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

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**17th Annual Conference on Quality in the  
Space and Defense Industries  
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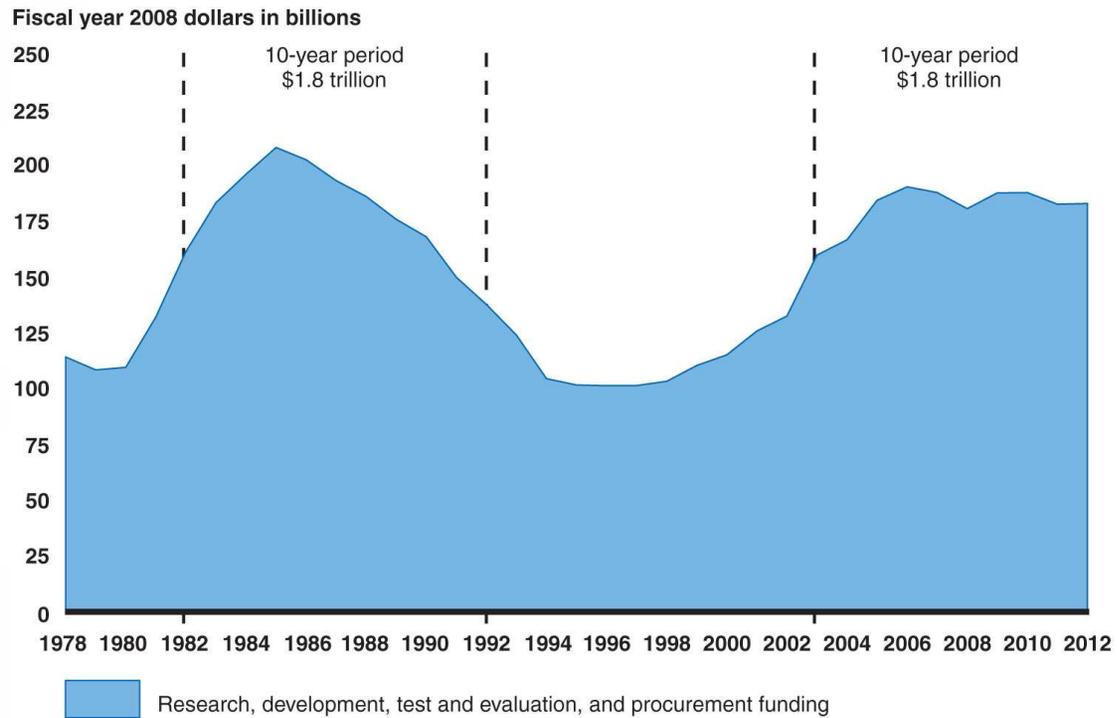
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# Agenda

