



***The Role of Systems Engineering  
In Program Management  
12th Annual NDIA SE Conference***

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# **Agenda**

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- **Major Policy Changes—**
  - **5000.02**
  - **Weapons Systems Acquisition Reform Act (WSARA) of 2009**
- **Systems Engineering Role in EVM**
- **Systems Engineering In Reliability**



# *Unclassified* **Excerpts from Secretary Gates Congressional Testimony – January 27, 2009**

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- **The situation we face today: A small set of expensive weapons programs has had repeated – and unacceptable – problems with requirements, schedule, cost, and performance**
- **I do not believe there is a silver bullet, and I do not think the system can be reformed in a short period of time...**
- **That said, I do believe we can make headway, and I have already begun addressing these issues**
  - **We must freeze requirements on programs at contract award and write contracts that incentivize proper behavior**
  - **Programs that cost more than anticipated are built on an inadequate initial foundation. I believe the Department should seek increased competition, use of prototypes, and ensure technology maturity so that our programs are ready for the next phases of development**

*Systems Engineering plays a critical role in changing the future*



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# ***DoD Instruction 5000.02 Summary***

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- **While we have much to do, the Department has taken action to address many of the issues related to program execution**
  - **Ensuring a proper foundation before initiating programs**
  - **Limiting requirements changes**
  - **Requiring mature technologies and system engineering discipline**
  - **Competitive prototypes to reduce risk, improve competition, inform decisions**
  - **Better integration between development and operational test and evaluation**
  - **Improvements in how we incentivize contract performance**
- **It will take time to realize the results of these changes ...but we are already seeing improvements**

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# Previous Acquisition Process

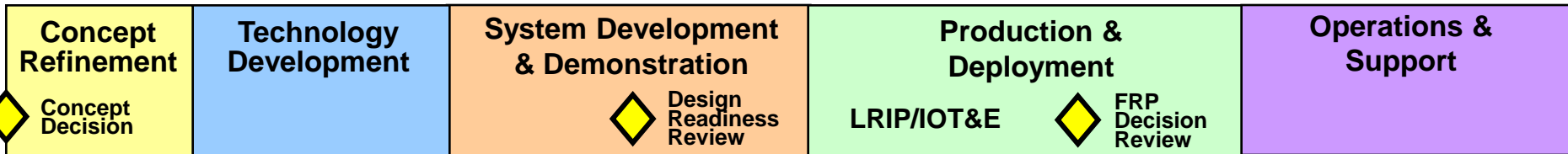
User Needs & Technology Opportunities



- Process entry at Milestone A, B, or C
- Entrance criteria met before entering phase
- Evolutionary Acquisition or Single Step to Full Capability

IOC

FOC



Pre-Systems Acquisition

Systems Acquisition

Sustainment

## Problems Identified

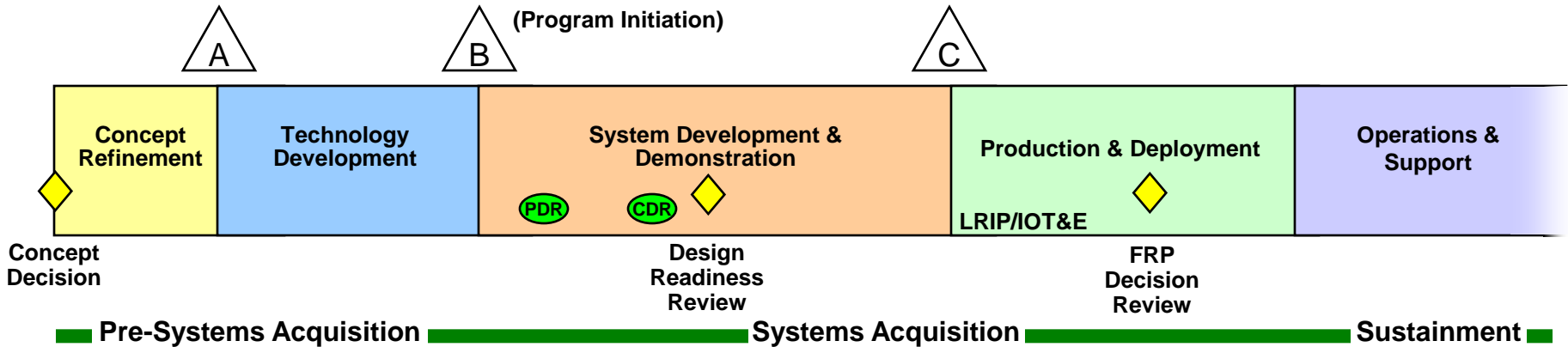
- Most potential programs proceed to Milestone B without a predecessor review to assess the capability need and direct analysis of alternatives
- Technical maturity is not adequately demonstrated prior to program initiation
- Program cost, schedule, and performance inadequately informed by design considerations
- Requirements “creep” continues to de-stabilize programs
- With the exception of Configuration Steering Boards at the CAE level, there is no formal and effective opportunity between Milestone B and Milestone C for MDA to assess progress, adjust / defer requirements, or, consistent with statute, re-structure the program



