Getting Better Outcomes from Weapon System Programs

Acquisition and Sourcing Management
U.S. Government Accountability Office

Matt Lea
Senior Defense Analyst
Dayton Field Office
937.258.7962
LeaM@gao.gov

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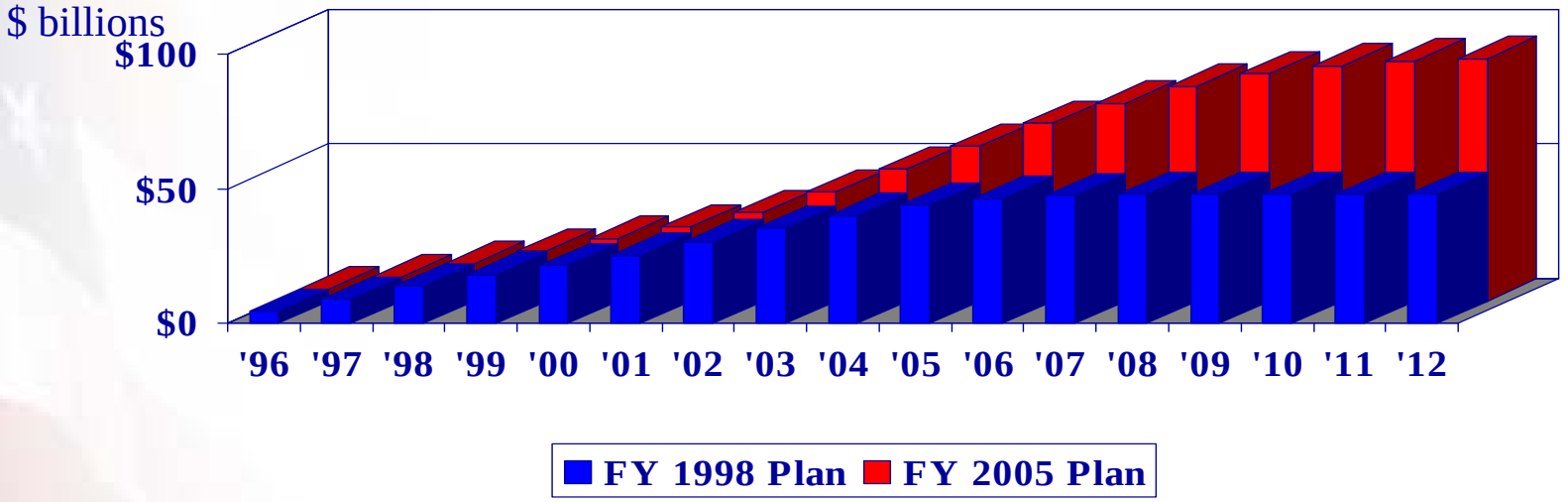
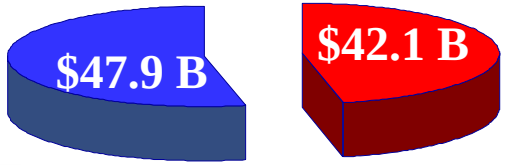
Placing Context On The Fiscal Environment

- Future demographics demand more from DOD's investment accounts
- Current practices yield systems at unexpectedly high cost, diminished results



FY '05: $89.95 billion total

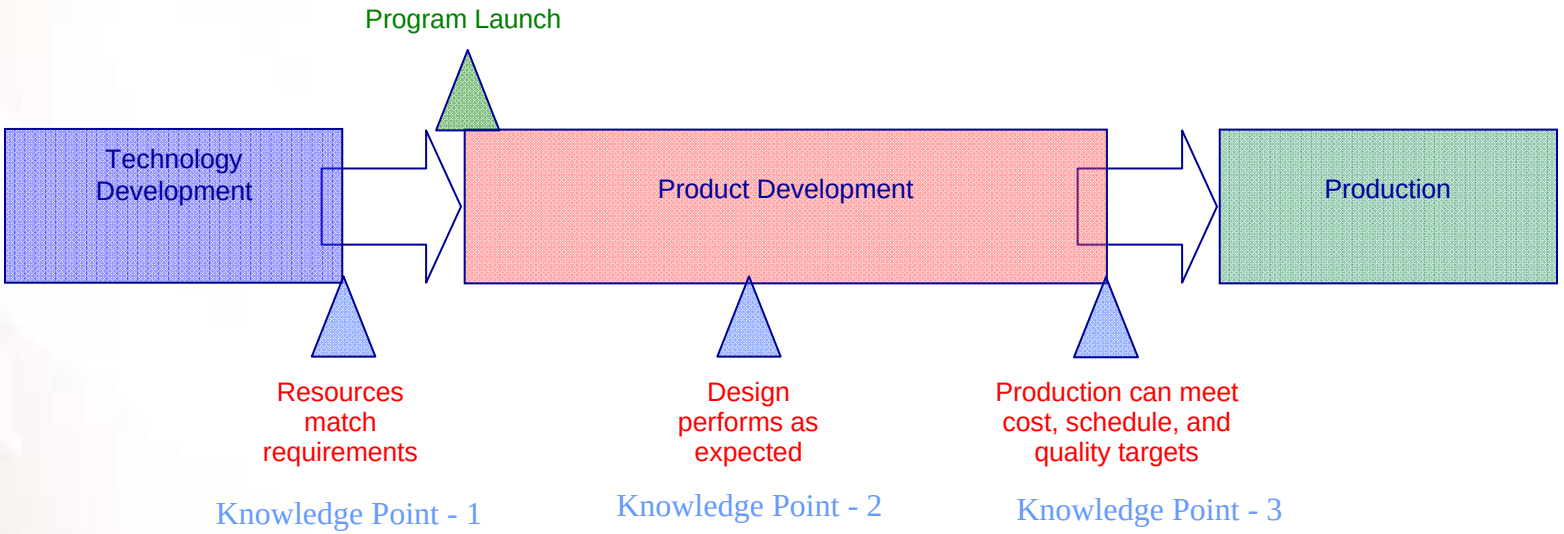
FY 1998 plan for completing development of 8 programs



Additional investment needed under FY 2005 plan for completing the 8 programs

[1]Source: Selected Acquisition Report data (12/31/96 and 12/31/03) on the 8 weapon systems among the highest R&D budget requests for FY 2003.
Note: All dollars are in constant FY 2005 dollars.

