A Framework for Enhancing Forward-looking Capability Delivery Metrics

Leonard Sadauskas

Presented at
12th NDIA SE Conference
Early Systems Engineering Track
28 October 2009

Disclaimer

The views and opinions expressed in this presentation are those of the author and do not reflect the policy of the Department of Defense

Motivation for this Presentation

- DoD has been in transition since 2003 from

  REQUIREMENTS to *CAPABILITIES-BASED* planning

- The state of the transition includes
  - JCIDS and a revised 5000
  - Testing in a Joint Environment Roadmap in 2004
  - Revitalized Joint Test and Evaluation (JT&E) Program in 2005
  - Development of Joint Capability Areas
  - Capability Portfolio Managers Directive in 2008
  - Several recent articles on Capability Test & Evaluation

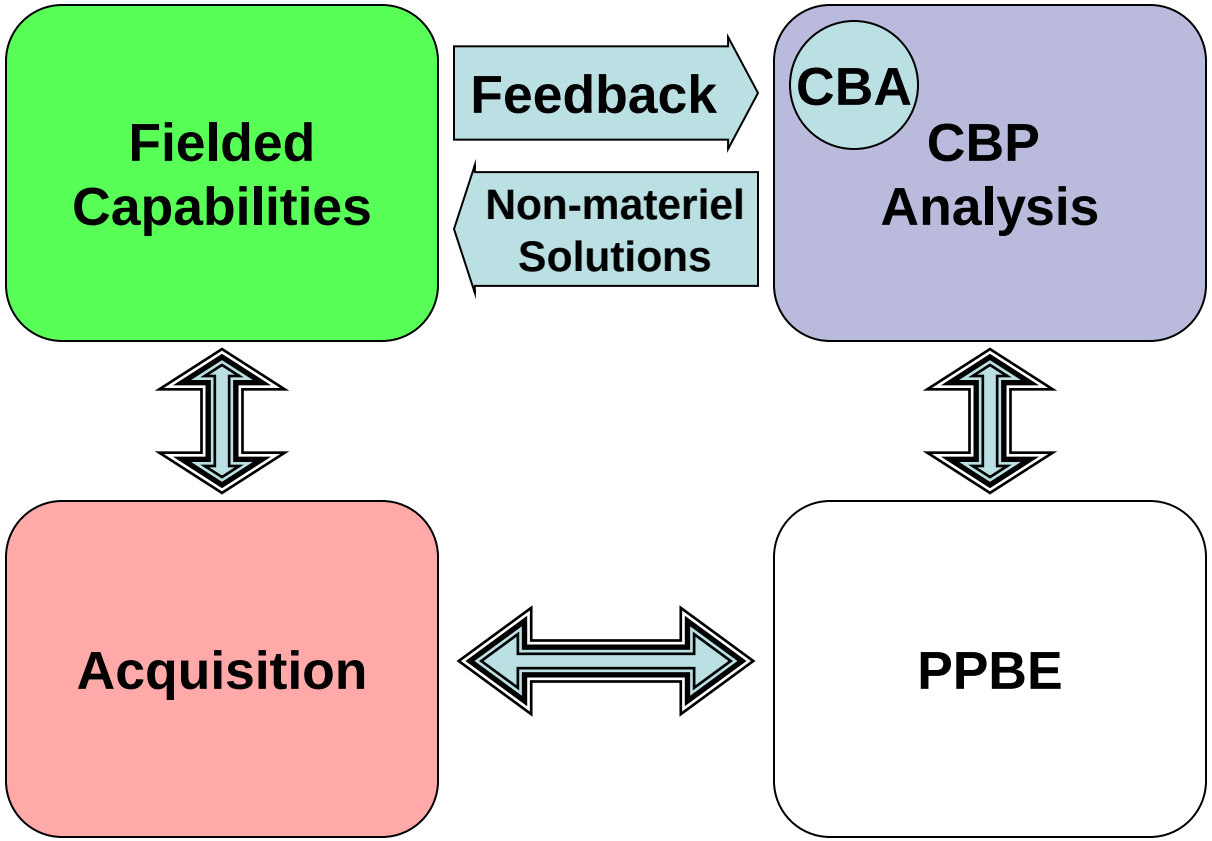
- **Yet the ability to predict a timely delivery of capability to the warfighter is the subject of the Weapons Systems Acquisition Reform Act of 2009**
- One conclusion is that our risk management process has neither embraced capabilities nor developed risk metrics for delivery of capabilities

Definitions Related to Capability

- Capability
  - The ability to achieve a desired effect under specified standards and conditions through a combination of means and ways across the DOMLPF to perform a set of tasks to execute a specific course of action
- Joint Capability Area (JCA)
  - Collection of like DoD capabilities functionally grouped to support capability analysis, capability portfolio management and …….
- Capabilities-Based Assessment (CBA)
  - Study that identifies the capabilities (and operational performance criteria) required to successfully execute missions
- Capability-based planning (CBP)
  - An overarching framework for planning under uncertainty that provides capabilities suitable for a wide range of modern-day challenges and circumstances while working within an economic framework that necessitates choice