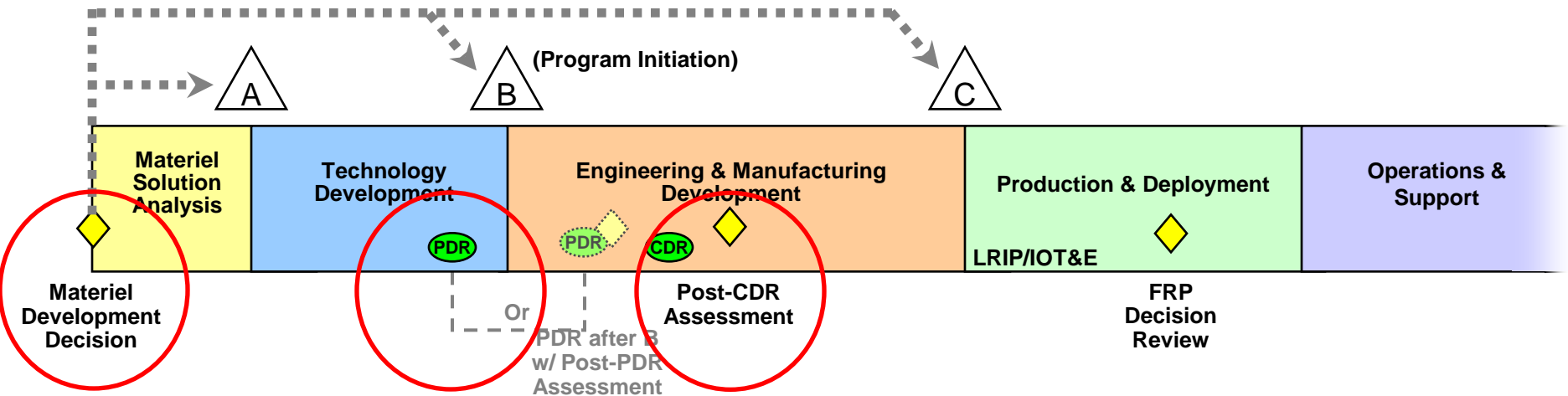
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# Comparison to DoDI 5000.2, May 12, 2003