Delivering the Product



The Knowledge-Based Approach

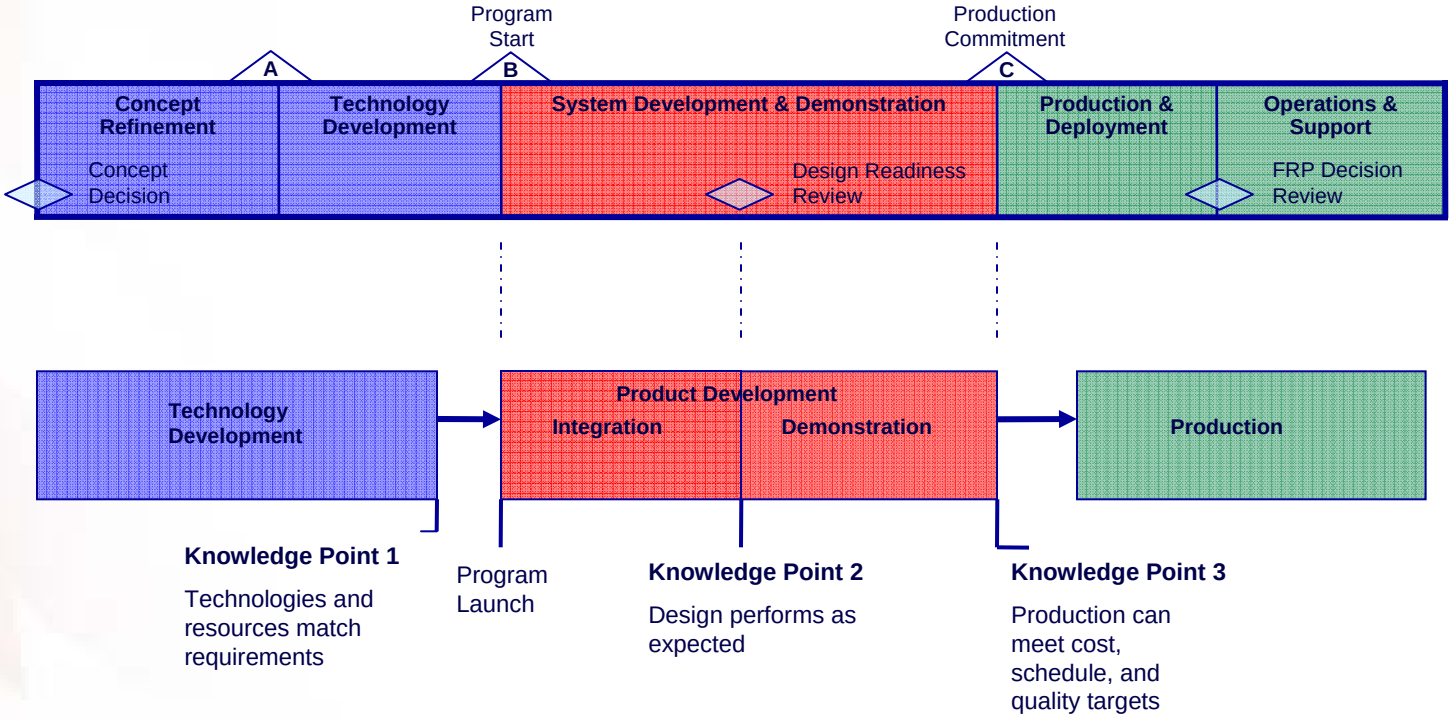
Technology development is done separately and in advance of product development; Milestone B is the dividing line.

Knowledge Point 1: At milestone B, a match is achieved between the user's needs and the developer's resources **(key indicator: technology readiness level).**