Capabilities-based Planning Framework

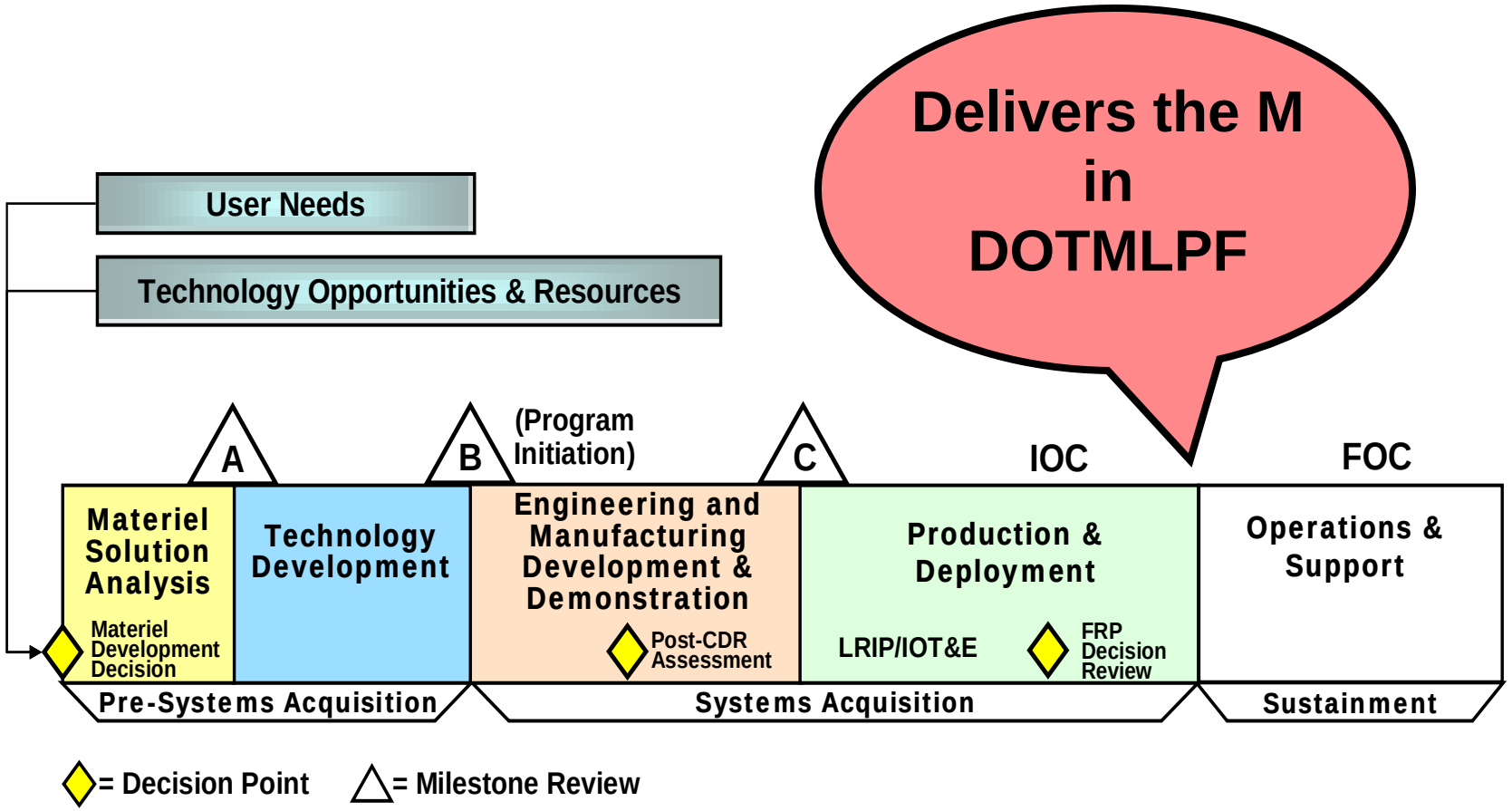
Adapted from DAU Course Material



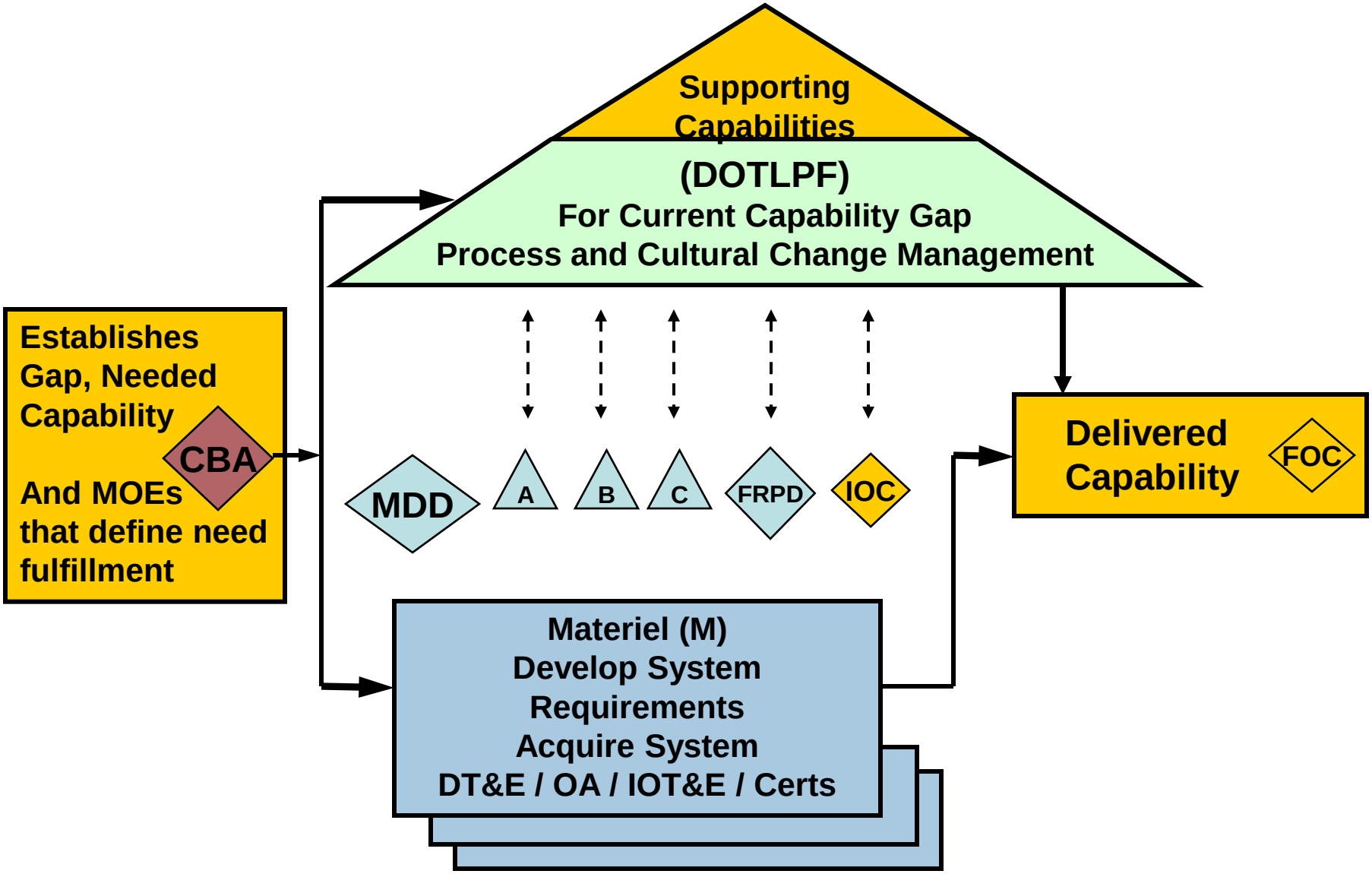
Implications of Delivering Capability

The ability to achieve a **desired effect** under **specified standards** and **conditions** through a combination of means and ways across the **DOTMLPF** to perform a set of tasks to execute a specific course of action

