sales process, and Indefinite Delivery/Indefinite Quantity (IDIQ) contracts, which allow any federal agency to place orders on pre-negotiated items. Obtaining these vehicles can be a long, resource-intensive process and should be considered only if the company is interested in working with the government in the long-term.

Identifying competitors, especially those that are successful in your target market, allows you to refine your differentiators and the value proposition for your technology over existing and competing approaches. If you envision selling product, it can help to use competitors' price and cost models to develop a pricing approach, and then ensure that the business strategy can support the cost estimate.

Once the potential market and competitors have been identified, develop marketing materials that are most meaningful to the intended customer. For example, cite TRL progression milestones when working with DoD, and promote credibility and solvency when working in the commercial market. For either, maintain focus on the technological benefit provided by product, the uniqueness of the solution, and the economic value proposition (i.e., cost savings or revenue enhancement). Marketing materials can be in many forms, like elevator pitches, quad charts, white papers, and brochures. Identify the individual(s) within the company with the appropriate skill sets to present this material – salespeople require both technical and business development strengths to have the best impact. Maintain a pulse on the target markets and assure your approach is up-to-date. Demonstrating awareness is an important way to win confidence.

Quality marketing materials and business development personnel are a powerful indicator of company maturity and commercial viability.

The T2C Team assists DARPA SBIR/STTR awardees in developing a quad chart and obtaining DARPA Public Release Center (PRC) approval for release of this information. This quad chart contains the technological and business interests of your company, and is used by the T2C Team with prime contractors and government agencies. The quad charts can be used in your own marketing efforts. The T2C Team frequently provides feedback on marketing materials to help maximize impact.

Business Readiness Planning

The overarching objective of the business plan is to articulate a company's strategy to generate sustainable revenue from your technology. A comprehensive business plan includes, at minimum, a description of the product(s) and/or service(s) to be delivered, how these products fit into and impact the existing market, product revenue and cost models, financing, in-house resource planning, servicing and sustainment commitments, contracting and partnering, and business risk management. Clearly, business plans are tightly interlinked with technology needs assessment and marketing research, and must be developed in parallel. You may pursue multiple business models before finding what works.

The details of the commercialization strategy depend on whether you have the capacity and capability to bring various business functions in-house (i.e., performed by employees). If you provide services, you must ensure adequate manpower. When selling products, planning will involve manufacturing requirements, sales management, customer/user support, and product enhancements. Some SBIR/STTR awardees may consider spinning out a new company to focus specifically on a product. Other companies may license IP, work with another company to manufacture the product, or work with another company to market, distribute, and support a product manufactured in-house.

The foundation of a business plan is a thorough review of your company's past and current financial performance, and the development of financial models. These typically project three to five years and

include product sales forecasting; manpower needs and key hires (especially dedicated marketing resources); operating expenses; cash flow requirements, and product pricing. Timing of costs and revenues drives funding decisions needed to best support and grow your business.

Once the projection is complete, sources of funding can be analyzed. These generally fall into two main categories:

- Government sources – DoD and other Federal, state, and local sources.
- Non-government sources – banks, internal and external investors (friends and family; angel, venture, debt and crowd funding), prime contractors, and partnerships with other companies. Contemplation of external investment should take into consideration the company's tolerance for varying levels of control.

A SBIR/STTR Phase II Option, which may be exercised at your PM's discretion at the end of the 24 month base period of performance, can provide extra funding to help bridge your company to Phase III (non-SBIR/STTR) funding.

Protection of intellectual property is critical and starts with clear understanding of the data rights provisions applicable to SBIR/STTR awards and continued the implications for Phase III. The [U.S. Patent and Trademark Office](#) website provides basic information to get started, including access to some pro bono services for provisional patent filing. Engagement of independent legal counsel is highly recommended.

There are many other resources available to small businesses in the area of business preparedness. The Small Business Administration's [Small Business Development Centers \(SBDCs\)](#) and the Defense Logistics Agency's [Procurement Technical Assistance Centers \(PTACs\)](#) and [NIST Manufacturing Extension Partnerships \(MEPs\)](#) are located throughout the U.S. and provide counseling and training services for small business owners at no or nominal costs.