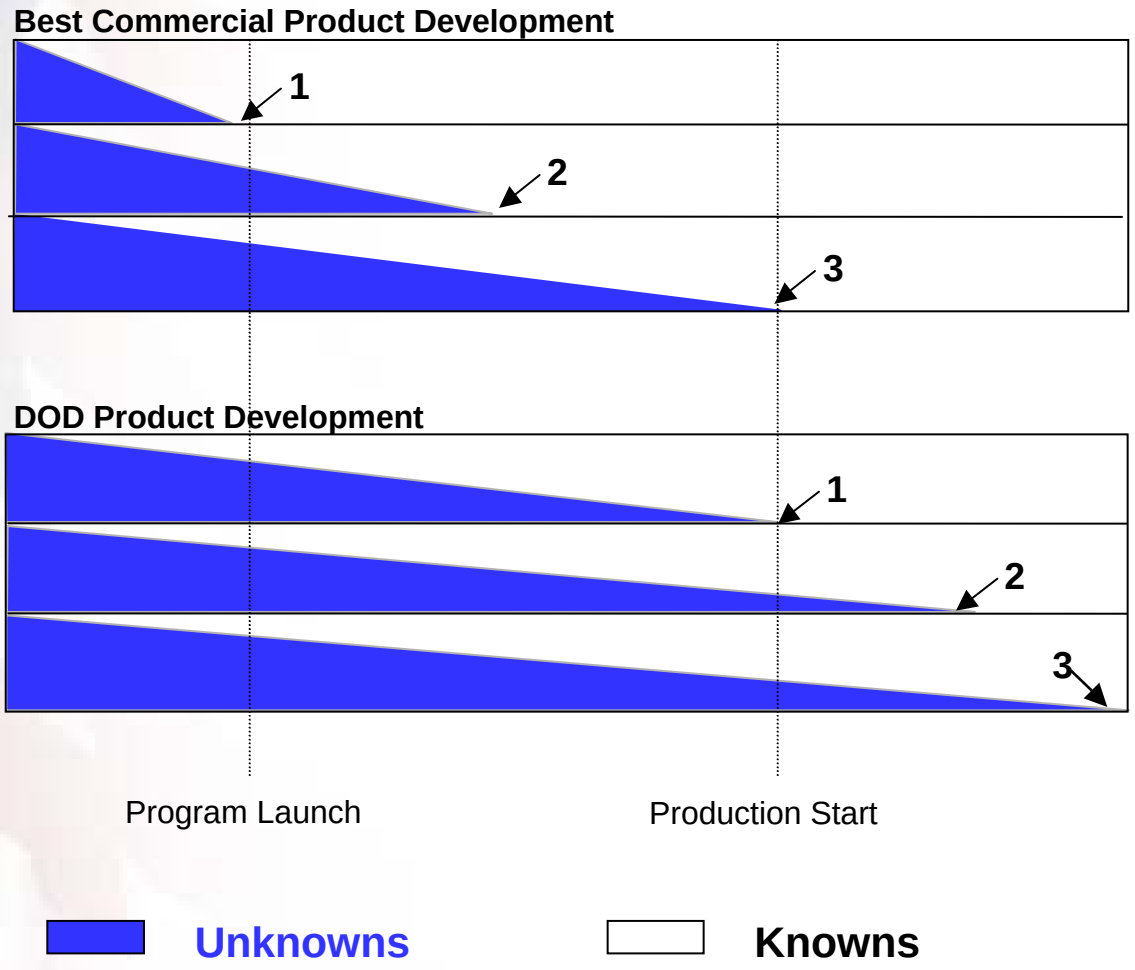
Knowledge Point 2: At Critical Design Review, the product design demonstrates its ability to meet user needs and is stable **(key indicator: % of engineering drawings released).**

Knowledge Point 3: At milestone C, it is demonstrated that the product can be produced within cost, schedule, and quality targets **(key indicator: % of key processes in statistical control**).

DOD Process and Best Practices Model Has Similar Framework



Knowledge at Key Junctures is Critical To Delivering Programs As Promised



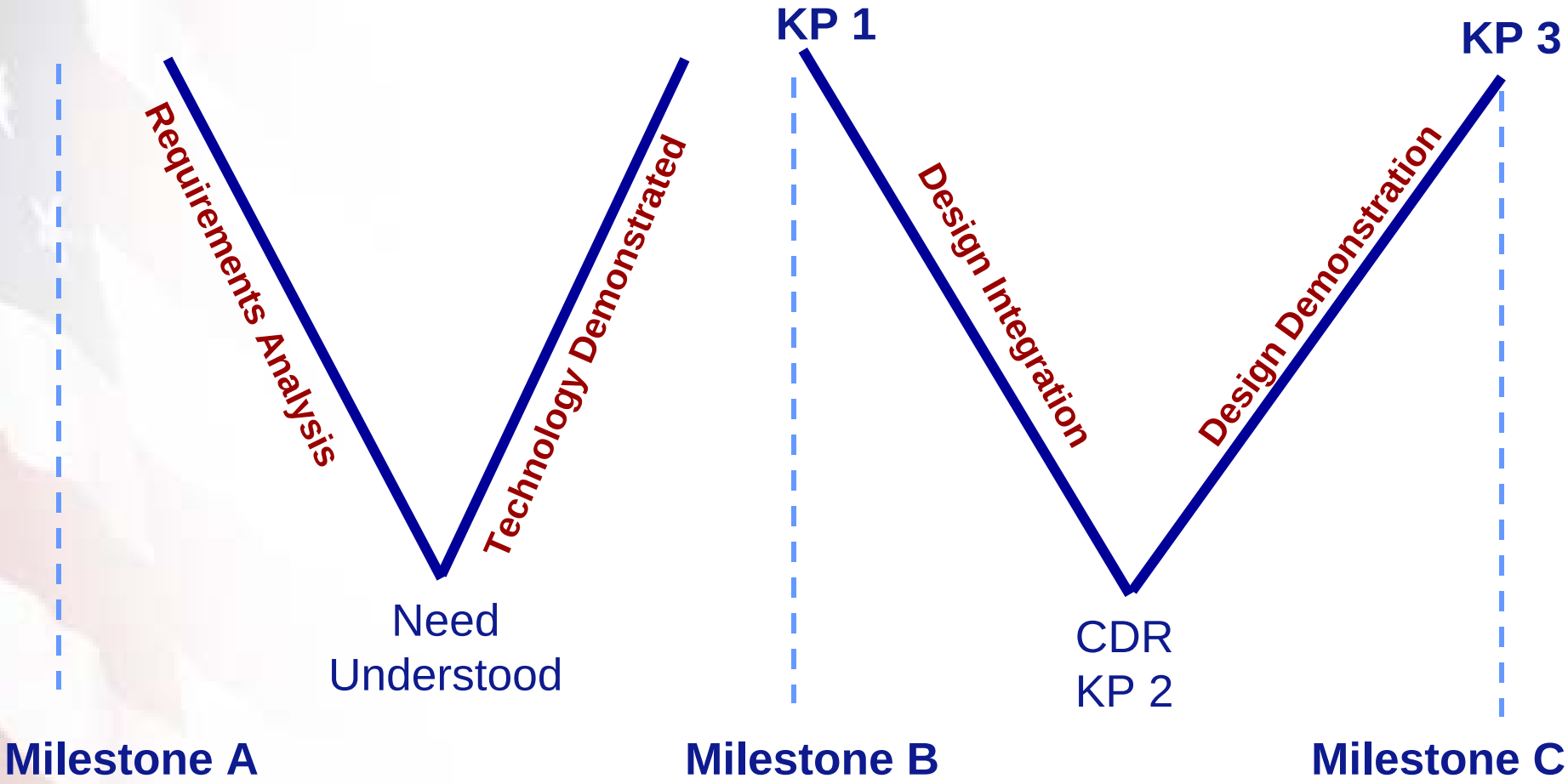
Knowledge Points:

1: Technology is mature enough to meet requirements (the match)

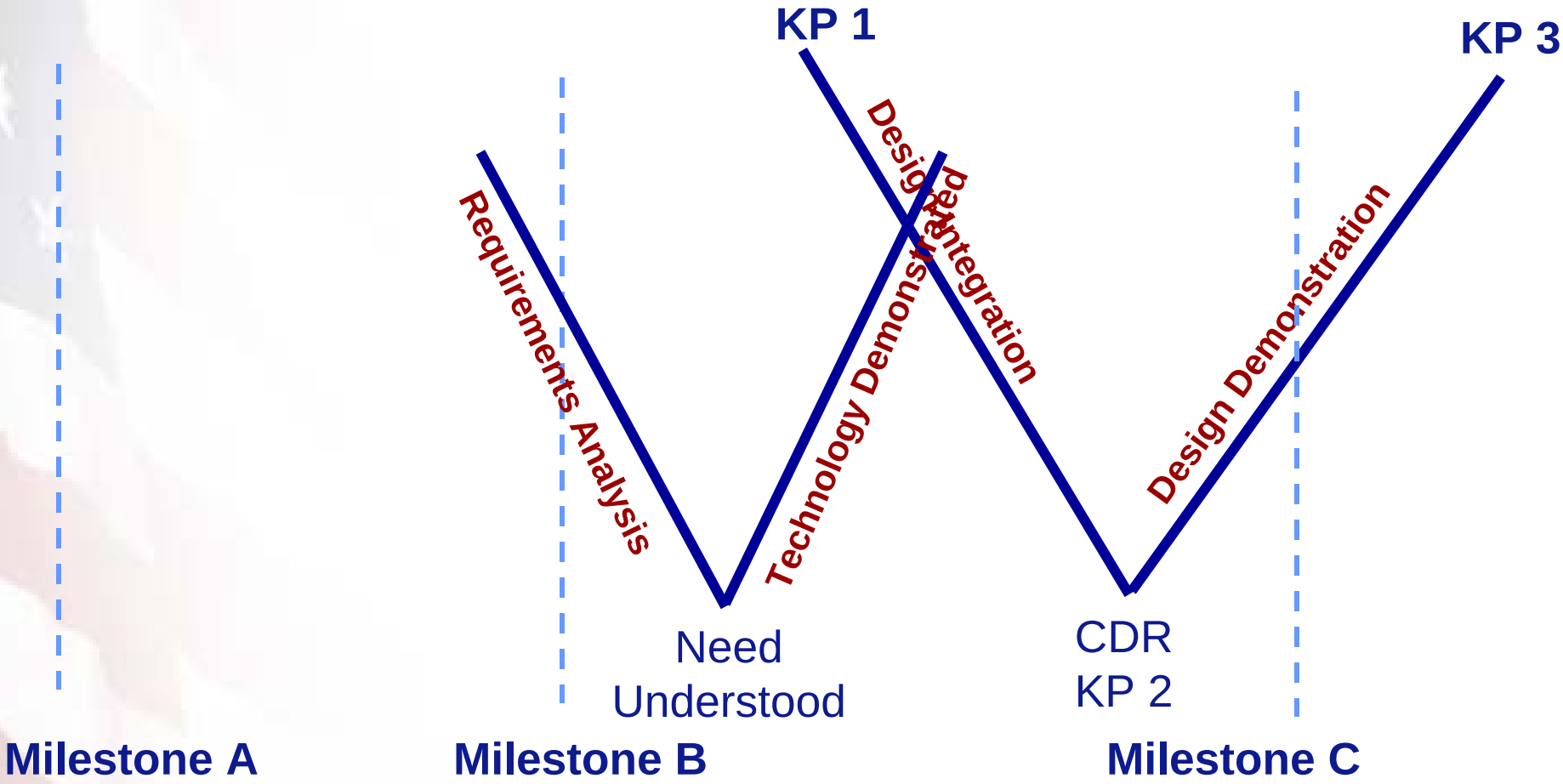
2: Design is mature

3: Production processes are mature

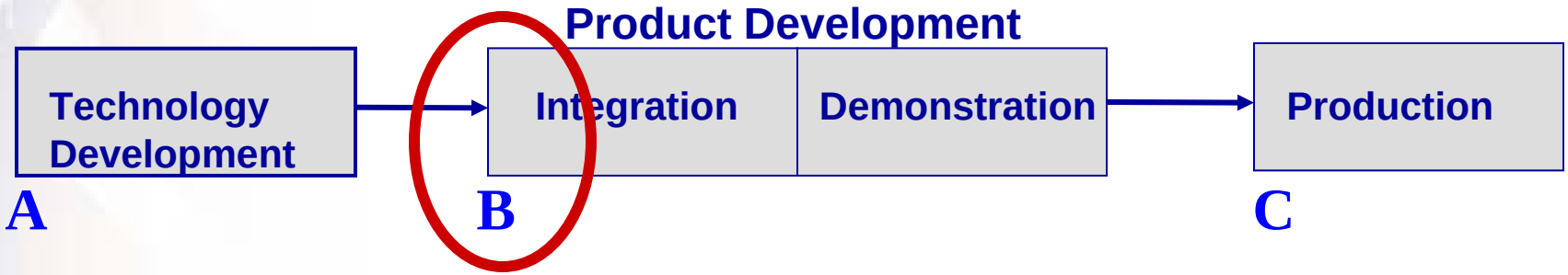
Knowledge Based Approach Aligns with Systems Engineering



