Air Force Concept Maturity Assessment

NDIA Systems Engineering Division
12th Annual Systems Engineering Conference
San Diego, CA
28 Oct 2009

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U.S. AIR FORCE

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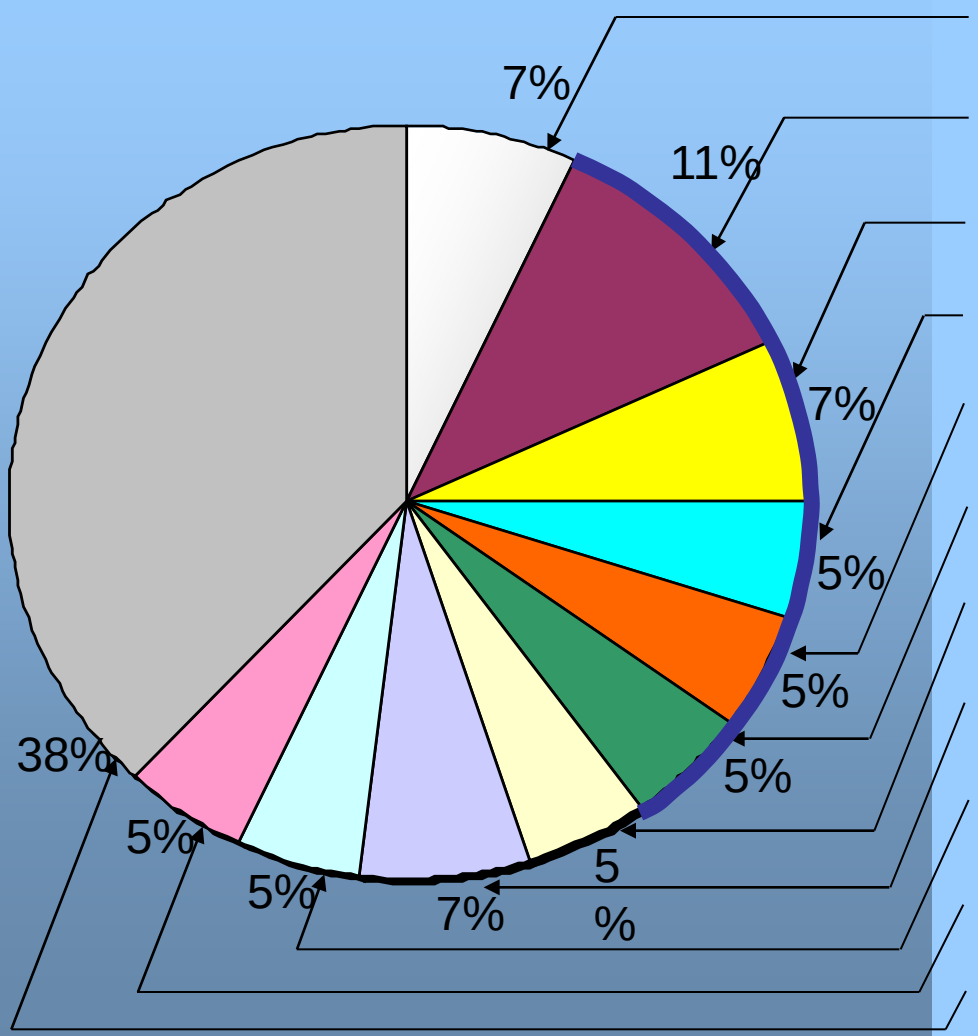
Agenda

- Background
- The Challenge
- Ongoing Efforts
- Path Ahead

The Problem …

Principal Causal Factors in Program Growth
(adapted from BAH study, 2002-2003)

