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Addressing JCIDS Capability and Solution Analysis: An AoA Manual for Materiel and Non- materiel Information Technology Activities

Kevan Barton

Charles Sinex

21-23 June 2005

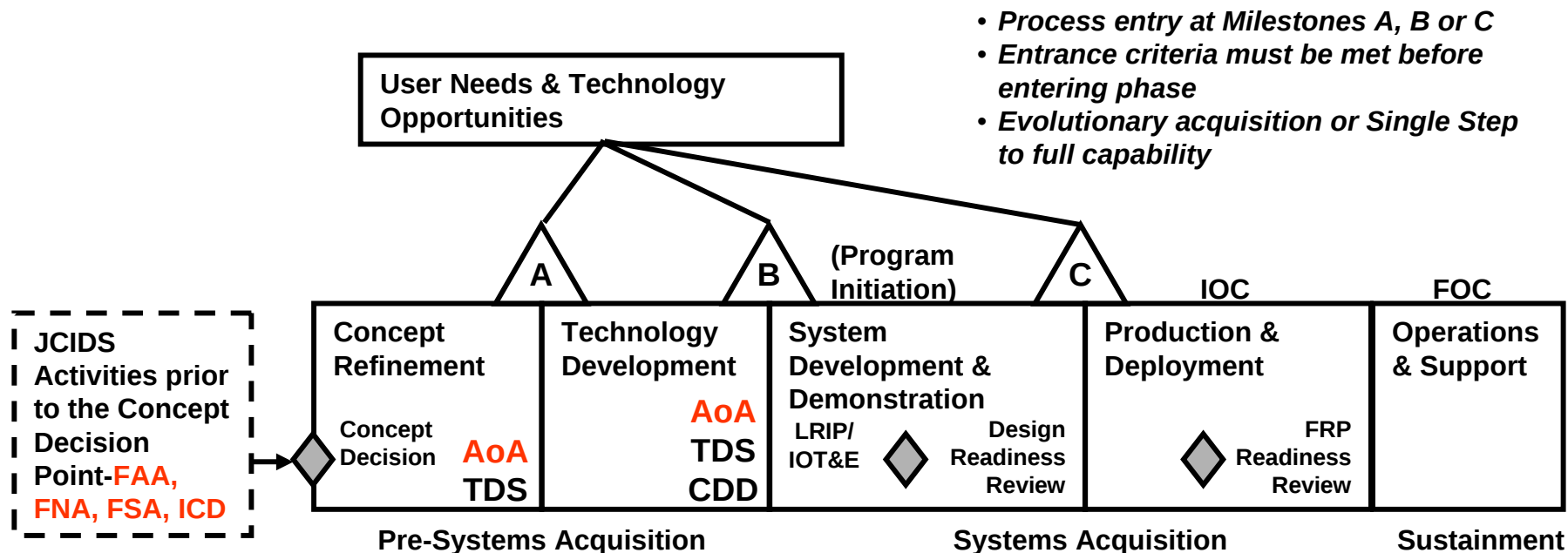
Why an AoA Manual?

Shortcomings of Existing Guidance

- **Focus on AoAs in the pre-JCIDS environment**
- **Focus on quantitative comparison of detailed designs, not qualitative comparison of conceptual designs**
- **Focus on platform and weapon systems rather than Information Systems and processes**
- **Limited guidance on concept and capability refinement**
- **Limited guidance on specific tools and techniques**

Acquisition Framework

Early Concept Decision & Refinement





Information Systems (IS)

Different from Platform/Weapons

- ISs are primarily concerned with handling and/or processing of information
- A major goal of many ISs is to increase the value of information by the application of appropriate processes---e.g., to move from signals to intelligence
- ISs can often be modeled as a process model-- a sequence of human and/or computer-controlled steps in the information processing chain
- Compared to major weapon systems, ISs generally:
 - *Follow a rapid technology cycle (1-3 years)*
 - *Are frequently upgraded, even during design*
 - *Have shorter lifetime before replacement*

IS Hierarchy



Intelligence
Knowledge
Information
Data
Signals

What Must the AoA Address? Six Specific Topics

- **The AoA plan and analysis should address the specific topics highlighted by DoD 5000.2 for PA&E assessment of the AoA:**
 - *Illuminated capability advantages and disadvantages*
 - *Considered joint operational plans*
 - *Examined sufficient feasible alternatives*
 - *Discussed key assumptions and variables and sensitivity to changes in these*
 - *Assessed technology risk and maturity*
 - *Calculated costs*
- **The AoA also provides the basis for the Technology Development Strategy (TDS) document**

