

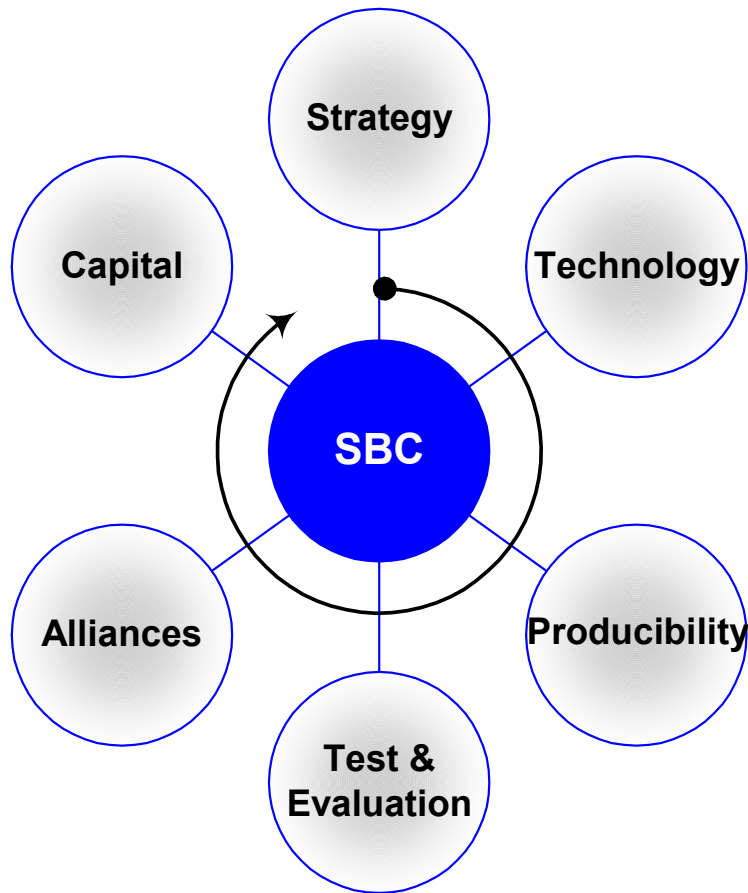
# SBIR Commercialization

*Is Your Small Business  
Ready for Prime Time?*

AIAA Los Angeles Section  
Enterprise Chapter  
El Segundo, CA  
18 March 2008

Dennis Wonica, Ph. D.  
[dwonica@laserlightnetworks.com](mailto:dwonica@laserlightnetworks.com)  
<http://www.laserlightnetworks.com>

# Roadmap: Six Phase 3 Pitfall Areas



- DoD vers. of SBIR Program
- Phase 3 only, “commercialization”
- Purpose
  - Guide decision making
- Point of View (POV):
  - Small Business Concern (SBC)
- For old hands: put yourself in position of small firm considering SBIR contracts for first time

# Phase 3: Background + Key

## ➤ Background

- “Congress wants to increase Phase 3 awards and transitions into acquisition programs” (Ref 2., p. 42)
- Congress funded National Research Council assessments
  - NRC reported 55% Phase 3 success rate, *yet*
  - “forced to conclude that even though Phase I and Phase II of the SBIR program are generally successful, and some firms have been able to cross the Phase III barrier, the vast majority of SBIR programs have not.” (Ref . 2, p. 77)

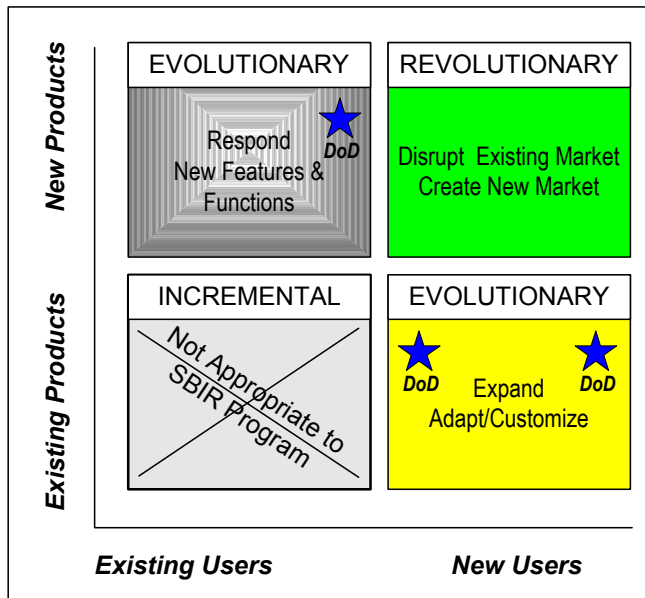
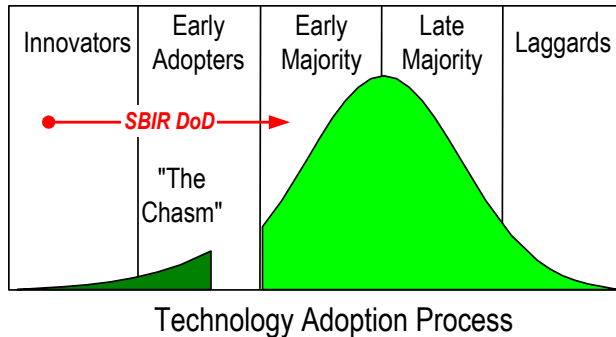
## ➤ Commercialization Dichotomy

- SBCs: mostly seek direct sales to non-Gov’t market
- DoD: direct sales to Agencies + insertion of technology into Prime Contractor’s major program
  - Agencies focus on maturation of technology readiness and aligning companies with its acquisition programs