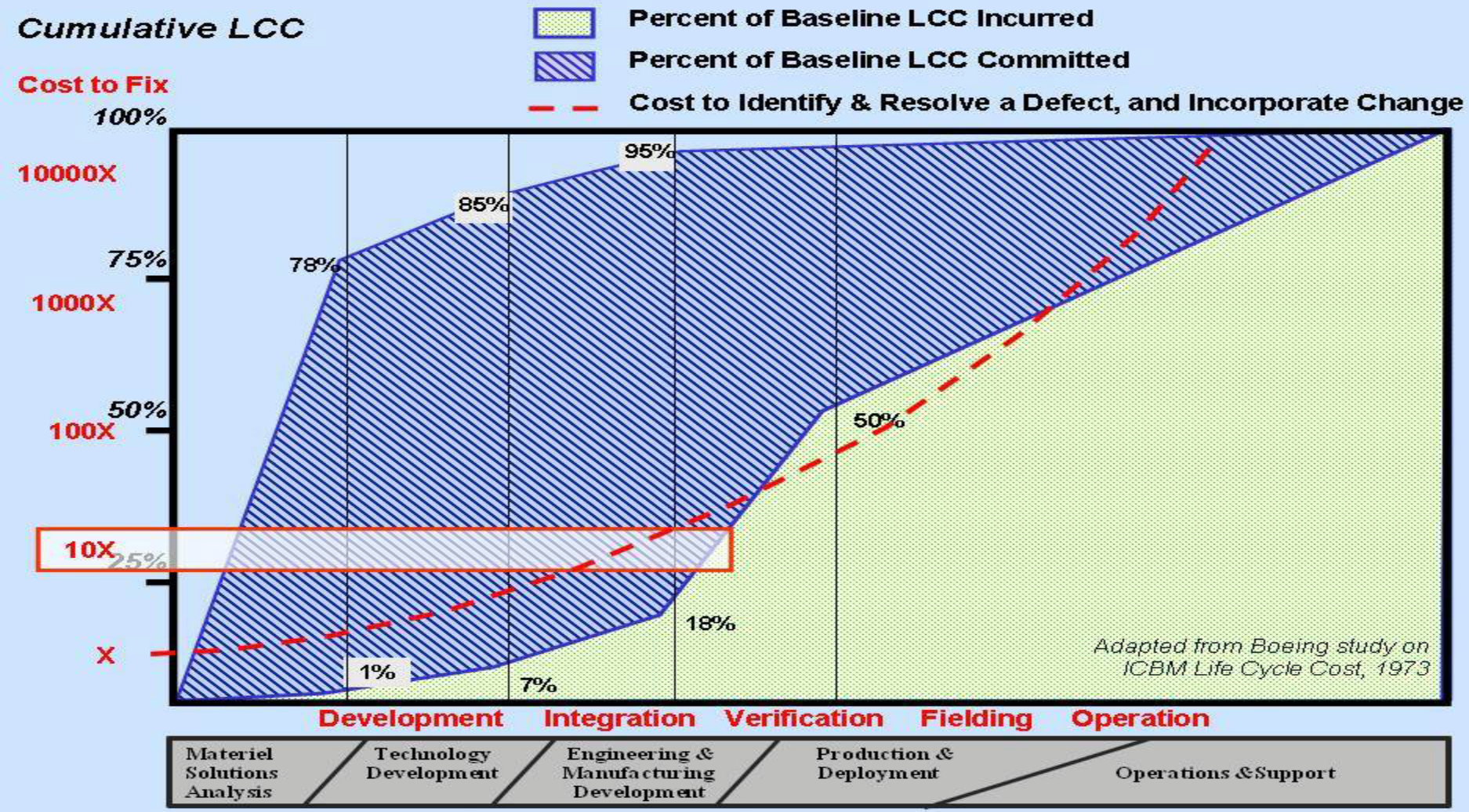


- Competitive Process "Over-Optimism"
- Requirements Immaturity
- Requirements Creep
- Optimistic Estimates
- Software & Integration Underestimated
- Inadequate Pre-Acquisition Planning and Risk Reduction
- Program Director Turnover & Experience
- Lack of Systems Engineers
- Programs Budgeted too Early
- Budget Instability
- Other (not all-inclusive)

