

# **GAO Review of Best Practices for Quality Assurance**

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# Agenda

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- GAO Audit Objectives
  - Background
  - Scope
  - Findings
  - Conclusions
  - Recommendations
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# Objectives

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- Identify the impact of quality problems on selected DOD weapon systems and defense contractors' practices that contributed to the problems
  - Identify practices used by leading commercial companies that can be used to improve the quality of DOD weapon systems
  - Identify problems DOD faces in terms of improving quality
  - Identify recent DOD initiatives that could improve quality
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# Background

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- A quality product is one that is delivered
    - on time
    - performs as expected
    - performs when need
    - can be obtained at an affordable cost
  - MIL-Q-9858A guided DOD quality efforts from the mid-1960's to the mid-1990's
  - DOD adopted commercial standards (i.e., ISO 9001) in mid-1990's
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# Scope

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## Commercial Manufacturers

- Boeing Commercial
- Cummins, Inc.,
- Kenworth Truck Company
- Siemens Medical Solutions
- Space Systems/Loral

## Commercial Customers

- American Airlines
- Intelsat

## DOD Weapon Systems –Prime\*

- ASDS - Northrop Grumman
- ATIRCM/CMWS - BAE
- EFV - General Dynamics
- F-22A – Lockheed Martin
- Global Hawk – Northrop Grumman
- JASSM - Lockheed Martin
- LPD-17 – Northrop Grumman
- MH-60S – Sikorsky
- PAC-3 – Lockheed Martin
- V-22 – Bell/Boeing
- WGS – Boeing

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\* These contractors are involved with over \$1 trillion, or about 76 percent of the \$1.5 trillion DOD plans to spend on weapon systems in its current portfolio

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## Objective 1: DOD Quality Problems and Prime Contractor Practices that Contributed to Problems

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- For the 11 programs we reviewed, quality problems resulted in
    - Over \$1.5 billion in cost overruns
    - Up to 5 years of schedule delays
    - Reduced weapon system availability
    - Military personnel deaths
  - Prime contractor practices that contributed to problems:
    - Poor systems engineering practices related to requirements analysis, design, and testing
    - Manufacturing processes not in control
    - Supplier quality problems
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## Objective 1: Expeditionary Fighting Vehicle Example of Systems Engineering Problem

- Contractor was only able to demonstrate 7.7 hours between operational mission failures during pre-production testing, well short of the 17 hour goal
- Primary problem was part and subsystem interferences
- Root causes
  - subassembly teams claiming the same space
  - inconsistent computer model checks
  - lack of design engineer experience
  - tight engineering model release schedules



Source: EFV Program Office.

- **4-year extension to SDD**
- **\$750 million cost growth**

## Objective 1: LPD-17 Example of Manufacturing Problems

Over 5,000 quality problems were found

- Faulty hydraulics piping welds due to inexperienced workers and improper documentation
  - Some rework was required
  - All welds had to be re-inspected
  - Could have resulted in injuries
- Peeling non-skid coating due to unclean surfaces and high humidity
  - Rework was required
  - Long-term solution has not been identified



- **3-year delay**
- **\$846 million cost growth**

## Objective 1: Patriot Advanced Capability-3 Example of Supplier Quality Problem

- Program has experienced a number of problems with the seeker portion of the missile
- A sub-tier supplier accepted non-conforming hardware without authority
  - seeker contractor identified quality problem
  - resulted in rework
  - re-inspection of components
- Same supplier also had poor workmanship and inadequate manufacturing controls
  - Operated in a development rather than a production environment
  - Facility was temporarily shut-down to address management and production problems



Source: PAC-3 Product Office, Lower Tier Project Office.

- **6-month schedule slip**
- **Delivery delay of 100 missiles**

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## Objective 2 – Commercial Best Practices – Systems Engineering

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Ensure that a product's requirements are achievable with available resources and technologies

- Siemens Medical Solutions
    - Clear, precise, measurable, comprehensive requirements
    - Quality and reliability requirements prior to commitment
  - Boeing Commercial Airplanes
    - “Mistake-proof” designs
    - Rating tool on critical designs
  - Space Systems/Loral
    - Reliability assessments
    - Highly accelerated life testing
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# Commercial Best Practices - Manufacturing

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Ensure that a product's requirements can be produced consistently with high quality and low variability

- Cummins, Inc.
    - Capability growth plan for manufacturing processes
    - Prototypes to validate design and production processes
  - Kenworth Truck Company
    - Electronic system for process documents
    - Pictures and engineering specifications
    - Training audits
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# Commercial Best Practices – Supplier Quality

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Ensure that suppliers have the ability to deliver high-quality parts

- Kenworth Truck Company
    - Hold first-tier suppliers accountable for quality problems attributed to lower-tier suppliers
  - Boeing Commercial Airplanes
    - 99% part conformance expectations for suppliers
    - Retain higher-performing suppliers
  - Siemens Medical Solutions
    - 98% part conformance expectations for suppliers
    - Levy financial penalties against non-conforming suppliers
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## Objective 3 – Problems DOD Faces When Trying to Improve Quality

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- Environment
    - DOD awards cost reimbursement contracts assumes most of the financial risks
    - Reliability is not emphasized at development start
    - Requirements are set without adequate systems engineering knowledge
  - Oversight
    - Risk-based approach used to oversee contractors
    - DCMA and service oversight varies by program
    - Information is not aggregated in a manner that would allow DOD to determine overall weapon system quality, prime contractor performance, or systemic problems
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## Objective 4 – DOD Initiatives that Could Improve Quality

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- Concept Decision Reviews
  - Time-Defined Acquisition
  - Configuration Steering Boards
  - Key Performance Parameters/Key System Attributes
  - Award and Incentive Fees
  - Establishing Reliability Goal and Demonstrating Reliability Prior to Production
  - New Reliability, Availability, and Maintainability Policy (7/08)
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# Conclusions

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- Despite adopting commercial quality standards and implementing new requirements and systems engineering policies, DOD still has difficulty acquiring high-quality weapon systems in a cost-efficient and timely manner
- Poor systems engineering, manufacturing control, and supplier quality are the underlying problems
- Improvements in analyzing requirements and successful implementation of several new initiatives could improve outcomes

It is going to take a **joint effort** between DOD and prime contractors to improve weapon system quality

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# Recommendations

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- As part of the concept decision review initiative, require systems engineering analysis be completed by the prime contractor prior to entering into a development contract
  - Establish measures to gauge the success of the concept decision review, time-defined acquisition, and configuration steering board initiatives
  - Identify and collect data that provides metrics about the effectiveness of prime contractors' quality management system by weapon system and business area over time
  - Develop evaluation criteria that would allow DOD to score the performance of contractors' quality management systems based on actual performance
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