Lean Aerospace Initiative
Plenary Workshop

Policy
Economic Incentives: C-17 Case Study

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Presented By:
Wes Harris
MIT

Research Sponsored By LAI
Economic Incentives
Presentation Outline

● Motivation
  – Key questions
  – Why the C-17?
  – C-17 Parameters

● Setting the Stage
  – Data sources
  – Defense Science Board C-17 Review
  – C-17 Should Cost Exercise
  – Primary environmental factors

● Data Analysis
  – Barriers, enablers, incentives

● Results
  – The gains
  – Lessons learned
  – Key findings
Motivation
Motivation for Study

- Cost-based pricing results in reduced profit levels when costs are reduced.
- In the production of major weapon systems, cost reductions achieved through the implementation of lean practices are frequently “captured” by the government customer.
- Cost reductions often occur before the contractor received adequate return on investment (ROI).
- Evidence: VECP and IMIP.
Key Questions

- What are the primary strategies, barriers, enablers and relationships of economically incentivized procurement of weapon systems in production?
- When production costs are reduced, how can contractors share in the benefits?
- What practices motivate defense aircraft contractors to invest more of their resources to become lean?
- What are the lessons learned in this study and are they transferable to other procurements?

Identify practices, strategies, enablers and barriers related to companies’ investments and sharing of cost savings
Why the C-17?

- Considered to be a model of acquisition reform
  - Innovative contract

- High Visibility
  - Congress
  - USAF
  - DoD
  - Public sector

- System complexity and maturity
  - Airframe, engine, spares

- Major weapon system in production phase
  - Aircraft in service
C-17 Parameters

- **Scope**
  - More than 22,000 drawings
  - More than 9,000,000 individual parts
  - 1,800 assembly workers at Long Beach, CA

- **Investment**
  - US Government $37.3 billion
  - Contractor $1.5 billion
  - Total $38.8 billion

- **Production**
  - 1,300 suppliers / 42,000 workers
  - More than 100 major assembly tools ($1.0 billion)
  - Assembly time: 17 months
  - 120 aircraft (FY88-FY03)
  - Average unit flyaway cost of P41-P120: $172 million
Setting the Stage
Case Study Data Sources

- **Literature review**
- **Background interviews** (more than 150 people interviewed)
  - Airframe, engine and electronics sectors
  - SPO, SAF, OSD
- **Case study specific** (more than 45 people interviewed)
  - SPO
  - DPRO
  - Contractor
DSB C-17 review, 12/93 - Fuhrman/Fain Report

- “Extremely negative management environment” between the contractor and the U.S. government
- Omnibus Agreement recommendation: Combine all issues, claims, deficiencies into a single settlement (12/94)
- C-17 is basically a sound design
- Detailed specific recommendations relating to:
  - Range/payload
  - Engineering processes and deficiencies
  - Financial incentives
  - Unit cost
  - Management Information Systems (MIS)
  - Application of CAD/CAM
  - Organization
  - Realistic production and testing schedules
<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
<th>Net Unit Cost Reduction: $100 m/unit</th>
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<tbody>
<tr>
<td>1993</td>
<td>Defense Science Board C-17 Review</td>
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<td>1994</td>
<td>Omnibus Agreement</td>
<td></td>
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<tr>
<td>1995</td>
<td>Should Cost Exercise</td>
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<tr>
<td>1996</td>
<td>Multi-Year Contract</td>
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Fundamental change in relationship between contractor and customer concomitant with extraordinary sharing of information and risk
C-17 Joint Should Cost Exercise

- Should Cost Exercise initiated Summer-1994
- Directed by the Service Acquisition Executive
- Purpose: determine lowest most probable cost and how to obtain same
- Senior Leadership Team
  - MGEN Scofield, Chairman
- Executive Review Council empowered to apply results of SCE
  - SAEs, IG, DCMC Commander, DCAA Director, USAF/CO
- Buy-out profile established
- Joint cost model developed
- Three (3) contract-strategy recommended
  - Production
  - Process improvement
  - Logistics/sustainment
Primary Environmental Factors

- **Stabilization of the C-17 aircraft design**
  - Positive impact on manufacturing processes
  - Positive impact on suppliers
  - Limited changes to the program management directive (PDM)

- **Non-Developmental Airlift Aircraft (NDAA) program competition**
  - Modified Boeing 747-400 freighter
  - Technical advantages, unit prices compared

- **Omnibus Agreement**
  - DSB recommended
    - Rebaseline program
    - Release parties from liabilities
    - Waive CCPD requirement
Data Analysis
C-17 Program Vision and Key Goals (1995 and Beyond)