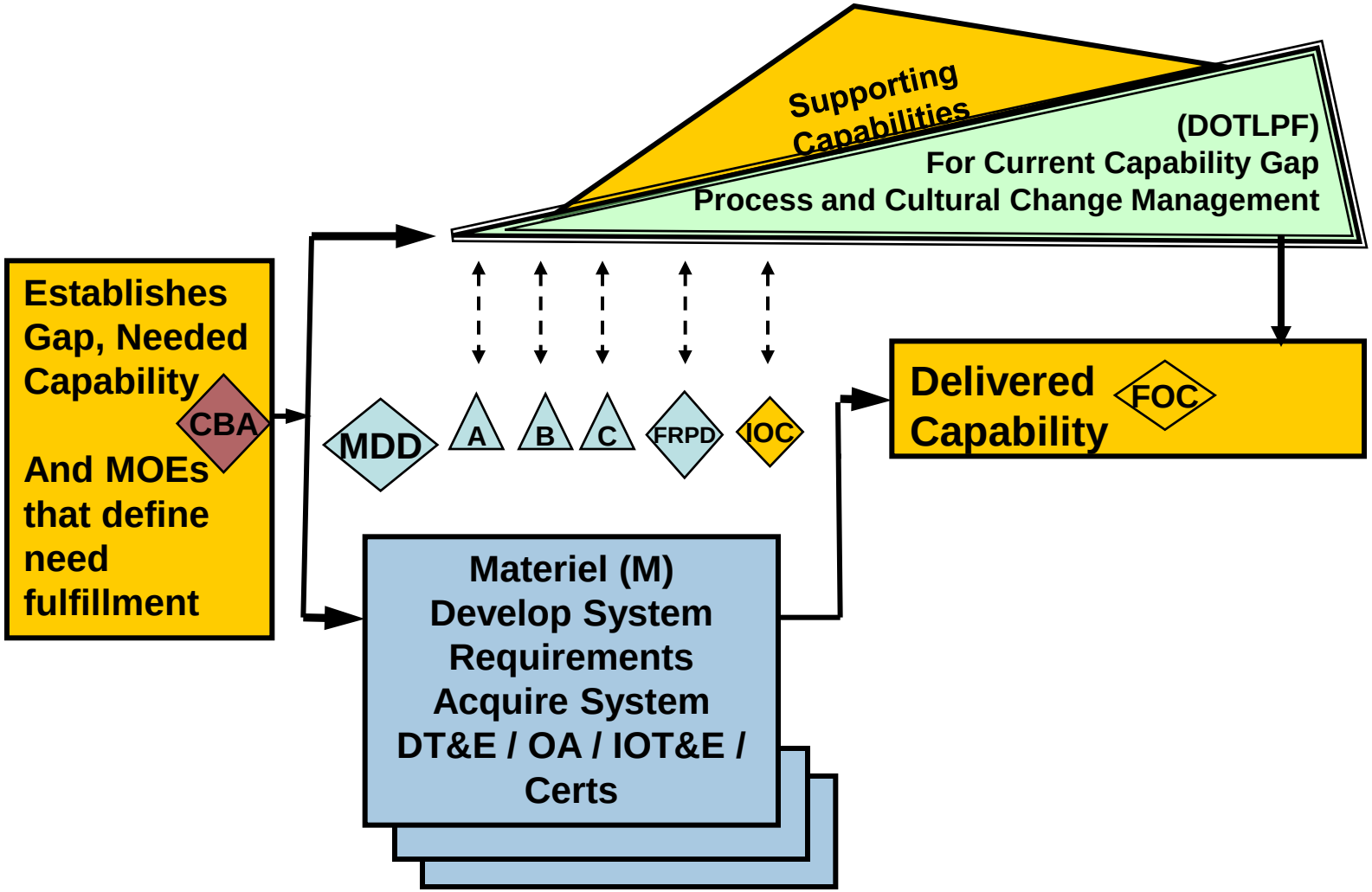
The 5000 Model for Delivering Capability



A Notional Model for Delivering Capability

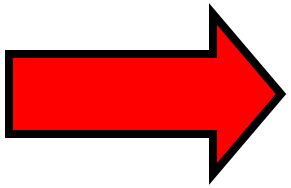


Often Seen Model for Joint Capability Delivery



The Capability Development and Delivery Metric of Interest

WSARA 2009 sec. 103.c: Performance Assessments



The extent to which the predicted cost**, schedule and performance is likely to result in the timely delivery of a level of capability to the warfighter** that is consistent with the level of resources to be expended and provides superior value to alternative approaches that may be available to meet the same military requirement

Analytical Approach

Defining success as the timely delivery of a level of capability (such as an increment) to the warfighter, then

$$P(\text{success}) = F\left(P_{\text{that each DOTMLPF element meets Schedule and Performance}}\right)$$

Simplifying with assumptions that each DOTMLPF element is:

- independent
- accomplished in series
- equal in importance
- has a known schedule, performance probability distribution

$$P(\text{success}) = P_D * P_O * P_T * P_M * P_L * P_P * P_F$$

Of course this is a gross oversimplification and removing these assumptions will produce a significantly more complex, albeit more robust model.

Current DAS Predictive Approach

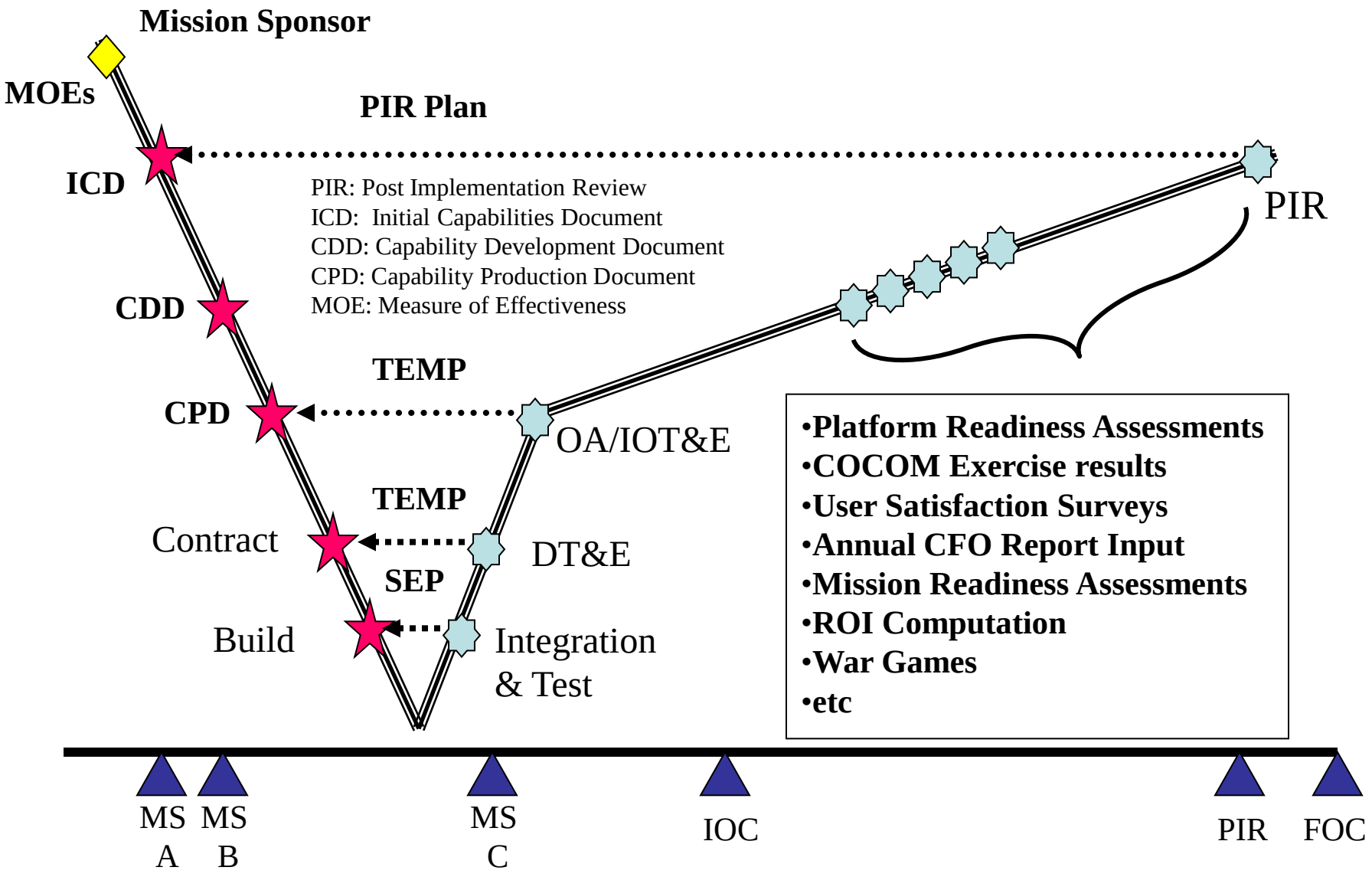
- For programs operating within their APBs, the key predictors for successful delivery of capability are T&E, certifications and post implementation review (PIR)
  - DT&E estimates the system's military utility when introduced
  - IOT&E translates measures of effectiveness (MOEs) into critical operational issues and predicts suitability and effectiveness when introduced
  - PIR verifies the ICD MOEs and collects customer satisfaction prior to FOC