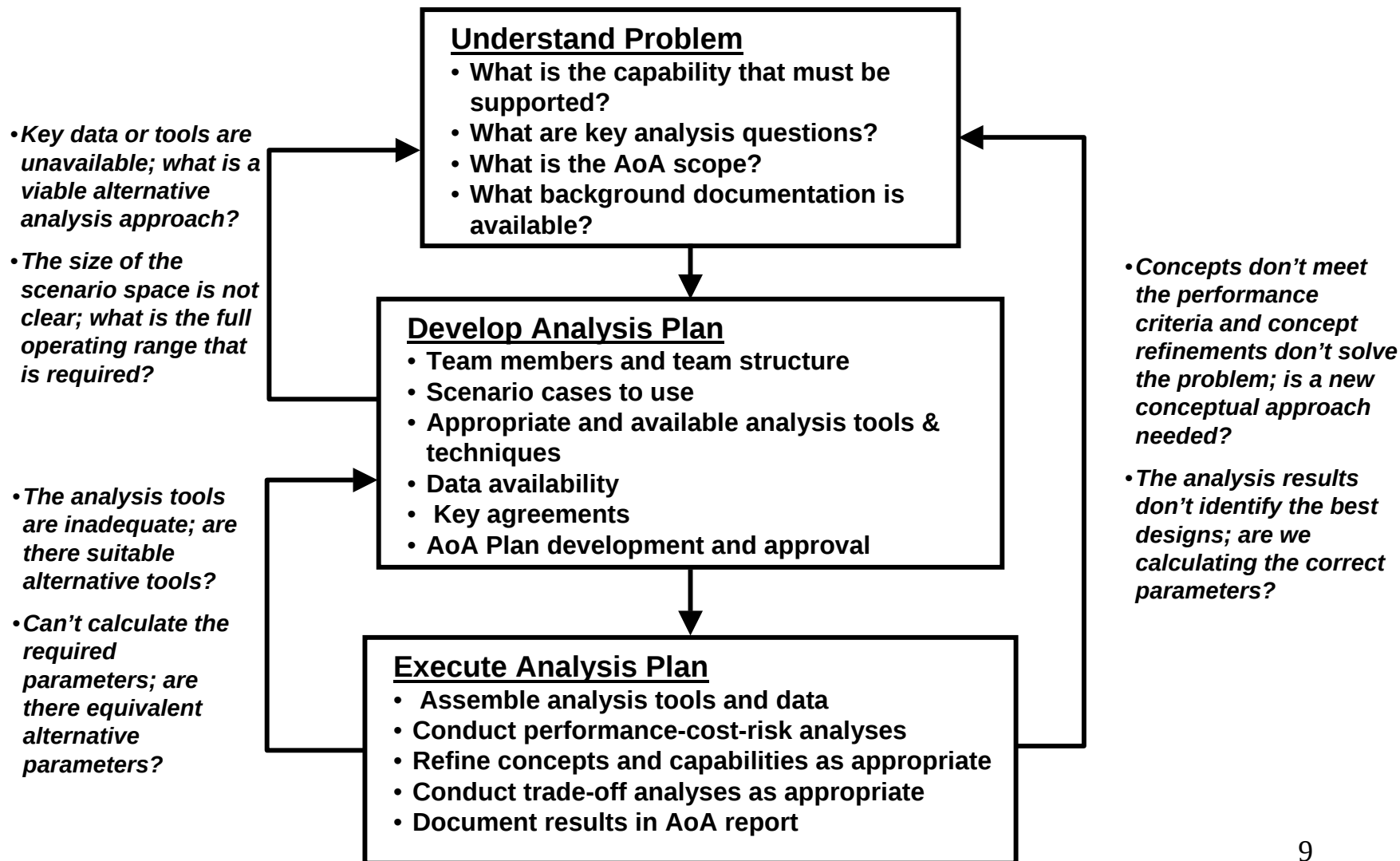
AoA Manual Outline

(13 chapters-- $\approx$ 175 pages)

- 1. Introduction**
 - 2. Defense System Acquisition Framework (JCIDS Overview)**
 - 3. AoA Methodology**
 - 4. AoA Study Plan**
 - 5. Preparing for Analysis**
 - 6. AoA Analysis Strategy**
 - 7. Capabilities Refinement**
 - 8. Concept Refinement**
 - 9. Performance Analysis**
 - 10. Cost Analysis**
 - 11. Technology Risk Analysis**
 - 12. Performance-Cost-Risk Tradeoffs**
 - 13. Final Results**
- Six Appendices (including examples of analysis techniques)**

AoA Methodology (Chapter 3)