## ⚡ SBC likely cannot serve Gov’t + non-Gov’t markets simultaneously

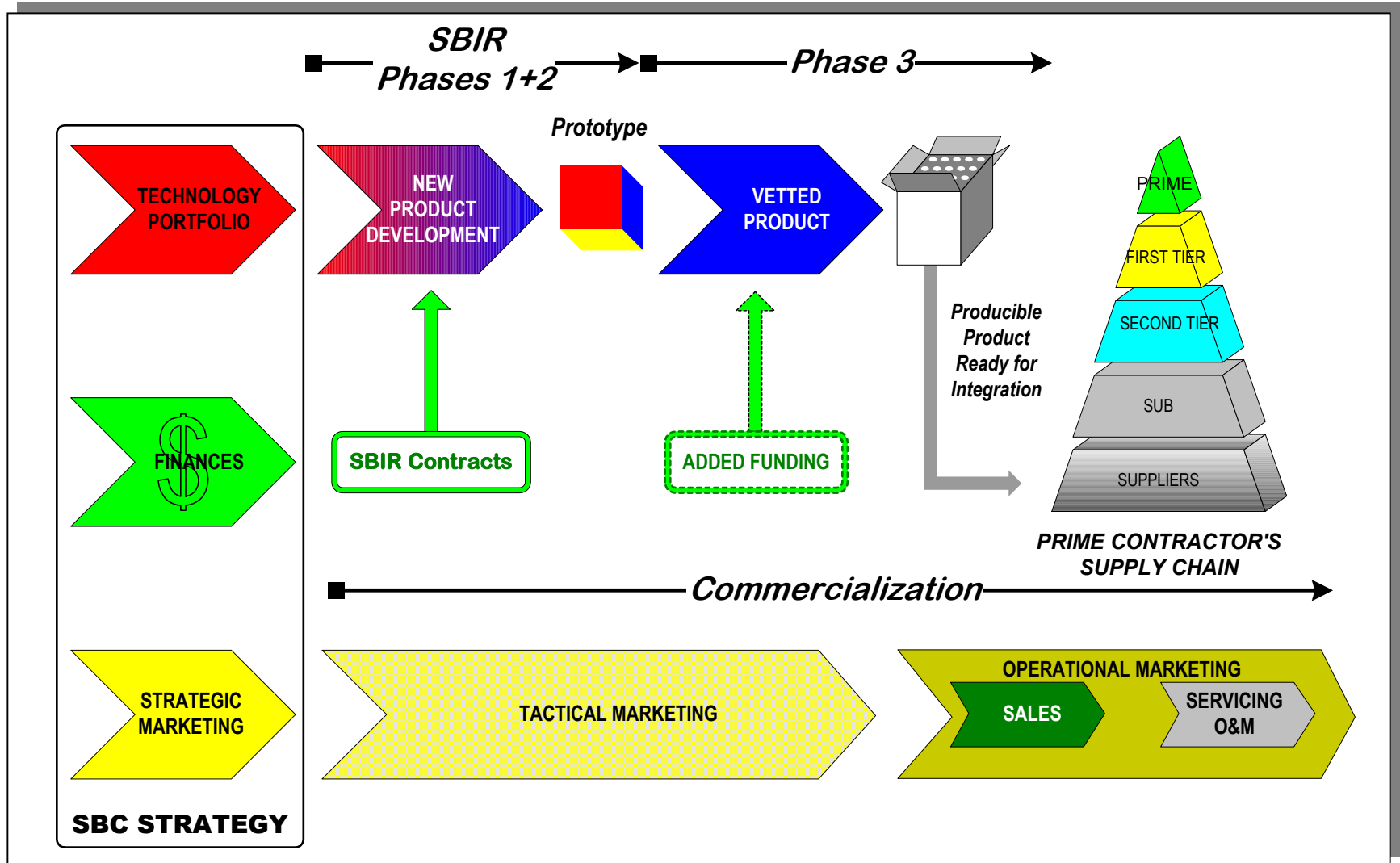
- Resource limited, high vs. low volume sales, product features, customer servicing, maintenance, other

# Strategy: Select Right Market, Obey Adoption Process



- DoD SBIR seeks Innovative Technology, *but*
- Truly revolutionary innovation does not belong in DoD market!
  - Not good for SBC
- DoD: seeks new product, new features & functions
  - Difficult, low-average chance of success for SBC
- Adapt existing product to DoD requirements
  - Highest chance for success for SBC

