Systems Engineering to Enable Capabilities Based Planning

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Capabilities Based Planning (CBP) Objectives

CBP should be a top-down, competitive approach to weigh options vs. resource constraints across a spectrum of challenges

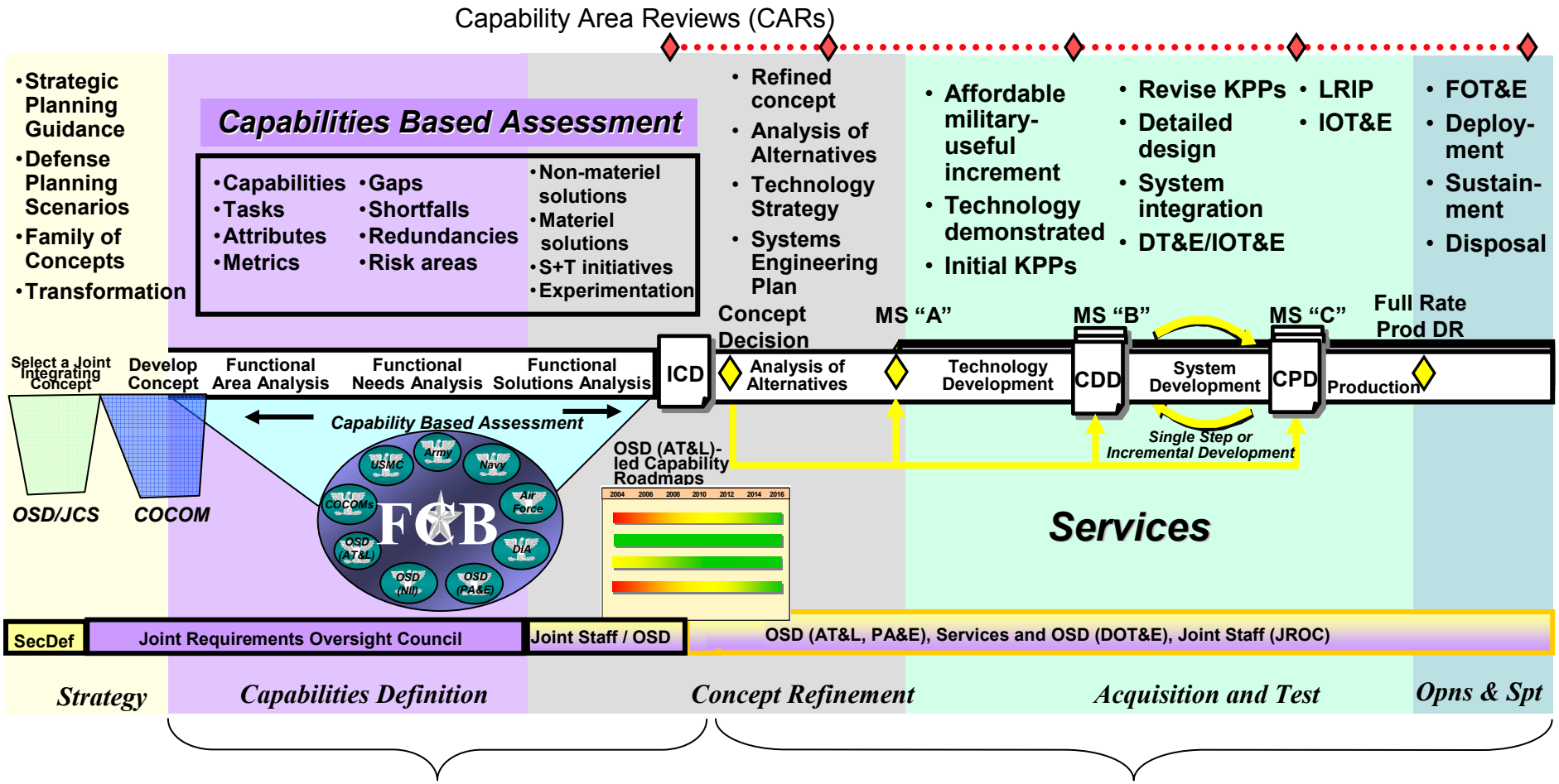
CBP should:

