GAO Review of Best Practices for Quality Assurance

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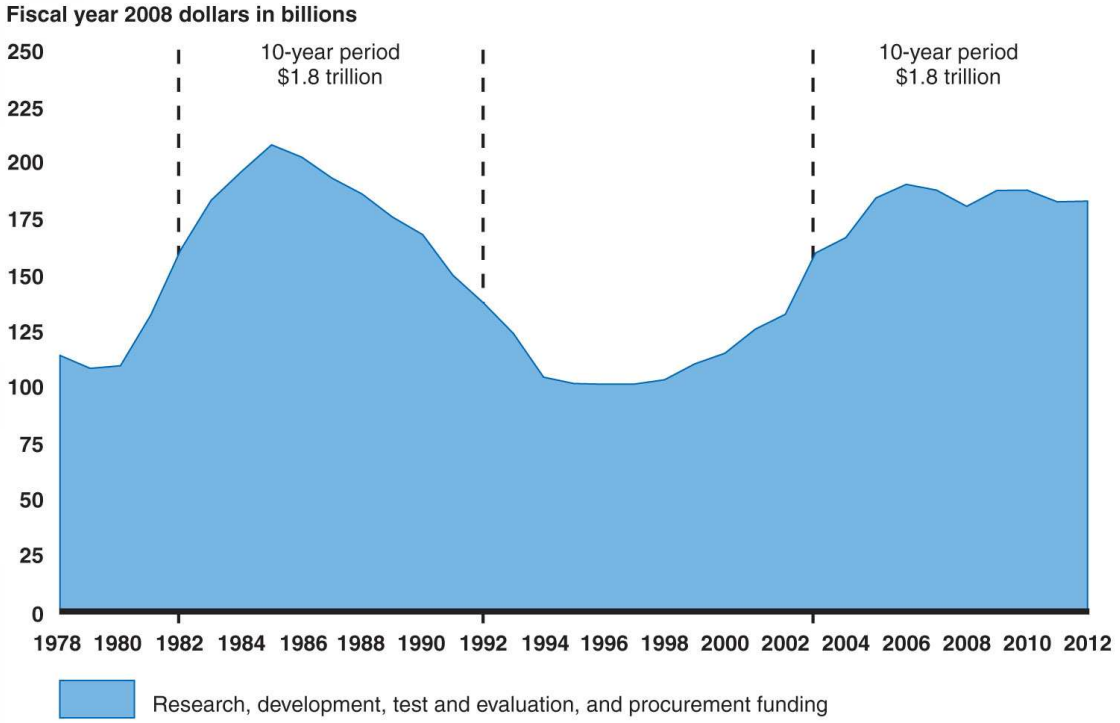
Agenda

