



Formal Written Testimony for Field Hearing

U.S. House of Representatives Committee on Small Business
Subcommittee on Contracting and the Workforce

Commercializing on Innovation: Reauthorizing the Small Business
Innovation Research and Small Business Technology Transfer
Programs Part II

Tuesday, March 8, 2016

Lynn MA City Council Chambers
3 City Hall Square
Lynn, MA 01901

The Honorable Richard Hanna (R-NY) Chair

The Honorable Seth Moulton (D.MA)

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Good afternoon gentlemen. My name is Ann Eskesen, founding president of the Innovation Development Institute, LLC a small four-person firm that since its founding has been located right here in the MA Sixth District.

First, may I thank you for your scheduling this hearing and particularly for your providing me opportunity to offer testimony on what will be the Fifth Reauthorization of the very important SBIR- STTR programs -- arguably, in terms of overall technology development and business impact briefly to be considered here - perhaps among the most important pieces of legislation ever enacted by the US Congress.

I had the distinct honor, exciting challenge and privilege of having been part of that small group of players involved in the development, passage and subsequent implementation of the original SBIR enabling legislation what is now more than three decades ago. That very active political involvement continued through the 1986, the 1992 and 2000 SBIR reauthorizations and, though to a much lesser extent on the front line, also in the long drawn-out, multiple Continuing Resolution effort required to achieve the Fourth reauthorization.

I make the point of this longtime SBIR association not with the intent of bringing attention to how old I am but to explain why – and to an extent how - the perspective I bring to this important discussion is almost certainly significantly different from that you will hear from almost everybody else. Clearly, as a long-time SBIR advocate, I strongly support Reauthorization but I would energetically argue that if we are truly to draw down the considerable value of *all* that SBIR has created, the extent and form of that value must be understood and factored into this Reauthorization discussion.

In my judgment - based on that thirty-five years of involvement - SBIR is far more usefully understood not simply as a program that funds R&D in small business but rather as an important technology, business and economic development resource that should be being managed as such.

The ‘Success Story’ approach to documenting the achievement of individual SBIR Awardees is powerful, sometimes awe-inspiring, often game-changing - testimony to the depth in talent and creativity that exists in small firms and to the value of giving such firms access to resources like SBIR. The fact of there being so many of these stories – thousands of them -and across such a range of endeavor further speaks volumes to the contribution of small firms in so many different fields. But, to date, even after what is now decades, there has been remarkably little attention paid to evaluation of the collectivity, the total population of what is now almost 23,000 business entities that are SBIR Awardees.

In these radically changed and changing times, there has perhaps never been a greater need or better opportunity for Congress carefully to review and examine the already considerable SBIR-STTR achievement and impact: in effect, to use actual data to make next generation SBIR policy decisions.

re·al·ize (rē'ə-līz') v.

- ❖ To comprehend completely or correctly
--Reviewing the record of SBIR-STTR across all the agencies, he finally *realized* the range and extent of the impact on the economy of these programs.
--We *realized* that among the array of SBIR projects are many directly relevant to our current concerns.
- ❖ To obtain or achieve, as gain or profit:
--She *realized* a substantial return on the investment made in that SBIR-involved firm.
--Licensing by fields-of-use not core to their own needs, enabled the SBIR Awardee to *realize* far more of the financial value of their developed technology(ies).

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To provide you what I think is a comprehensive and useful overview of what I mean by that and what it involves, my thoughts for this Hearing organized around the important idea of enabling you (and others) more fully

“to realize the value of SBIR”

As the attached slide indicates, a dictionary definition of the verb ‘to realize’ has two distinct, very different meanings.

1. By reference to useful external indicators, more completely to understand how SBIR Awardees – collectively -- measure up.

Being the data-junky I am - using solidly, real data-anchored¹ charts and graphs – the next few pages will synopsise the SBIR condition/achievement in various relevant areas to include:

- VC funding
- Intellectual property: patents
- Extent of M&A transactions
- Business Collaborations;
- As well as a significant Employment Impact Analysis: creation by SBIR awardees by-state of well paid, STEM based jobs with all the ripple-effect impact that that has in a community

2. From the premise that \$43B in Phase I and II awards has been a federal ‘investment’ - a different (but very useful) way to think about SBIR - the data from the various analyses noted above will solidly shows SBIR has already returned many multiples of that sum.



This time² I am also arguing, however, that Reauthorization should – *must*?- include serious consideration that we take a leaf out of the VC portfolio management playbook and that of the technology development practices of most major and mid-sized corporations

to allow/enable/encourage management of the program in ways that support effective drawdown of significantly more of the value of what SBIR has created.

The world in which SBIR awardees – and the rest of us – now do business and function is a fundamentally different place from that in which the idea of SBIR was conceived and crafted ... and yet, in real terms, though with genuine efforts attempted by the agencies to help their awardees move the technology to use-condition, the core of how the Phase I and Phase II project specific process is managed is fundamentally as it has ever been.