Post Implementation Review (PIR) Defined

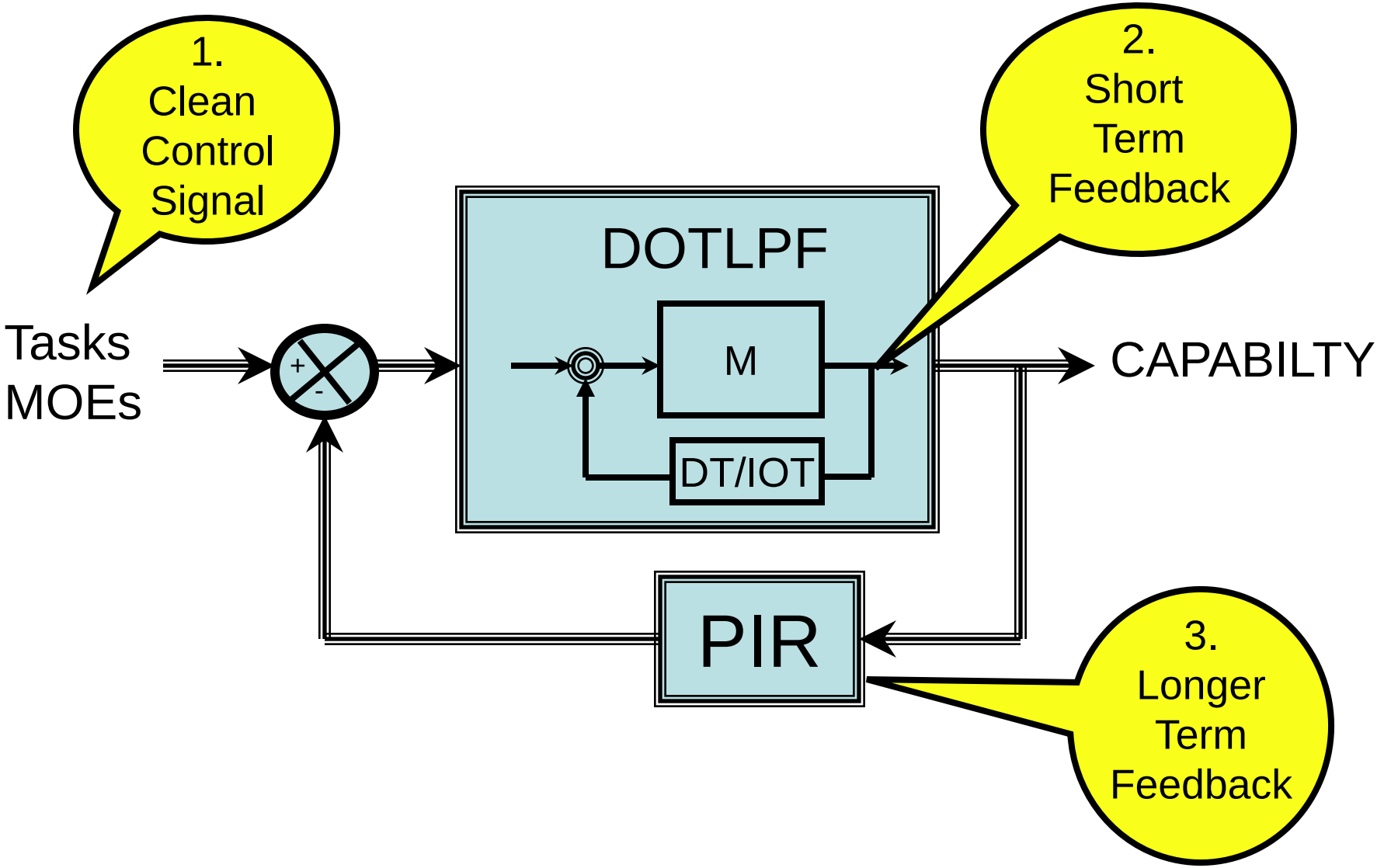
An analysis of an investment or acquired system that is part of a capability portfolio, operating in its intended environment, using data collected from various sources to answer the question:

Did we get what we needed, and if not what to do about it?