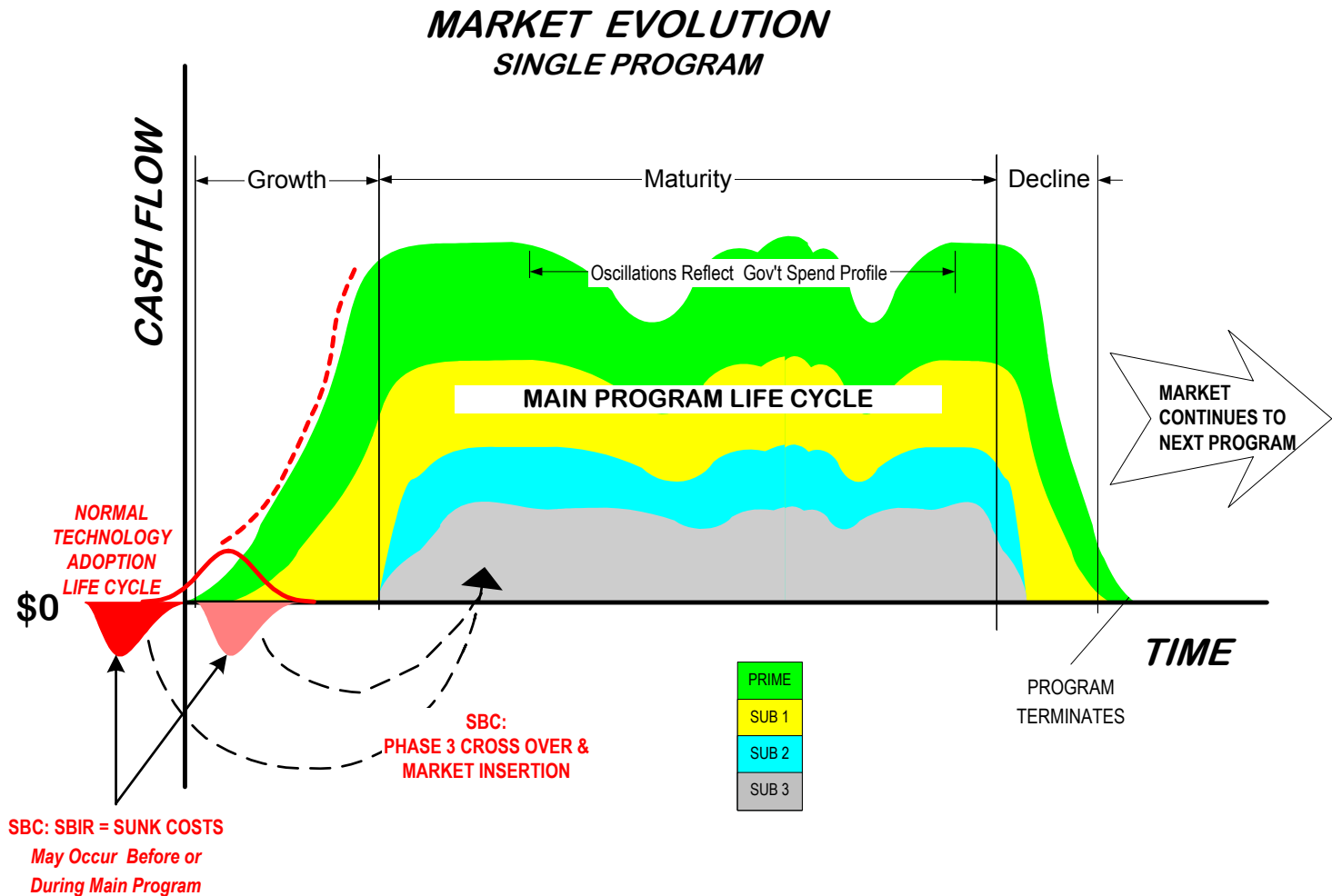
# Strategy: Business Case for SBC



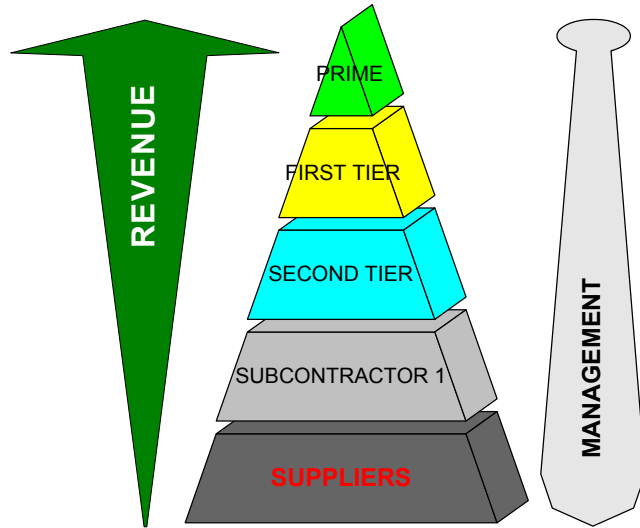
# Clarification: Marketing & Sales

- Government M&S consistently cited as problem area for SBC
  - Easier for tech firm to market Business to Government than either B to B or B to C(onsumer), since Government customer:
    - Identifies itself (usually)
    - Identifies general product features, usually uses specific requirements
    - Uses explicitly defined procedures and processes to acquire product
    - Defines profit margins, contracts, timing, et al
  - SBIR technology market is more “pull” than “push”
    - Generally, product performance counts more than anything else, though product must integrate with platform
  - SBIR is in “Innovator” and “Early Adopter” categories of New Technology Adoption
- Commercialization: all business activities and processes associated with bringing product to marketplace
  - Includes Tactical + Operational Marketing processes

# Strategy: Understand DoD Market

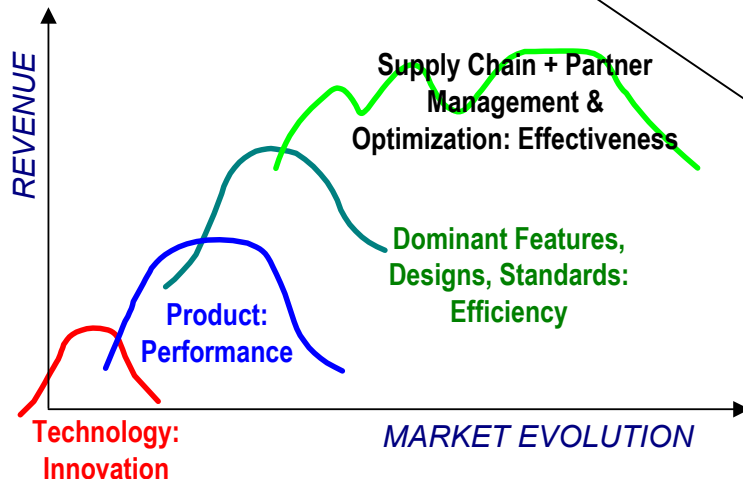


# Strategy: Recognize Position in Chain



## ➤ Recognize:

- Defense/Aerospace sector = oligarchic market
- If direct sales is your Phase 3 goal, product usually integrates into prime's platform
- You will be at bottom of vertical supply chain in market dominated by prime
- Most new innovation comes from within the value chain itself—prime, customers, tiers, suppliers—not from outside (= SBC)