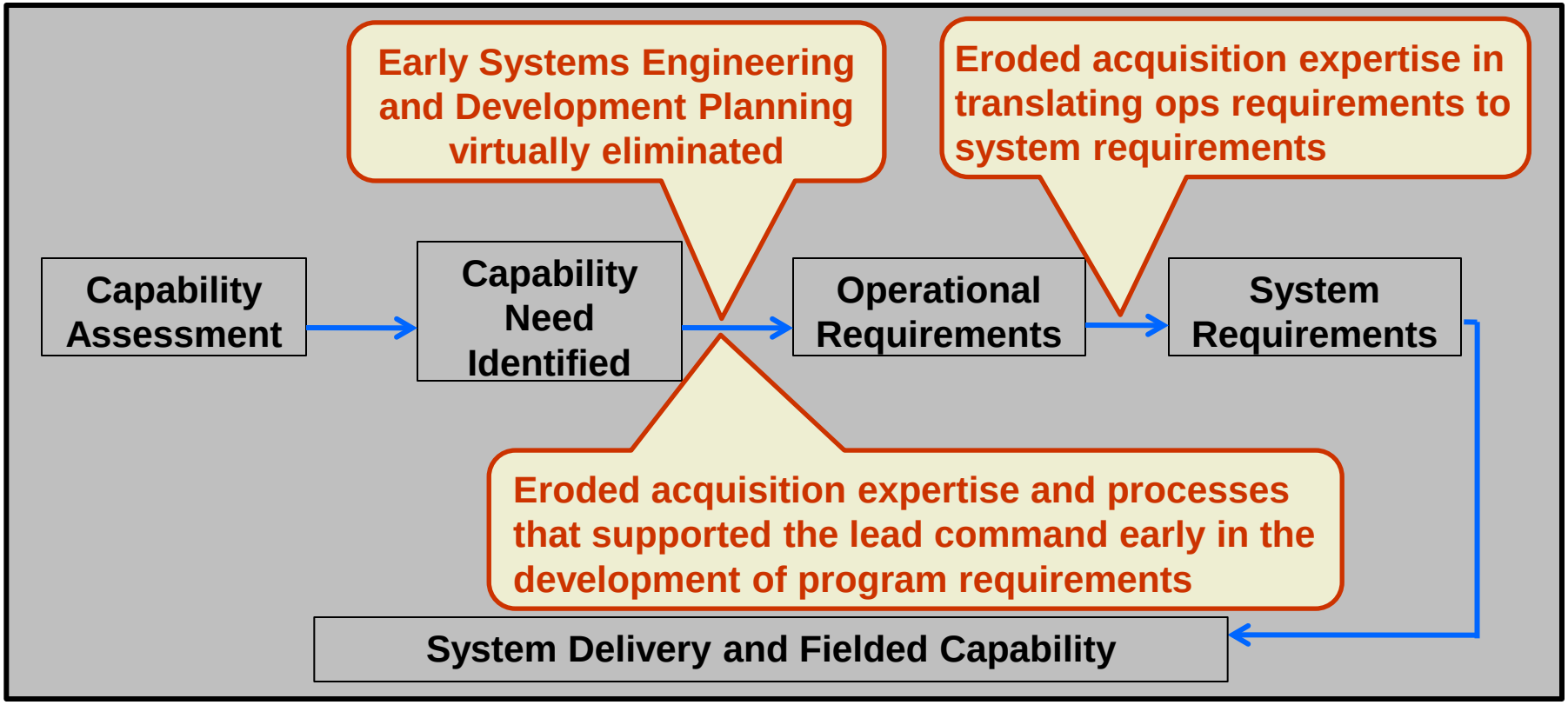
Nearly 40 Years of History

- General Accounting Office, "Acquisition of Major Weapons Systems," (GAO Report to Congress, B-163058), March 1971; cited in DAPA Project report
- The Boeing Company, "ICBM Life Cycle Cost," unpublished study, 1973
- General Accounting Office, "Lasting Change in Weapons Acquisition," GAO/NSIAD-93-15, December 1992
- General Accounting Office, "Best Practices: Successful Application to Weapon Acquisition Requires Changes in DoD's Environment," GAO/NSIAD-98-56, February 1998
- General Accounting Office, "Best Practices: Setting Requirements Differently Could Reduce Weapon Systems' Total Ownership Costs," GAO-03-57, February 2003
- Government Accountability Office, "Assessments of Selected Major Weapon Programs," GAO-05-301, March 2005
- Defense Acquisition Performance Assessment (DAPA) Project report, January 2006
- Government Accountability Office, "Best Practices: Stronger Practices Needed to Improve DoD Technology Transition Processes," GAO-06-883, September 2006
- National Research Council of the National Academies, "Pre-Milestone A Systems Engineering: A Retrospective Review and Benefits for Future Air Force Systems Acquisition," The National Academies Press, December 2007
- Government Accountability Office, "JOINT STRIKE FIGHTER: Recent Decisions by DoD Add to Program Risks," GAO-08-388, March 2008
- Government Accountability Office, "DEFENSE ACQUISITIONS: Better Weapon Program Outcomes Require Discipline, Accountability, and Fundamental Changes in the Acquisition Environment," GAO-08-782T, June 2008