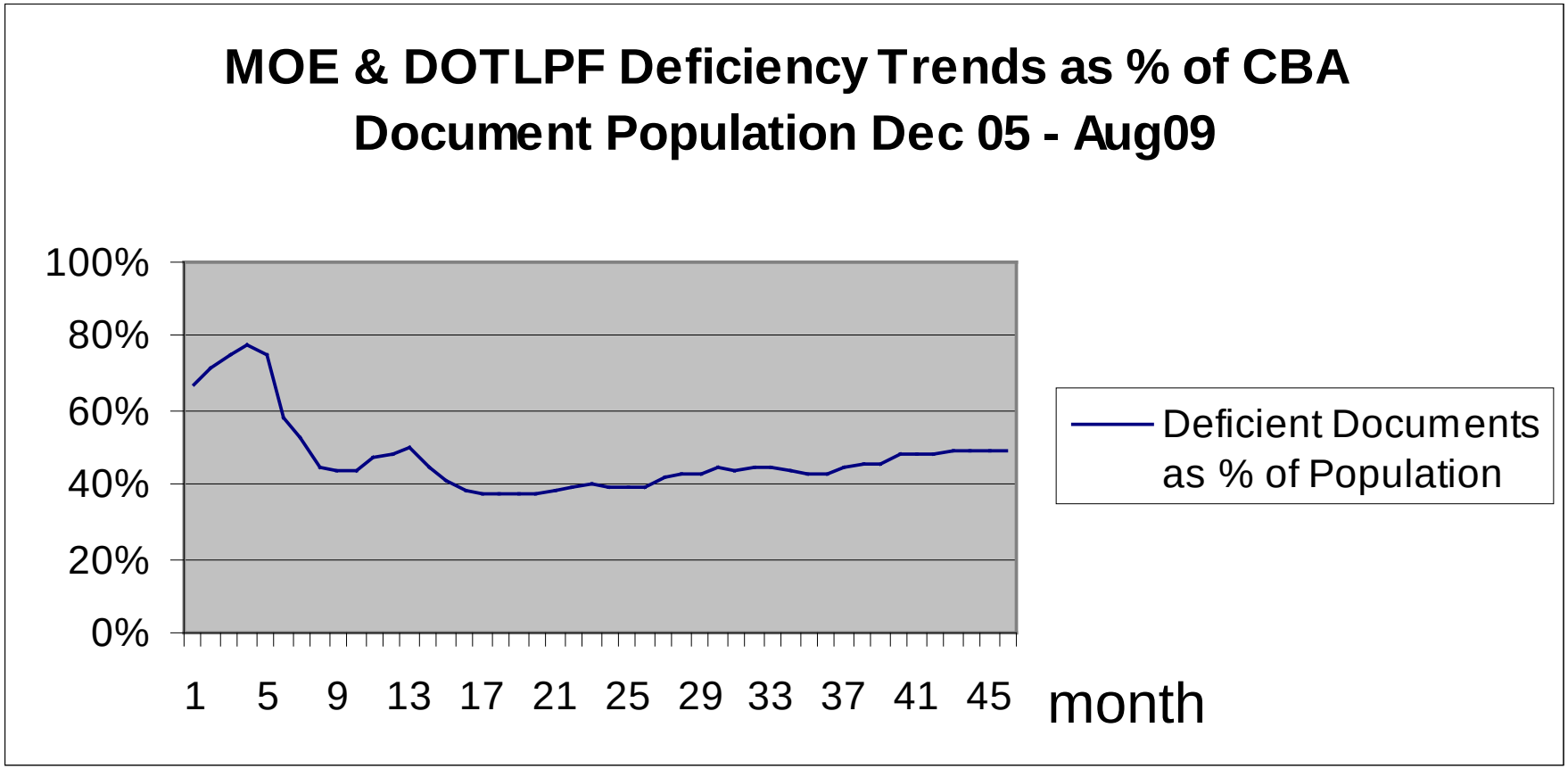
System and Capability Verification



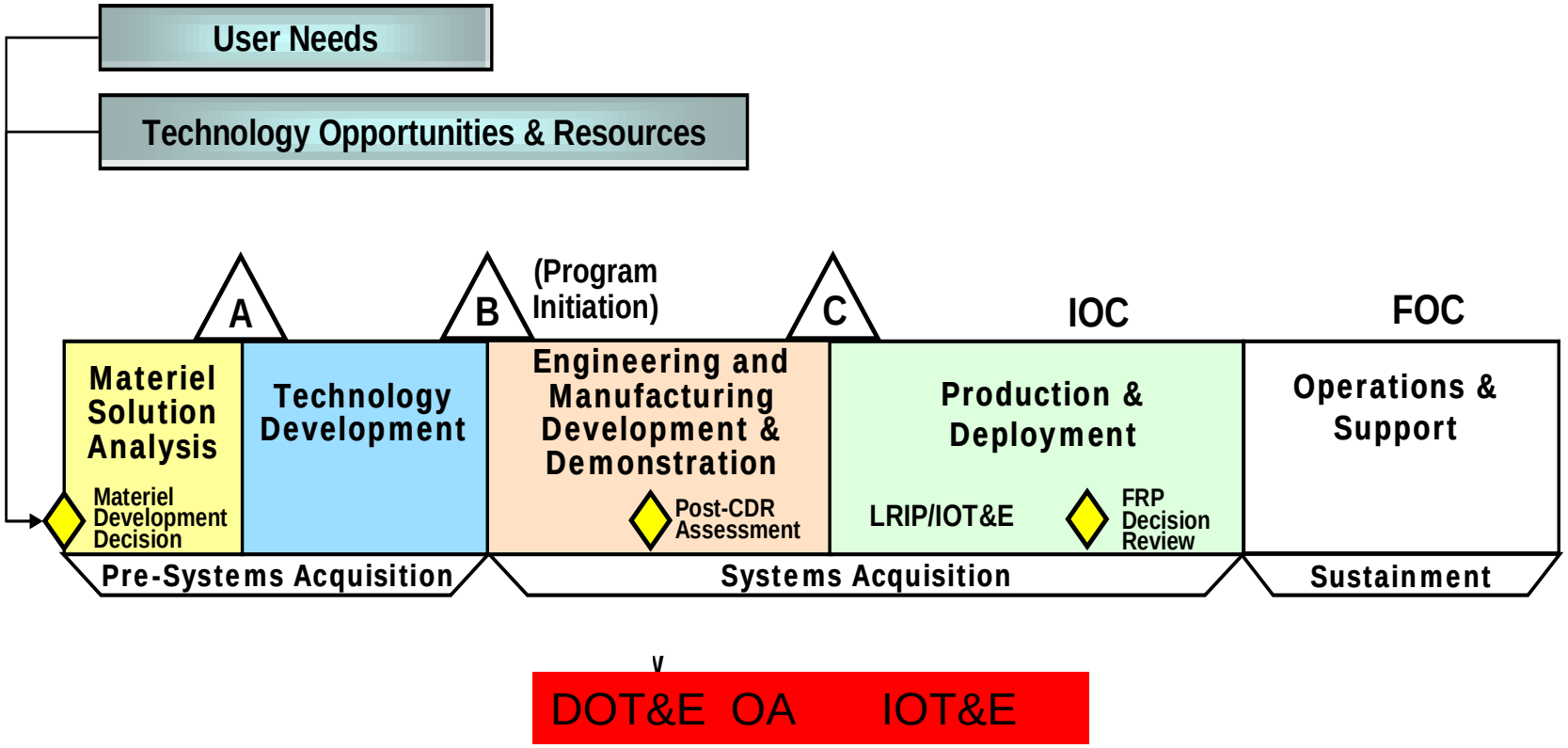
Notional Model for Enhancing Forward-looking Schedule and Performance Predictors