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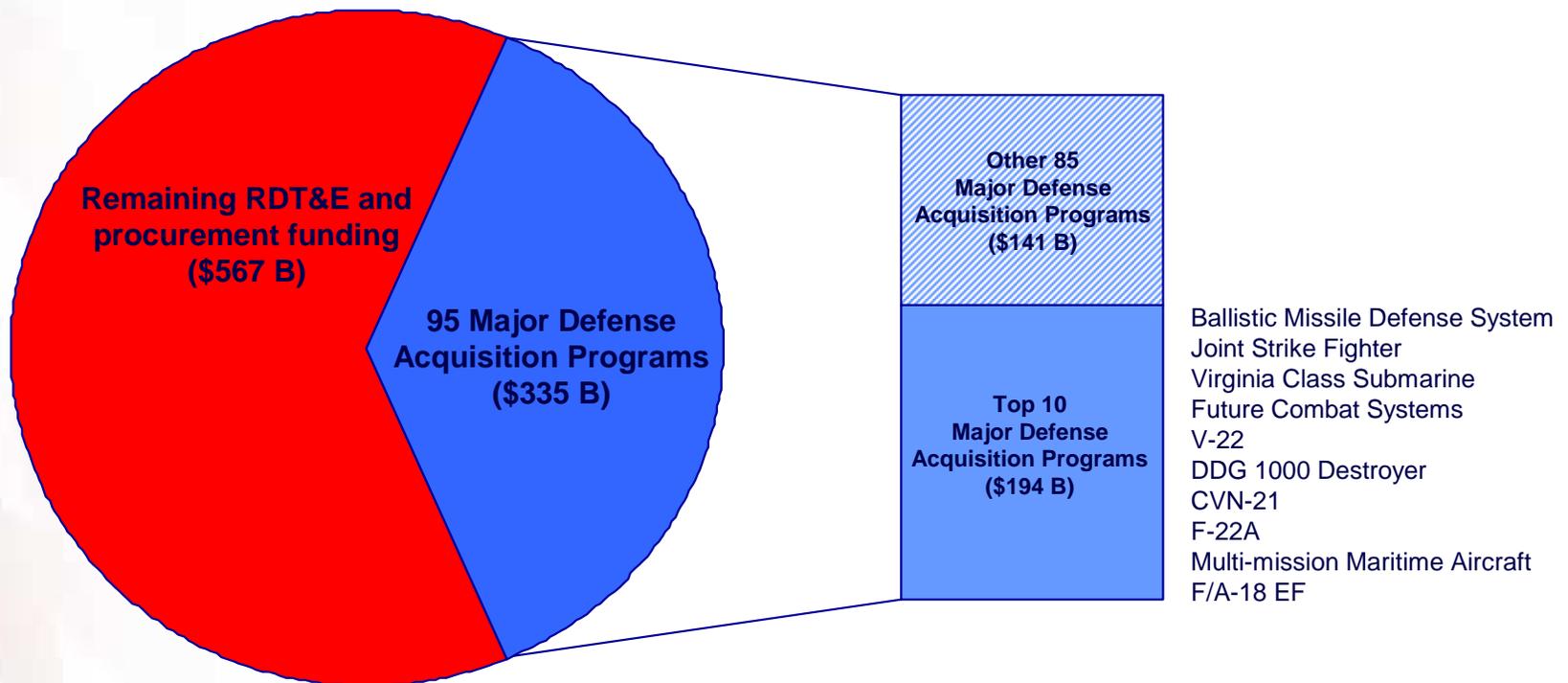
- DOD Investment in Weapon Systems
  - DOD Acquisition Program Outcomes
  - GAO Report on Best Practices for Quality Assurance
    - Objectives
    - Findings
    - Conclusions
    - Recommendations
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# DOD's Investment Levels Are Highest in Two Decades



Source: GAO analysis of national defense budget estimates for 2008.

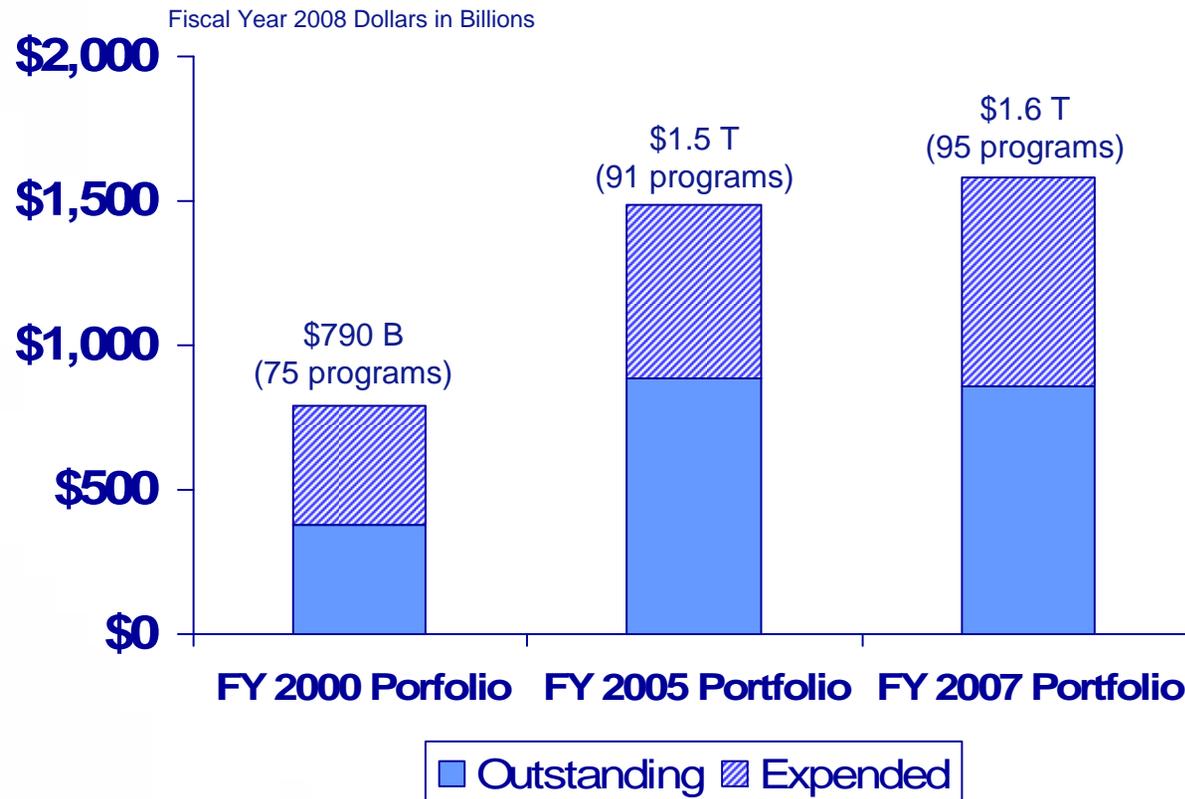
# Major Defense Acquisition Programs Represent a Major Portion of DOD's Investment Accounts



