

Defense Technology Small Business Advisors
A Committee of
The Small Business Technology Council
Washington, D.C.

Mining the Small Business Resource



Issues and Recommendations

Volume I - Number 4

How Can Small Business Better Support the Nation's Defense Mission?

A White Paper

January 2007

Robert-Allen Baker, Editor

Preface

Small technology firms with less than 500 employees now employ 54.8 percent of all scientists and engineers in US industrial R&D. However, these nearly 6,000 scientists and engineers are able to obtain only 4.3 percent of extramural government R&D dollars.¹ This deficit may help explain the signal failure of most major defense programs to realize advanced technology goals – a problem repeatedly documented in recent years by GAO studies, and acknowledged by DoD and even prime contractors themselves. Global competition for technology development makes this especially important for DOD. Today, both India and China graduate more scientists and engineers than does this nation.

By the summer of 2005, therefore, innovative technology entrepreneurs collaborating under the banner of the Small Business Technology Council (SBTC) decided to begin contributing their commercialization experience – and their policy recommendations -- to government and Congressional discussions on improved mining of the nation's small business resource, through White Papers and related strategies. In May 2006, a formal SBTC committee, Defense Technology Small Business Advisors, was founded to drive this influencing agenda.

The resulting series of White Papers, collectively titled *Mining the Small Business Resource: Issues and Recommendations*, have been noticed and well received in the defense community, government agencies and Congress, as major new initiatives were crafted. This White Paper, fourth in a series, is intended to help focus the national policy discussion on innovative technology solutions during 2007 and beyond, as the US enters a new era of transformation. Like previous White Papers, this edition samples the best-informed thinking on technology transition in the defense community.

To complement these White Papers, spotlight key issues, and coalesce defense community influencers, SBTC launched in September 2006 a series of high-profile conferences. That first event, *SBIR in Rapid Transition*, with strong corporate sponsorship and sold-out participation, will spawn followon 2007 conferences in early March and late August, and during 2008 as reauthorization of Small Business Innovation Research legislation looms.

SBTC welcomes your comments, and encourages your response through our website, www.sbtc.org.

Sincerely,

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Robert-Allen Baker, Editor

¹ National Science Foundation; "Science and Engineering Indicators, 2006"; Washington, DC 2006

Background

Late in 2006, Dr. James Finley (Dep. Undersecretary of Defense – Acquisition, Technology & Logistics) spoke at a Small Business Technology Council (SBTC) conference and proposed a series of practical, informal meetings with select small defense technology firms on key technology transition issues and practices². The proposal was unprecedented, as his speech marked the first time that a government official of Finley's stature directly engaged small business leaders in a frank discussion of acquisition issues.

Yet, there was a powerful policy precedent: passage of the 2006 National Defense Authorization Act, with its mandate in Sec.252 for a four-year DoD SBIR Commercialization Pilot Program (CPP), designed to accelerate transition of SBIR technologies meeting high-priority warfighter needs. Sec. 252, with its innovative linkage through SBIR of the defense community's requirements, acquisition and R&D components, and its tough CPP reporting requirements, appeared to open access to small technology business as never before.

The defense community has traversed a parallel road since 2000, with programmatic focus on mainstream technology transition by DoD, and critical assessments by GAO and Congress. While this work uncovered many DoD obstacles to technology transition, and created new DoD tools to expedite such transition, problems remained – as large and small defense technology firms well knew. Thus, in late 2006 Dr. Finley declared his intention to lead improvement of DoD technology transition, overall. "My duties," he said, "are to support the Secretary ... with matters relating to acquisition and the integration of technology. I have three major goals: One, to reduce cycle time; two, to increase competitiveness; and three, to broaden communications."³

Accordingly, SBTC and its Defense Technology Small Business Advisors (DTSBA) Committee plan a 2007 focus on technology transition enhancement in three areas:

- (1) Strategies to accelerate maturation of competitive technologies developed through the SBIR program, thus reducing cycle time.
- (2) Expanded use of cash and non-cash incentives in defense programs to create SBIR technology "pull" – increasing competitiveness and contributing to reduced cycle time.
- (3) Improved leveraging of the SBIR resource throughout the DoD Acquisition Enterprise.

Five key factors drive this agenda:

- The Congressionally-mandated DoD SBIR Commercialization Pilot Program
- DoD AT&L emphasis on acquisition and procurement improvements – especially as regards affordability and insertion of innovative technologies
- Serial GAO reports calling on DoD to significantly improve the insertion of advanced, innovative technologies in its Programs of Record
- Impending reauthorization of Small Business Innovation Research program legislation
- The prospect of reduced dollars to finance "Phase III" SBIR technology transition, as Congressional earmarks are increasingly questioned.