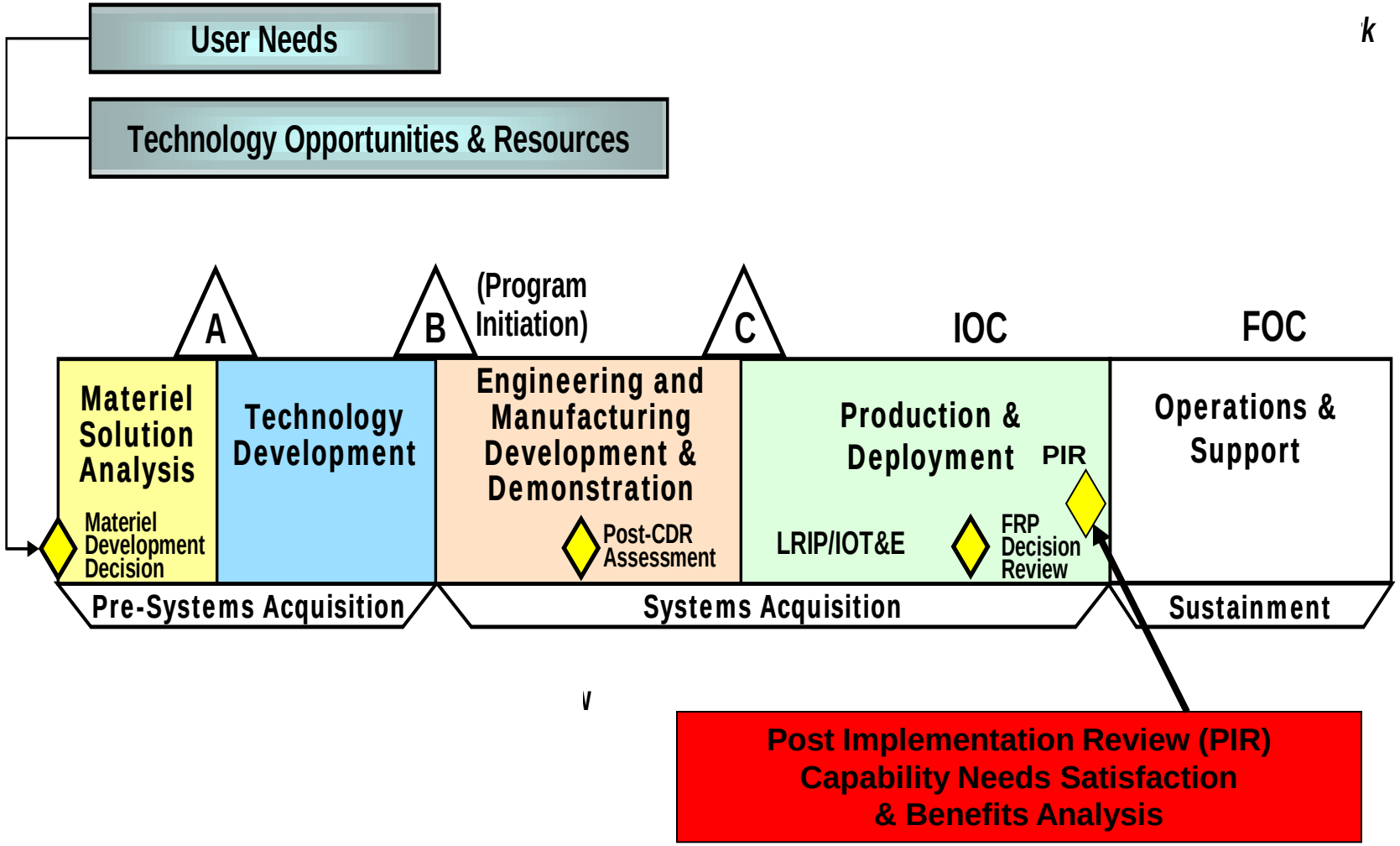
1. Clean Control Signal (Problematic but doable)



