

# Competition in DoD Systems Acquisition: Past Lessons and Future Considerations

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# Study Objectives

1. Compile, organize, and review past studies that address the impact of competition on weapon systems acquisition
2. Compile competitive program savings/loss estimates for a representative cross section of programs
3. Develop insights to facilitate future competition decision-making
4. Investigate a preliminary framework to enable the acquisition community to evaluate alternative competitive acquisition strategies

# Defense Market Overview

## Buyer

- Monopsony (single buyer)
- Fragmented customer (Administration, Congress, Military Services)
- Multitude of stakeholders and interests (military, economic, political, social)

## Seller

- Publicly-held companies with fiduciary responsibilities to stakeholders
- Limited by:
  - Relatively inelastic demand
  - Closely regulated fee structures
  - High entry/exit barriers

*Conditions vary greatly from competition in the commercial sector*

# Insights to Facilitate Future Program Decision-Making

# Background and Context

- Study leverages competition study library composed of approximately 300 documents
  - 40% included estimates of production savings/losses due to competition
  - 70% prepared before 1990; 90% prepared before 2000
- Significant changes have occurred since then
  - Reduction of prime contractors
  - Defense industry structure and composition
    - Increased vertical integration as primes acquire former subcontractors
    - Increased outsourcing by primes (government has limited insight into fixed-price subcontracts)
    - Limited suppliers at lower tiers for key components
  - Following Defense Acquisition Act of 1986, government can no longer require unlimited technical data rights indiscriminately for all development efforts
  - Bid protests have declined, but still considered a major impediment

# Change in Industrial Base

<b>Prime Contractors in Key Defense Market Sectors</b>			
<b>Sector</b>	<b># Firms in 1990</b>	<b># Firms in 1998</b>	<b># Firms in 2008</b>
<b>Tactical Missiles</b>	13	3	5
<b>Strategic Missiles</b>	3	2	2
<b>Fixed-Wing Aircraft</b>	8	3	4
<b>Rotary Aircraft</b>	4	3	4
<b>Expendable Launch Vehicles</b>	6	2	3
<b>Satellites</b>	8	5	4
<b>Surface Ships</b>	8	2	2
<b>Torpedoes</b>	3	2	2
<b>Tactical Wheeled Vehicles</b>	6	4	5
<b>Tracked Combat Vehicles</b>	3	2	2

# Development Lessons/Insights

- Prototyping
  - Applied to several programs, e.g.,

<b>F-35 Joint Strike Fighter</b>	<b>F-22 Advanced Tactical Fighter</b>
<b>AH-64 Apache Attack Helicopter</b>	<b>Landing Craft Air Cushion (LCAC)</b>
<b>A-10 Thunderbolt Ground Attack Aircraft</b>	<b>M1 Abrams Tank</b>

- Studies dating back 50 years don't document impact on technical, schedule, or cost risk
- Some suggest that it may reduce EMD time, but require additional resources and time leading up to EMD start
- Consensus that prototype contractors were more responsive to program office direction, but could not be objectively measured
- Would doubling development budget of one firm have a better payoff?

# Development Lessons/Insights

- Codevelopment

- Applied to several programs in the 1980s, e.g.,

<b>Integrated Electronic Warfare System (INEWS)</b>	<b>V-22 Osprey</b>
<b>Comanche helicopter</b>	<b>Tactical Communications Jammer (TACAN)</b>
<b>Line of Sight Rear (LOS-R) for Forward Area Air Defense (FAAD)</b>	<b>Javelin missile</b>
<b>Advanced Air-to-Air Missile (AAAM)</b>	<b>A-12 Avenger II</b>
<b>Joint Primary Air Training System (JPATS) T-6A Texan II</b>	<b>Multifunctional Information Distribution System-Low Volume Terminal (MIDS-LVT)</b>

- Studies reviewed don't document impact on technical, schedule, or cost risk
- Some questions to be considered:
  - What is the likelihood that the cost of additional prototypes required to qualify two co-developers for production will be recovered through competition?
  - What is the likelihood that two contractors become comfortable cooperating and form a joint venture company, thereby, eschewing competition?
  - Would doubling development budget of one firm have a better payoff?