Early Decisions Impact Overall System Life Cycle Cost



Problem Statement & Visual Depiction



Problem Statement

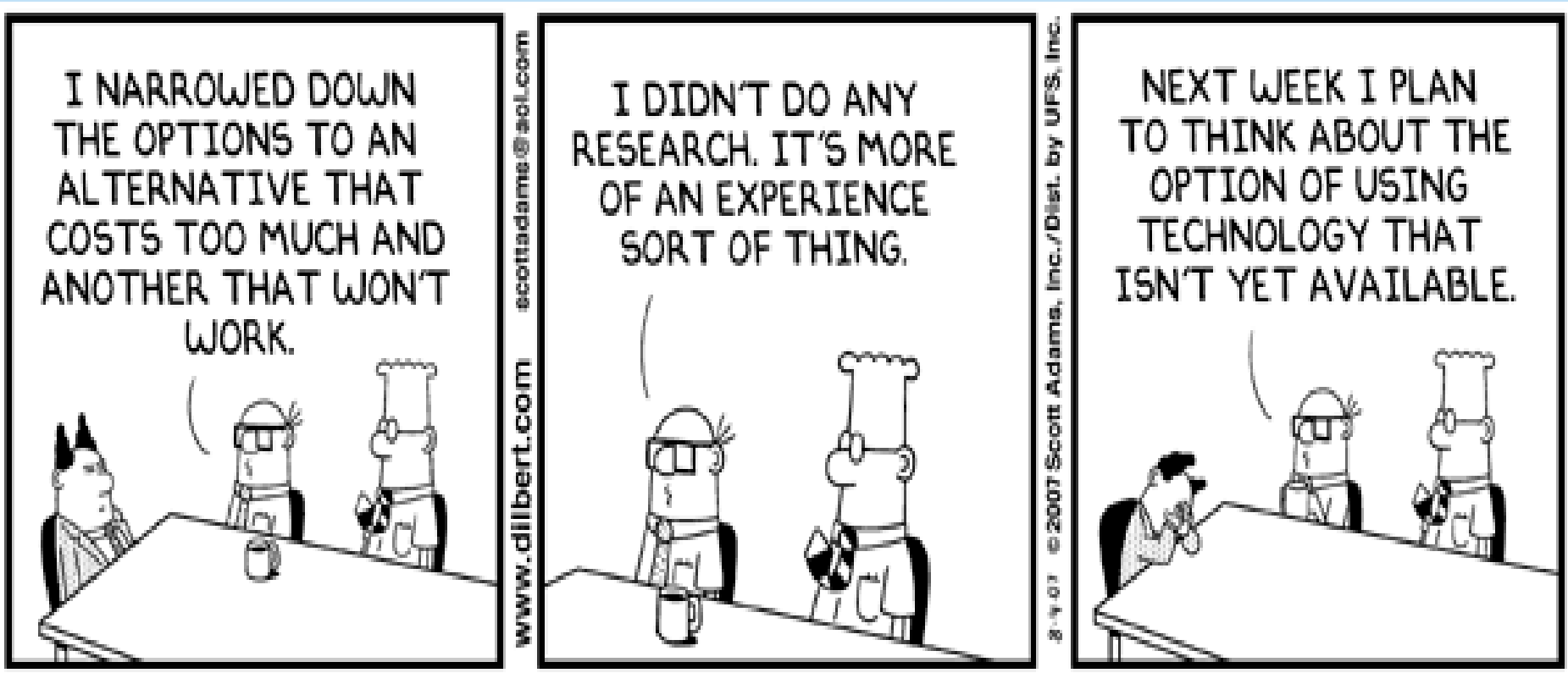
"Overstated and unstable requirements that are difficult to evaluate during source selections"

"Ensure acquisition involvement and leadership in support of the lead command early in the development of program requirements"

NRC Recommendations

1. Air Force leadership should require that Milestones A and B be treated as critical milestones in every acquisition program and that … the "Pre-Milestone A/B Checklist" … be used to judge successful completion.
2. Assess career field needs and develop a program to address
3. Pre-A decisions should be supported by rigorous SE processes and analyses involving teams of acquirers, users, and industry
4. A development planning function should be established in the military departments to coordinate the concept development and refinement phase of all acquisition programs to ensure that the capabilities … as a whole are considered and that unifying strategies such as … interoperability are addressed.