## Defense Acquisition Management System, May 2003 – December 2008



## Defense Acquisition Management System, Revised December 8, 2008



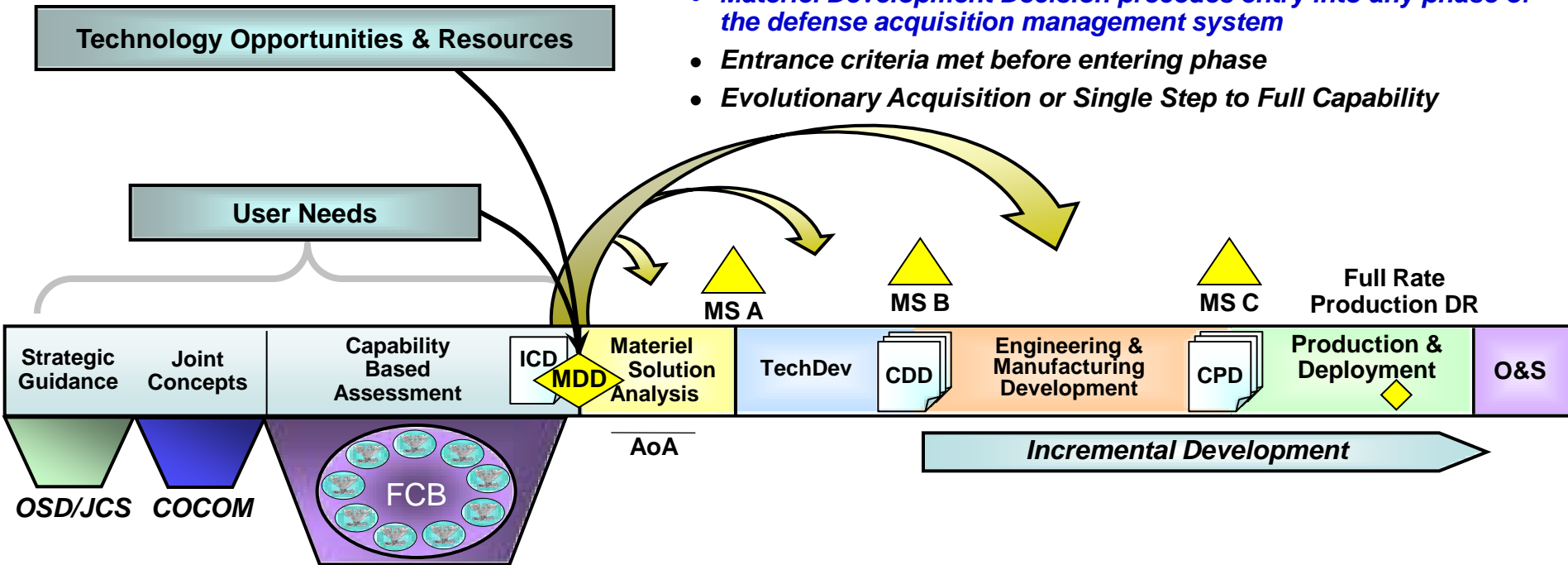
Greater emphasis upfront—where systems engineering is most critical



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# Opportunities for SE to have Impact —MDD and Material Solution Analysis

- *Material Development Decision precedes entry into any phase of the defense acquisition management system*
- *Entrance criteria met before entering phase*
- *Evolutionary Acquisition or Single Step to Full Capability*

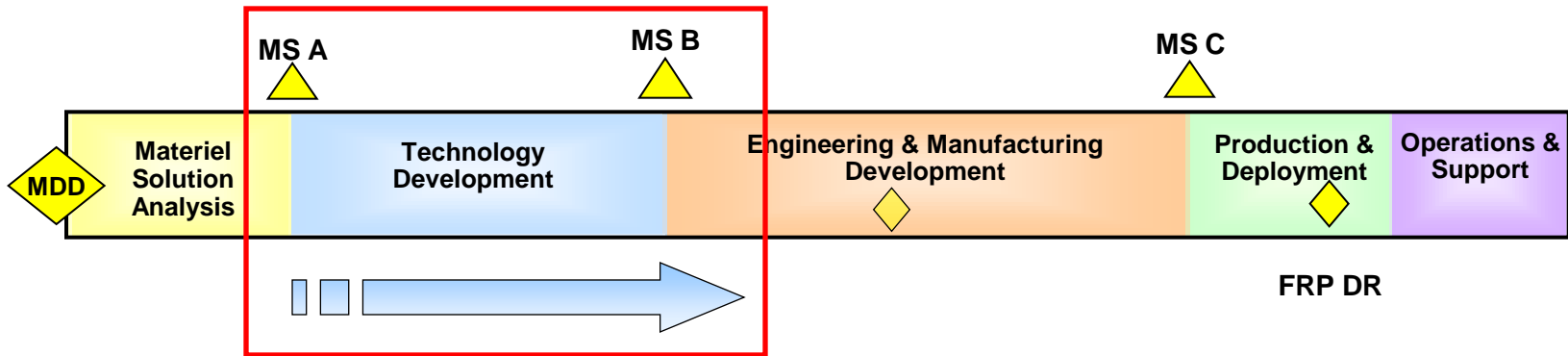


- JROC recommends that the Milestone Decision Authority (MDA) consider potential materiel solutions
- MDA ensures necessary information is available to support the decision
- Materiel Solution Analysis Phase begins with the MDD—the formal entry point into the acquisition process, mandatory for all programs
- At the MDD, the Joint Staff presents the JROC recommendations; the DoD Component presents the ICD and a preliminary concept of operations, a description of the needed capability and operational risk, and the basis for determining that non-materiel approaches will not sufficiently mitigate the capability gap
- D,PA&E (or DoD Component equivalent) proposes Assessment of Alternatives (AoA) study guidance
- MDA approves the AoA study guidance; determines the acquisition phase of entry; identifies the initial review milestone; and designates the lead DoD Component(s)
- Decisions documented in an Acquisition Decision Memorandum (ADM)