Additional Requirements for Doing Business with Government

There are many unique requirements for doing business with the Government. The [Defense Acquisition Guidebook](#) will help improve understanding of the DoD acquisition process, and the statutory and regulatory requirements associated with the process. Other considerations may include:

- If the technology or product is restricted by [International Traffic in Arms Regulations \(ITAR\)](#). Study the requirements for sharing information and materials pertaining to items on the U.S. Munitions List. Failure to comply results in penalties ranging from criminal (up to \$1M per violation and up to 10 years imprisonment) to civil (including seizure of articles and any vessel, aircraft or vehicle involved in attempted delivery; revocation of exporting privileges; fines up to \$500,000 per violation; and debarment).
- Review the [export.gov](#) website for resources and training information on exporting.
- Review the [Defense Contract Audit Agency \(DCAA\)](#) website to obtain tools such as checklists, and understand the type of audits DCAA conducts and what can be expected during a DCAA audit.
- Review the DoDI 8510.01 - [Risk Management Framework \(RMF\)](#) for cybersecurity requirements for receiving, processing, storing, displaying, or transmitting DoD information.
- Review the [DoD Office of Small Business Programs \(OSBP\) Cyber Resources](#) page to obtain cybersecurity training and helpful guidance on compliance with DoD cybersecurity standards.
- Review the [Defense Security Service \(DSS\)](#) site for resources and information about personnel and facility security clearances and requirements.

These guidelines and requirements are complex, and can be onerous to small businesses. The ability to comply with these regulations gives many large defense contractors their stable market position. A key advantage to partnering and working with prime contractors is their ability to help guide you through and shield you from these requirements. However, it is important to familiarize yourself and comply with all guidelines and regulations, for your own protection.

Best Practices and Summary

- Take ownership of transition and commercialization - it is your responsibility.
- Create a detailed business plan.
- Ensure the technology has a real application, i.e., solves a customer's needs or fills a customer's capability gap (versus "nice to have" or a "great" technology).
- Maintain flexibility – keep up with the pace of technology evolution and resultant changes in government requirements; identify trends that will define future needs and expectations. Have patience and perseverance – transition and commercialization takes time. Adapt to course changes.
- Achieve balance between addressing critical needs versus attaching non-essential bells and whistles.
- Balance the right level of cost to consumer vs. functionality.
- Involve stakeholders early in the process. Meet the stakeholders if feasible. Talk with them frequently to maintain their interest and stay on their radar.
- Identify and know about potential collaborators, partners and funding sources. Understand their program needs and areas of interest. Learn how they engage with others.
- Be knowledgeable about the DARPA PM and his/her interest areas – review the biography on the DARPA website; know their SETA (Scientific and Engineering Technical Advisor) as they can be a valuable resource.
- Nurture the relationship with DARPA PM who can serve as champion, make introductions, identify cross-pollination opportunities with other DARPA programs, vet new ideas, etc.
- Maintain a wide network of contacts and sponsors.
- Develop relationships with other SBIR/STTR performers – they can be valuable sources of information, and are potential collaborators.
- Be attentive to restrictions and compliance requirements - ITAR, export control, certifications, etc.
- Learn and understand government accounting, invoicing and auditing practices.
- Protect yourself with written covenants, e.g., non-disclosure agreements, formal teaming agreements.
- Pursue opportunities that align best with company's strategic vision/plan, interests and skill sets of existing workforce.
- If a new supplier in a market looking for early adopters, develop strategic partnerships with other suppliers who can coordinate or provide related services to your targeted customers.
- Be knowledgeable about contracting mechanisms and pros/cons of each.
- Build your engagement team. Effective teams include individuals with technical, customer and operational domain experience.
- Always ask "Who has money?" – put more effort on reaching out to them.
- Develop a "call plan". Aim to connect with program managers, technical, engineering and business development staff. Reach out to your network to help connect with your "call list".
- Be timely in following up after introduction is made. Pitch your project, but also take time to listen to customer's needs and interest areas.
- Attend trade shows and conferences sponsored by government agencies or commercial entities. Prepare for these events by reviewing attendees and speakers lists to identify targeted connections to be made and research their needs, ensuring company representatives can speak to both technical and business aspects, and have a follow-up plan with contacts made. Sign up for One-on-One meetings with targeted connection point if offered.
- Attend financing (angel and venture) and licensing opportunity events.
- Attend Industry Days for solicitations of interest to connect with potential stakeholders and collaborators. If unable to attend, review Q&As and briefings posted on FedBizOpps after event.
- Use the open communication period of any solicitation to obtain insights. Ensure proposal complies with ALL solicitation instructions. Review the evaluation criteria information contained in the BAA and write to them.
- Be prepared for funding gaps as government contracting is not an agile process. You may need to narrow down target markets or programs to maximize and conserve company resources.
- Take advantage of free training (webinar and in person) offered by various organizations, such as the Small Business Administration (SBA).

Summary

Successful transition and commercialization plans are adapted to best suit each company and each project. You must be prepared to lead the effort beyond Phase II to ensure that a variety of stakeholders, advocates, funding sources and partners are working in concert to shepherd your technologies from concept to operational environment or market. Start as soon as possible to develop a comprehensive plan that captures the inter-relations between technological need, market analysis, and business readiness planning. Maintain focus, adjust and adapt.