**SBC Inserted Here in Phase 2 to 3 Transition**

# First Key Problem

## Possible Wrong Business Strategy for SBC

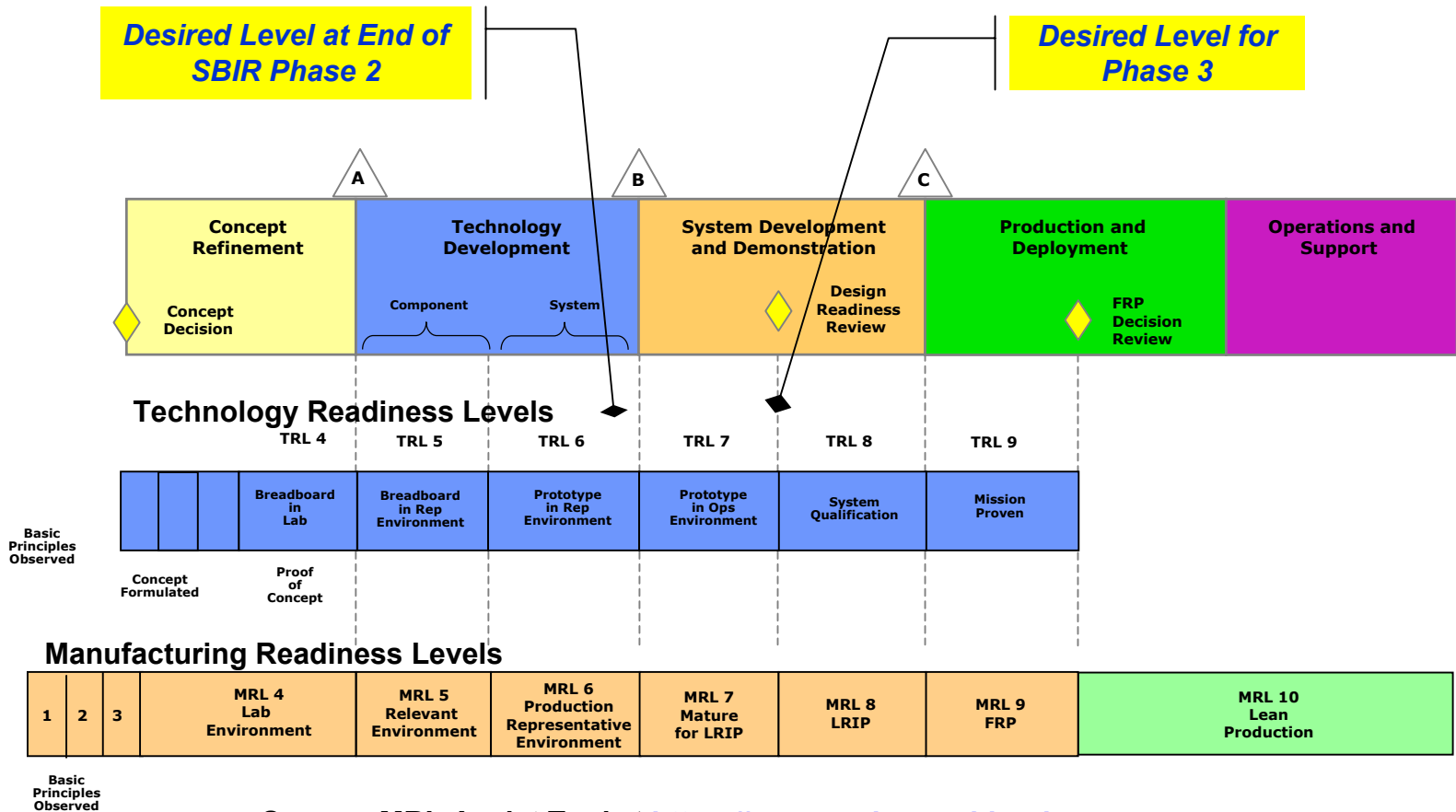


- You innovate at start of Growth Stage but sell in Mature Stage
  - You receive little or no revenue from Growth Stage

- DoD/SBIR may be wrong path for your product's insertion
  - Normally, successful tech innovation company follows dashed red path (see slide #7), continues along entire revenue curve in commercial market
  - Path = lower risk, high margins, large revenue, rapid growth
- Nothing inherently wrong with DoD acquisition process
  - Do you want to be in this market long term, or at all?
  - If you are in this market provide value and commitment to DoD customer to succeed

# Technology & Producibility:

## Understand Defense Acquisition Process



Source: MRL Assist Tool at <https://www.molasses.bipod.org>

# Second & Third Key Problems

## Technology & Manufacturing Maturity

- Your technology may not be as ripe as you think
  - Technology Readiness Level (TRL) = metric
  
- You may not be able to produce an acceptable product
  - Manufacturing Readiness Level (MRL) = metric
  - Transitioning from Phase 2 prototype to product ready for integration with platform usually requires greater overall effort in maturing manufacturing readiness than in maturing technology
  
- At Phase 2 completion, most efforts are only at TRL and MRL 4-5—many at TRL<4
  - General DoD goals at end of Phase 2: TRL 6 and MRL 6

# Fourth Key Problem

## Test & Evaluation (T&E)

- Vetting your prototype indoors or in parking lot by demo with “all functions operating as advertised” won’t be enough for Phase 3
- By SBIR definition, R&D does not include testing
  - Agency Program Office really wants TRL & MRL 7/8 product for insertion into prime program
- Major program tests at two levels:
  - At completion of full-scale development of system and in operational environment
  - T&E “sells” final product to customer, tests extensive & exhaustive
- Likely you need help to mature both technology and producibility to level 7/8
  - Specialized testing, equipment, access to special facilities
    - THESE ARE CAPITAL INTENSIVE SUNK COSTS DIFFICULT TO FUND