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**Opportunities for SE to have Impact**  
**—Prototyping and Competition**

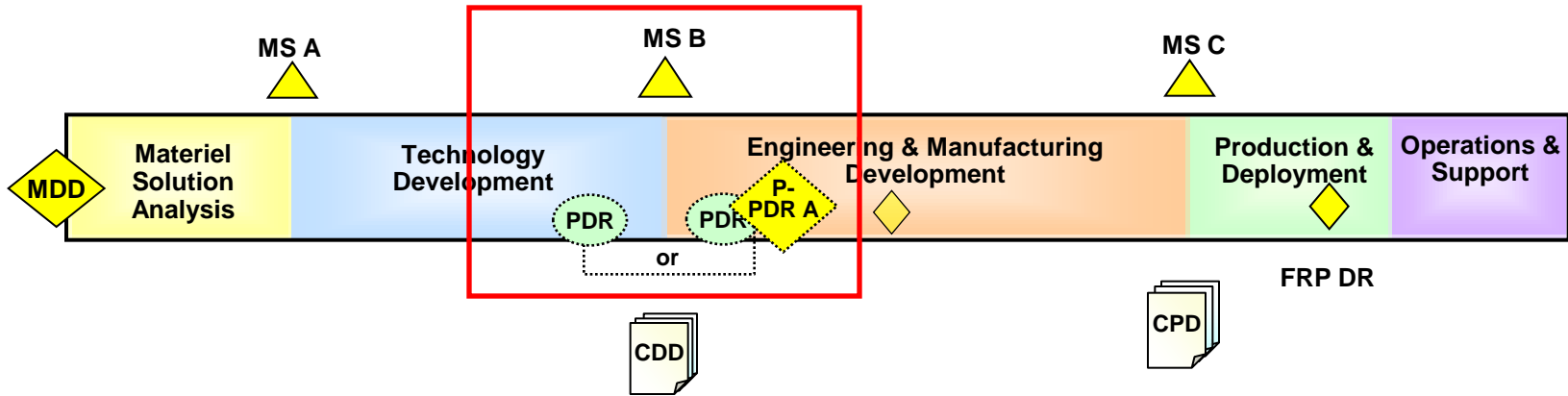


- The Technology Development Strategy and associated funding shall provide for two or more competing teams producing prototypes of the system and/or key system elements prior to, or through, Milestone B. Prototype systems or appropriate component-level prototyping shall be employed to reduce technical risk, validate designs and cost estimates, evaluate manufacturing processes, and refine requirements. . . .





# Unclassified Opportunities for SE to have Impact —Preliminary Design Review



## PDR Before Milestone B

or

## PDR after B and Post-PDR Assessment

- Consistent with:
  - Technology Development Phase objectives
  - Associated prototyping activity, and
  - The MDA approved TDS
- Planning reflected in the TDS
  - Establishes the allocated baseline and underlying architectures
  - Defines a high-confidence design
- Conducted at the system level
- Informs requirements trades; improves cost estimation; and identifies remaining design, integration, and manufacturing risks.