- Link DoD decision-making to the Defense Strategy
  - *Encompass the full set of DoD challenges*
- Inform risk tradespace -- identify joint capability gaps, redundancies and opportunities
  - *Generate common framework for capability trades*
  - *Couple programmatic capability development to operational needs*
- Facilitate the development of affordable capability portfolios

A Perspective for Acquisition

- Defense acquisition has traditionally focused at the program level
- Under CBP, acquisition will widen its perspective
  - Shape, engineer, and validate solutions to capability needs
  - Make decisions on systems within a capabilities context (systems perspective)
  - Engineer the relationships across the set of systems that together satisfy the need (systems of systems)
  - Synchronize the interaction among programs to satisfy multiple capabilities (capability roadmaps)
  - Incorporate an integrated sustainment approach (total lifecycle systems management)

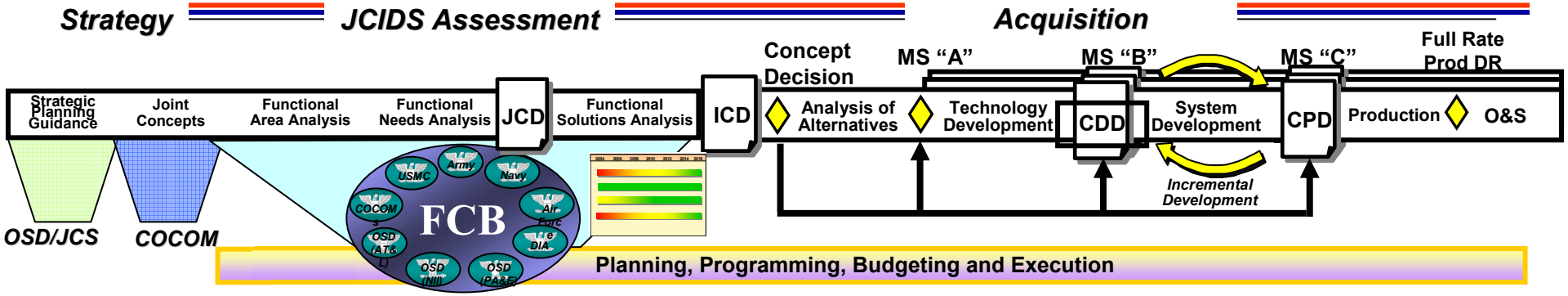
DoD End-to-End Capabilities Based Planning Process