Increasingly, DoD and its three military departments have embraced Acquisition Enterprise reforms to expedite technology transition. But GAO continues to be critical, and Congress has shown a willingness to legislate anew in this area. Now, small defense technology business presents itself as a broker of better practices and processes.

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² *SBIR in Rapid Transition* was held 27 September 2006 in Washington, DC by the Small Business Technology Council, with about 300 leading defense community participants from industry and government.

³ Dr. James Finley, "Pushing for a Sense of Urgency", *Defense AT&L* (Defense Acquisition University) November-December 2006, p.2

Summary

1. Accelerating Maturation of Competitive Technologies

Congress has signaled with increased frequency that small business defense technologies can be successfully competitive, with efficiencies of cost and delivery time, if these technologies are sufficiently mature. To accelerate maturation of these technologies at their source (the SBIR program), process enhancements are necessary.

Policy Recommendations

- **Identify and promote “best” technology transition practices.** These will emerge from the 2006-07 increment of the DoD SBIR Commercialization Pilot Program in the Army, Navy and Air Force. Distill needed process improvements as they emerge, and advocate for same in DoD agencies. Assess results via semi-annual reviews involving DUSD AT&L, DoD agencies AT&L and DTSBA. Develop and implement consequent training modules for key defense program transition stream participants. Implement key GAO recommendations⁴ to strengthen technology transition: (1) develop a gated transition process, (2) include criteria to support funding decisions, (3) expand the use of process-oriented metrics, and (4) set aside funds for transition.
- **Remediate contracting gaps.** These include (1) gaps between SBIR Phase I and II contract decisions, imperiling project survival and staff retention; and (2) gaps between small and large firms due to continued misunderstanding of SBIR data rights. Training modules are needed, as well an information dissemination strategy in defense Programs of Record. SBIR data rights must be enforced by agency program and contracting officers, so that such data is not released by the government to the detriment of Small Business Concerns (SBCs). Reduce gap duration by 50%.
- **Leverage technology maturation resources.** Develop and implement a matching fund strategy such that during SBIR Phase II work, R&D funding is matched by acquisition funds, where a complete Phase III transition plan is in place.
- **Expand current small business quotas to include SBIR.** By statute, federal contracts mandate a 23% small business participation; expand by requiring that 50% of SBC participation is reserved for advanced technology producers, and that all RDT&E contracts over \$100M have this SBIR subcontracting goal included in the Request for Proposal and the awarded contract.
- **Enhance and strengthen DoD Open Architecture initiatives.** Clearly define and maintain system component interfaces (software and C4I elements, but also logistics, mechanical, structural, and electrical elements). Then open the competition for best-of-breed component technologies to businesses small and large. If the component technologies of an individual weapons system are truly form-fit-and-function replaceable, the pace of technological innovation can be dramatically accelerated.

2. Expanding Use of Incentives

DoD generally relies on large contractors to make decisions about technology provision, creating a hurdle for small firms. Both Congress and DoD acknowledge that incentives to large firms may help improve contractor performance, and Congress has asked DoD to track incentive use regarding SBIR technologies (Commercialization Pilot Program). More explicit policies are needed.

⁴ GAO-06-883, “Stronger Practices Needed to Improve DoD Technology Transition Process”, September 2006, p.1

Policy Recommendations

- **Matching funds incentive.** A SBIR transition incentive would provide DoD Program Managers with matching R&D funds for each dollar of Program R&D committed to a Phase III contract with a SBIR company to continue development and/or insertion of SBIR-developed technology.
- **Incentivize defense contractors to achieve small business subcontracting goals.** Where small business/SBIR subcontracting goals are set by the DoD program office in the RFP as an explicit percentage of the total contracted effort, penalties (e.g., fee reduction) or incentives (e.g., award fees) should be employed.
- **Cash awards to high-performing technology transition stream players.** Annual awards of \$2,500.00 should be made by all Major Defense Acquisition Program offices.

3. Leveraging the SBIR Resource Throughout the DoD Acquisition Enterprise

Under current SBIR funding and schedule rules, technologies can't progress fast enough for direct incorporation into Programs of Record, nor have small firms the resources to pursue required testing and evaluation (T&E) themselves. Military requirements and resource communities are generally unacquainted with the SBIR resource, and its ability to shorten cycle times.