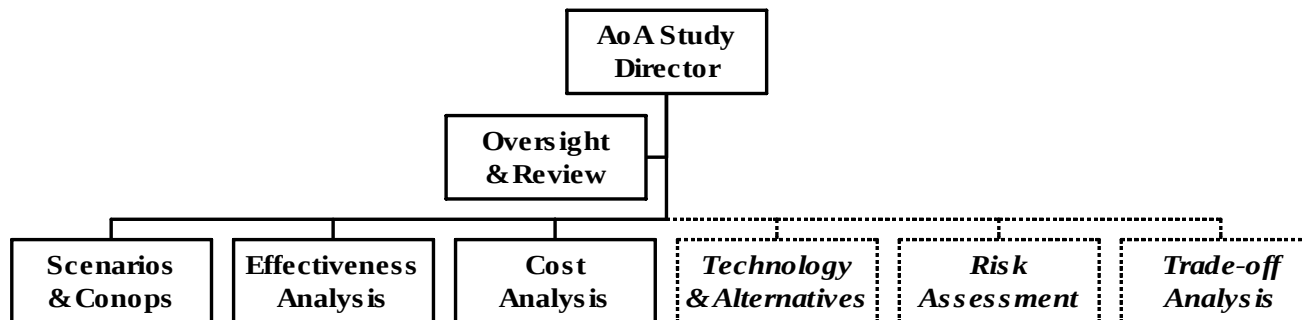
An Iterative Process



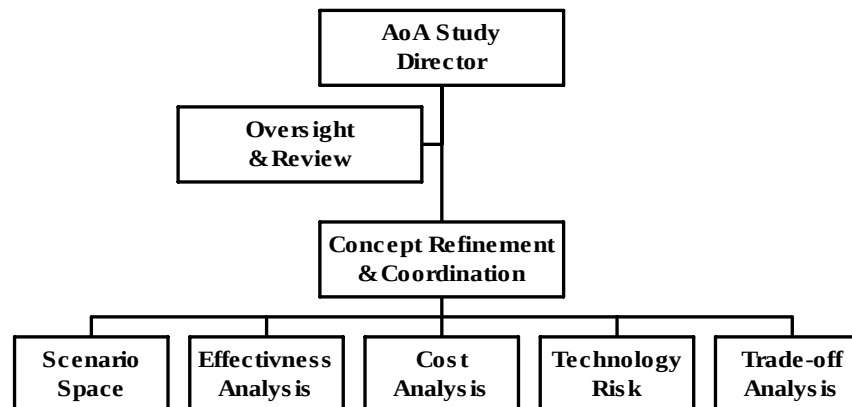
AoA Team Structure (Chapter 5)