There is no “one size fits all” approach to transition and commercialization. Planning for success is a continuous process, start early and keep refining.

Appendix A - Transition and Commercialization Strategy Development Template

Purpose

For many DARPA Programs, during award negotiations it is beneficial to negotiate transition and commercialization-related milestones in addition to the more traditional technical milestones. Of note, the end outcome of a project does not need to be the development of a transition or commercial-ready technology for there to be value in having and completing transition and commercialization milestones. In order to develop transition and commercialization milestones that are most beneficial to DARPA and the project performer, it is useful to ask project performers certain questions about their initial proposed path to technology transition and commercialization so that the business milestones may be appropriately tailored. This Transition and Commercialization Strategy Template is intended to serve as a roadmap for advancing the proposed technology toward commercial viability and aide in the development of business milestones related to technology transfer and commercialization of your DARPA funded technology.

Strategy Development Lead

It is often helpful to designate a single member of the project performer team as the Strategy Development Lead so that responsibility for coordinating and leading transition and commercialization strategy activities, and any associated milestones, for the project is clearly identified. The Strategy Development Lead should be an integral team member with intimate knowledge of the project technology and should participate in all project reviews. A lead technical PI with strong interest in the military and commercial applicability of the technology may also be an appropriate Strategy Development Lead.

Transition and Commercialization Strategy Updates

The strategy that is aligned with a technology's development should not be static; rather, it should change and adapt along with learning in the development of the technology. It is valuable to update the initial Transition and Commercialization Strategy during the course of a project. Updates to the strategy should be discussed between project performer and DARPA personnel during and along with technical updates. These updates should include key learnings from previous and concurrent transition and commercialization milestones and the impact on the project's transition and commercialization approach. This may also include a description of what is unknown and the proposed path to a better understanding of what is unknown.

Transition and Commercialization Strategy Template

Following is a list of key questions that should be considered, addressed and answers incorporated into the initial version of your Transition and Commercialization Strategy.

Provide a summary of transition and commercialization activities conducted during Phase I, and the Technology Readiness Level (TRL) achieved. Discuss how the preliminary transition and commercialization path or paths may evolve during the Phase II project. Describe key proposed milestones anticipated during Phase II such as: prototype development, laboratory and systems testing, integration, testing in operational environment, and demonstrations.

Technological Need

1. What product(s) are you building?
 - a. Is it a full product or a component?
 - b. Who needs your product?
 - c. How does the product make their lives easier/better/cheaper?
2. What products are you currently selling?
 - a. How does this new product/effort fit within the company?
3. Who would you sell it to - the end customer, a supplier or to an integrator?

- a. Why would they buy it?
 - b. How does the product make their lives easier/better/cheaper?
 - c. How do you know they need it?
 - i. Have you had discussions with the customer?
 - ii. Have you sold similar products to the customer?
 - iii. Did you come from the same industry as the customer and know there is a need?
4. Where are you in the product development process?
- a. Do you have a prototype?
 - b. How long before prototype becomes marketable?
 - c. What major technical milestones lie ahead in creating and testing the product?

Market Analysis

5. What does the market look like for the product?
- a. How many units are needed?
 - b. How much will they cost?
 - c. How much can you charge?
6. Who is your competition?
- a. How does your customer solve this problem now?
 - b. Are there other companies that make something similar or a product that serves the same need?
 - c. What makes you different from competition?
7. How will you market your product?
- a. Directly to integrators?
 - b. Directly to end customer?
 - c. Existing customers or new customers?
 - d. What kind of budget is required?
8. Who will sell your product?
- a. What kind of sales force do you need?
 - b. Is it a highly technical sale?
 - c. Will you sell in just the US or other geographies?

Business Readiness

9. Who will make the product?
- a. Do you plan to manufacture yourself?
 - b. Will someone else manufacture for you?
 - c. Will you license the technology to someone else?
 - d. What are alternative models to be considered?
10. When you are successful, how can you keep someone from copying your product?
- a. Do you have IP protection?
 - b. Do you have trade secrets?
 - c. Is there a first mover advantage?
11. What does the company look like currently
- a. How many employees?
 - b. Who are the key people and what are their backgrounds and current roles?
12. What human resources do you need to make the product? Sell the product?
- a. What people do you have?
 - b. Who do you need to hire?

13. If the product is successful, will it be profitable?
 - a. What does it cost to make?
 - b. How much can you sell it for?
 - c. How much support is required?
 - d. What does the sales cycle look like?
14. What do the company's finances look like over the next 3-5 years?
 - a. How would you obtain funding needed from government?
 - b. How would you obtain non-government external financing?

Appendix B - Commercial Readiness Level Scale

Please note that proposed technologies are not expected to be transition-ready or commercially mature at the start of the project period, nor must any specific CRL be reached by the project's end.