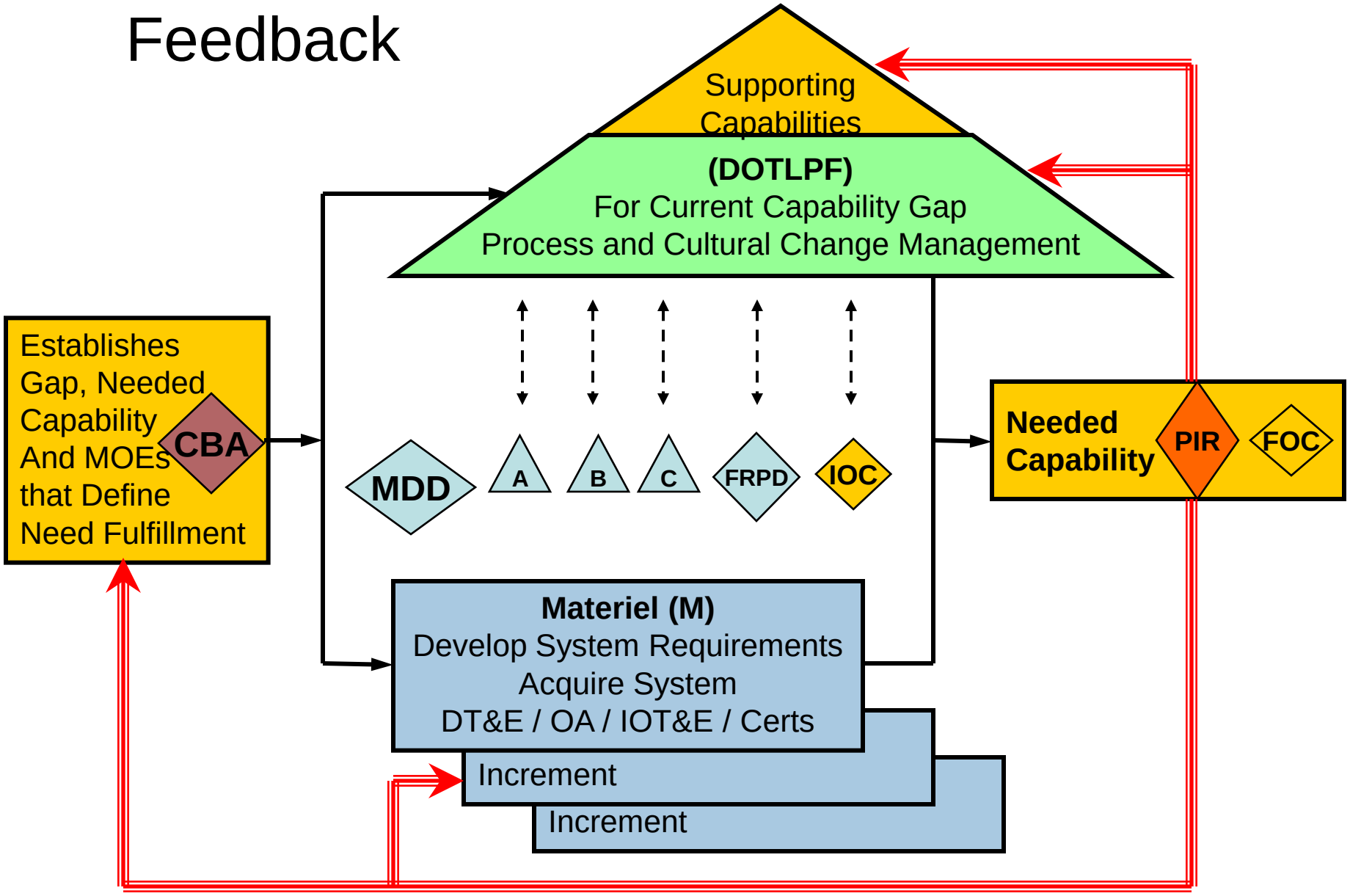
2. Short Term Feedback



3. Longer Term Feedback in 5000 (DAG Ch 7.9)



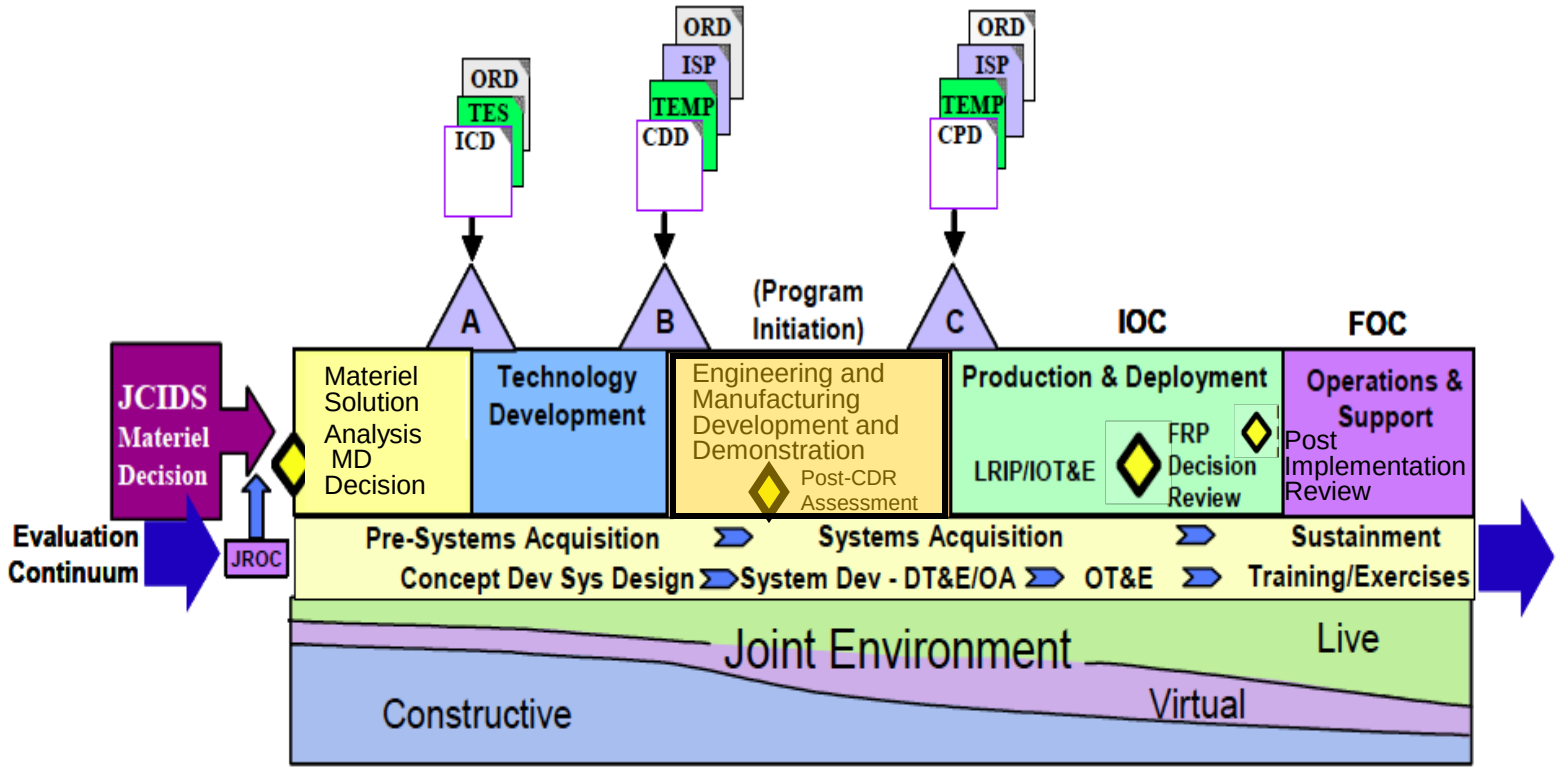
3. Longer Term Capability Delivery Feedback



First Steps for Predictor Enhancement

- **DAG Chapter 9.9.10**
- DoD Instruction 5000.02 requires that PIRs be conducted for MAIS and MDAP programs in order to collect and report outcome-based performance information. **The T&E community will participate in the planning, execution, analysis, and reporting of PIRs, whose results will be used to confirm the performance of the deployed systems and possibly to improve the test planning and execution for follow-on increments or similar systems.**

Vision for Continuous Predictor Enhancement



Adapted from Testing in a Joint Environment Roadmap

?

Backup

Abstract

- The Weapon Systems Acquisition Reform Act of 2009 includes a Performance Assessment requirement to evaluate the extent to which current metrics are likely to predict a timely delivery of a level of capability to the warfighter that is consistent with the level of resources to be expended and provides superior value to alternative approaches that may be available to meet the same military requirement.