No Universal Style

"Conventional" AoA Team Structure

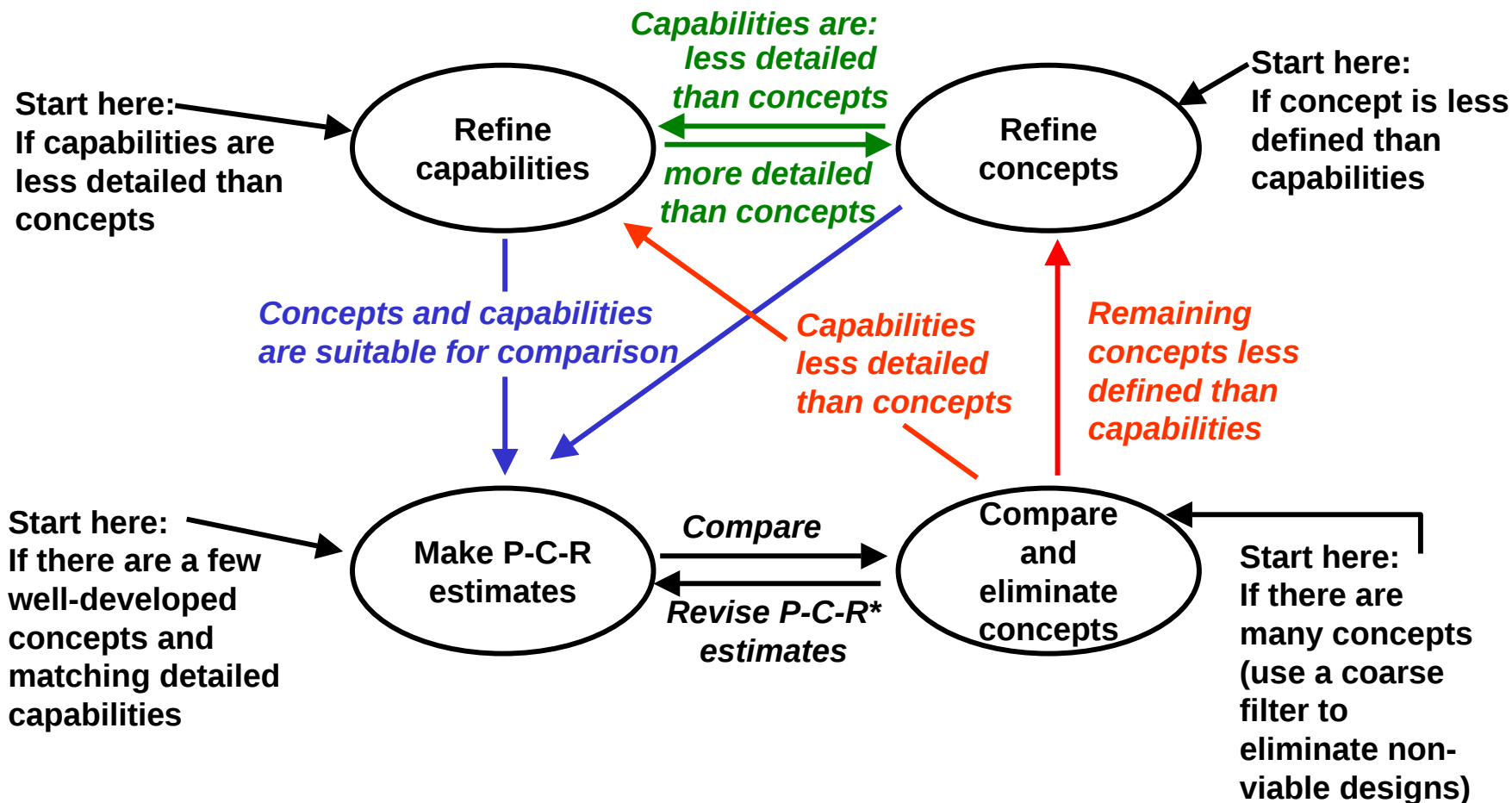


Candidate Team Structure for Initial AoA in JCIDS



Analysis Strategy (Chapter 6)

How to Move between Tasks



* P-C-R: Performance-Cost-Risk

Candidate Tools and Techniques Where They Work

Tools & Techniques	Concept Refinement	Capability Refinement	P-C-R Calculations	Trade-off Analysis
Subject Matter Experts	X	X	X	X
ATAM	X		P, R	
Analysis by Analogy			P, C, R	
QAM	X		P, R	
M&S			P, R	
Hierarchical Structures	X	X		
QFD	X	X		
TRIZ	X			

Candidate Tools and Techniques Where They Work (cont.)

Tools & Techniques	Concept Refinement	Capability Refinement	P-C-R Calculations	Trade-off Analysis
MADT- VFT				X
MADT-AHP				X
Technology Readiness Level (TRL)			R	
Technology S-curves	X		R	
Fast Heuristics				X
Parametric Costing			C	
Engineering Costing			C	
Cost Sufficiency			C	

Summary

-
-
- **AoAs have changed significantly under JCIDS with a broader range of roles and activities for the AoA team:**
 - *Capability refinement*
 - *Concept refinement*
 - *Performance-Cost-Technology Risk Assessments*
 - *Trade-off analysis*
 - **AoAs before Milestone A frequently may not have quantitative metrics**
 - **The AoA is not a one-time event; it is reviewed and revised or redone in spiral development**
 - **A number of analysis tools are available for the AoA that work well with qualitative metrics**
 - **The new Manual provides specific guidance for conducting AoAs in this new environment**