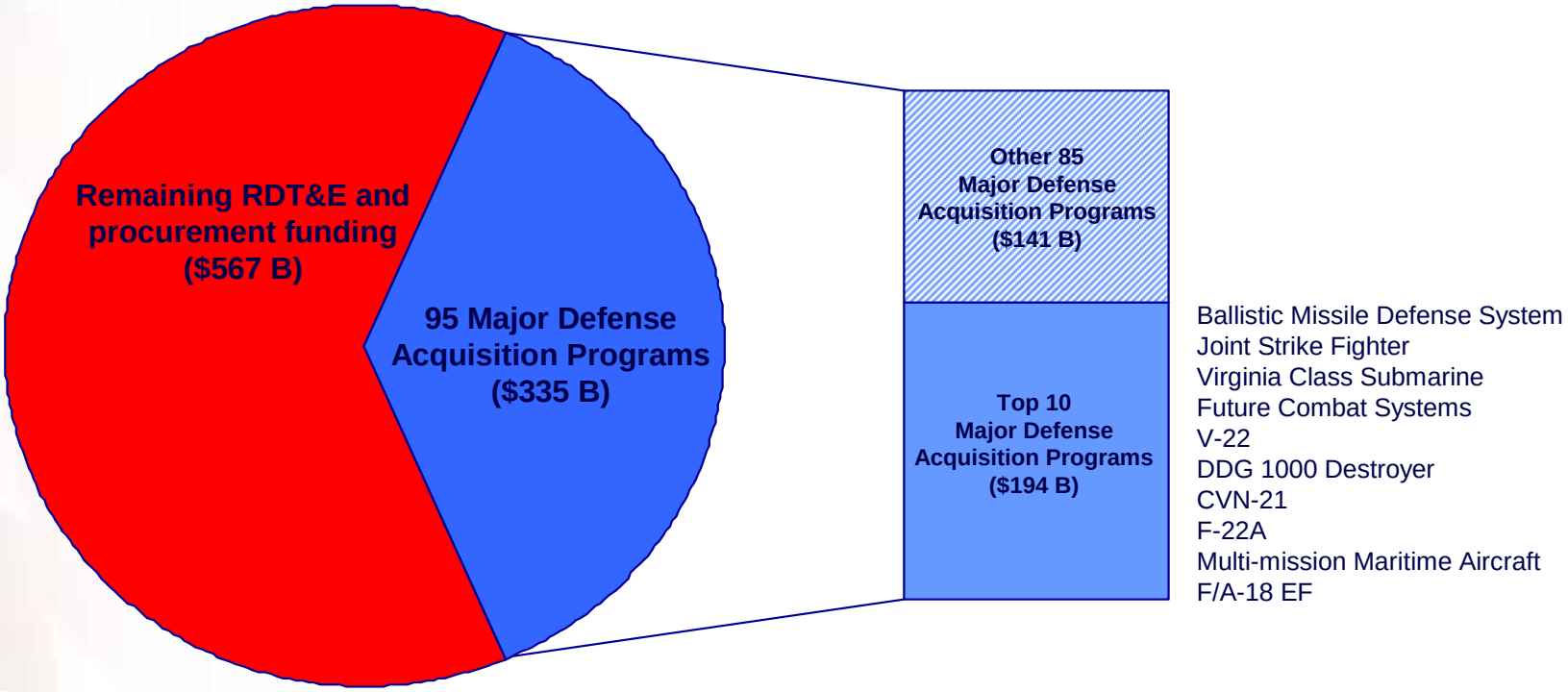
- DOD Investment in Weapon Systems
- DOD Acquisition Program Outcomes
- GAO Report on Best Practices for Quality Assurance
  - Objectives
  - Findings
  - Conclusions
  - Recommendations

DOD's Investment Levels Are Highest in Two Decades



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

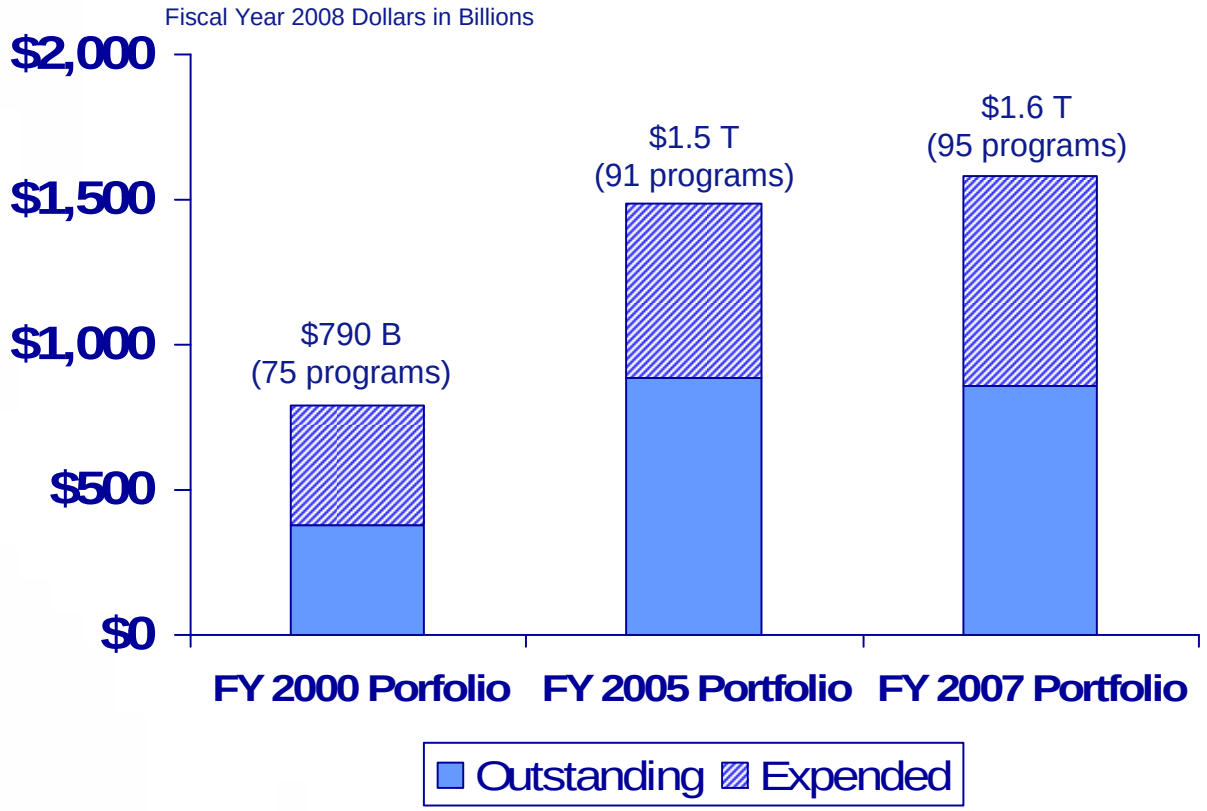
Major Defense Acquisition Programs Represent a Major Portion of DOD's Investment Accounts