# Production Lessons/Insights

- Government must base dual sourcing decision on realistic requirements & sound judgment
  - Total quantity required
  - Annual production rate
  - Schedule
- Conditions that increase probability of DoD achieving savings
  - Development must be complete ... product must be stable
  - Implementation must occur as early in production phase as possible
  - Remaining production quantity must be 'significant'
  - Initial source must perceive a real threat and both sources must be willing & able to compete
- Contractor behavior that has decreased production cost
  - Move production plant to a geographic location with lower labor rates/overhead
  - Reduce engineering & manufacturing support personnel

# Past Production Competition Estimates

Program	Range of Estimated Savings (+)/Loss (-)		Sample of Some Deficiencies of the Estimates
	Low	High	
<b>AN/ALQ-165 Airborne Self-Protection Jammer (ASPJ)</b>	8.3%	17.8%	Program employed co-development strategy; ASPJ never produced; estimates based on conjecture
<b>CG-47 Class Aegis Cruiser</b>	-51.0%	19.6%	Only one study showed added cost, but program office felt government cost exceeded savings; estimates do not apply to entire program
<b>Cruise Missile (Tomahawk Missile)</b>	3.0%	20.7%	No competition for ALCM; cruise missile engine second source non competitive; estimates for Tomahawk airframe & guidance only
<b>DDG-51 Arleigh Burke Class Aegis Destroyer</b>	-13.9%		No sole source period in program for baselining; loss shown based on very preliminary data; continuous upgrades to hull & combat system during life of program make units incomparable
<b>Evolved Expendable Launch Vehicle (EELV)</b>	*		Program on-going; experienced cost growth because of failure of expected commercial market to occur
<b>Javelin (AAWS-M) Medium Anti-Armor Weapon</b>	*		Program employed co-development strategy; firms formed a joint venture & did not compete during production
<b>Joint Primary Air Training System (JPATS) T-6A Texan II</b>	*		RFP allowed 9 competing prototypes; major mods required for presumably "off-the-shelf" options
<b>Multifunctional Information Distribution System-Low Volume Terminal (MIDS-LVT)</b>	*		Program ongoing; program office claimed cost reduction of 50% over first 8 lots
<b>MK-46 Torpedo</b>	-43.6%	-11.8%	Competition resulted in a loss; however, second source won final two winner-take-all lots
<b>MK-48 Torpedo</b>			
Mod I	23.7% (Warhead) 11.6% (Elec. Ass.) 61.2 % (Exploder) 61.8% (Test Set)	54% (Warhead) 55% (Elec. Ass.) 80% (Exploder) 79% (Test Set)	Second source won all competitions; no sole source learning curve for exploder & test set; high estimates discredited
ADCAP	-0.2%	16.3%	Competitors bid aggressively; estimates do not include winner-take-all buyout

\*Note: No estimates of savings/loss due to competition were included in the studies in the library.

# Past Production Competition Estimates

Program	Range of Estimated Savings (+)/Loss (-)		Sample of Some Deficiencies of the Estimates
	Low	High	
<b>AIM-54C Missile</b>	-18.5%	11.0%	Most studies do not include all production buys; there were only two competitive buys -- split buy in FY89 & winner-take-all in FY90
<b>Sidewinder AIM-9 Missile</b>			
AIM-9B	-6.7%	20.7%	Estimates based on only one sole source lot; initial source learning curve did not change during competition
AIM-9D/G	-71.3% (G&C)	0.7% (G&C)	Second source dominated competitions & both sources raised prices as a result; data does not include Chapparral & FMS units produced concurrently
AIM-9L	-3.8%	24.0%	Savings estimate assumed sole source would increase profit margin during life of program
AIM-9M	-35.4%	12.7%	Savings resulted from high sole source profit which declined during life of competition
AIM-9R	-38.2%	12.9%	Exclude first lot from cost improvement curve
<b>Sparrow AIM-7 Missile</b>			
AIM-7F	-31.4% (G&C)	57% (G&C)	Savings based upon assumption about which lot was first completed; consensus that competition increased production cost; profits increased significantly
AIM-7M	-28.6% (G&C)	29% (G&C)	Based on recurring unit price savings
<b>SSN 688 Class Attack Submarine</b>		*	Savings based on comparison of initial contract prices to budget; Initial contract prices, based on aggressive bids, grew significantly as a result of claims against the government
<b>Standard Missile</b>			
MR RIM-66A	-4.2%	59.2%	Systems were never produced by a second source; no data available to support savings estimate
ER RIM-67A		34.0%	
SM-2	15% (GC&A)	35% (GC&A)	Program experienced purchase of initial source & ultimate merger of both sources into joint venture
	18.1% (Rocket Motor)	32% (Rocket Motor)	Do not include entire procurement

\*Note: No estimates of savings/loss due to competition were included in the studies in the library.