Policy Recommendations

- **Require SBIR education for DoD Acquisition Officers in training.** Defense Acquisition University curricula should describe the SBIR resource and how the resource can be mined by technology transition stream players from requirements, resource and acquisition communities.
- **Create shorter, more focused weapon system development cycles.** Weapons systems should be remodeled every 36 to 48 months, with incremental improvements, Output from three such cycles over the current 10-year cycle will exceed the sought "revolutionary" improvements.
- **Transfer responsibility (and funding) for hitting technology maturity goals to the R&D community.** New training and process modules will be required, and appropriate funding.

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How Can Small Business Better Support the Nation's Defense Mission?

1. Accelerating Maturation of Competitive Technologies

A recent GAO study focused precisely on the technology maturation problem: "... (DoD) routinely accepts high levels of technology risk at the start of major weapon acquisition programs. The acquisition community works with technologies before they are ready to be transitioned ... A defined phase for technology transition is not evident. These shortcomings contribute significantly to DoD's poor cost and schedule outcomes ... GAO recommends that DoD strengthen its technology transition processes by developing a gated process with criteria to support funding decisions; expanding the use of transition agreements, relationship manager and metrics; and setting aside funding for transition activities."⁵

In a November 2006 commentary on this study, DTSBA said:

"DTSBA concurs, and cites related findings by the same GAO Acquisition and Sourcing Management Group regarding underutilization of SBIR technology resources in DoD Programs of Record. As noted by Navy *Team Submarine* Director Richard McNamara at the *SBIR in Rapid Transition* conference on 27 September, 2006, utilization of SBIR technologies in major programs produces cost and cycle time savings of 30% over mainstream practices – if the field is leveled through use of incentives that create technology pull".⁶ SBIR can *shorten* the time to field new systems, if SBIR technologies are allowed to compete.

Although selection of SBIR technologies can contribute to technology risk management and mitigation, the following specific issues need to be programmatically addressed to significantly improve the DoD technology transition process and mine the SBIR resource:

Best transition practice identification and promotion

Despite ~20 years of DoD SBIR history, best transition practices haven't been identified. However, this is anticipated from the 2006-07 increment of the DoD SBIR Commercialization Pilot Program in the Army, Navy and Air Force and from initiatives like Navy *AIRSpeed 06*. (For example, the 2006 Navy CPP effort incorporates the GAO-06-883 recommendations of a gated transition process, criteria for funding decisions, process-oriented metrics and special funding for transition activity.) Once these best practices are translated into work process improvements, advocacy will be required throughout the key DoD agencies in the form of "business cases" to ensure affordability, and then implementation strategies including development of education/training modules.⁷

Contract delays

Current practice is such that delays between SBIR Phase I and II contract decisions and funding create hardships for small firms that can have severe consequences for project survival and staff retention. Federal tracking procedures appear to be inadequate. Additional delays occur with Phase III subcontracts to SBIR firms due to continued misunderstanding of SBIR data rights.

Incentives and leveraging technology maturation resources

See Sec. 2, below

Present DoD acquisition strategies result in strong reliance on large prime contractors to make decisions about technology and provider selection. There is an inherent conflict in this process creating a high hurdle to inclusion of small businesses in major DoD acquisition programs. A means to incentivize the prime contractors and the Program Offices to include appropriate SBIR

⁵ GAO-06-883, "Stronger Practices Needed to Improve DoD Technology Transition Process", September 2006, p.1

⁶ SBTC-DTSBA, "What is Our Response to GAO-06-883?", 16 November 2006

⁷ "DoD Needs Better Tech Transfer Processes", *R&D Magazine*, November 2006, pp. 31-33

technology would greatly facilitate transition and result in more cost-effective weapons systems. Both “carrot” and “stick” measures must be adopted, especially including expansion of current small business quotas to include SBIR.

Open Architecture theory and practice

While the tenets of Open Architecture are commonly understood to support more inclusive acquisition program participation by small firms, practice in many programs appears to have had the opposite and undesirable consequence of excluding small firm participation. The architecture of weapons systems must be open. This concept includes not only software and C4I elements, but also logistics, mechanical, structural, and electrical elements of the weapons system. Once these interfaces are defined clearly (and maintained), the competition for best-of-breed for component technologies (systems) can be opened up to businesses small and large. If the component technologies of an individual weapons system are truly form-fit-and-function replaceable, the pace of technological innovation can be dramatically accelerated.

It is important to note that open architecture is not the same as open source. True Open Architecture means that a third party can integrate new technology into the system without the participation or permission of the original system integrator. Access to the underlying technical data and source code must be made available by either party, if required to support the system. Access to the tech data and source code should be made on a case-by-case basis consistent with protecting the data rights of all parties.