Continuously tracking, as we do, all things SBIR related – *see next page Table* – certain factors are worth noting. With now almost 23,000 firms having been SBIR involved across every field of technical endeavor

- SBIR-STTR is often a mirror for what is happening in the larger economy. As we continuously data-log and begin to see emerging patterns, trends, changes of emphasis and apparent anomalies, we are struck how so often soon afterwards we are reading in NYT, WSJ, Economist or hearing on PBS what we have noticed in SBIR but that we had seen being talked about for the larger economy: long duration, living lab?
- With some of the detail broken out by a few states as part of the employment-related comments later in this testimony, SBIR has become the largest single concentration of technical talent involving, for example, three times as many graduate level engineers and scientists as all US academic institutions added together

¹ Though we have, at their request, provided parts of our data and analyses to some agencies (SBA and DHS) and as a featured speaker in many settings, I am not aware of any other source (public or private) that is tracking the types and sheer range of data about all SBIR-involved firms that we do.

² Especially if making SBIR permanent is a serious consideration: not, in my judgment a decision to be made lightly

idi-developed SBIR-STTR relational database systems: tracking elements

Core data on SBIR-STTR involved firms 1983-present (22,865 as March 2016)

- Detailed Company Profile: full contact info
- Names by which firm is/has been known. Address history & multi-site locations. Any/all data relevant to company history
- Personnel: Current & previous management team: job titles and bios; all PIs to include when these persons relocate
- Business Identifier: primary business and technology focus
- Business summary: synopsis of company background, areas of technology focus, target applications/markets
- Overview Financial & Business condition: start date; employment range; revenues; first & last years of SBIR involvement.
- As applicable, detailed sourcing and extent of VC, IPO etc
- IP status to include full detail of patents (US and world), inventors, fee payment status, citations, in- and out-licensing
- Where applicable - spins-in & -out. Acquisitions
- Media coverage: business, popular press and other sources
- Document repository: Professional and technical papers and presentations, White Papers; Nutshells; & marketing materials
- Business or Technology Recognition Awards
- Powerful tech application, indexed classification system in progress:

SBIR-STTR status

- Full detail of extent and form of SBIR-STTR involvement: sources, dollars, Phase I-II conversions, Abstracts, outcomes
- Any forms of follow-on federal funding: Phase III procurement contracts, earmarks and plus-ups

Also tracked: NAICS codes, various tech classification systems, DUNs & CAGE numbers, Congressional District, GSA Schedule status and Number

Background to idi SBIR database development:

With the considerable support of the then freshman US Senator from New Hampshire, the late Mr Warren Rudman, of U.S. Senator John Glenn and others who understood well the critical importance of technology innovation to a health of an industrialized economy, growing out of the effective functioning of an small-scale pilot program twice in NSF (1977 and 1979) and once in DOD (1980), the bill to initiate SBIR across the range of federal agencies passed the Senate almost unanimously.

In the House, however, the proposed bill was perceived as highly controversial, drawing major opposition from powerful players in

- the academic and non-profit research communities who saw small firms and SBIR as competition for an R&D pie that was, at the time, static. We would be taking a piece of their already limited pie.
- and, importantly, from within the agencies. There was genuine concern that an influx of small firms with little/no federal procurement experience, c/would make an SBIR-type effort very high maintenance. Lots of small deals make for considerably more work than fewer big ones.

These were legitimate concerns that found support among many Members. Those advocating for SBIR were subjected to the rigors of a seven committee sequential referral: a very effective way to run ragged the very small group of us involved.

Passage of the enabling legislation was finally achieved, however. The bill was signed into law by President Reagan in July 1982 with the first round of SBIR Phase I solicitations beginning October 1, 1982: FY 83.

Shortly after, I was recruited by Donald Templeman, the SBA official charged by SBA Administrator³ George E. Saunders with SBIR implementation. I was assigned two responsibilities:

1. To get out the word to qualified small businesses around the country - the potential SBIR community - about the availability of this as yet very small, but important, new resource.⁴
2. To make sure that those in the agencies who had been a primary source of opposition⁵ to the enabling legislation were in compliance with the requirements of the law.

To address these two very different objectives in support of effective SBIR implementation, I began what (entirely unintentionally) has become a more than thirty-year commitment – that of systematically keeping the SBIR⁶ Record across all agencies in a single system.

Initially I simply followed the money – agency, company, state, project title, Phase, dollars – in Excel 1.0 (truly) on a DEC Rainbow (a what?). Fortuitously, we were early adopters of 4D⁷, the very powerful relational data-based systems we still use. As the wealth, diversity and detail of data relevant to business and technology endeavor become available – now at an ever accelerating pace – we were, and have, been able to incorporate that new data into our systems and to develop the routines and powerful algorithms most effectively to mine those systems to generate the types of systematic analyses that follows here.

³ Long before the head of the SBA became a Cabinet position

⁴ SBIR percentage of extramural R&D was a legislated phased-in to 1.25% over five years. At 0.25% in civilian agencies and 0.1% in DOD, across all the participating agencies the FY 83 SBIR budget totaled the princely sum of \$35M

⁵ It is interesting that that opposition was not mitigated and did not go away for a long time. What did happen was that, SBIR being so small even when fully implemented at the (then) 1.25%, the problem was solved in many agencies by appointing as SBIR Program Managers interesting players -- many being square pegs in round holes -- who delighted in the freedom that their new position provided them to take risks and to experiment without serious interference from senior persons.