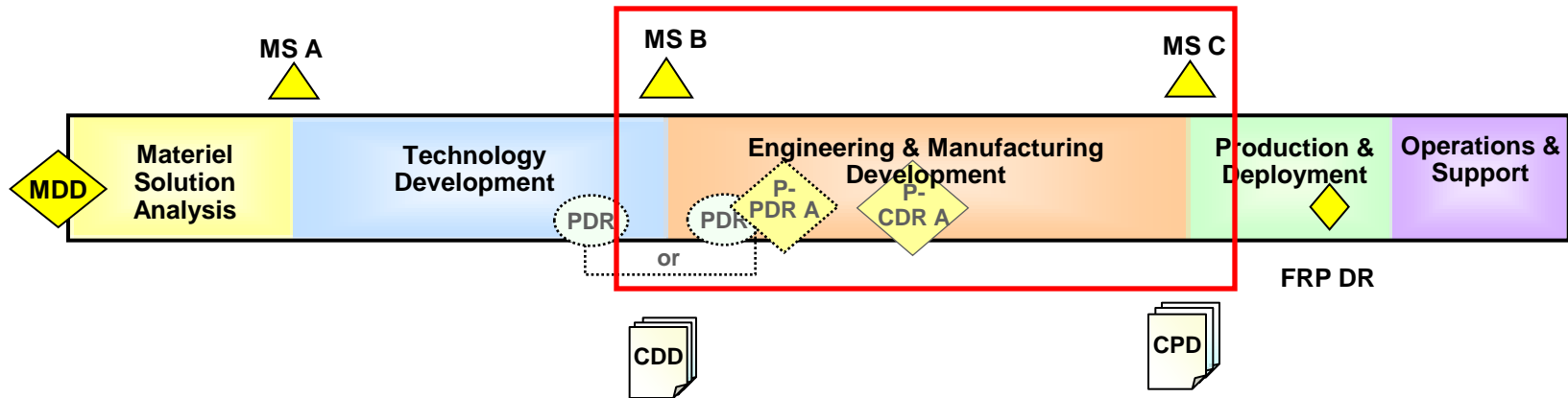
- ~~If a PDR has not been conducted prior to Milestone B:~~
- Plan for a PDR as soon as feasible after program initiation
  - PDR report to the MDA prior to the Post-PDR Assessment
    - Report reflects requirements trades based upon the PM's assessment of cost, schedule, and performance risk
  - Formal assessment; results documented in an ADM

**2009 WSARA requires before Milestone B**



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# Opportunities for SE to have Impact —Engineering and Manufacturing Development Phase



... develop a system or an increment of capability; complete full system integration; develop an affordable and executable manufacturing process; ensure operational supportability; implement human systems integration; design for producibility; ensure affordability; protect Critical Program Information; and demonstrate system integration, interoperability, safety, and utility.

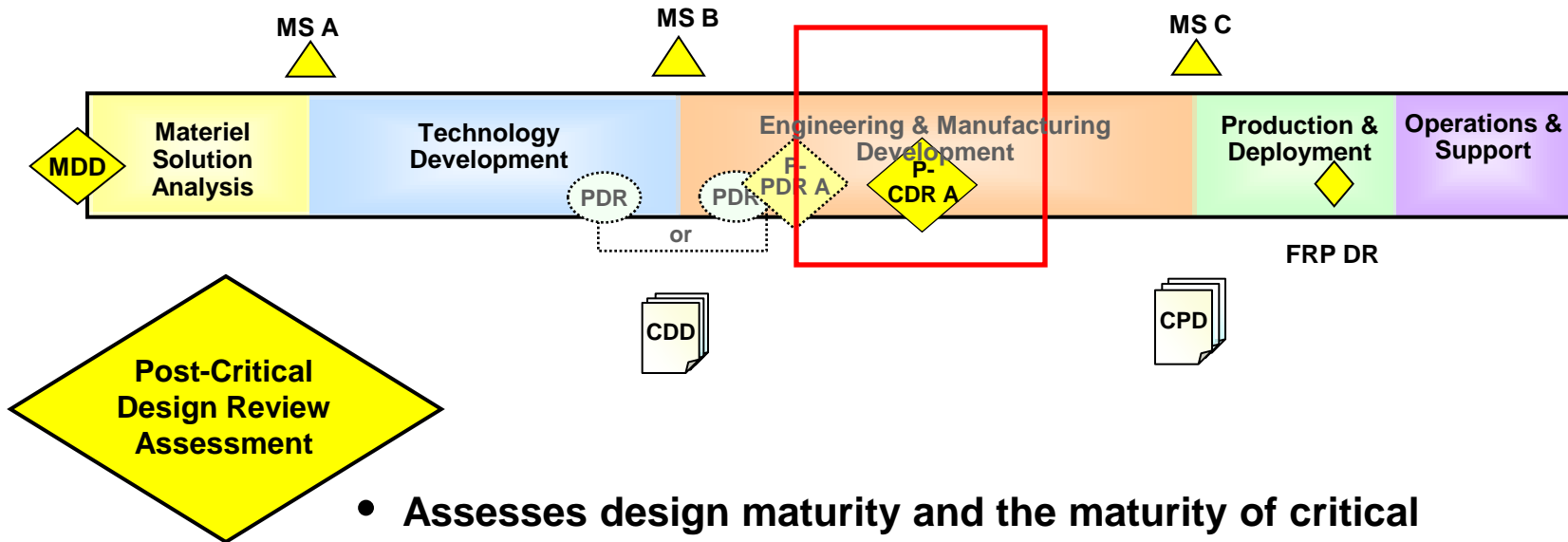
- Integrated System Design
- Define system and system-of-systems functionality and interfaces
  - Complete hardware and software detailed design and reduce system-level risk
  - Establish product baseline for all configuration items