2. Expanding Use of Incentives⁸

“Tech insertion is expensive and risky. Who’s going to pay for it? I’m not incentivized to do this.”
Senior Engineer, Northrop Grumman Ship Systems

Incentive use to accomplish technology transition, another subject of critical study by GAO’s Acquisition and Sourcing Management Group, includes cash and non-cash incentives. There are at least four possible incentivization categories:

- Performance incentives to large contractors and DOD program officials
- Contract term and bonus incentives for integration of SBIR technologies into Programs of Record and/or fielded systems
- Set-aside of defense program dollars for SBIR Phase III transitions
- Enhanced data rights protections

The issue of incentivization, as one of the key solutions to the problem of DoD commercialization of advanced technologies, has become specific and practical; since it’s not a general issue, the scope of a remediation approach is necessarily broad, and inclusive of various types of incentives that might accelerate SBIR candidates.

DoD Incentive Tools

The DoD *Manager’s Guide to Technology Transition*, among other key DoD basic directives, clearly addresses cash and non-cash incentives, and cost-based incentives:

CASH INCENTIVES

There are also positive incentives. Milestone payments for completing an observable technical event is a method for giving the contracting parties incentives to strive for better research results while avoiding many FAR-based requirements that are in cost-type R&D contracts.

⁸ This section borrows in its entirety from the September 2005 SBTC whitepaper, *Incentives and Technology Transition*, updated in May 2006.

To expand DoD's access to commercial developers and their technology, commercial incentives should be used. Factors that affect a company's decision to participate in a government project include the solicitation method, instrument structure (including cash and non-cash incentives), and contract administration methods. A commercial incentive would increase the contractor's profit, market share, or IP rights.

NON-CASH INCENTIVES

Enhanced communications also might give contractors more incentive to participate. For example, when the pre-solicitation information is exchanged, the government could share the technology roadmaps for DoD's critical future requirements and compare them with industry's plans for commercial technology development.

Another non-cash approach, award-term incentives, are designed to entice the contractor to transition workload well, provide superior support, and control prices through extensions or reductions of the terms that are directly based on performance. When using award-term incentives, the government establishes objective performance parameters in the underlying contract and announces up front that it intends to shorten or lengthen the period of contract performance (to a minimum or maximum) according to the contractor's performance against the parameters. The objective of this tactic is to establish long-term contractor relationships with proven producers of products or services.

The award term structure is similar to that for an award fee, but the incentive is a performance period rather than cash. This is effective if performance metrics are objective and when a long-term business relationship is of value to the government and the contractor. Points are awarded during each year of the contract depending on performance in each measurement category. Decisions about extending or shortening the contract are made each year, according to a moving, multiyear average of the contractor's point total. Extensions can be set, according to performance that exceeds requirements ...

COST-BASED INCENTIVES

Share-in savings (SIS) provisions are cost-based incentives, now referred to by DoD as 'efficiency savings.' An SIS contract encourages contractors to use their ingenuity and innovation to get the work done quickly and efficiently to share in the savings attributed to their planning and execution ... Contractor actions include reducing management costs ... and outsourcing. Savings can be shared.

Profit incentives are another form of cost-based incentive ... the DFARS now include a provision to increase the negotiated fee according to the contractor's use of innovative technology. This incentive is based on a Congressional desire to encourage innovation and is completely consistent with DoD's objectives.⁹

But merely having an array of DoD incentive tools has not translated into expedited transition of advanced technologies, according to GAO. GAO's Acquisition & Sourcing Management Group has focused on this shortcoming in a number of reports, especially GAO-06-66 "Defense Acquisition: DoD has Paid Billions in Award and Incentive Fees Regardless of Acquisition Outcomes" (December 2005) and GAO-06-257T "DoD Acquisition Outcomes: A Case for Change" (November 2005).

Additional Incentive Tools and Incentive Process Improvements

Following the July, 2004 HASC subcommittee meeting, Small Business Technology Council

⁹ *Manager's Guide to Technology Transition in an Evolutionary Acquisition Environment* – Version 1.0; Office of the Under Secretary of Defense (Acquisition, Technology and Logistics); January 31, 2003; pp. 2-27 – 2-28. The current Version 2.0 cites the same language.

leaders were asked to recommend methods of accelerating SBIR Phase III commercialization in DoD programs. Two of the six entrepreneurs' responses focused on new cash incentives:

“Our second recommendation is to establish a matching funds incentive for DoD program managers who make Phase III SBIR contract awards. The Phase III SBIR transition incentive would provide DoD Program Managers with matching R&D funds for each dollar of Program R&D committed to a Phase III contract with a SBIR company to continue development and/or insertion of SBIR-developed technology. The matching funds incentive should include a limit of not more than \$2 million in matching R&D funds for any single SBIR effort. The second element of the Phase III SBIR transition incentive would provide matching procurement funds (up to a limit of perhaps \$5 million per SBIR effort) for procurement of SBIR-developed technology end items through direct contracts with a SBIR company or for SBIR-developed items procured under a SBIR company's GSA schedule ...