⁶ Later to include STTR

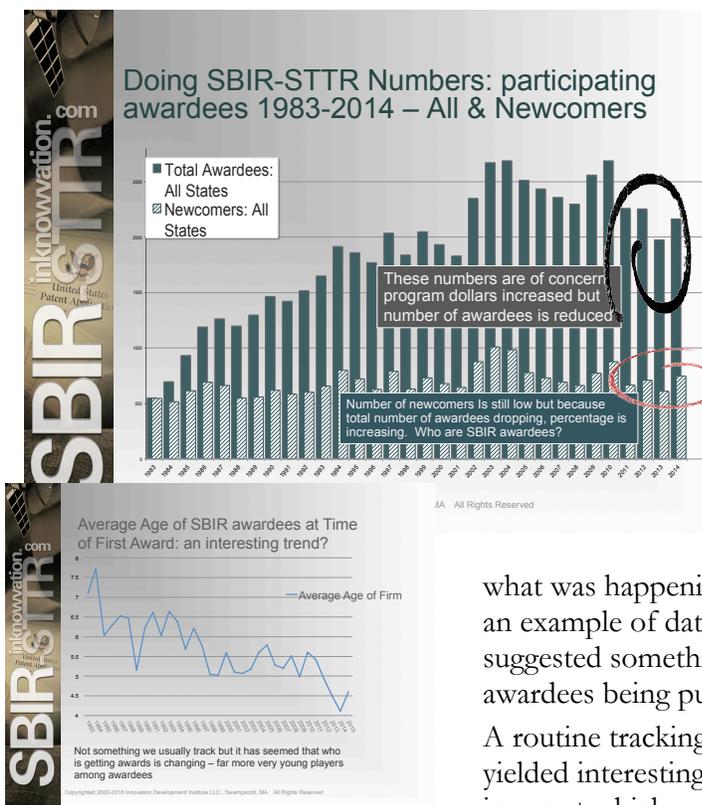
⁷ 4D; a relational databases management system and IDE with its own programming language that has since expanded to an SQL backend, integrated compiler, integration of PHP a several productivity plug-ins and interfaces.

Doing some basic SBIR-STTR numbers:

These are various idi prepared slides with, as appropriate, supplementary comments. Some of slides – for example these first two being grounded in Awards Data - while in very different format could likely be generated from the Basic Awards and By-State data available on the SBA SBIR.gov site.



In strong contrast, we suspect that most of what follows here is not SBA (or other source) do-able.



The idi systems are anchored in a range of useful *Awardee data*. This makes possible, for example, tracking in any year SBIR Newcomer Awardee vs previously funded, either in program as a whole or even in a particular agency. This type of routine can provide useful indicator that something has changed/is changing – a simple example of using data to provide insight into what might be happening - and why. At the very least, it suggests the need to question.

In this example it is clear that beginning in 2011-12, though available program dollars are increasing, number of Awardees is seriously reduced. Why?

In this instance, we had a pretty good idea what was happening – discussed here next in VC funding – but, as an example of data-use, recent entry of a current crop of awards suggested something else might be a factor: an uptick in new awardees being pure start-up: opening doors with SBIR funds.

A routine tracking of age of Awardees at time of first SBIR award yielded interesting chart to left did suggests major downward shift in age at which small firms are entering SBIR.

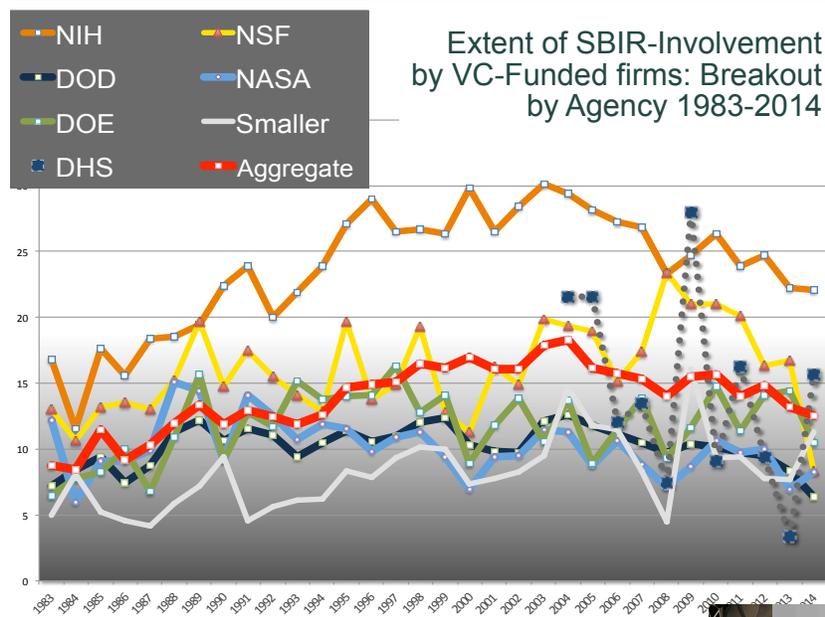
Could this be what we are seeing in the chart above?

In fact, while an interesting trend, other changes in the Current Awardee profiles suggest that Age of Awardees was not a factor.

Venture Capital in the SBIR space.