System Capability and Manufacturing Process Demonstration

Demonstrate the ability to operate in a useful way consistent with the approved key performance parameters and that system production can be supported by demonstrated manufacturing processes



# Unclassified Opportunities for SE to have Impact —Post CDR Assessment



- Assesses design maturity and the maturity of critical manufacturing processes
- Considers whether the program provides capability consistent with the Acquisition Program Baseline (APB) approved at Milestone B
- MDA determines whether
  - (1) an adjustment should be made, or
  - (2) the program should be permitted to proceed without change
- Results documented in an ADM



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**2009 Weapon Systems Acquisition Reform Act**  
***Greater Emphasis placed on Systems Engineering***

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**☐ Establishes Directors of Developmental Test and Evaluation and Systems Engineering**

- Newly created roles reporting directly to USD AT&L, through DDR&E
- Responsible for issuing joint guidance relating to the integration of developmental test and systems engineering, and managing the associated workforces
- Components required to develop and implement plans to ensure they have the appropriate resources for developmental testing and systems engineering, and the two Directors are required to assess these plans.

**☐ A Joint Annual Report to Congress (first one due March 31, 2010) shall:**

- Report on the activities undertaken during the preceding year establishing Directors and accomplishing policy and guidance, review and oversight
- Highlight activities relating to the MDAPs for the preceding year including:
  - ✓ A discussion of the extent to which the MDAPs are fulfilling the objectives of their SEPs and TEMPs
  - ✓ A discussion of the waivers of and deviations from requirements in TEMPs, SEPs, and other testing requirements that occurred for the MDAPs, any concerns raised by such waivers or deviations, and the actions taken/planned to address such concerns.
  - ✓ An assessment of the organization and capabilities of the DoD for SE, development planning, and DT&E with respect to MDAPs



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# **WSARA SE Implications for Programs**

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- ***Systems engineering and developmental test and evaluation now recognized in law as inherently necessary in requirements definition, development planning, and early acquisition***
- ***Need for Program Office formation and PM skill-sets after Materiel Development Decision (MDD) and prior to Milestone (MS) A***
- ***Increased importance of the Technology Development Strategy (TDS) (as a surrogate Acquisition Strategy) at MS A***
- ***Earlier engagement with industry and different contracting strategies for technology maturation, competitive prototyping, data rights, Preliminary Design Review (PDR) before MS B, etc.***
- ***Explicit need for earlier, formal SE process application (e.g., data, configuration, and risk management)***

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# Systems Engineering in Earned Value Management

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- ❑ **Earned Value is a management technique that relates resource planning to schedules and to technical, cost and schedule requirements**
  - **During the planning phase, an integrated baseline is developed by time phasing budget resources for defined work.**
  - **These time-phased “planned value” increments constitute a cost and schedule measurement baseline**
- ❑ **There are two major objectives of an earned value system**
  - **to encourage contractors to use effective internal cost and schedule management control systems; and to**
  - **Permit the customer to be able to rely on timely data produced by those systems for determining product-oriented contract status**
- ❑ **Success of EVM is dependant on good technical performance baseline measures and can be more effective as a program management tool if augmented with rigorous systems engineering processes**



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## Systems Engineering in Reliability

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- ❑ **DODI 5000.02 Additional Technology Development Phase Requirements: PMs for all programs shall formulate a viable Reliability, Availability, and Maintainability (RAM) strategy that includes a reliability growth program as an integral part of design and development. RAM shall be integrated within the Systems Engineering processes, documented in the program's Systems Engineering Plan (SEP) and Life-Cycle Sustainment Plan (LCSP), and assessed during technical reviews, test and evaluation (T&E), and Program Support Reviews (PSRs).**

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