Actual Acquisition Strategies Do Not Align with Systems Engineering



Knowledge Point 1: Match Developer Resources With User Needs



Milestone B Business Case Is Key

- If a program is unexecutable within resources at Milestone B, negative consequences are unavoidable
- Essential elements of a sound business case:
  - **A requirement exists that warrants a materiel solution consistent with national military strategy priorities**
  - **The materiel developer has the requisite mature technologies and technical knowledge necessary to meet the requirement**
  - **Systems engineering employed and preliminary design has been established**
  - **The materiel developer has a knowledge-based product development plan that will attain high levels of design and production maturity at the right times.**
  - **Reasonable estimates and funding is available to fully resource the product development and production plan**

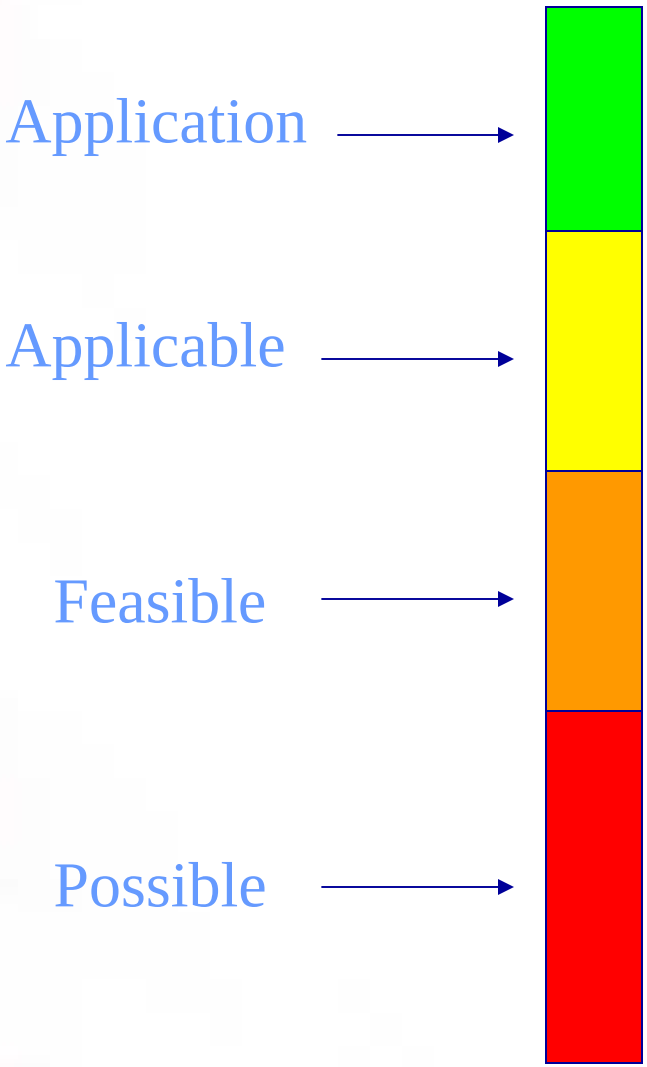
Immature Technologies at Product Launch Have Weakened DOD Business Cases

- Achieving high level of maturity critical indicator that business case is executable.
- Beginning product development with immature technologies longstanding DOD problem.
- Predictability is key, invention cannot be scheduled and costs difficult to predict.
- Cost of proceeding into system development without completing technology development can be dramatic.

Best Practices for Including Technology Onto Products

- Technology development separate from product development
- Responsibility for technology development to S&T organizations rather than product managers
- Development follows disciplined process
- Environment is critical for technical maturation
- Decision makers need tools and authority
- Technology not brought onto product unless demonstrated that it meets requirements.

Technology Readiness Levels For Intended Product



9 Actual system "flight proven" through successful mission operations

8 Actual system completed and "flight qualified" through test and demonstration

7 System prototype demonstration in an operational environment

6 System/subsystem model or prototype demonstration in a relevant environment

5 Component and/or breadboard validation in relevant environment

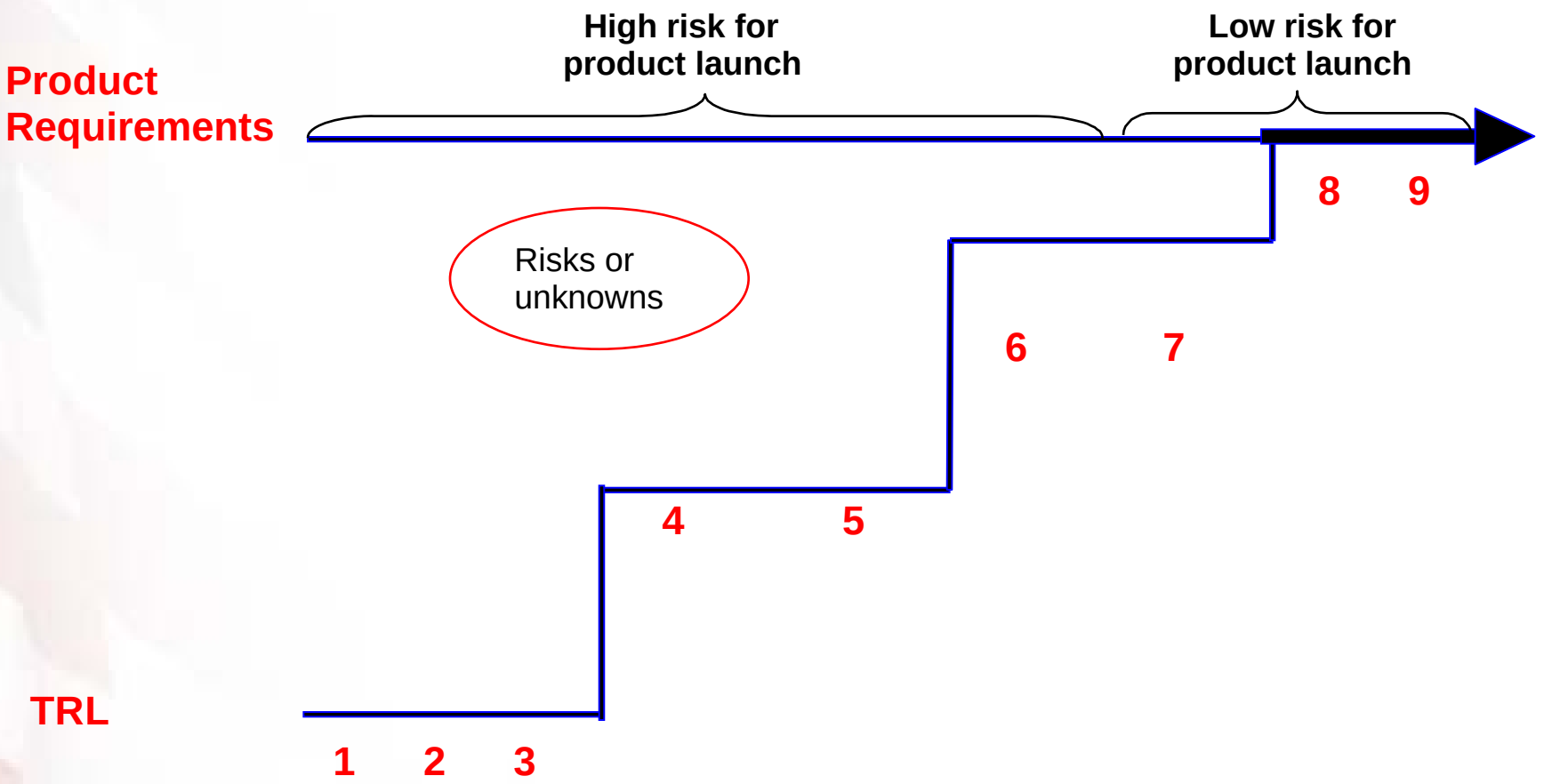
4 Component and/or breadboard validation in laboratory environment