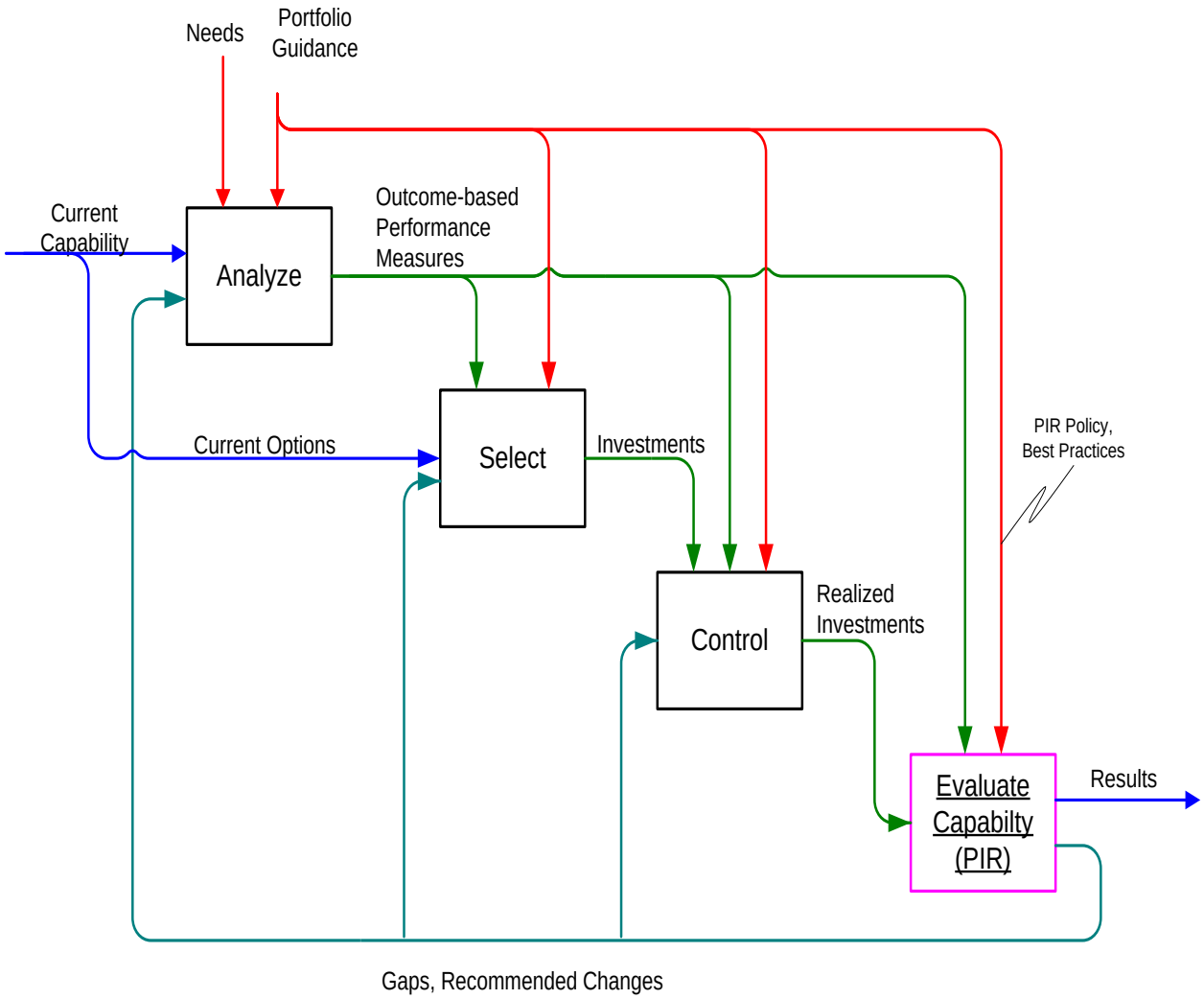
- Development of forward-looking metrics is a long standing quest within the Department and remains in the forefront of Congressional interest. The author discusses the implication of predicting capability performance vice system performance and offers a control system framework for enhancing the quality of such forward looking metrics. The key elements of the framework are a clean input signal, a short term predictive feedback loop and a long term feedback loop to continually improve the predictive metric.

DODD 8115.01 IT Portfolio Management

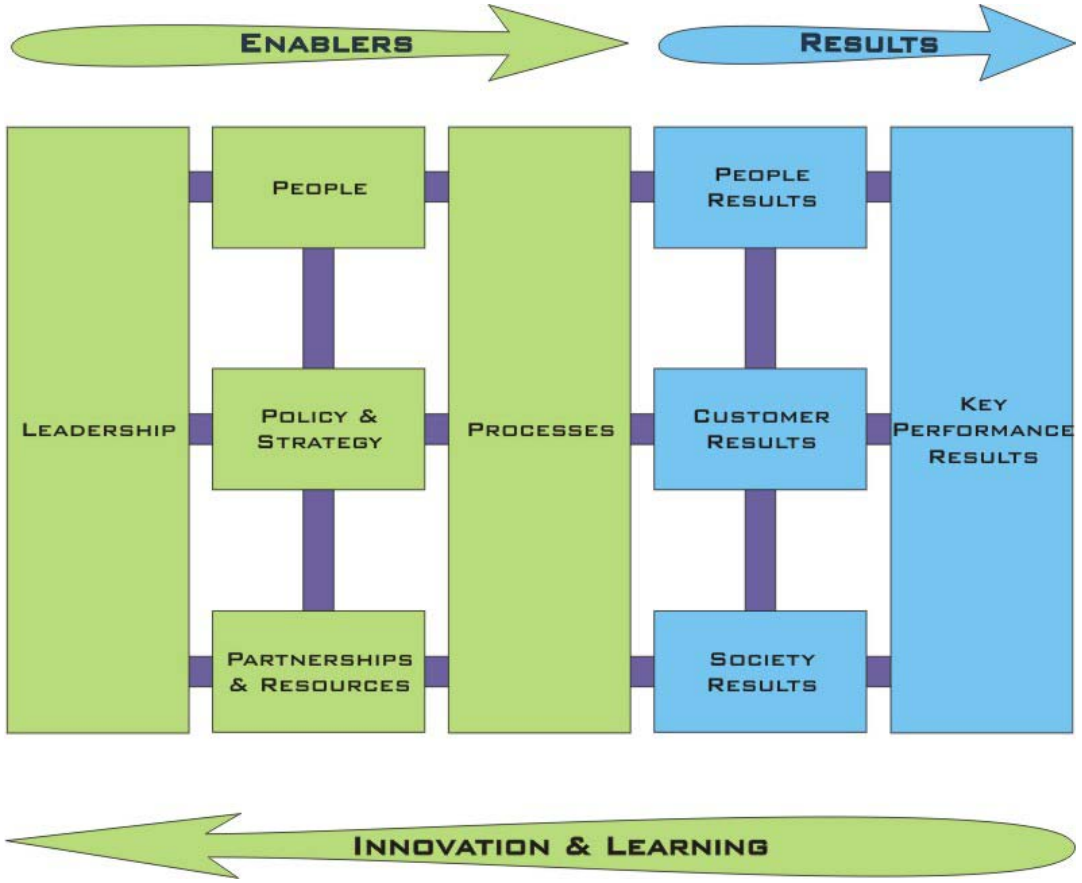
- **4.4. All authorities addressed in Section 5 of this Directive shall manage DoD portfolios by performing the following core functions:**

- 4.4.1. Analysis. Links portfolio objectives to Enterprise vision, mission, goals, objectives, and priorities; develops quantifiable outcome-based performance measures; identifies capability gaps, opportunities, and redundancies; identifies risks; and provides for continuous process improvement.
- 4.4.2. Selection. Identifies and selects the best mix of IT investments to strengthen and achieve capability goals and objectives for the portfolio and demonstrates the impact of alternative IT investment strategies and funding levels.
- 4.4.3. Control. Ensures a portfolio is managed and monitored using established quantifiable outcome-based performance measures. Portfolios are monitored and evaluated against portfolio performance measures to determine whether to recommend continuation, modification, or termination of individual investments within the portfolio.
- 4.4.4. Evaluation. Measures actual contributions of the portfolio against established outcome-based performance measures to determine improved capability as well as to support adjustments to the mix of portfolio investments, as necessary.

DODD 8115.01 IT Portfolio Management



European EFQM Model



ARTICLES AND REPORTS

- Steven Hutchison, A Capability Focused T&E Framework, Defense AT&L: Jan-Feb 2009

- Chris DiPotto, Paving the Way for Testing in a Joint Environment, Defense A&L: Sep-Oct 2009

- Hutchison-Lorenzo-Bryan, Capability Test Methodology and Joint Battlespace Dynamic Deconfliction, Defense AT&L: Jan-Feb 2009

- DOT&E, Testing in a Joint Environment Roadmap, Strategic Planning Guidance FY 2006-2011, Final Report: Nov 12, 2004