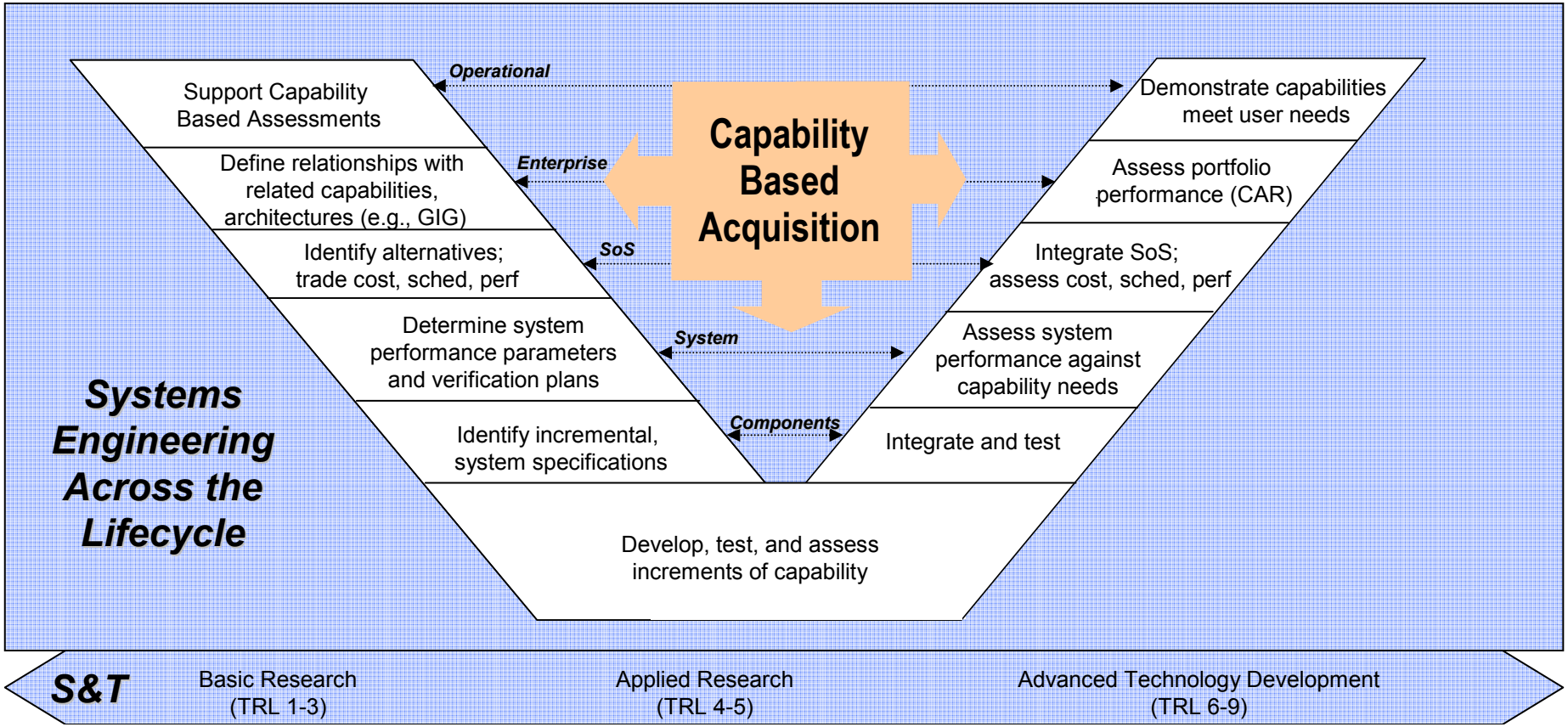


Joint Capabilities Integration and Development System (JCIDS)

DoD 5000 Acquisition Policy

Acquisition Engagement Across Strategy, JCIDS and Acquisition Processes





What have we learned?

- Rigorous, top-down determination of joint capabilities takes time
  - Requires sound analysis of alternatives, and
  - Cooperation from multiple communities that have not traditionally worked together
- Capabilities will be satisfied by grouping of legacy, new systems and technology insertion – Systems of Systems
  - Solutions will cross organizational and funding “stovepipes”
  - Solutions must integrate with other related capabilities and enterprise architectures (e.g., Global Information Grid)
- System designs should be extensible to support future, yet to be defined, capabilities
- Management oversight of capabilities has ripple effects on individual programs
- Early and continuous involvement of acquisition in requirements determination allows for greatest leverage to determine optimal, joint solutions

Systems Engineering is an enabler of Capabilities Based Planning

System-of-Systems (SoS) System Engineering Considerations

- Certain capabilities only appear in a System-of-Systems context
  - How do we systems engineering these SoS capabilities?
  - How do we perform testing (V&V) of these SoS capabilities?
  - How do we sustain capabilities over time?
- Example
  - Capabilities such as Combat Identification must be implemented in numerous systems across all Services and Agencies to enable the joint warfighter to use that capability in combat

FY05 Activities to Address SoS – SE Beyond Platform Study

- Task
  - Characterize ongoing systems engineering efforts within the Services and Agencies to develop and field capabilities that extend beyond individual platforms or systems
    - *Include both the enterprise level SE processes and the cross systems engineering initiatives*
- Objective
  - Capture current experience base and assess implications for DOD policy, regulations and best practices
- FY05 Progress
  - Completed a first order review of pool of examples based on available data