How NOT to do it …

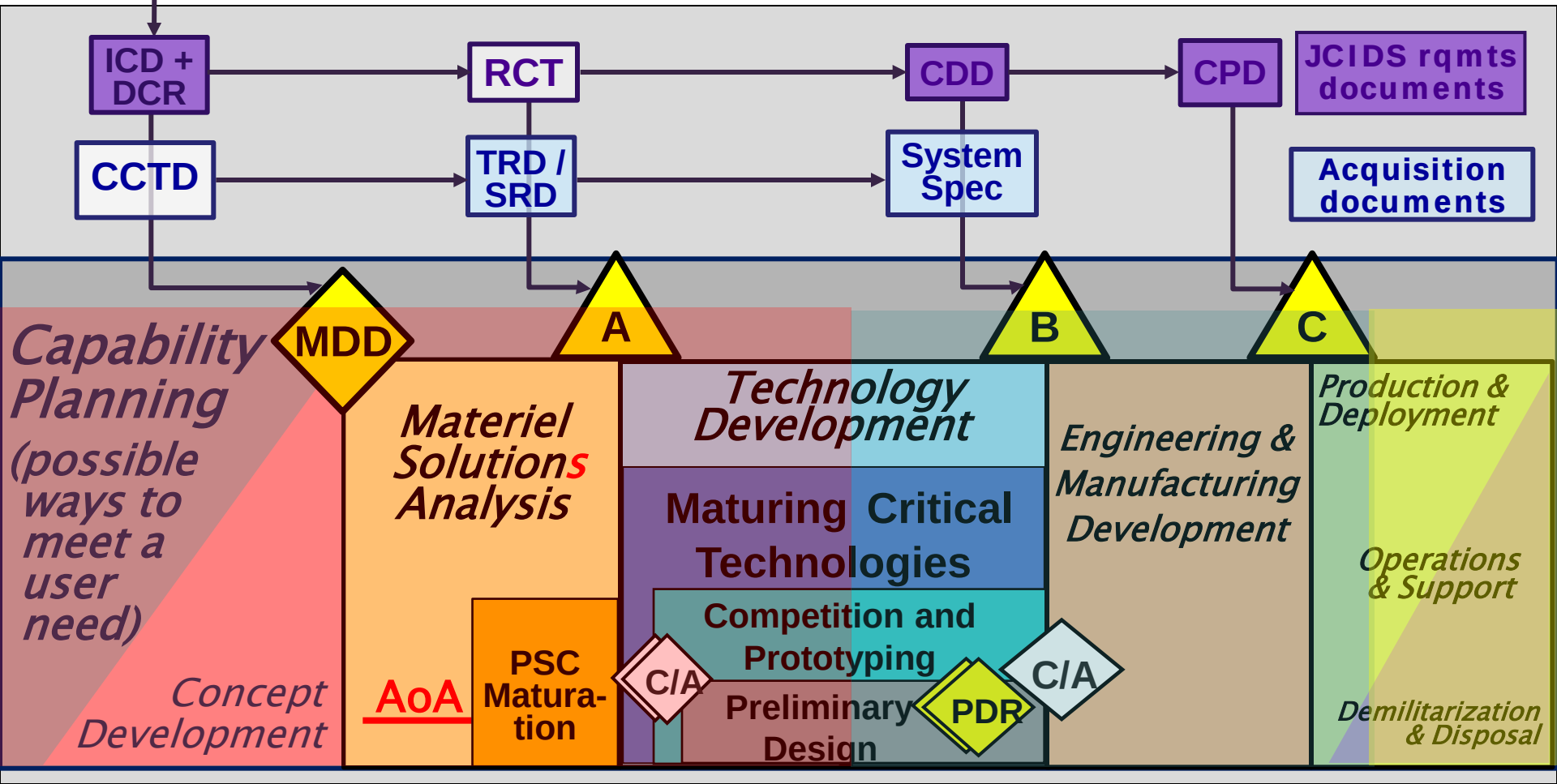


SO WHERE ARE WE NOW?