# Fifth Key Problem

## Forced Alliance

- SBIR process forces alliance between SBC and Prime—presents hidden problems that cannot be resolved by Agency
  - Agency expects prime + SBC will work together spontaneously
  - DoD bears explicit financial burden
  - Prime bears no burden until/if Agency insists it work with SBC
  - SBC incurs most risks: Intellectual Property protection, contract termination, product integration w/platform, other

- Corporate alliances in general account for nearly 1/3 of firms' revenues and values and continues to rise as much as 25%/yr
- Failure rate of all alliances could be as high as 60-70%

Source: **The Elements of Value Network Alliances—Strategies for Building Alliance Partnerships**, Deloitte Research, 2008

# Alliance: Prime POV

- Market not really competitive, SBC provides little strategic advantage
  - TRL/MRL likely immature - more work required, more trouble than it is worth, integration work needed
  - “Not invented here” opposition
  - For worthwhile technology, could acquire SBC or employ key people to obtain know-how through back door
- Gov’t should offer (fee) incentive to work with SBC
  - Primes access all available lower tiers, subs, suppliers as needed, what’s special about SBC?
- SBC may gain access to prime’s resources by including prime as part of SBIR contract
- Generally, rapid technology change unattractive in markets with high levels of vertical integration
  - Possible technological immaturity or obsolescence

# Alliance: SBC POV

## ➤ Seeks

- Access to new market, primarily direct sales contract to prime and/or Agency
- Access to complementary resources/capabilities or facilities from prime to reduce own costs
- Cooperation that mitigates risk and increases flexibility in responding to this market's uncertainties

## ➤ SBC on including prime as part of Phase 1-2

- Appears to be reverse subsidy—a contract that steers away from informality of alliance
- Why should SBC give money to extremely large company when it needs it itself?

# Alliance: Business Case

## SBC POV



- Alliances should decrease costs for specialized assets needed to support contract
  - Costs not offset by SBIR—may not benefit from alliance
  - Unattractive high exit barriers for investors, equal to increased sunk costs
  - SBC may be left more vulnerable than it was entering SBIR Program
  
- Alliance usually occurs near Phase 3
  - Little value before insertion into market—it may be too late!
  - Development of internal resources, assets, and capabilities take time, added risks are:
    - Lost opportunity costs in open market
    - Possibly first mover (or second mover) advantage
    - Product may be so specialized that it has lost potential opportunities in open market → “dual usage” misnomer

# Sixth Key Problem

## Capital

- Highly likely funds required beyond Phase 2
  - Phases 1+2 combined < \$1M
- Consider amount, cost of capital, sources
  - Amount includes hardware, labor, overhead, special parts, special equipment, facility, etc.
  - Cost of capital is zero for Phases 1/2
  - Cost of capital may be substantial for Phase 3 for firm needing external investment
  - Depending on SBC size and maturity, you may need to give up equity in return for external capital—a strategic decision
- Weighted Average Cost of Capital WACC
  - $WACC = (E/V)r_E + (D/V)r_D (1-T)$ 
    - E=Equity      D=Debt      V=E+D      T= marginal tax rate
    - $r_E$  = cost (rate) expected for Equity       $r_D$  = cost of Debt

# Capital: Decision Tree Analysis

- Tool for evaluating risk – value:
  - Government regulations define profit + time line
  - Overall process sequential
    - Phase 1  Phase 2  Phase 3
  - Construct realistic time line with defined decision points
  - Win probabilities known from program history
  - Qualify prototype maturity within discrete uncertainties
  
- Consider options, weigh risks at each Phase, determine possible outcomes, assign probabilities of occurrence based on information available now
  - Metric: Expected Monetary Value (EMV) *today* using probability weighted average of discounted cash flows
  - EMV incorporates both upside and downside risks + actions to take at each stage, range of values captures potential risk in investment in product
  - Use EMV to decide overall GO/NO GO and at each stage

# Capital: Example Decision Tree

## ➤ Characterize Phases:

	Contract						Proposal			
	Type	Price	Cost	Percent Profit	Annual Profit	Duration (yrs)	Cost	Psuccess	Pfailure	WACC
<b>Phase 1</b>	FFP	\$100	\$80	25%	\$20	1	-\$10	15%	85%	0%
<b>Phase 2</b>	CPFF	\$750	\$682	10%	\$34	2	-\$30	40%	60%	0%
<b>Phase 3</b>	CPFF	\$33,000	\$30,000	10%	\$1,000	3	-\$100	50%	50%	15%

All Amounts in \$K

## ➤ Characterize Strength of Phase 2 Prototype:

Prototype	Outcome	Dev Duration (yrs)	Dev Cost	Psuccess
Strong	10%	2	-\$1,000	80%
Average	30%	2	-\$1,500	50%
Weak	10%	2	-\$2,000	20%

Consistent with NRC's claimed 55% Success Rate

- EMV = -\$6K for specific example
  - Conclusion: *No Bid* even Phase 1

Tables extracted from Ref. 4; see for details

# Capital: Free Cash Flow to Equity

Phase 3 Investment Costs for Strong Prototype (\$K)			
Equity	E	\$400	\$1,000
Debt	D	\$600	\$0
Total		\$1,000	\$1,000

Company Data			
Tax Rate	T	40.0%	40.0%
Interest Rate	$r_D$	12.0%	12.0%
Cost of Equity	$r_E$	8.0%	12.0%
Discount Rate	$r_E + (D/E) * (1-T) * (r_E - r_D)$	4.4%	12.0%
Interest Expense	$D * r_D * (1-T)$	\$43.20	\$0.00

Year	Earnings on Phase 3	Earnings - Tax	Earnings - Tax - Interest Expense	Interest
1	\$1,000	\$600	\$557	\$600
2	\$1,000	\$600	\$557	\$600
3	\$1,000	\$600	-\$43	\$600