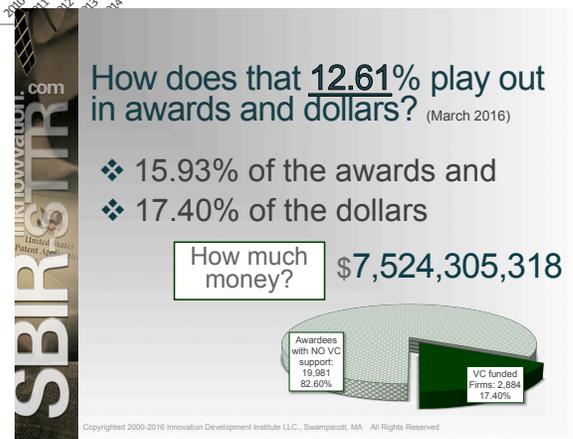
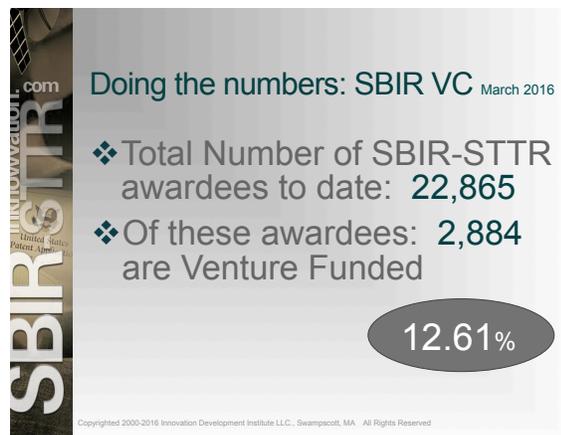
Given the major – one might say dominant - role played in last SBIR Reauthorization to enable full SBIR eligibility and access to VC funded firms, except for a strong emphasis on how to get Venture Capital now major focus at many SBIR organized events and elsewhere, remarkably little focus seems to have been given to the role that VC actually plays – and has long-time played - in the SBIR space. From the premise that this is not only interesting but also very important, for this Discussion I have opted to focus on this area somewhat more than the others indicated.

In the midst of the dot.com boom and burgeoning IPOs, we began to track⁸ in considerable detail the form and extent of VC activity in the SBIR space – still the only such compilation, I think, that exists and that permits analysis across a number of variables: *see By-Agency chart below.*



Though, not surprisingly, the strongest VC SBIR presence being in the National Institutes of Health, by plotting VC funded firms by Year and By Agency, chart here clearly indicates some level of VC presence in every agency. Other manipulation of VC data also shows clearly that over the life of the program

- A full 60.94% of all VC-funded SBIR Awardees have an NIH involvement
- But—not so obviously—some 31.96% of all VC funded SBIR awardees have Awards in the Department of Defense⁹



⁸ Our VC data is compiled and cross-checked across a range of sources, one firm/one round at a time: highly labor intensive. Increasing availability and access to well-grounded (accurate) VC data makes this part of our systems highly detailed and substantial.

⁹ Though we do often use aggregate DOD data in some analyses and reports and also for NIH, our systems are set up to support breakout by all Defense Services and by NIH Institutes and Centers. Similarly, we can carve out data by NASA Flight Centers etc i.e. all agencies in which different parts of the larger entity may make and manage their own awards

The very strong VC SBIR presence even before the major changes in most recent Reauthorizations is indicated two slides above. Calculating to 12.61% of awardees over the Life of the Program, collectively VC firms have been awarded 15.93% of the awards and 17.40% of the total dollars.

Important note on “All years” versus “Currently active”:

Reflecting radical changes in all aspects of our lives nationally and internationally since passage and implementation of the SBIR enabling legislation, today’s United States is a very different place from that of 1982. Though understanding trends through by-year breakouts is often interesting and sometimes highly informative - it is increasingly useful to separate out Current Data from lifetime. There are important differences and much of our analytical work is anchored in making that distinction.

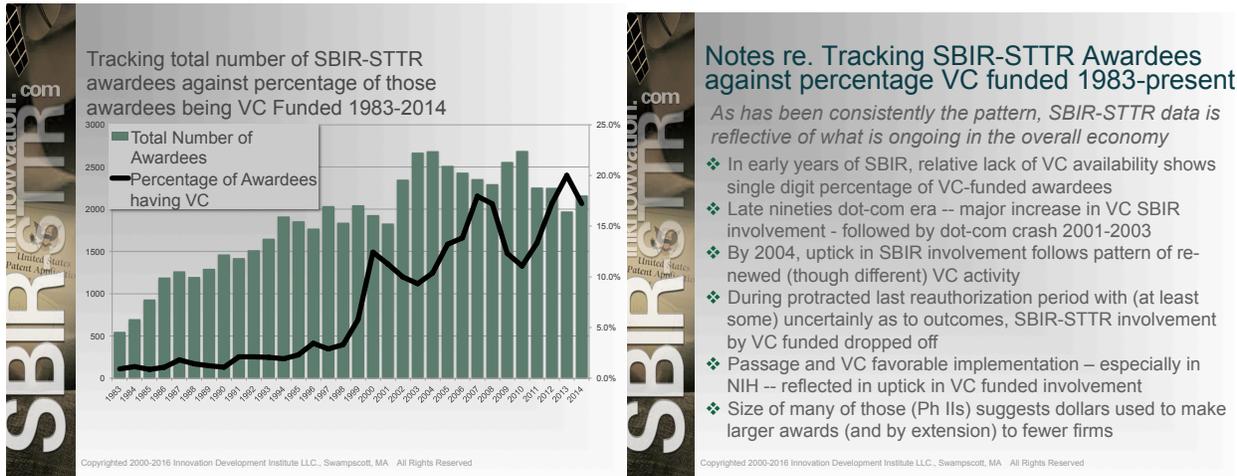
With the preference here being to cover various areas of relevant interest to which we suspect Members have not been previously exposed or even knew is available, to stay with reasonable time/volume limits we opted to do that Lifetime and Current parsing only on a limited basis.