3. Analytical and experimental critical function and/or characteristic proof-of-concept

2 Technology concept and/or application formulated

1 Basic principles observed and reported

Using TRLs to Match Technology with Product Launch Requirements

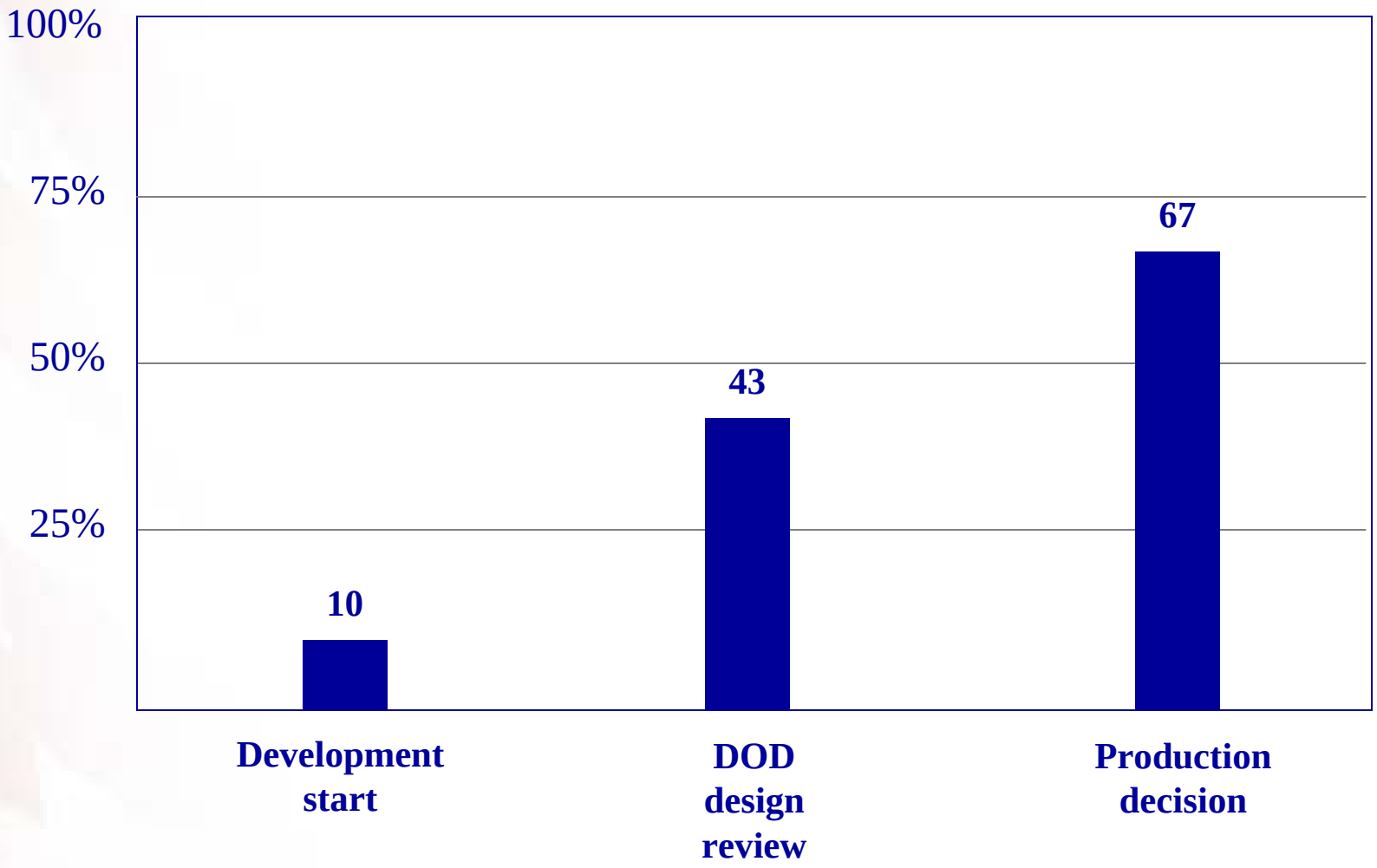


DOD Has Made Constructive Changes In Policy, But Implementation Remains A Challenge