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Back-up slides

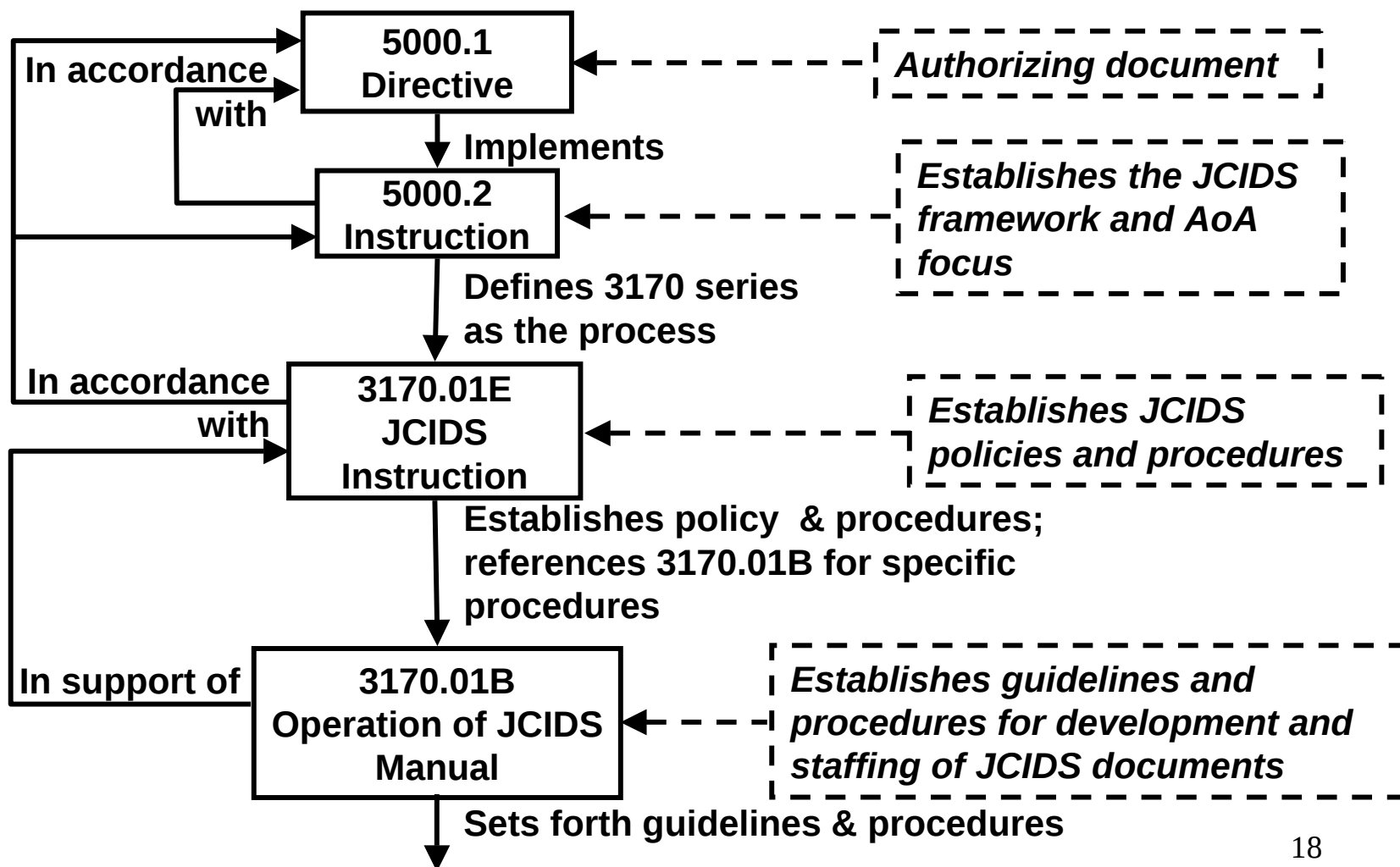
Issues with DoD Acquisition

Why JCIDS?

- **Need to plan for future uncertainty**
 - *JCIDS adopts Capability Based Planning*
- **Very long product development times**
 - *JCIDS adopts Evolutionary Acquisition w/ Spiral Development as the preferred strategy*
- **Stove-piped planning**
 - *JCIDS is top-down driven from a Joint perspective*
- **Emphasis on process rather than product**
 - *JCIDS promotes flexibility subject to compliance with statutory and regulatory requirements*
- **Difficulty in introducing “novel, innovative” systems**
 - *AoA must consider alternative, novel concepts and help define a pre-acquisition decision Technology Development effort*