# Limitations of Past Production Competition Estimates

- Savings estimates based on incomplete pictures of programs (i.e., snap-shot in time of production buys to date, only subsystems of a system included, etc.)
- Savings estimates do not consider potentially significant contractor & government in-house costs attributable to competition (e.g., second source start-up costs, government costs, claims/litigation, engineering change orders, O&S costs)
- Savings estimates based on questionable estimating methodologies (e.g., assumed learning curve shift and rotation)
- Savings estimates for programs that reflect pre-1990s industrial base

*Estimates are generally flawed & should not be used as analogies for future programs*

# Framework for Evaluating Competition at the Program Level

# 'Recent' Competition Legislation/Guidance

- USD AT&L Guidance (Sep 2010) & Implementation Directive (Nov 2010), *Better Buying Power: Obtaining Greater Efficiency and Productivity in Defense Spending*
  - Requires competitive acquisition strategies for all ACAT IC, ID, II, III, and IV programs to be presented at each program milestone.
  - Requires DoD to remove obstacles to competition (e.g., utilizing open systems architectures, setting rules for acquisition of TDPs, increasing the role of small businesses, etc.)
- OMB Memo M-09-25, *Improving Government Acquisition* (July 2009)
  - Requires that contracts non-competitively awarded/solicitations with one bid, cost-reimbursement contracts, and T&M/LH contracts must be reduced by 10% in FY2010 (combined share of \$)
- USD AT&L Directive-Type Memo 09-027, *Implementation of the Weapon Systems Acquisition Reform Act of 2009*
  - Implements & institutionalizes PL 111-23
- PL 111-23, *Weapon Systems Acquisition Reform Act of 2009* (May 2009)
  - Requires acquisition strategies to include measures to ensure competition or option for competition throughout program life cycle at prime/subcontract level
  - Suggests potential measures to address this requirement (i.e., competitive prototyping, dual-sourcing, acquisition of complete TDPs, etc.)
  - Requires competitive prototyping for MDAPs prior to Milestone B approval unless waived by MDA
- DoDI 5000.02 (Dec 2008)
  - Requires competitive prototyping at the system or key subsystem level during the TD phase.
- USD AT&L Guidance, *Prototyping and Competition* (Sep 2007)