**RDT&E and Procurement Funding 2008-2012**

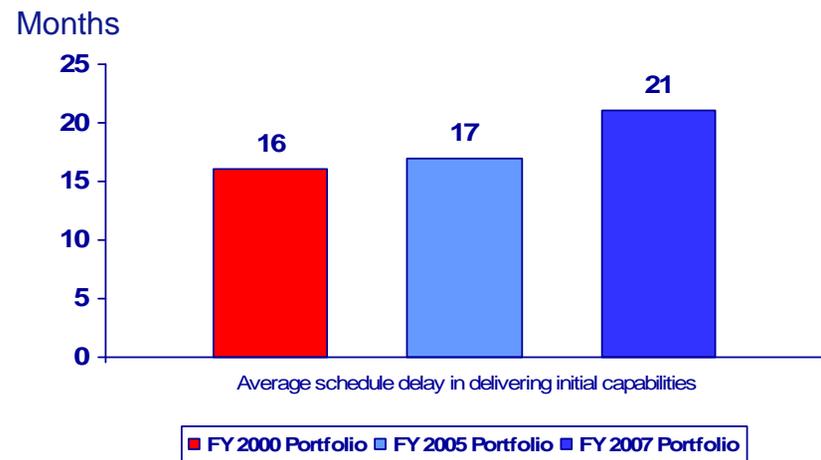
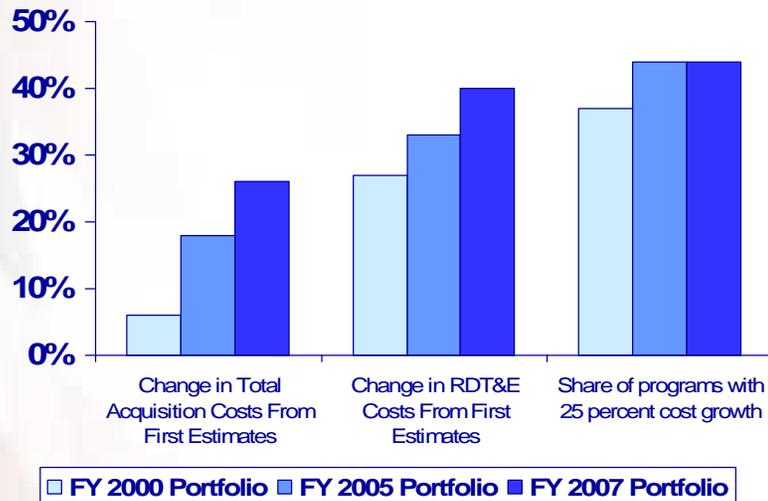
Source: GAO analysis of DOD data.

# DOD Has Increased Its Commitment In Major Defense Acquisitions Programs.....



Source: GAO analysis of DOD data.

# ....But DOD Outcomes Are Not Improving



Source: GAO analysis of DOD data.

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# GAO Review of DOD Quality Assurance

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- Objectives
    - Identify impact of quality problems on DOD weapon systems and contractor practices that led 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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# DOD Quality Problems and Prime Contractor Practices that Contributed to Problems

- 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

## 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**

## 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**

## 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**

# Commercial Best Practices – Systems Engineering

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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# Problems DOD Faces When Trying to Improve Quality

- 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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## 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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# 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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## For Additional Information

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- To get a copy of this report, visit [www.gao.gov](http://www.gao.gov)
    - Report #: GAO-08-294 (February 1, 2008)
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