Study Observations

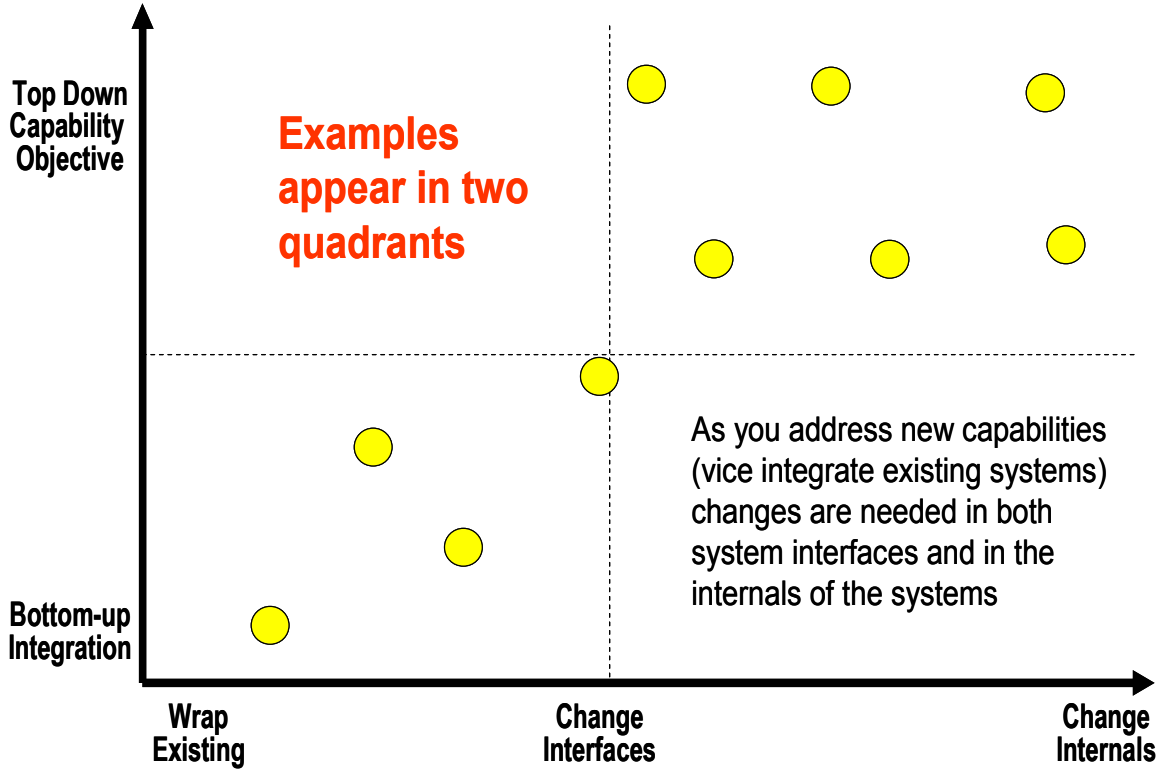
Three general classifications of SoS SE:

1. Engineering a 'collective' from legacy systems
   - Majority of the cases
   - Ranged from integration of new and existing systems for better interoperability to addressing new top-down requirements by integrating existing systems
2. Clean Sheet Developments
   - One case -- Future Combat Systems
3. Organizational, enterprise-wide engineering initiatives
   - New, limited experience
   - Focus on planning, developing, and integrating systems to meet broad 'enterprise needs

Engineering a "Collective" from Legacy

Some Observations:

- Authority
  - PMs continue to own individual systems
  - No owner of the collective
  - Program success is independent of ability to integrate successfully



- Technical approaches attempt to minimize impact on internal system functionality and limit changes to interfaces
  - Degree to which this can be done, and changes stay with interfaces, the smoother the process
  - …but this may not be the most optimal solution

Enterprise-Wide Systems Engineering

- Organizational efforts that focus on strategic objectives through
  - Investment decisions
  - Architecture principles
  - Standards and protocols
  - Engineering practices
- Measured, and/or motivated by a different set of priorities
  - Goal-oriented, organizational and stakeholder issues
- Characterized by multiple constituents with different goals and priorities
  - Requires systems engineering application to address multiple systems and SoS constraints and objectives

FY06 Activities to address SoS – SoS SE Definition and Optimization Project

- Task
  - Codify SoS SE and determine any unique SE considerations
  - Establish relevant SE process metrics
  - Experiment with models to optimize technical program resource drivers
- Objective
  - Pull together expertise from academia, industry, government to identify research, tools, training needs
- Progress
  - Conducted 1st in a series of SoS SE workshops
    - Reviewed current policy
    - Discussed perspectives and motivations
    - Identified key issues for definition, requirements processes, and other issues

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