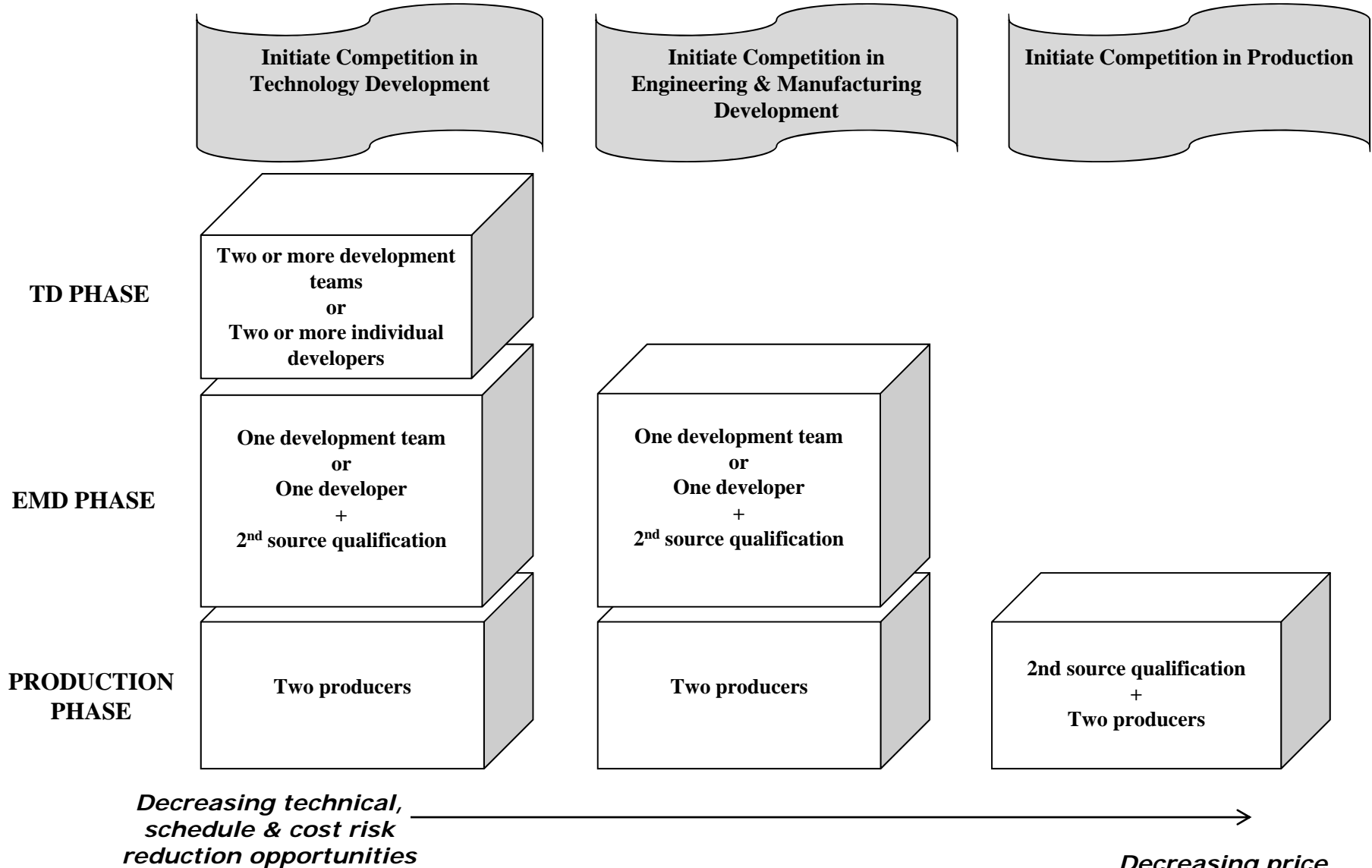
# Competition is Not for All Programs

- Despite well-intentioned regulatory/policy environment, it is very easy to get this wrong
- Absolutely no magic formula for programs that appear good candidates, but there are ways to maximize probability of success
- Rigorous, objective program-specific discovery & evaluation is essential and requires:
  - Time to think about the problem
  - Multi-disciplined approach (systems engineering, cost analysis, financial analysis & contracting)
  - Willingness to adapt acquisition strategy as necessary throughout the life of the program
- Important reference : “*Establishing Competitive Production Sources: A Handbook for Program Managers*,” Defense Systems Management College (DSMC), Aug. 1984.

# Critical Questions

- Why?
  - Technical risk reduction
    - Arguably the most important objective
    - Deliver best technical solutions & quality systems faster
    - Control costs
  - Industrial base maintenance
    - More firms = greater design & build capability
    - Deliver best technical solutions & quality systems faster
    - Control costs
  - Price reduction
  - Law & policy
- When?
  - Technology Development (i.e., MS A)
  - Engineering & Manufacturing Development (i.e., MS B)
  - Production (i.e., MS C)

# Understanding Your Options



# Evaluate Your Options

## Cost Analysis

- Non-recurring start-up
- Recurring production
- Recurring govt mgmt
- Logistics support

## Industrial Base Analysis

- Industrial capability health
- Industry financial health

*Addressed in subsequent slides since most relevant to cost analysis community*

## Technical Analysis

- Level/type of technology
- Availability of sources
- Status of TDP
- Potential for technological innovation
- Plans for future development
- Proprietary data

## Program Analysis

- Program funding
- Program development schedule & risk
- Production lead times
- Degree of subcontracting
- Lower tiers
- Contracting & legal issues
- Program management complexity

# Non-Recurring Start-Up Costs

- R&D
  - Second source effort to translate & utilize design specs
    - Reverse engineering of select components
    - Redesign of components/subsystems that developers claim as proprietary
  - Technology transfer technique will directly impact second source level of effort
    - Form, fit & function may require substantial development effort
    - TDP may require reverse engineering
- Technology transfer
  - Initial source preparation & Government qualification of TDP (faulty TDPs have resulted in second source claims against the Government)
  - Initial source technical assistance to second source
- Qualification
  - Contractor qualification hardware
  - Government test & evaluation
- Capital equipment, test equipment & tooling
  - Contractor special tooling & test equipment
- Government & contractor management
  - Administration associated with solicitation, evaluation & award of second source contracts
- Facilities

# Recurring Production Costs

- Large body of work that addresses ‘accepted’ analytical techniques for evaluating recurring production cost considerations
- In general, these techniques consider and compare two scenarios
  - Sole source: 100% production by initial source (i.e., what cost would be in the absence of competition)
  - Dual source:  $x\%$  production by initial source +  $y\%$  production by second source (i.e., what cost would be as a result of dual source competition)
- Impact of competition on recurring production cost is influenced by the initial & second sources’ willingness & ability to compete, but ability to predict firm behavior is limited at best
- There are additional recurring Government costs associated with two vice one source, e.g.,
  - SE/PM
  - GFE testing (when breakout is used as a means to establish competition)
  - Royalties (when licensing is used as a means to establish competition)