The Defining JCIDS Documents

A Sequence of Four

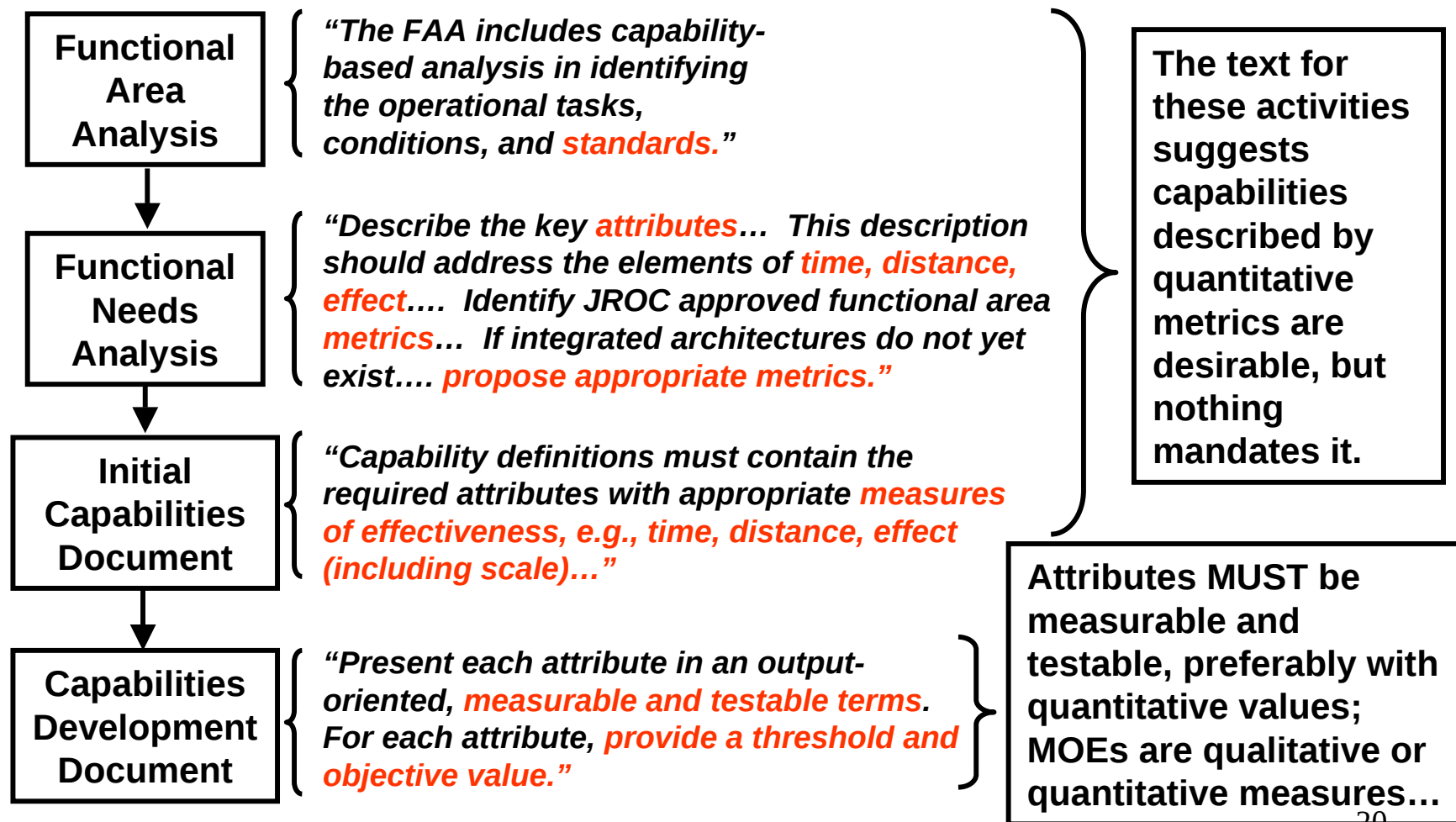


Capabilities Based Planning

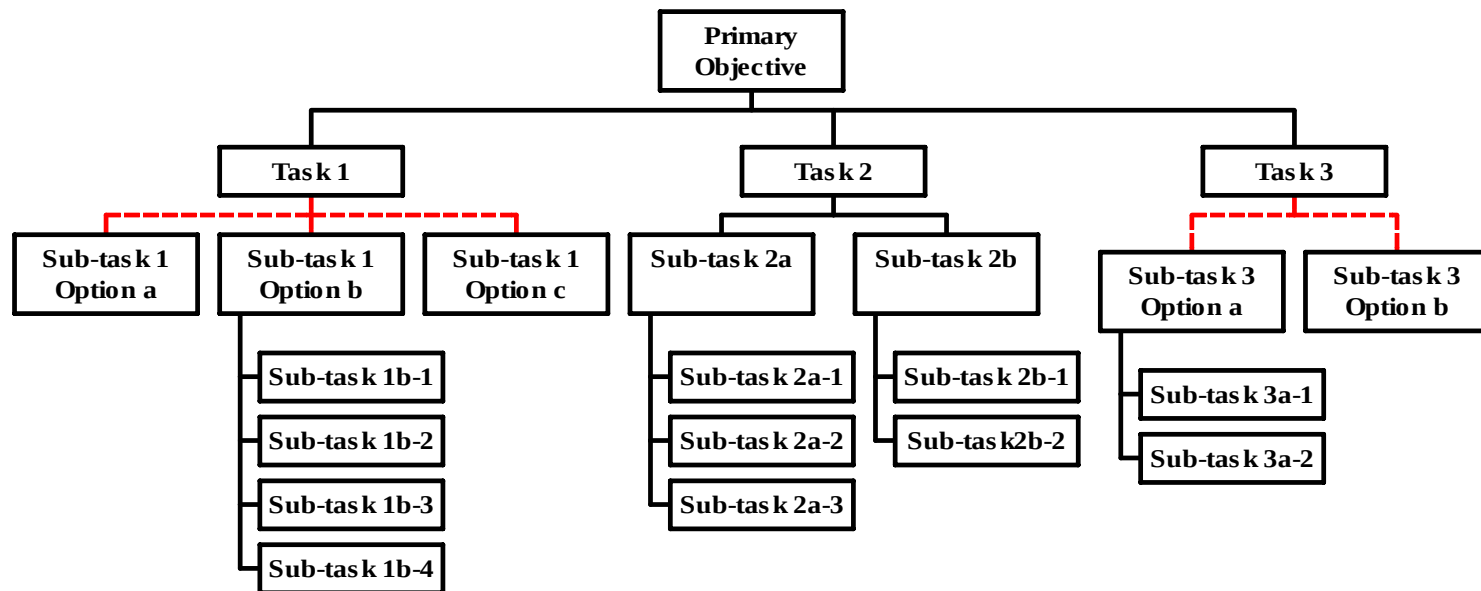
What is it in JCIDS?