A Phase III SBIR transition incentive such as the one we propose would provide a powerful rationale for Defense Program Managers to incorporate successful small business technology developments in their programs ... This incentive would result in a growing number of Defense Program Managers who have experience employing small high-tech businesses not only for providing rapid technology solutions, but also in the critical role of providing low cost risk mitigation and competitive alternatives ...

These properly transitioned Phase III efforts would stimulate DoD program managers to more often consider small business in providing competitive alternatives and rapid innovation in their programs and simultaneously broaden and strengthen the defense industry and manufacturing base in the United States.

Our third recommendation is to increase the incentive for prime contractors to achieve their small business subcontracting goals ... where small business subcontracting goals are set by the DoD program office in the RFP as an explicit percentage of the total contracted effort, penalties such as fee reduction (or incentives such as award fee increases) should be employed to encourage prime contractor fulfillment of those goals. For example, the prime contract could require that at least 75% of the small business subcontracting goals be met in each year of the contract or fee reduction of 25% would be triggered for that period. Small business subcontracts should also be required to reflect the nature of the prime contract in the following manner: a large R&D contract for development of the Future Combat Systems for the US Army should include a significant fraction of small business subcontracts to high-technology small business and not be predominantly for non-technical services (e.g. travel agent and janitorial services) ...

The relationship between the large DoD prime contractors and their small business subcontractors is increasingly important as the contracting trend in DoD moves to even larger and broader contracting such as with the Navy Marine Corps Internet (NMC I) and the Army's Future Combat System (FCS) as two examples. We therefore suggest that all RDT&E contracts over \$100M have specific small business subcontracting goals included in the Request for Proposal and the awarded contract.

In a 2005 policy statement *Fighting an Unconventional Enemy: How Small Business Can Better Meet Defense Acquisition Needs*, the Small Business Technology Council refined these two recommendations:

“(3) Require that all proposals over \$100 Million from ACAT I and II programs include SBIR subcontracting plans and goals. Proposals must be evaluated on these plans, and - once contracted - measured against them such that incentive fees accrue for exceeding the plans, and penalties are enacted for under-achievement ... In addition, the DoD AT&L Office should provide a plan for requiring and incentivizing prime and subprime defense contractors to subcontract with DoD SBIR firms, as is currently done with minority and

veteran-owned small businesses. SBIR metrics would be recorded with those other small business metrics.

(4a) *Establish a Phase III “new money” set-aside via authorized monies which offers funding matches as an incentive to DoD program managers to make Phase III SBIR contract awards.* The Phase III SBIR transition incentive would provide DoD Program Managers with matching R&D funds for each dollar of program R&D committed to a Phase III contract with a SBIR company to continue development and/or insertion of an SBIR-developed technology. The matching funds incentive should include a limit of not more than \$2 million in matching R&D funds for any single SBIR effort. A second element of this Phase III SBIR transition incentive would provide matching procurement funds (up to a limit of perhaps \$5 million per SBIR effort) for procurement of SBIR-developed technology end items through direct contracts with a SBIR company. Monitoring of regular reports on such activity, and evaluation of results, is essential.¹⁰

Incentivization Case Study: NAVSEA PEO Submarine

A practical, and successful approach to cash incentives use for enhancement of SBIR Phase III activity in DoD programs has been in place since 1988 in Program Executive Office – Submarine, a Naval Sea Systems Command (NAVSEA) office. Under the leadership of Richard McNamara, Executive Director of PEO SUB, over \$1B in Phase III work in key submarine programs has been generated since 1988, from an SBIR investment of ~\$150M. PEO SUB’s Phase III total is 82% of total NAVSEA Phase III awards between 1988 – 2004. McNamara, in his June, 2005 address at The National Academies of Science symposium on SBIR Phase III issues, credited PEO SUB’s open competition and incentives policies for helping achieve this notable success.¹¹

As an example, PEO SUB offers a small business subcontracting incentive in its *Virginia*-class program through a formal plan incorporated as clauses in the *Virginia*-class construction contract:

“(a) The VIRGINIA Class Program Office is committed to increasing small business subcontracting participation in submarine construction efforts consistent with cost/benefit considerations and attainment of acquisition objectives. Therefore, the Contractor may earn a Small Business Subcontracting Incentive Fee (SBSIF) for increasing the level of small business subcontracting participation under this contract.