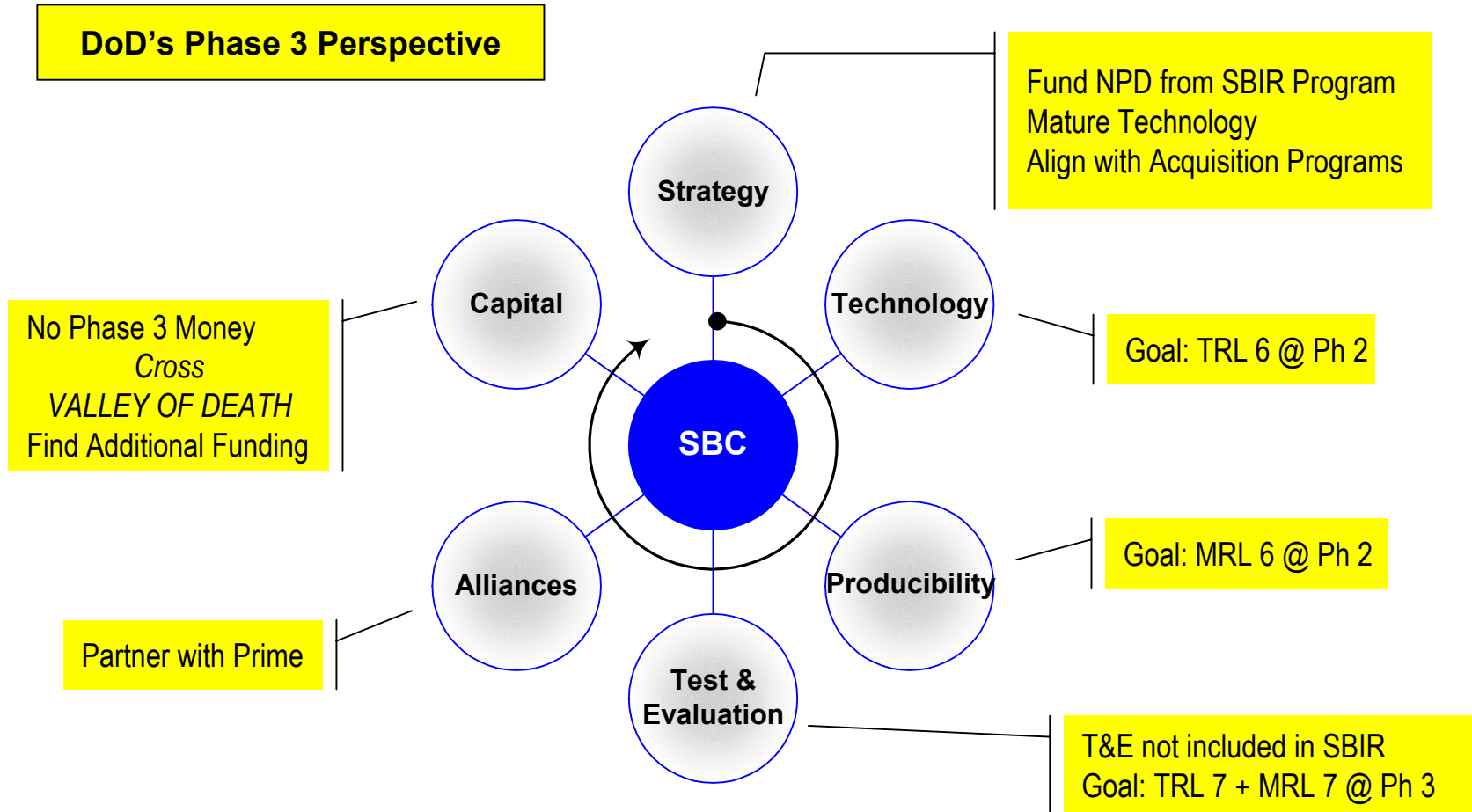
	<b>Debt + Equity</b>	<b>All Equity</b>
NPV	<b>\$606</b>	<b>\$441</b>
	$\Delta =$	<b>\$165</b>

- FCFE = Cash available to Investors
- Combined Debt + Equity financing usually superior to all Equity Deal
- Debt provides leverage, increases Net Present Value

Different to Reflect Equity Investment

# Summary

## Do You Align with DoD Program?



# Recommendations: Strategy



Define, pursue correct strategy for your firm

- First devise strategy, then decide if SBIR Contracts fit
- Position your new product—may not be defense sector
- Do not neglect DoD customer if you stay in this sector



Bias win probability for Phase 1 in your favor through focused, pre-solicitation marketing