- **DOD 5000 policy says most of the right things about separating technology development from system development**
  - Calls for technology maturity to TRL 6 (relevant environment)
  - Calls for evolutionary approach as a check on reqts.
  - Short development cycle times (5 years or less)

- **However,**
  - Best practice standard is TRL 7 (operational environment)
  - Most individual programs do not even abide by policy
  - Many programs fall outside: satellites, MDA, ships
  - Those within are unique: eg., FCS, JSF
  - Preference is still for revolutionary, not evolutionary
  - Knowledge gaps and optimistic estimates at MS B are the norm and are reinforced with approval and funding

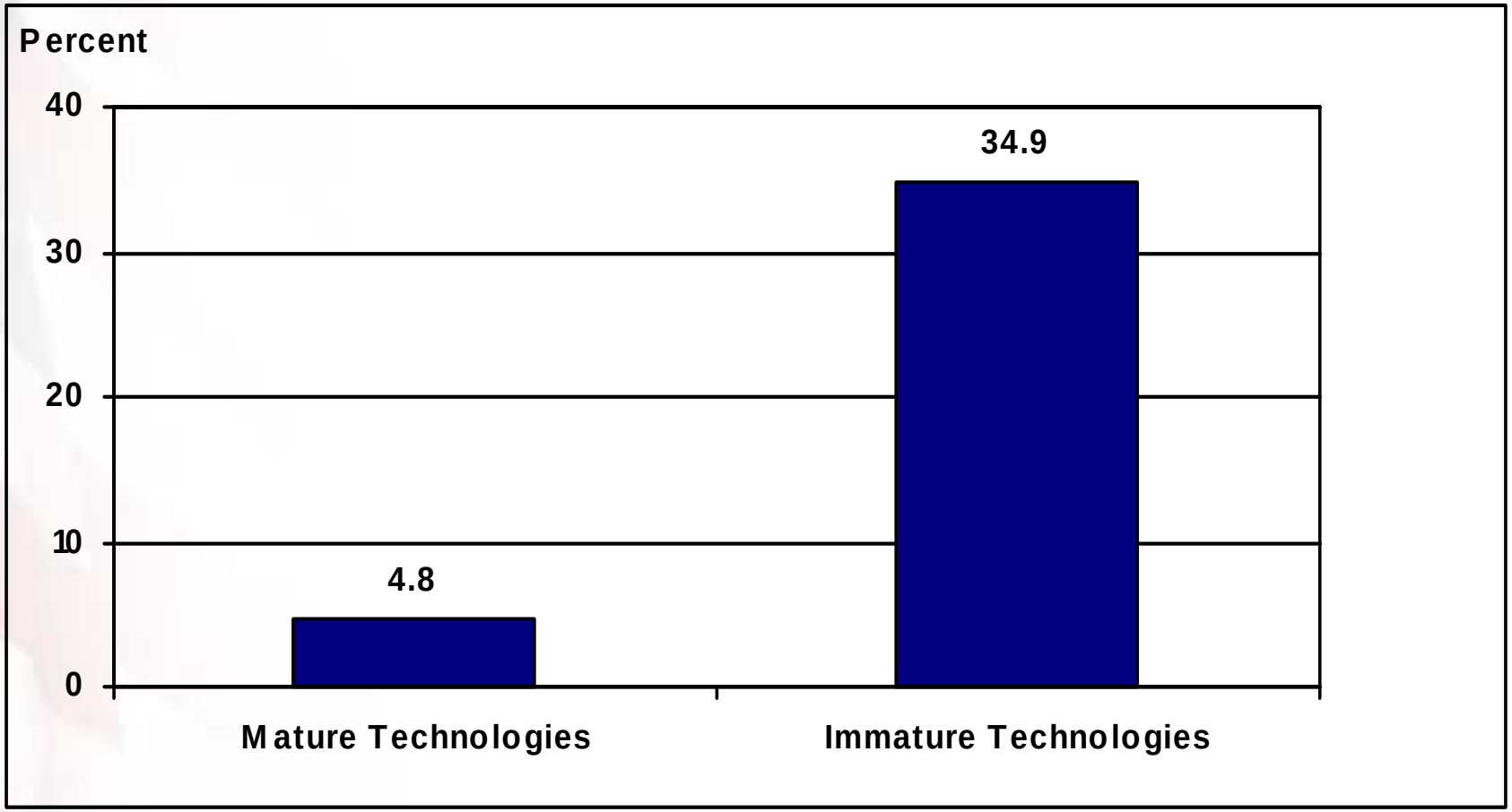
Percent of Programs that Achieved Technology Maturity at Key Junctures



Source: *Defense Acquisitions: Assessments of Selected Major Weapon Programs.* GAO-06-391. Washington, DC.: March 2006.