RDT&E and Procurement Funding 2008-2012

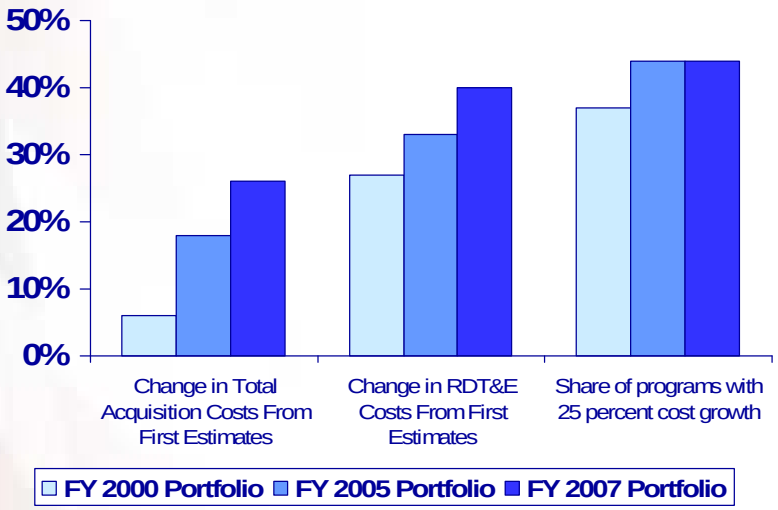
Source: GAO analysis of DOD data.

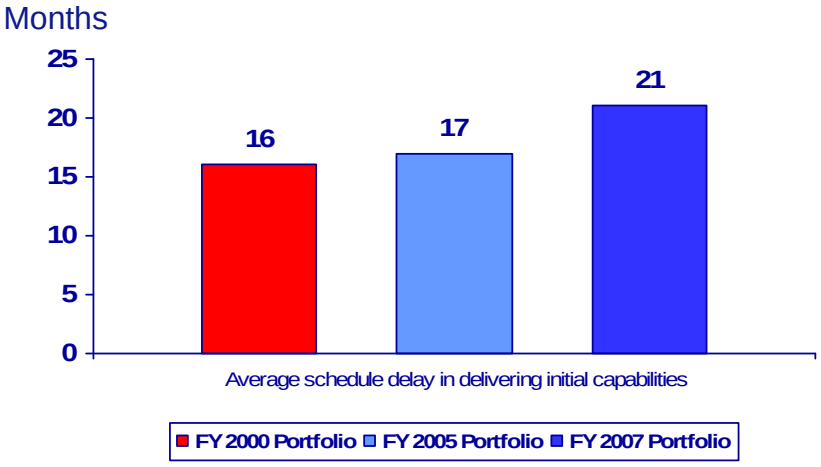
DOD Has Increased Its Commitment In Major Defense Acquisitions Programs…..



Source: GAO analysis of DOD data.

….But DOD Outcomes Are Not Improving





Source: GAO analysis of DOD data.

GAO Review of DOD Quality Assurance

- 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

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

Programs reviewed included: ASDS, ATIRCMS/CWMS, EFV, F-22A, Global Hawk, JASSM, LPD-17, MH-60S, PAC-3, V-22, and WGS.

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

Commercial companies visited included: American Airlines, Boeing Commercial, Cummins Inc., Intelsat, Kenworth Truck Company, Siemens Medical Solutions, and Space Systems/Loral.

Commercial Best Practices - Manufacturing

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

Commercial Best Practices – Supplier Quality

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

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

DOD Initiatives that Could Improve Quality

- 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)

Recommendations

- 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 effectives of prime contractors' quality management system by weapon system and business area over time
- Develop evaluation criteria that would all DOD to score the performance of contractors' quality management systems based on actual performance

For Additional Information

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