Avoid customer Phase 3 Dead End

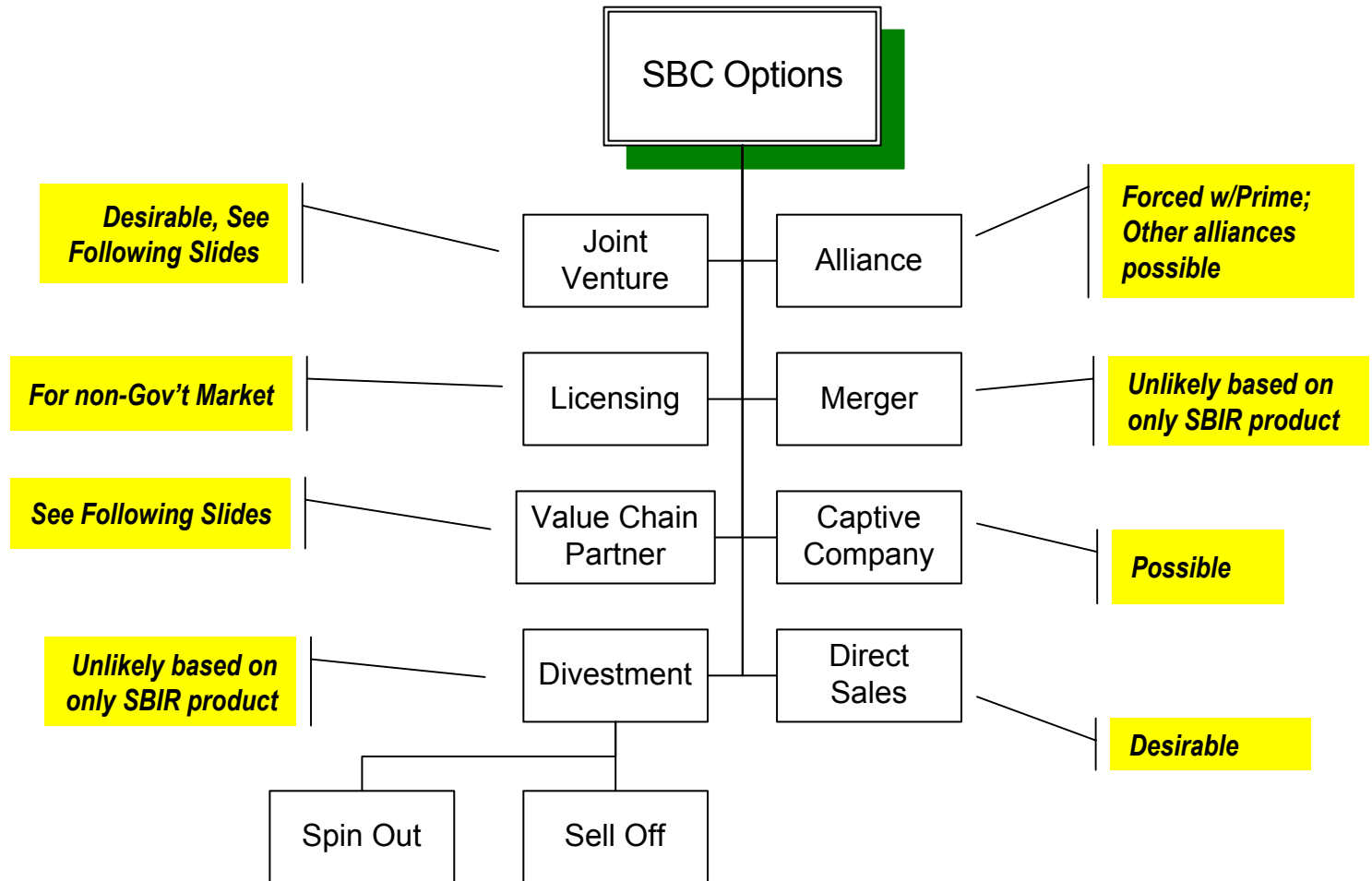
- Multiple awards sometimes indicate serious intent
- Reaffirm commitment throughout contract after win
- Find agency customer w/tie-in to real program  $\equiv$  Operations
  - Corollary: Be wary if agency lab is primary customer
  - Be wary of customer bias for “preferred solution”



Good indicators of customer commitment:

- Participation in Integrated Product Dev. Team in Phase 2
- Phase 3  $\equiv$  Pre-Planned Product Improvement (P<sup>3</sup>I)

# Recommendations: Seek Options Besides Direct Sales



# Recommendations: Other Options

## Gov't & Non-Gov't

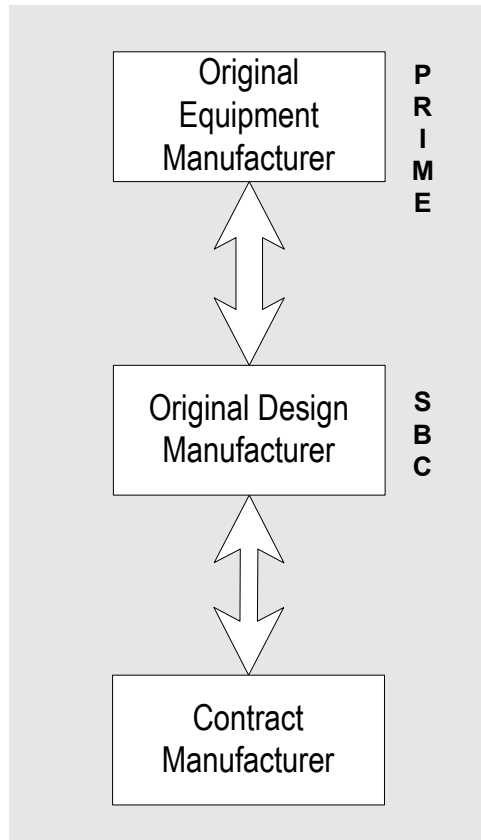
- Patent most viable IP protection; **Licensing** = revenue generator
  - ~~Gov't~~—has royalty free license + march-in rights
  
- **Joint Ventures based on equity arrangements**
  - Formal arrangement, not informal alliance
  - Equity participation better aligns two-party arrangements, provides incentive for trust and to mutually succeed
  - Contracts identify min expectations but provide no incentive for max effort—more useful as technology matures and deliverables become definitive
  - DoD cannot enter into equity arrangement under SBIR Program
    - Federal VC-types: OnPoint (Army); In-Q-Tel (CIA); Red Planet Capital (NASA)
    - Other Federal: DeVenCI (OSD); RTT (Navy)
  
- **Captive Company**
  - Provide product exclusively to larger company but remain independent

# Recommendation:

## Ally at Different Level within Chain

- Use/Partner w/Contract Manufacturer (CM)
  - Advance **MRL**
  - Prototyping
  - Low Rate Initial Production (LRIP)
- More equitable basis than direct alliance with prime, each provides complementary value
  - CM receives more contracts
    - Unlikely CM “steals” intellectual property—not their focus to develop technology
  - SBC needs manufacturing assistance, gets to production without expending resources on non-core processes
- **Proper Alliances** (Gov’t & non-Gov’t markets)
  - Mitigate business concerns: capital, testing, customer entrée, sales, other complementary assets