One of those exceptions is the noticeable change in the levels of VC activity.

VC funding in overall SBIR-STTR population: perceived changes

Interested to see what may have been the impact(s) of the provision in the most recent SBIR Reauthorization concerning seriously modified program eligibility requirements involving Small Firms being majority owned (more than 50%) by VC investors – and with our being the ONLY source having the detail re. which SBIR-involved firms are VC funded, by whom for how much and when -- we recently ran a routine through our system to determine what – if anything – had changed.

Though the results are preliminary, they give serious pause for thought: In key agencies, VC funded firms—in a small number of states—may be pushing out non-VC funded



Related but different routines show that

- In less than four years, the Percentage of VC funded firms being SBIR involved has increased to 14.14% from the 12.62% over life of program: a very fast impact
- Not surprisingly, the most pronounced impact of VC eligibility have been in NIH with a 25% set-aside specific to that agency for VC funded firms, the percentage of NIH current awardees being VC funded is now increased to 22.66%

It is striking more recently that, in very strong contrast to earlier years

- Very few SBIR firms are receiving VC funding *after* their becoming awardees – for the longest time - the usual pattern use to be
 - Apply for SBIR/Found the firm (or vice versa) and
 - usually some time later, achieve Series A VC funding status
- Announced VC deals and subsequent rounds primarily now involve those already having VC
- Many coming into the SBIR program for the first time involve those already VC funded

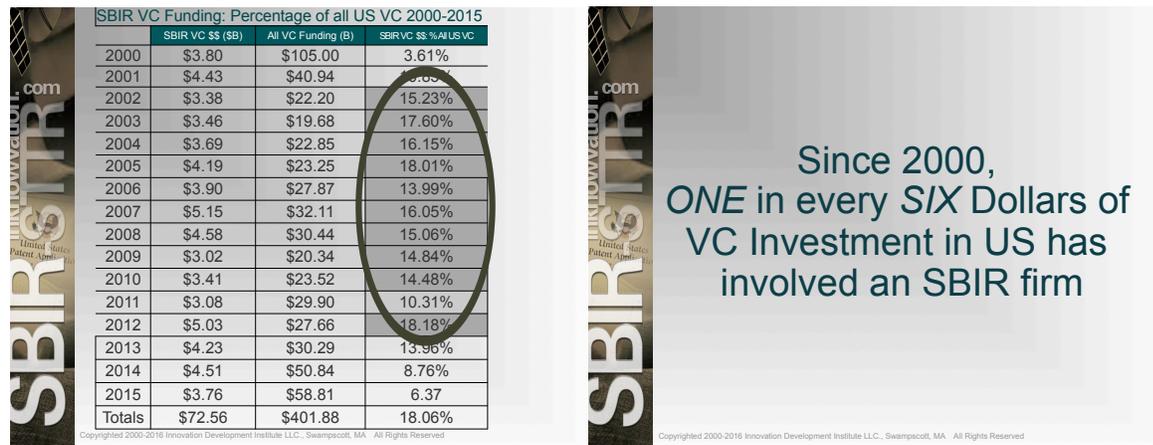
Extensive VC involvement in SBIR:

Over the period of the high profile activity of the dot.com boom and subsequent crash -- when we began a systematic basis to track VC involvement in SBIR -- it was striking that

- while, from 2002, VC activity in the general dropped off precipitously,
- VC involvement in SBIR specifically remained broadly consistent and has stayed within a fairly narrow dollar range for several years.

With 2015 dollars incomplete as yet and the major uptick in VC large-scale investment activity among ‘unicorns’ in 2014 probably skewing the numbers, the data shows clearly that

- Since 2002, One in SIX/SEVEN VC dollars being invested in the US involves an SBIR firm
- Over the period we track to include some pre-2000 to present, we can document over \$82 Billion (with a B) of VC investment in SBIR involved firms – almost DOUBLE the total award dollars of \$43B across the entire program: by itself, this is powerful evidence of the strong ROI on the \$43B of US federal SBIR ‘investment’



We have never been under any illusions that the non-dilutive, technology development SBIR dollars were the value-added factor that drove this expansion of VC SBIR involvement but the extent of this involvement *is* validation of the importance of SBIR of a population of defined technical capability and talent. The VC (and Tech Seekers) know that. Why don't we?

Now, as the number of small firms in the program is dropping – to include a particular kind of small firm that, in many states, we can ill afford to lose – I find myself asking the question:

“Whom are we not now funding where the profile they present
has none of the classic VC appeal and access to SBIR dollars is
one of their few available options to get their companies off the ground and contributing?”