- **Capabilities definition (3170)**
 - *“The ability to execute a specified course of action. It is defined by an operational user and expressed in broad operational terms in the format of an initial capabilities document or a DOTMLPF recommendation. In the case of material proposals, the definition will progressively evolve to DOTMLPF performance attributes identified in the CDD and the CPD”*
- **Attributes definition (3170)**
 - *“A testable or measurable characteristic that describes an aspect of a system or capability”*
- **Metrics definition (based on general community usage)**
 - *Quantifiable parameters that show to what extent attributes are achieved by a particular system*
 - *Metrics have three elements*
 - A clear description of the parameter being measured
 - A testable and measurable value for its threshold
 - A testable and measurable value for its objective

Where They are Specified



Generic Hierarchical Task Structure

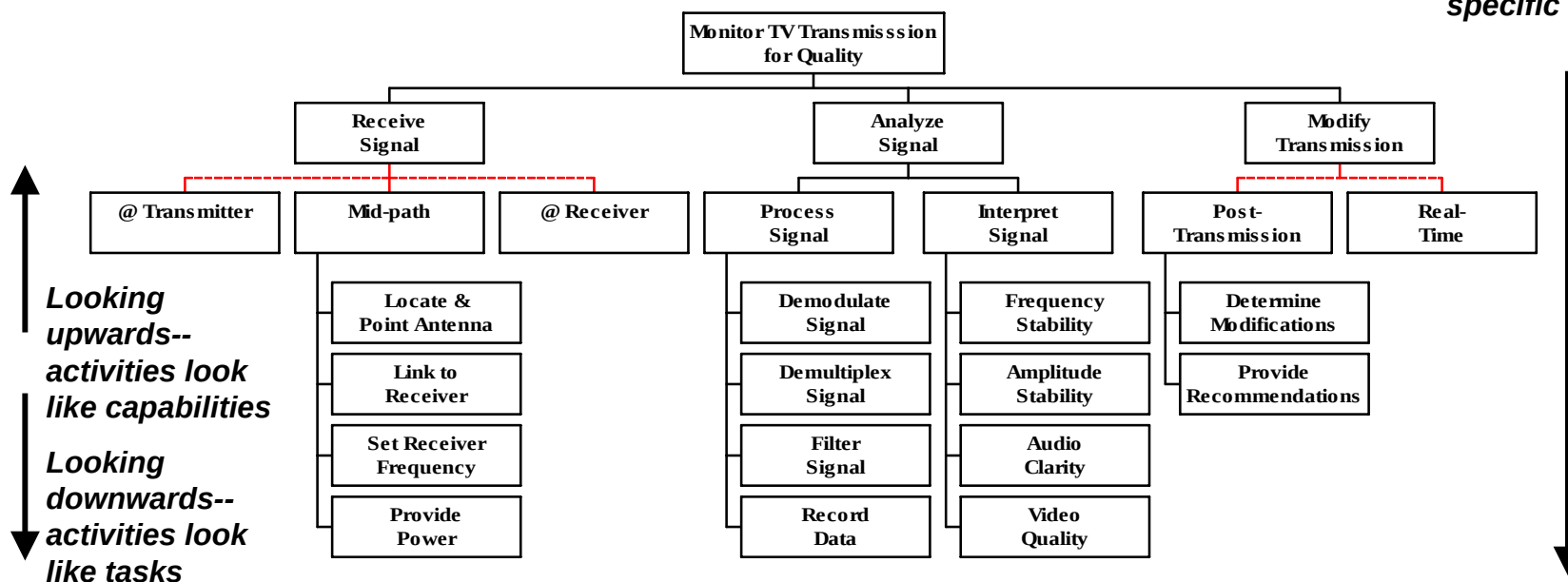


- All tasks are required (logical AND)
 - - - Any combination of tasks is acceptable (logical OR)