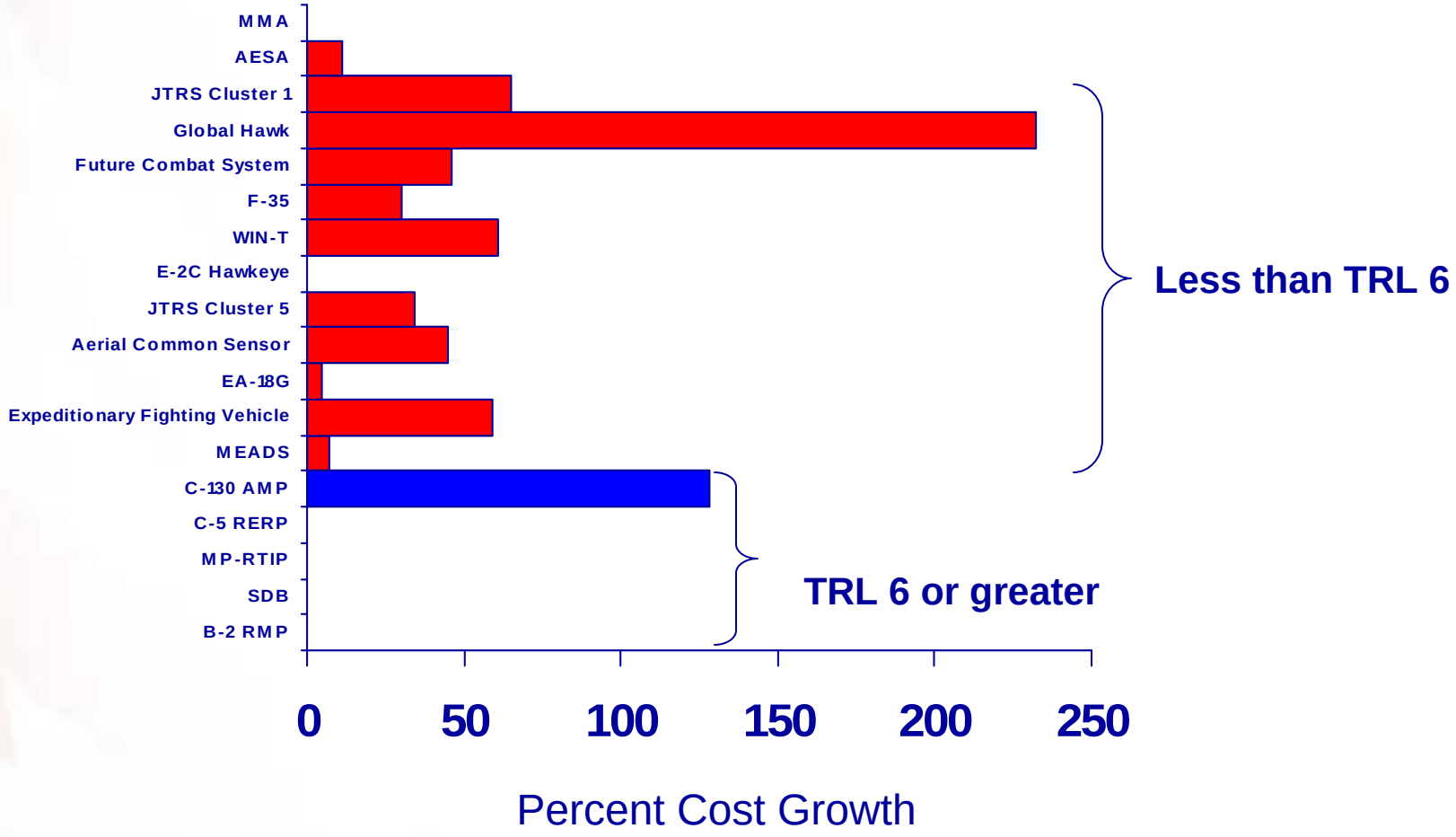
Immature Technologies Continue To Spill Over Into System Development

Average Program Research, Development, Test and Evaluation Cost Growth From First Full Estimate



Source: Defense Acquisitions: Assessments of Selected Major Weapon Programs. GAO-06-391. Washington, DC.: March 2006.

Condition Continues Under Revised Policy



Source: Defense Acquisitions: Major Weapon Systems Continue to Experience Cost And Schedule Problems Under DOD's Revised Policy. GAO-06-368. Apr. 13, 2006

Challenges That Remain To Getting Better Outcomes

- How will initiatives like strengthened focus on SE, EMRLS, etc., succeed when incentives encourage starting programs too early, making revolutionary technical leaps, underestimating cost and risk, and promising record delivery times?
- Can we employ evolutionary acquisition and trade requirements to match a 5-year cycle and to mature technologies?
- Can we provide S&T the funds, organization, and authority to do the necessary pre-acquisition SE and technology development work?
- Can we put managers in a position to succeed with a shorter cycle and hold them accountable for results?
- Can capabilities-based requirements be controlled so that tradeoffs can be made?
- If the solution requires the invention of numerous technologies, is so complex that the government cannot be the integrator, and so expensive that it takes most of a service's budget, is it really a viable solution?

Encourage Best Practices By Changing Incentives

- ✓Use knowledge-based approach for decision making
- ✓Measure knowledge against high and clear standards
- ✓Separate technology development from product development
- ✓Realign technology responsibilities and funding
- ✓Discipline requirements-setting process by demanding match
- ✓Send signals through investments on individual programs

GAO Reports On-line

Reports Available at www.gao.gov

- **Best Practices: Better Support of Weapon System Program Managers Needed To Improve Outcomes. GAO-06-110. Washington, D.C.: November 30, 2005**
- **Defense Acquisitions: Stronger Management Practices Needed to Improve DOD's Software-Intensive Weapons Acquisitions. GAO-04-393. March 1, 2004**
- **Best Practices: Setting Requirements Differently Could Reduce Weapon Systems' Total Ownership Costs. GAO-03-57. February 11, 2003.**
- **Best Practices: Capturing Design and Manufacturing Knowledge Early Improves Acquisition Outcomes. GAO-02-701. July 15, 2002.**
- **Best Practices: Better Matching of Needs and Resources Will Lead to Better Weapon System Outcomes. GAO-01-288. March 8, 2001.**
- **Best Practices: A More Constructive Test Approach Is Key to Better Weapon System Outcomes. GAO- NSIAD-00-199. July 31, 2000.**
- **Best Practices: DOD Training Can Do More to Help Weapon System Program Implement Best Practices. GAO/NSIAD-99-206. August16, 1999.**
- **Best Practices: Better Management of Technology Development Can Improve Weapon System Outcomes. GAO/NSIAD-99-162. July 30, 1999.**
- **Best Practices: DOD Can Help Suppliers Contribute More to Weapon System Programs. GAO/NSIAD-98-87. March 17, 1998.**
- **Best Practices: Successful Application to Weapon Acquisition Requires Changes in DOD's Environment. GAO/NSIAD-98-56. February 24, 1998.**
- **Best Practices: Commercial Quality Assurance Practices Offer Improvements for DOD. GAO/NSIAD-96-162. August 26, 1996.**