(b) The following table identifies the percentages against which the Contractor’s performance for the purposes of the SBSIF will be measured for each evaluation period.

	FY03	FY04	FY05	FY06	FY07	FY08	FY09	FY10
Small Business (SB)	TBD%	TBD%	TBD%	TBD%	TBD%	TBD%	TBD%	TBD%
Woman Owned Small Business (WOSB)	TBD%	TBD%	TBD%	TBD%	TBD%	TBD%	TBD%	TBD%
Small Disadvantaged Business (SDB)	TBD%	TBD%	TBD%	TBD%	TBD%	TBD%	TBD%	TBD%

¹⁰ *Fighting an Unconventional Enemy*; Small Business Technology Council; January 20, 2005; p.3

¹¹ For an independent look at PEO SUB’s unique technology transition strategy, see: Johnson, William; “Delivering Combat Power to the Fleet, Now! A Case Study in Rapid Acquisition”; *Naval Engineers Journal*; Fall, 2004

HUBZone Small Business	TBD%	TBD%	TBD%	TBD%	TBD%	TBD%	TBD%	TBD%
Service Disabled Vet	TBD%	TBD%	TBD%	TBD%	TBD%	TBD%	TBD%	TBD%

(c) The Contractor's SBSIF percentage score for each period will be determined for each category identified in the table above by adding xx's subcontracted amount for each category to yy's subcontracted amount for each category and dividing that sum by xx's total subcontracted amount, less amounts subcontracted from xx to yy, plus yy's total subcontracted amount.

For the purposes of this clause, small business contractors who graduate to large business size status during the execution of Phases I/II under an Small Business Innovative Research (SBIR) Program topic are considered to be Small Businesses for the follow-on SBIR Phase III under that topic.

(d) Periods and SBSIF Available: The SBSIF is spread over ten yearly evaluation periods (FY03-FY12). The evaluation for each yearly period will be cumulative. The SBSIF pools available for each yearly period and the allocation to small business subcontracting categories are as follows:

	FY03	FY04	FY05	FY06	FY07	FY08	FY09	FY10	FY11	FY12
Total Incentive Available	\$200,000	\$266,667	\$333,333	\$400,000	\$466,667	\$533,333	\$600,000	\$666,667	\$733,333	\$800,000
Small Business (SB)	\$100,000	\$133,333	\$166,667	\$200,000	\$233,333	\$266,667	\$300,000	\$333,333	\$366,667	\$400,000
Woman Owned Small Business (WOSB)	\$40,000	\$53,333	\$66,667	\$80,000	\$93,333	\$106,667	\$120,000	\$133,333	\$146,667	\$160,000
Small Disadvantaged Business (SDB)	\$20,000	\$26,667	\$33,333	\$40,000	\$46,667	\$53,333	\$60,000	\$66,667	\$73,333	\$80,000
HUBZone Small Business	\$20,000	\$26,667	\$33,333	\$40,000	\$46,667	\$53,333	\$60,000	\$66,667	\$73,333	\$80,000
Service Disabled Vet	\$20,000	\$26,667	\$33,333	\$40,000	\$46,667	\$53,333	\$60,000	\$66,667	\$73,333	\$80,000

SBSIF not earned in a period shall not be transferred to later periods.

(e) For each percentage point by which the Contractor exceeds its goal for each applicable category, the Contractor will be paid 3% of the available SBSIF for that period. The percentage achieved in excess of the goal will be rounded to two decimal places for the purpose of determining the SBSIF earned.¹²

Performance Awards: a Personal Approach to Incentivization

An obvious, yet unstudied, cash/non-cash incentive concerns reward and compensation of DoD civilians in Major Defense Acquisition Program (MDAP) offices on the basis of their performance and contribution to national defense and security missions. Under the traditional DoD human resources management system, such incentives were not possible. But in early 2004, DoD and the Office of Personnel Management launched design of the National Security Personnel System (NSPS), a major, embattled management overhaul that remains in-process. As the NSPS *Proposed Regulation*, said:

¹² *Small Business Incentive Clauses for VIRGINIA-class Follow-on Construction Contract*; PEO SUB; May 16, 2002; pp. 1 - 2

“(The) current system is inadequate to manage DoD civilian personnel in today’s national security environment. Current pay system results in outstanding performers being paid the same as poor performers. Rigid, inflexible rules hinder DoD’s ability to act without delay to meet mission needs and manage from a ‘total force’ perspective DoD needs a flexible, agile HR system to meet the demands of a dynamic national security mission.”¹³

In discussing NSPS operational requirements, OSD cited two Key Performance Parameters that could support tech transfer incentivization:

“High Performing: Employees/supervisors are compensated/retained based on performance/contribution to mission.