Hierarchical Structure Example

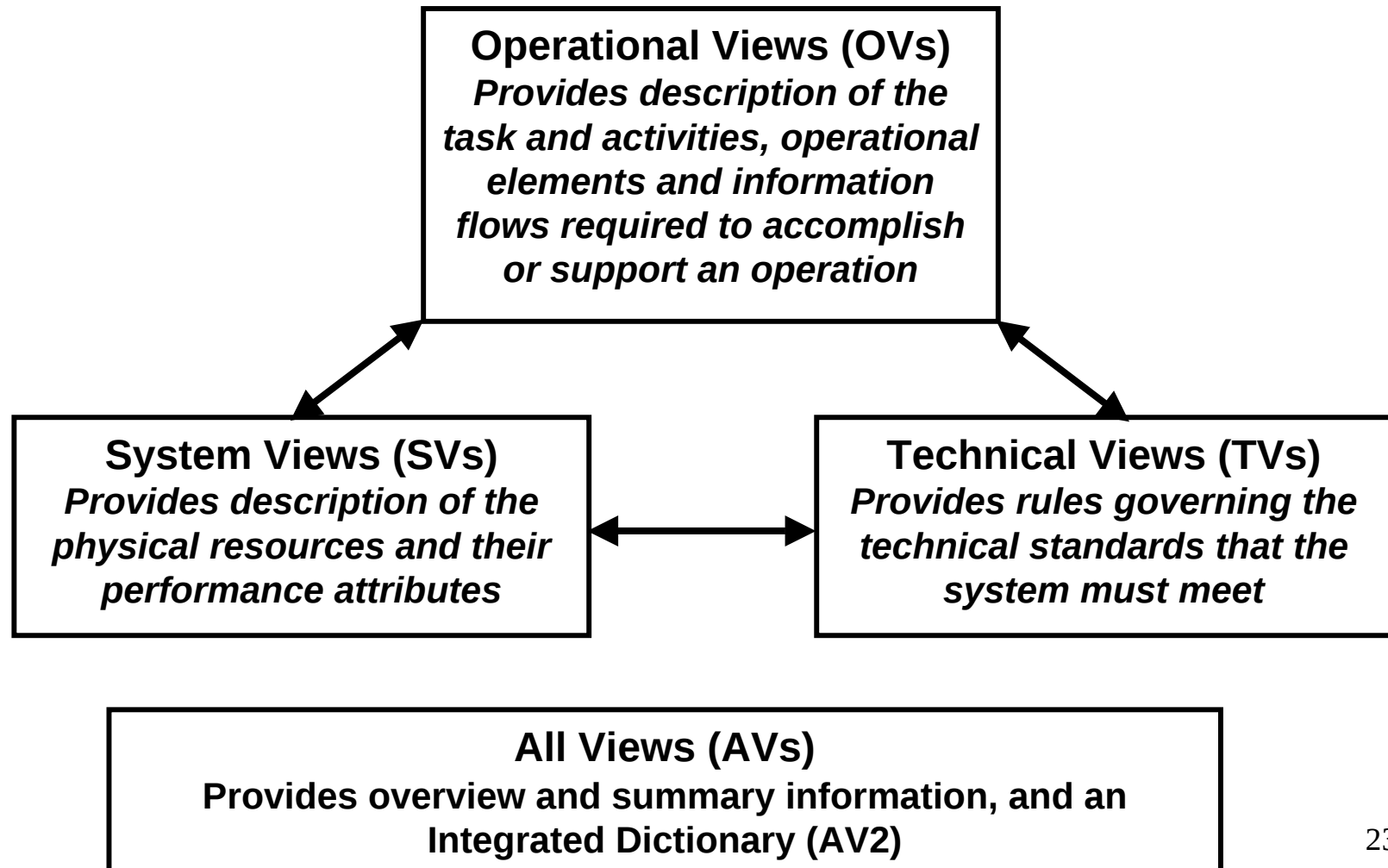
Concept or Capability Refinement

“Refining” capabilities inevitably narrows the solution space and eventually leads to specific tasks



- All tasks are required (AND)
- - - - - Any combination of tasks is acceptable (OR)

Architecture Framework Required Description for New Systems



Notional OV-5 Activity Diagram

Key View for IT System Analysis