Along with “why are we not systematically mining the SBIR talent pool” as are the VC (and large corporations) this – in my judgment – is a policy question that needs to be asked

SBIR-STTR issued patents



With the data showing a major uptick in issued patents beginning in 1998, since then a US patent issues to an SBIR-STTR involved firm **12-14 times a day** every day: 365 days a year

Doing the SBIR-STTR Numbers: issued US patents (March 2016):

- ❖ 125,423 issued patents - most still current
- ❖ 20,404 Patent applications
- ❖ Extensive portfolio of international IP holdings <250,000

Quality indicator: High Citation rate

- ❖ Patent transfers: academic licensing and spin-outs. Corporate licensing Totals? c. 45,000-50,000

Systematic compilation of data relevant to tracking extent and form of in- and out-licensing recently begun. Scale of such endeavor has clearly increased substantially in past decade with perhaps important policy and program management implications

Extent of SBIR-STTR awards: comparison of awardees holding patents versus non-patent holders (June 2016)

Data as of June 2016	Whole SBIR-STTR Program	Firms with Patents	Firms without Patents
Number of SBIR-STTR awardees	22,844	8,397	14,447
Percentage of awardees		36.76%	63.24%
Number of SBIR-STTR awards	108,213	70,847	37,366
Percentage of awards		65.47%	38.53%
Average awards per awardee	4.74	8.44	2.59

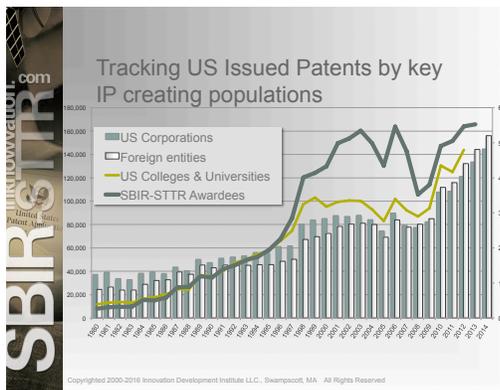
Total SBIR award dollars: \$29.26B vs \$13.98B

Patents: a (the?) key factor in knowledge-based economy:

Since if you don't own your technology, as a small firm you can't raise capital, nor can you collaborate with others on a technical level – the way business is now done. Among the data we carefully track therefore concerning SBIR involved firms is Patent related: filing, in- and out-licensing etc., Citations rates and fee-paying tec.

SBIR-involved companies are diligent Patent Filers in their own right – see top two slides. By any criteria of relevance, a population collectively issuing 12-14 patents a day is a major resource. Further, though our data in this space is still very a work-in-progress, there is clear indication that an increasing number of SBIR-involved are licensing in technology (to underpin their SBIR activities) from Universities and others and, in a growing number of cases, cross-licensing and out-licensing¹⁰ to other small firms, as well as to large and mid-sized corporations.

The data is clear and solid that Patent-holding SBIR Awardees – their own patents and/or those they have licensed-in – do far better in the SBIR Award stakes than non-IP holding. This slide represented strictly patent holders showing clearly that being approximately one-third of awardees, they are receiving over two-thirds of the SBIR awards. Given that a percentage of the Non-Patent holders are in space where patents as such are less relevant, these statistics may be even more impressive than at first sight.



Tracking US issued patents by key IP creating populations:

Consistent with major increase*¹¹ in SBIR funding in 1992, there was an important uptick in number of issued patents

- ❖ Where patents issued to academic institutions leveled off in late nineties, SBIR patent activity continued to increase.
- ❖ Drop off of patent issuances for both populations in 2008-2009 more a function of problems within Patent Office than of change in filing rates
- ❖ Important recent pick-up in academic patent filings may be reflection of growing interest by smaller institutions in spin-out of start-ups and out-licensing as potential source of revenue.

¹⁰ Handled properly, patent licensing can be very profitable especially for patented technology already put to use – a sunk cost. Properly structured, such a patent may be licensed many times. Though the scale is different, IBM is a case in point. The firm reports a 90% profit rate on almost \$3B of annual patent royalty income. That represents to only 2.1% of IBM revenues but factors to 17+% of IBM's pre-tax profits. There is much to be said for SBIR firms – particularly those rich in IP but limited in market-access – to be encouraged to out-license to generate a revenue stream. Our data shows clearly that out-licensing is common practice among VC funded entities

¹¹ By careful design, the 1992 reauthorization (incrementally) increased SBIR percentage but also pool against which the percentage applied. Latter was immediately implemented increasing the SBIR total pool from c. \$400M in FY 92 to c.\$750M in FY 93



Extent of M&A Transactions involving SBIR-STTR firms (March 2016)

To date, we have in-system record of **1,975** M&A transactions involving SBIR-STTR firms

- ❖ 22,865 SBIR-STTR involved firms
- ❖ 1,975 M&A transactions
- ❖ 1,384 acquiring firms
- ❖ 369 of the M&A transactions have involved a buyer themselves being/ having been SBIR awardees

8.64%
of SBIR awardees acquired

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M&A activity in the SBIR-STTR space. Consistent with the extent of large and mid-sized corporate involvement with SBIR-involved firm in collaborative endeavor of various types – briefly outlined in next section – there is a steady and continuing stream of reported Acquisitions of SBIR-STTR associated firms by Corporate entities.

Ranging in price from a few million – General Electric in 2004 buying the assets of a bankrupt DE-based AstroPower for only \$15M – to the more recent acquiring of long-time SBIR-involved MA-based Genzyme by Sanofi-Aventis for an amount in excess of \$20B .. and every price between, the fact that over

8.64 percent of SBIR involved firms have been acquired speaks volumes to the perceived value of what SBIR involved firms have created.