Fiscally Sound: ... managers will have flexibility to manage to budget.”¹⁴

Similarly, NSPS benefits would include the following:

“Proposed HR system provides greater flexibility to respond effectively to mission needs, while fostering excellence ... Employees will have greater opportunity to affect their pay through excellent performance – pay increases base on performance and/or contribution to mission success; clear performance expectations linked to strategic DoD goals and objectives.”¹⁵

While NSPS could help incentivize civilians in DoD acquisition programs, NSPS does not apply to military Program Managers. To compound the problem, almost all military Program Managers serve on a rotational basis – a problem that recently came to the attention of the HASC Subcommittee on Tactical Air and Land Forces, in which one ranking member advanced the often heard suggestion that, because of the rotation issue, acquisition program management be reserved for civilians.

3. Leveraging the SBIR Resource Throughout the DoD Acquisition Enterprise

“Socializing” the SBIR Resource: an Education and Training Challenge

Since at least early 2004, DoD agency SBIR directors – responding to Navy SBIR and DARPA SBIR initiatives – have regularly discussed the issue of “socializing” the SBIR resource, i.e., making the SBIR resource more familiar to agency requirements and acquisition components where most program decisions are made regarding technology insertion.

By November 2005, it was apparent that both House and Senate versions of legislation that would be passed at the 2006 National Defense Authorization Act contained language mandating a four-year DoD SBIR Commercialization Pilot Program (CPP), designed to accelerate transition of SBIR technologies meeting high-priority warfighter needs. Sec. 252, with its innovative linkage through SBIR of the defense community’s requirements, acquisition and R&D components – ensured by strict, broad CPP reporting requirements – fundamentally redirected the discussion among DoD agency SBIR directors.

More importantly, all three DoD military departments responded with SBIR program reforms designed to socialize the SBIR resource by linking this R&D component directly with at least the intra-agency acquisition component. Navy SBIR accomplished this in 2005 with a new SECNAVINST (Instruction) and reinforced it with 2006 Navy SBIR CPP planning. Army and Air Force each responded in 2006 with realignment of their SBIR programs with acquisition functions, and with external requests for proposals to assist in supporting realignment, beginning with their SBIR CPP programs.

¹³ *Department of Defense National Security Personnel System Proposed Regulations*; Office of the Secretary of Defense; 10 February, 2005; p. 3

¹⁴ *Ibid.*, p. 5

¹⁵ *Ibid.*, p. 6

In addition, DoD’s Office of Small Business Programs responded in 2006 by appointing a DoD-wide SBIR CPP coordinator, former Navy NAVAIR SBIR Director Carol VanWyk.

But in its 2006 fourth quarter meeting, SBTC-DTSBA principals agreed that to help ensure effective socialization of the SBIR resource throughout DoD components other than R&D, the Defense Acquisition University would have to revive a prior requirement that all DoD Acquisition Officers in training successfully negotiate a comprehensive SBIR curriculum.

System Development Cycle Reduction

The GAO¹⁶ cites six recommendations for DoD including a gated process, transition agreements, and funding to the S&T community to manage transition of technology to acquisition programs. DoD takes strong exception to the last.

This is the fatal flaw that prevents S&T (especially SBIR-developed) technologies from being ready to be included in a production weapon system development. It is the classic chasm that must be bridged whether for a commercial development or a weapon system. The DoD argument is based on the fact that it is only the “acquisition community” that has the “training and discipline to field systems”. They argue that the S&T community may be able to field stand-alone systems but not the complex systems-of-systems programs. This misses the point.

In general, S&T developments to appropriate levels of maturity to be incorporated into the integration of the “system-of-systems” looks like a stand-alone development. These developments, be they hardware or software, should be carried individually to the level that can be acceptably incorporated into the integration effort that the development of a weapon system platform, like DDG-1000, should be. *This decouples the technology risk from the integration risk.*

In the current DoD model, the individual technology development has neither the time nor the resources to complete development to a mature system (the parts of the system-of-systems referenced earlier). Thus, the integration effort (major weapons system) is forced to accept technologies that provide the performance demanded by the operational requirements, but at a lower level of maturity than they should. This process is shown graphically in Figure 9 (refer to Figure 1) from the aforementioned GAO Report.¹⁷



Figure 1 - GAO Report Figure Showing Concurrent Technology and Product Development

A complementary argument can be made that the acquisition community lacks the “training and discipline” to mature the technology and qualify it as fit for service. The issue is not “fielding”; it is getting the system to be manufacturable and tested – which can be done outside of the frenzy of

¹⁶ GAO-06-883, “Stronger Practices Needed to Improve DoD Technology Transition Process”, September 2006, p. 53

¹⁷ *Ibid.*, p. 23

a major acquisition program. The sheer size of the acquisition program reduces the probability of successfully developing the component technologies.