CRL	Description
1	Knowledge of applications, use-cases, & market constraints is limited and incidental, or has yet to be obtained at all.
2	A cursory familiarity with potential applications, markets, and existing competitive technologies/products exists. Market research is derived primarily from secondary sources. Product ideas based on the new technology may exist, but are speculative and unvalidated.
3	A more developed understanding of potential applications, technology use-cases, market requirements/constraints, and a familiarity with competitive technologies and products allows for initial consideration of the technology as product. One or more "strawman" product hypotheses are created, and may be iteratively refined based on data from further technology and market analysis. Commercialization analysis incorporates a stronger dependence on primary research and considers not only current market realities but also expected future requirements.
4	A primary product hypothesis is identified and refined through additional technology-product-market analysis and discussions with potential customers and/or users. Mapping technology/product attributes against market needs highlights a clear value proposition. A basic cost-performance model is created to support the value proposition and provide initial insight into design trade-offs. Basic competitive analysis is carried out to illustrate unique features and advantages of technology. Potential suppliers, partners, and customers are identified and mapped in an initial value-chain analysis. Any certification or regulatory requirements for product or process are identified.
5	A deep understanding of the target application and market is achieved, and the product is defined. A comprehensive cost-performance model is created to further validate the value proposition and provide a detailed understanding of product design trade-offs. Relationships are established with potential suppliers, partners, and customers, all of whom are now engaged in providing input on market requirements and product definition. A comprehensive competitive analysis is carried out. A basic financial model is built with initial projections for near- and long-term sales, costs, revenue, margins, etc.
6	Market/customer needs and how those translate to product needs are defined and documented (e.g. in market and product requirements documents). Product design optimization is carried out considering detailed market and product requirements, cost/performance trade-offs, manufacturing trade-offs, etc. Partnerships are formed with key stakeholders across the value chain (e.g. suppliers, partners, customers). All certification and regulatory requirements for the product are well understood and appropriate steps for compliance are underway. Financial models continue to be refined.
7	Product design is complete. Supply and customer agreements are in place, and all stakeholders are engaged in product/process qualifications. All necessary certifications and/or regulatory compliance for product and production operations are accommodated. Comprehensive financial models and projections have been built and validated for early stage and late stage production.
8	Customer qualifications are complete, and initial products are manufactured and sold. Commercialization readiness continues to mature to support larger scale production and sales. Assumptions are continually and iteratively validated to accommodate market dynamics.
9	Widespread deployment is achieved.

Appendix C – DoD Technology Readiness Levels²

Technology Readiness Level	Description
Basic principles observed and reported	Lowest level of technology readiness. Scientific research begins to be translated into applied research and development. Example might include paper studies of a technology's basic properties.
Technology concept and/or application formulated	Invention begins. Once basic principles are observed, practical applications can be invented. The application is speculative and there is no proof or detailed analysis to support the assumption. Examples are still limited to paper studies.
Analytical and experimental critical function and/or characteristic proof of concept	Active research and development is initiated. This includes analytical studies and laboratory studies to physically validate analytical predictions of separate elements of the technology. Examples include components that are not yet integrated or representative.
Component and/or breadboard validation in laboratory environment	Basic technological components are integrated to establish that the pieces will work together. This is relatively "low fidelity" compared to the eventual system. Examples include integration of 'ad hoc' hardware in a laboratory.
Component and/or breadboard validation in relevant environment	Fidelity of breadboard technology increases significantly. The basic technological components are integrated with reasonably realistic supporting elements so that the technology can be tested in a simulated environment. Examples include 'high fidelity' laboratory integration of components.
System/subsystem model or prototype demonstration in a relevant environment	Representative model or prototype system, which is well beyond the breadboard tested for TRL 5, is tested in a relevant environment. Represents a major step up in a technology's demonstrated readiness. Examples include testing a prototype in a high fidelity laboratory environment or in simulated operational environment.
System prototype demonstration in an operational environment	Prototype near or at planned operational system. Represents a major step up from TRL 6, requiring the demonstration of an actual system prototype in an operational environment, such as in an aircraft, vehicle or space. Examples include testing the prototype in a test bed aircraft.
Actual system completed and 'flight qualified' through test and demonstration	Technology has been proven to work in its final form and under expected conditions. In almost all cases, this TRL represents the end of true system development. Examples include developmental test and evaluation of the system in its intended weapon system to determine if it meets design specifications.
Actual system 'flight proven' through successful mission operations	Actual application of the technology in its final form and under mission conditions, such as those encountered in operational test and evaluation. In almost all cases, this is the end of the last "bug fixing" aspects of true system development. Examples include using the system under operational mission conditions.

² Department of Defense, Technology Readiness Assessment (TRA) Guidance, April 2011