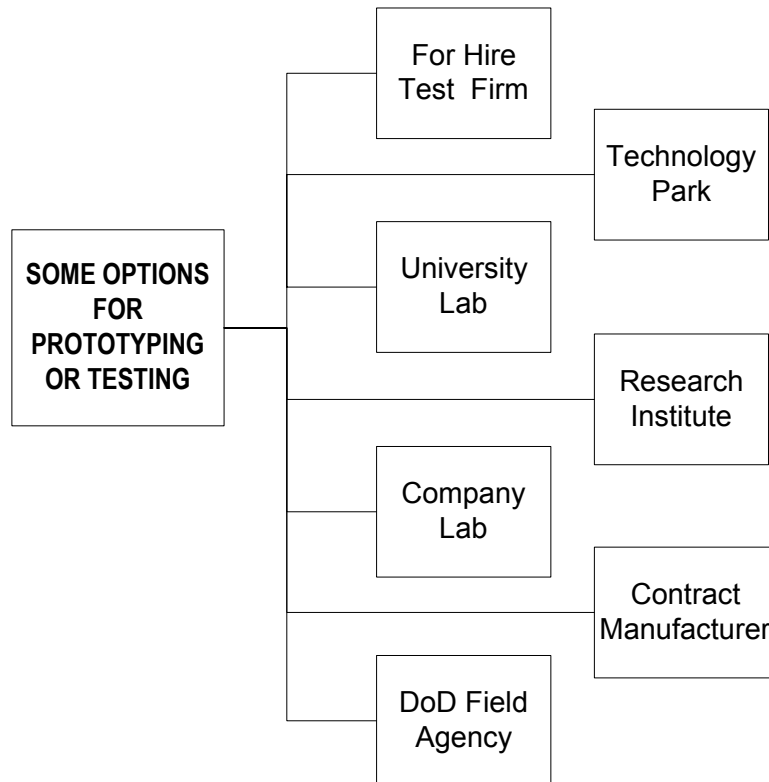
# Partner Model for SBC within Value Chain



Partnering Model  
for SBC

- SBC resembles Original Design Manufacturer (ODM)
  - SBC owns and designs product
  - SBC supplies design to CM
  - For Gov't market, product “branded” by prime for sale to DoD
- Advantages to using CM:
  - Geared toward lower volumes
  - Uses greater mix of assemblies
  - Provides quality of workmanship required in military/aerospace work
  - Solves export regulations problem—they reside in USA
  - Handles documentation required by Primes

# Recommendations: TRL + T&E



## ➤ TRL:

- Adapt existing product to DoD requirements
  - Clearly define NPD path
  - Require moderate to low additional development
- Produce Strong Phase 2 Prototype
- Know when to quit

## ➤ T&E:

- Testing facilities exist – depends on what you test, complexity
- Government facility useful for large demos or on DoD platforms
  - Low to no cost
  - Government Furnished Equipment (GFE) possible

# Recommendations: Capital

- Perform your own calculations
  - Use Decision Tree Analysis, compare to sales in open market
  - Debt: Bank loan rate = ? Or Investor demanded return rate,  $r_D$ 
    - How much will bank lend your firm? Collateral required?
  - Equity: Investor demanded rate,  $r_E$

Note: Nominal ROI for Angel = 25%/yr. Compounded =  $(1+0.25)^3 = 1.95$  after 3 yrs.

  - ➔ Debt combined with Equity provides greater FCFE than all Equity
- Fund Phase 3 internally if possible
  - How much can your firm self fund? How long can you go?
  - How low can you go? If Ph. 2  $\leq$  \$750K, how much lower for Ph. 3 development?
- Venture Capitalists & Angels usually don't fund Gov't projects
  - ➔ Find motivated Private Investor when funding modest, low cost
- Difficult to repay investors only from earnings from Ph. 3 contract
  - Profit limited by Fed Acquisition Reg. to  $\leq 15\%$
  - Larger contract – how much work can you absorb?
  - ➔ Pursue commercially viable NPD to increase profit margin

# Still Failing to Commercialize?

## *Sacrifice 2 Goats*



- Officials at Nepal Airline sacrifice 2 goats to appease Akash Bhairab, the Hindu sky god, following technical problems with one of its Boeing 757 aircraft  
-- Sep 2007
- No more problems reported



# Recent Info

## ➤ NRC recommendations:

- Increase Ph. 1 to \$150K and Ph. 2 to \$1M
- Increase funds to agencies for management
  - Not yet passed

## ➤ Dec 2007:

- James Finley/DUSD for Acquisition & Technology affirmed \$85M new FY08 monies for RDT&E *for insertion of new technologies from only SBCs*
- Monies to Navy, Army, Air Force major programs
- Does not require SBC to be SBIR recipient but urges agencies to look to SBIR award pool
- ➔ Monies could be used for T&E



# References

## ➤ Ref 1

- **An Assessment of the Small Business Innovation Research Program**, Charles W. Wessner, Editor, National Research Council, ISBN: 0-309-11085-8, 2007, <http://www.nap.edu/catalog/11989.html>

## ➤ Ref 2

- **SBIR and the Phase III Challenge of Commercialization: Report of a Symposium, Committee on Capitalizing on Science, Technology, and Innovation: An Assessment of the Small Business Innovation Research Program**, Charles W. Wessner, Editor, National Research Council, ISBN: 0-309-66633-3, 2007 <http://www.nap.edu/catalog/11851.html>
- 

## ➤ Ref 3

- **The Business of Commercialization in DoD SBIR Program**, D. Wonica, 2007

## ➤ Ref 4

- **The Business Case for SBIR Commercialization**, D. Wonica, 2008  
[LaserLight Networks](#)