- Price reduction and affordability
- Open communications
- Mutual trust and respect
- Approval to produce aircraft beyond unit 40
  - Undersecretary of DoD mandated C-17 price reduction
- Completion of reliability and maintainability assessment
  - IOC and milestone IIIB realigned to June 1995
  - Retrofit and evaluate design changes in support of reliability, maintainability and availability evaluation
C-17 Barriers and Enablers to Economically Incentivized Procurement

- **Barriers**
  - Budget instability
  - Non-value added oversight
  - Color of money
  - Excessive profit
  - USAF spares system
  - Acquisition reform

- **Enablers**
  - Open communications
  - Mutual trust and respect
  - Lean leadership
  - Should Cost Exercise
  - Integrated process teams
  - Acquisition reform
C-17 Economic Incentives

- **Multi-year contract**
  - Reasonably-firm government commitment to 120 aircraft
  - Additional contractor-funded investment to reduce cost

- **Award fees**
  - Joint cost model
  - Incentive for cost reduction and sharing of cost savings

- **Performance based payments**
  - Reduced contractor debt service
  - Reduced government oversight burden

- **Three-contract structure**
  - Moved risk to field support
  - Isolates flyaway cost to production contract
C-17 Economic Incentives (cont)

- **NDAA competition**
  - Incentive to reduce cost

- **Economic order quantity (EOQ) funding**
  - Solidify supplier base, reduce cost
  - Government investment to become more lean
  - Commitment of contractor resources to reduce costs through process improvements

- **Future liability limits**
  - Variation in quantity
  - Supplier mortality
  - Program discontinuation reopener

Economically incentivized contract based on extraordinary sharing of information and risk
Results
C-17 Gains

U.S. Government
- Technically sound aircraft
- Reduced cost
- Most competitive product
- More complete understanding of contractors goals and constraints
- Potential for additional cost reduction

Contractor
- Resonably-firm government commitment
- Reward for accepting additional risk
- Enhanced corporate reputation
- Reduced debt service
- Government assistance in becoming more lean
- Share in cost reduction savings
C-17 Lessons Learned

- High level senior commitment and support enhance program success
- Information and risk, openly shared, precede development of economic incentives
- Reasonably-firm customer commitment, over a finite time period, to the production program reduces mutual risk
- Contractor investment of its resources to reduce unit cost enhance program success
- Innovative use of U.S. government of the following concepts can form foundation of risk-reward balance
  - Multi-year contract
  - Waiver of Certified Cost and Pricing Data (CCPD)
  - Performance Based Payments (PBP)
  - Economic Order Quantity (EOQ) Funding
  - Join Cost Model (JCM)
  - Variations in Quantities (VIQ) options

“From Uncontrolled Chaos to a Win-Win Environment

C-17 unique, ground breaking usage
Key Findings

- Leadership and use of IPTs increased communication and information flow
- Mutual trust and respect enabled *internalization* of strategic goals and visions
- Incentives preceded by risk-reward balance
- Specific incentives determined through delicate negotiations

Economically incentivized procurement is possible in today’s environment
Follow-Up

- **Interview stakeholders to determine status of C-17 Acquisition**
  - DSB review
  - Should Cost Exercise
  - Joint cost model
  - Lean practices
  - Risk-reward balance
  - Affordability
  - Quality

- **Report, briefings to LAI, C-17 stakeholders (10/98)**

- **LEM datasheets**

- **“How-To” model for economically incentivized procurement**
Economically Incentivized Procurement: Enablers

C-17 Case Study Enablers

- Acquisition Reform: 10% Contractor, 60% Government
- Joint Should Cost Exercise: 30% Contractor, 78% Government
- Lean Leadership (non-specific): 70% Contractor, 78% Government
- Kadish & Kozlowski: 80% Contractor, 89% Government
- Mutual Trust and Respect: 80% Contractor, 78% Government

Percent of interviewees identifying an enabler
Economically Incentivized Procurement: Barriers

C-17 CASE STUDY BARRIERS

- **Budget Instability**: 30% Contractor, 44% Government
- **Non-Value Added Oversight**: 30% Contractor, 44% Government
- **Colors of Money**: 30% Contractor, 44% Government
- **Excessive Profit**: 10% Contractor, 44% Government
- **USAF Spares System**: 10% Contractor, 22% Government
- **Acquisition Reform**: 30% Contractor, 40% Government

Percent of interviewees identifying a barrier

- 0%
- 10%
- 20%
- 30%
- 40%
- 50%