We have detail of price paid on some 50% of the deals – the balance are assumed to be smaller transactions i.e. no public record - but those 50% total some \$451,290,993,219 – an amount that registers even among those used to federal government budget numbers



Corporations having acquired multiple SBIR-involved *Italics=SBIR involved firms*

L3 Communications	L3:40	24
<i>Titan Corporation</i> (acquired by L3)		16
SAIC		13
General Electric		12
Raytheon		11
BAE Systems, Lockheed Martin Corporation		10
Agilent Technologies; EDO Corporation, General Dynamics; JDS Uniphase Corporation; Philips		9
<i>Invitrogen Corporation</i> ; PerkinElmer, Inc., Pfizer Inc.; Teledyne Technologies, Inc		8
Johnson & Johnson; Northup Grumman; Thermo-Fisher Scientific		7
3M; Amgen; ATK Inc.; Beckman Coulter; Bristol-Myers Squibb; Charles River Laboratories; Corning, Inc.; Genzyme Corporation; Gilead Sciences, Inc; Cx Technologies, Inc.; Qiagen NV; Sierra Nevada Corporation; Ultra Electronic Holdings		6

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Corporations having acquired multiple SBIR-involved *Italics=SBIR involved firms*

<i>Affymetrix, Inc.</i> ; Becton Dickinson & Co.; Boeing Company; CACI International, Inc.; Danaher Corporation; <i>Flir Systems, Inc.</i> ; GlaxoSmithKline; Medtronic Inc.; Merck & Company, Inc.; Microsoft Corporation; Roche Holding AG.; SRA International, Inc.; Tyco International Ltd; WL Gore & Associates, Inc.	5
Alion Science & Technology; <i>Allergan, Inc.</i> ; <i>Argon ST</i> ; Bayer AG; <i>Corixa Corporation</i> ; DRS Technologies; Goodrich Corporation; Honeywell International; <i>II-VI, Inc.</i> ; <i>Integra Life Sciences</i> ; Intel Corporation; <i>Intermagnetics General Corporation</i> ; Inverness Medical Innovations; ITT Corporation; ManTech International; <i>Millennium Pharmaceuticals</i> ; Monsanto; Moog Inc.; MSC Software; Novartis AG; Sanofi-Aventis SA; Siemens; Sigma-Aldrich Corporation; Smiths-Group plc; Thermo Electron Corporation; Veeco Instruments, Inc.;	4
37 Firms have acquired Three firms: to include 10 SBIR firms	3
135 Firms have Acquired Two	1139 Firms have Acquired One

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Tech Seeker-SBIR collaborations:

- ❖ Our data – ever developing – indicates over **2800** Large / Mid-sized corporations having **Working Relationships** with one/more SBIR involved small firms: partnering, licensing to/from, investing in and acquiring
- ❖ Over life of program, this has involved some **7500** SBIR-STTR firms – some 30% of all participating firms
- ❖ All indications are that among currently active awardees that percentage is **increasing significantly** perhaps already at some 35%

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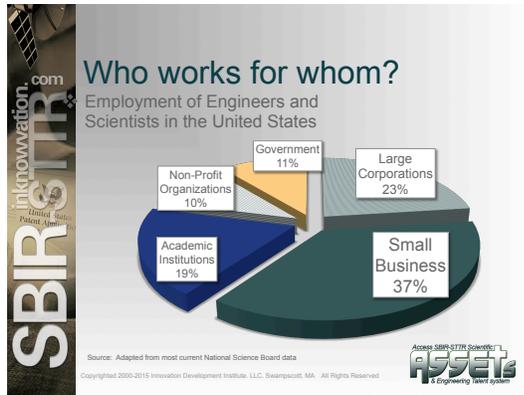
SBIR-STTR: Tech Seeker Collaborations:

For reasons that can be discussed at the hearing if there is time/interest, a striking development of the past 15-20 years has been the important shift in extent and manner by which Major/Mid-sized Corporations (US & international) now relate to small, technology-based corporations. Though not peculiar to the SBIR community, as perhaps the most readily identifiable population of technology-verified competent small firms the extent of this Tech Seeker involvement with SBIR Awardees has become a major factor in how many do business.

SBIR Employment impact

Finally, no data analysis involving the SBIR-STTR Program would be complete without some indication of the major high-quality job creation. For the purpose of this Hearing, we are focused on

- Who do the population of US based Engineers and Scientists work for
- STEM Job data
 - For the United States
 - That specific to Massachusetts and New York
 - That data most likely relevant to Member of the House Small Business Committee



At the time of development of the SBIR enabling legislation-early eighties - the data showed that some 15% of graduate levels engineers and scientists in the United States were employed by small firms. The argument continued that small firms were collectively were in receipt of - I think I recall – some 2% of the federal R&D dollar.

SBIR, we argued urgently, was a means to even up that score at least a tad; that we were squandering that resource by denying the country better access into that talent pool.

The percentage of federal R&D dollar going to small business has crept up a couple of points in the interim but that percentage of graduate level engineers and scientists that, according to NSF data now work for small firms has increased substantially to some 37%.

According to NSF data now work for small firms has increased substantially to some 37%.

- By 1996, NSF data showed, there were more graduate level engineers and scientists working for small firms than all the academic and non-profit institutions added together
- By 2000, there were more graduate level engineers and scientists working for small firms than all the Large US Corporations added together
- Today, that level of small business employed graduate level engineers and scientists has reached 37% ... and growing.