New JCIDS and DoDI 5000.02 (with additions)

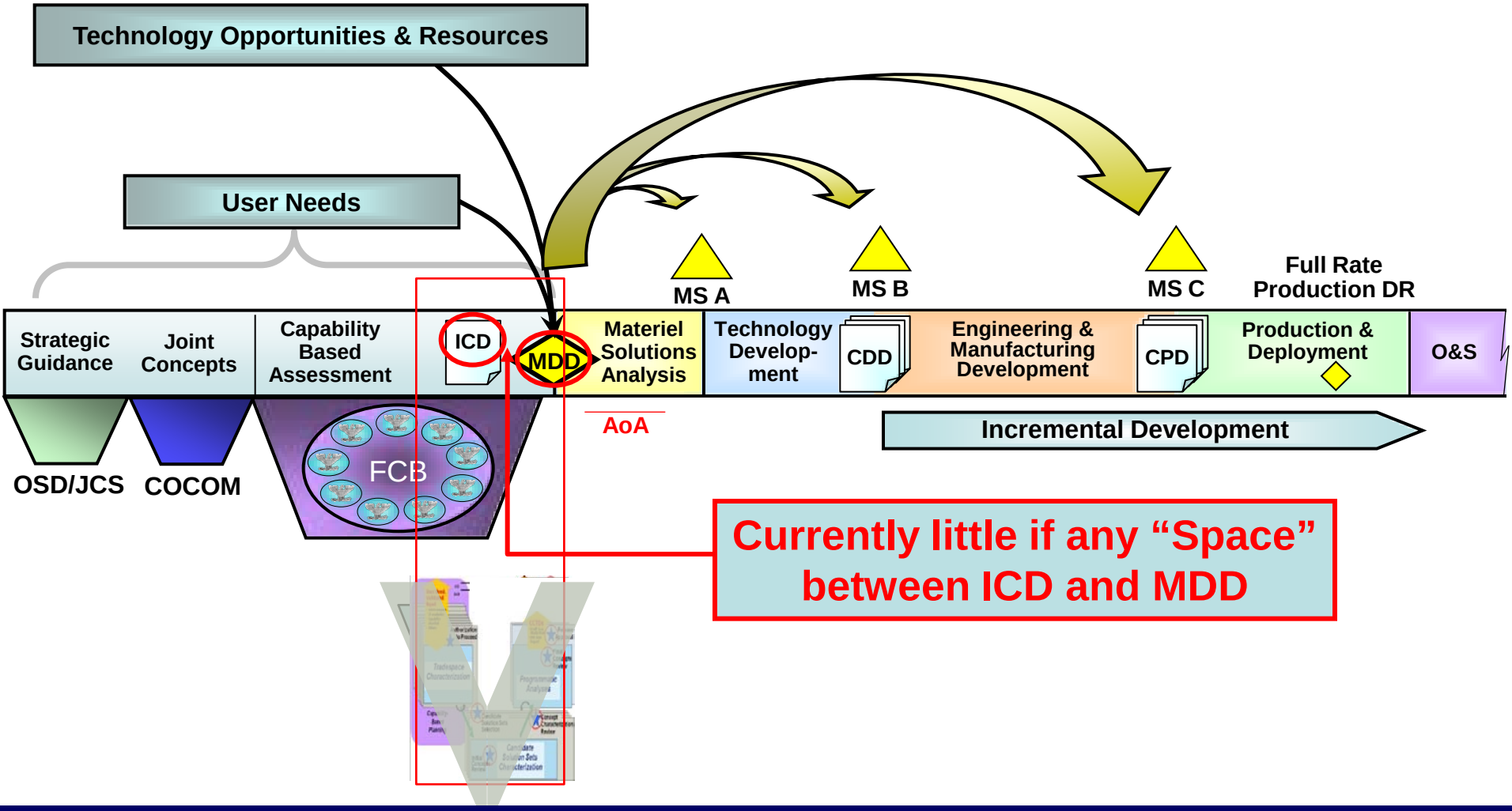
Capabilities-Based Assessment

ICD – Initial Capabilities Document
DOTMLPF – Doctrine, Organization, Training, Materiel, Leadership & Education, Personnel, Facilities
DCR – DOT_LPF Change Recommendation
CDD – Capability Development Document
CCTD – Concept Characterization and Technical Description
RCT – Requirements Correlation Table