# Industrial Base Analysis

- Industrial capability analysis
  - OUSD AT&L/IP annual report to Congress on March 1
    - Insights regarding the health of each industrial sector: Aircraft, C4I, ground vehicles, missiles, services, ships & space
    - Evaluations and assessments of design, development, production and technological capabilities.
  - “... Across several industry sectors, but particularly within the aircraft sector, the high demand for titanium is increasing both the cost and the production cycle time for DoD programs. As future aircraft, both military and commercial, use more titanium in their design, titanium suppliers face increased pressure to meet demand from the aircraft industry, as well as demand from other industries such as automotive, health, and industrial. The shortage of titanium, coupled with long lead times, has delayed the production of large forgings such as airframe bulkheads, landing gears, and engine components...”  
(extract from annual report dated Mar 2009)
- Financial health analysis
  - Evaluate individual firms using ratios, trends and other analyses
    - Solvency (e.g., Z-score trend, quick assets/total assets ratio, etc.)
    - Profitability (e.g., net profit margin, interest coverage ratio, return on assets, etc.)
    - Operating performance (e.g., total asset turnover, inventory turnover, growth, etc.)
  - Z-score is a measure of overall firm health
    - Original Z-score model was developed in 1968 by Robert Altman to classify manufacturing firms as bankrupt or non-bankrupt based on five key financial ratios.
    - NCCA leveraged this research to develop a Z-score model geared specifically to the defense industry & routinely used the model in the early 1990s to evaluate major Navy contractor financial health

# Summary of Major Findings

1. No definitive evidence that competition has consistently reduced technical, schedule, or cost risks for major weapon systems acquisition programs
2. Past estimates of competitive weapon systems program savings/losses are not appropriate for application to future weapon system programs
3. Credible estimation of the nonrecurring costs to establish & recurring costs to maintain competition is paramount to making the 'right' decision
4. O&S cost implications must be considered if systems are not identical
5. One-size-fits-all competition policies and acquisition strategies have not and will not work for all programs
6. Prospective competitors must be willing and able to compete

# “The Defense Industry Enters a New Era”

- USD AT&L presented prepared remarks at the Cowen Investment Conference on 9 February 2011
- Goals in the new era of defense industry as laid out by USD AT&L:
  - A strong, vibrant, and financially successful defense industry
  - Structural change largely through market forces but adjusted where the interests of the taxpayer and warfighter require
  - Preserving and enhancing competition
  - Equal attention to the health of smaller and mid-sized companies, spinouts, new entrants, and service providers,
  - Encouraging open entry into the defense marketplace,
  - Full advantage taken of the opportunities of globalization.

# “The Defense Industry Enters a New Era”

- Excerpts from prepared remarks from USD AT&L
  - “Sometimes competition is provided by having two or more providers of the same thing go head-to-head, but where this is not possible we can still harness this power through a wide variety of other competitive strategies that provide real incentives for increased productivity. Where program costs can be reduced, government and industry can share the savings, which will be directly reflected in earnings and profit.”
  - “...a key part of our defense industrial strategy is to encourage new entrants. These offer competition, renew and refresh the technology base, and ensure that defense is benefiting from the main currents of emerging technology. We must accordingly work constantly to lower the barriers to entry. We are addressing many of these barriers – such as needless or time-consuming paperwork – as part of the Better Buying Power initiative because they impose unnecessary costs. But another objective of eliminating non-productive processes is to make it easier for companies to do business with us. We continue to seek industry feedback and ideas on how to do this.”

# Back-Up

# Framework for Evaluating Competition at the Enterprise Level

# Hypothesis

Early & maximum involvement of the Industrial Base in acquisition programs has enterprise-level technical and cost benefits that may far exceed program-specific competition objectives.

# Competition Cost Impacts

- **Development**
  - More developers require additional investment and costs
- **Production**
  - Competition can mitigate monopolistic behavior and control/reduce unit costs
- **O&S**
  - Allowing for multiple configurations will result in additional non-recurring and recurring costs
- **Enterprise Level Cost Benefits**
  - Increases probability of program success and reduces costs of future programs
  - Reduces requirements and associated costs for similar threat addressing programs within portfolio (i.e., development of broader/cross-cutting solutions)
  - Improves overall Industrial Base productivity and cost efficiency performance on future programs
    - Increases the overall performance value per production dollar within the Industrial Base

*The following slide represents a notional representation of these ideas*

# Competition Cost Impacts