US: Extent of STEM employment: All States & those with SBIR-STTR connection	
Employment ¹	118,266,253
STEM jobs ²	7,356,855
Calculated Percentage of jobs in Country that are STEM related	6.22%
Calculated SBIR-STTR employment ³	505,672
Percentage STEM Jobs Resident in SBIR-STTR involved firms: factoring to some 0.02% of Business establishments	6.87%

1. US 2013 Census Data
2. ASTRA | ASTRA's 2015 STEM on the Hill™ State STEM Report Cards
3. Innovation Development Institute, LLC March 2016
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It would be difficult from our own systems to determine what percentage of that 37% are SBIR-connected but using STEM related data the following compilations prepared by idi would suggest that, though different by state, it isn't small.

Note particularly that folded into the chart – last line – is the calculation of SBIR establishments as the percentage of all businesses in area of focus. In this US as a whole slide, that means

- STEM jobs represent 6.22 % of all US jobs
- 6.87% of STEM jobs have an SBIR-connection
- with SBIR firms factoring to only 0.02% of business establishments.

A remarkable SBIR contribution (ROI) by any standard of reckoning – particularly when applying the common-

ly cited (but not readily attributable) adage that the creation of one-high paying (STEM-type) job in a community have a significant multiplying job creation impact (5-7). Music to the ears of areas of the country struggling with less than optimal, quality job employment rates.

Massachusetts: Extent of STEM employment: All State & those with SBIR-STTR connection

Employment in State ⁽¹⁾	3,070,703
STEM jobs in State ⁽²⁾	269,561
Calculated Percentage of jobs in State that are STEM related	8.78%
Calculated SBIR-STTR employment ⁽³⁾	54,580
Percentage State STEM Jobs Resident in SBIR-STTR involved firms: <i>factoring to some 1.33% of State's Business establishments</i>	20.25%

(1) US 2013 Census Data
(2) ASTRA | ASTRA's 2015 STEM on the Hill™ State STEM Report Cards
(3) Innovation Development Institute, LLC March 2016

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New York: Extent of STEM employment: All State & those with SBIR-STTR connection

Employment in State ⁽¹⁾	7,688,492
STEM jobs in State ⁽²⁾	419,770
Calculated Percentage of jobs in State that are STEM related	5.46%
Calculated SBIR-STTR employment ⁽³⁾	21,129
Percentage State STEM Jobs Resident in SBIR-STTR involved firms: <i>factoring to some 0.26% of State's Business establishments</i>	5.03%

(1) US 2013 Census Data
(2) ASTRA | ASTRA's 2015 STEM on the Hill™ State STEM Report Cards
(3) Innovation Development Institute, LLC March 2016

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Applying the same interpretative analysis to MA and to NY shows that

- in Massachusetts, a full 20.25% of STEM job in this State have an SBIR connection
- with that achievement made by what calculates to only 1.33% of business establishments
- while in New York, though with substantially higher STEM job levels, only 5.03% have an SBIR connection with SBIR awardees being only 0.26% of business establishments

US House of Representatives Small Business Committee: By Member State SBIR employment impact

State	Total Employment	STEM Employment	% STEM Related	SBIR Employment	% Stem Jobs SBIR related	SBIR % of State Firms
MA	3,070,703	269,561	8.80%	54,580	20.20%	1.33%
VA	3,131,723	329,716	10.50%	39,519	12.00%	0.73%
CA	13,401,863	968,826	7.20%	112,814	11.60%	0.66%
NJ	3,492,216	236,751	6.80%	15,940	6.70%	0.35%
OH	4,587,136	256,644	5.60%	14,740	5.70%	0.40%
HI	502,530	23,369	4.70%	1,242	5.30%	0.40%
NY	7,688,492	419,771	5.50%	21,129	5.00%	0.25%
MI	3,535,685	241,733	6.80%	11,068	4.60%	0.35%
NV	1,047,657	35,109	3.40%	1,516	4.30%	0.18%
FL	7,134,644	318,692	4.50%	13,474	4.20%	0.17%
NC	3,421,195	200,171	5.90%	7,973	4.00%	0.32%
IA	1,305,216	61,425	4.70%	2,223	3.60%	0.20%
MO	2,355,336	124,781	5.30%	3,698	3.00%	0.18%
MS	902,638	33,979	3.80%	756	2.20%	0.13%
KS	1,150,401	68,941	6.00%	1,080	1.60%	0.17%
US Total	118,266,253	7,356,855	6.20%	505,672	6.87%	0.40%

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At-hearing Talking points. ...*realizing the value of SBIR: Full value drawdown initiatives*

- Lessons from VC and Tech Seeker playbooks: managing portfolio.
 - The limiting condition of stove-pipe program management
 - Reduced(ing) risk tolerance: impacts and reaction
 - Loss of mid-sized firms 25-50 employees
-
- Legislatively enabling SBIR access into agency demonstration dollars
 - Permit - encourage - creative engagement by PM of the wealth of demonstrated SBIR talent e.g teamed projects
 - Empower SBIR-STTR Program Managers: e.g. 5% discretionary funding a la ERISA
 - Encourage new ways of enabling SBIR awardees to generate revenue streams: out-licensing very common among VC funded firms.