The GAO report compares the practices of industry to those of the DoD. DoD argues that it isn't a fair comparison because of the different motivations of industry and the government.¹⁸ While true, the differences do not defeat the argument. Take modern automotive platforms as an example. The objective of the automobile manufacturer is to reduce "changeover time". Metrics such as reducing from 48 months to 24 months are suggested in the NIST Motor Vehicle Manufacturing Program¹⁹ as a means to make the US automotive industry globally competitive. While that study focused on manufacturing technologies to reduce time and expense in vehicle changeover time, the key objective of reducing the period between new models is germane. The decade-long DoD development programs are a cause, not a symptom. It cannot be denied that automobiles are also complex systems-of-systems. The short changeover time, driven in part by consumer demand and competition (is this really different from the DoD situation where the asymmetrical enemy evolves ever faster?) allows more frequent opportunities to insert technologies as the platform emerges.

When there is only one development per decade, the S&T/R&D community must try to hit that one target encouraging it to overstate maturity in order to hit a window of opportunity that may not open for another decade. This creates a vicious circle – the technologist overstates maturity, the acquisition professional reaches deeper into the technology for many systems in the system-of-systems. Each time this happens, the risk to the program increases and forces complicated risk mitigation plans and expensive parallel and backup efforts. The GAO report cites a cost-weighted Average Program RDT&E Cost Growth of 4.8% for "mature technologies" and 34.9% for "immature technologies"²⁰ – nearly an order of magnitude difference. With this "vicious circle" it is inevitable that weapon systems will be over budget and delayed. The goal must be to create a "virtuous circle" – one in which each element gains positive reinforcement from the others. Short development cycles create the environment for the virtuous circle; long cycles force the vicious circle.

How to solve this dilemma?

- **Create (and hold to) shorter, more focused weapon system development cycles.** There should be a new "model" of the weapons system being delivered every 36 to 48 months. Each of these is an incremental improvement over the previous model. The cumulative improvement of the three delivery cycles over the current 10-year cycle will exceed the "revolutionary" improvement sought today. The argument that these won't be supportable is overstated. Most of the technology and equipment in each succeeding generation will retain high degrees of commonality especially with enforcement of Open Architectures advocated earlier. "Backward compatibility" will be maintained so that the early models are "automatically" upgraded to the capability of later models when systems are replaced with spares resulting from the next generation technology.
- **Transfer responsibility (and funding) for hitting maturity goals for individual technologies to the S&T community; provide whatever training and discipline is required.** Hold the S&T community responsible for "finishing" the development of individual systems to the point where they can be incorporated into the complex systems-of-systems without further technology risk. Their weight, cost, performance must be well-known and quantified before being "inducted" into the acquisition program. This is entirely consistent with the "Knowledge Based Approach" advocated by the GAO.²¹

¹⁸ GAO-06-883, "Stronger Practices Needed to Improve DoD Technology Transition Process", September 2006, p. 50

¹⁹ <http://www.atp.nist.gov/focus/mvmt.htm>

²⁰ GAO-06-391, "Assessments of Selected Major Weapon Programs", March 2006, p. 12

²¹ GAO-06-391, "Assessments of Selected Major Weapon Programs", March 2006, p. 9

- **Exert discipline on the acquisition community to eschew sexy, high-risk technologies in their programs.** Do not reward risk, punish schedule and cost overruns.

How do Small Businesses (SBIR) play a role? Under current funding and schedule rules for SBIR Phase II, even small technologies cannot be carried forward to a point where they are suitable for direct incorporation into the “system of systems”. There is limited opportunity for the small business to independently make the necessary investment in testing and qualification that differentiates immature from mature technology. Funding for military qualification and transition to manufacturing can be included in the SBIR program. A Phase IIB program that focuses on achieving a stable product design for the resultant technology is consistent with the Knowledge Point 2 in the March 2006 GAO report²² and would greatly facilitate the easy transition into the weapon programs.

Phase III funding should not be tied to a particular weapon system, but tied to a part of a strategic plan that identified the technology need. Let the small businesses, either singly or in concert, deliver a finished system into the “catalog” of technologies that are selected for integration in the short, focused acquisition program. This concept should extend to the entire DoD S&T Enterprise of which the Small Business plays an important part, but the need is most urgent for the technologies developed by small businesses.

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²² *Ibid.*, page 9