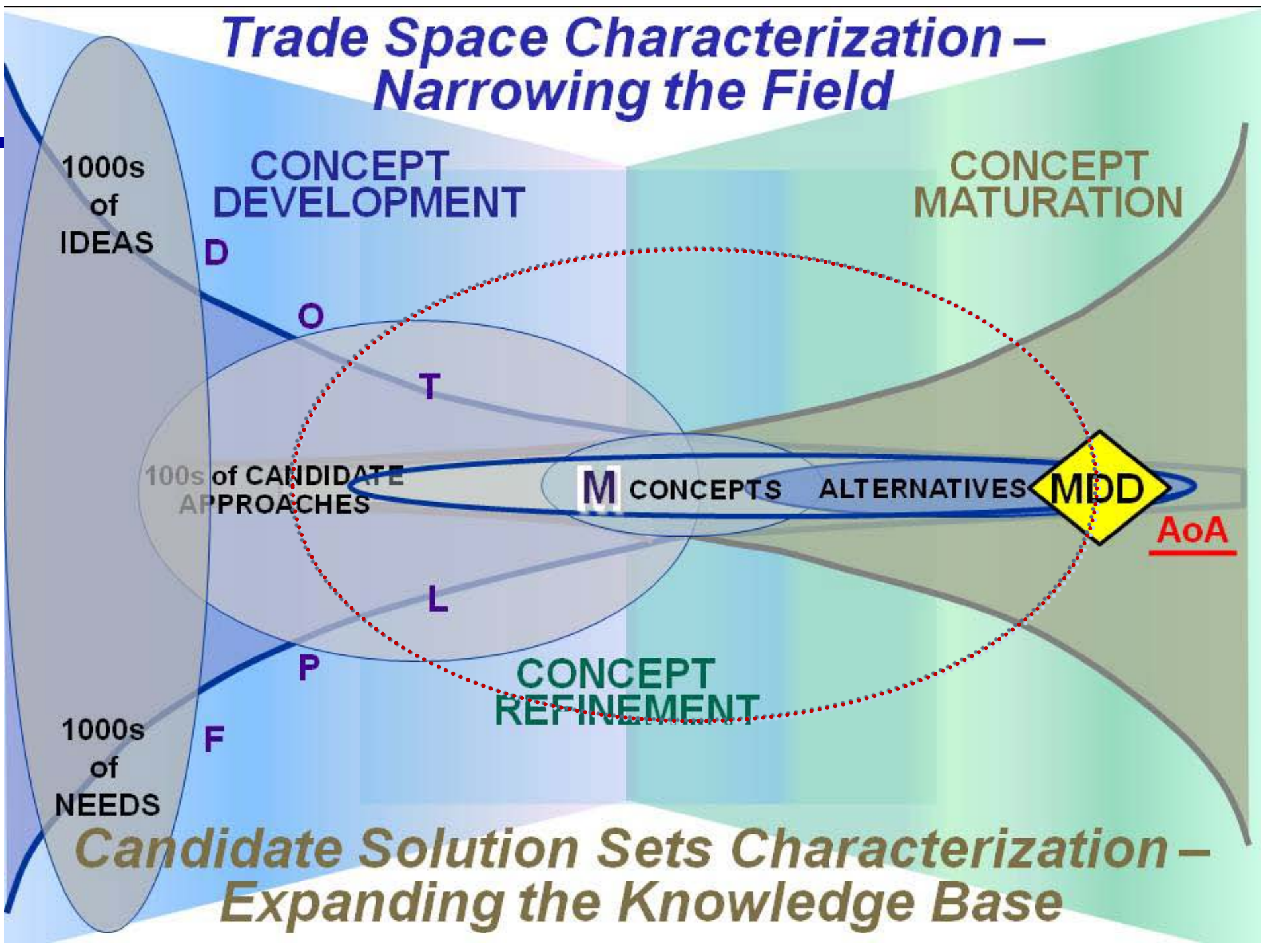


THE CHALLENGE

Filling the Space Between CBA and MDD



DEMANDS APPLICATION OF EARLY SE


Trade Space Characterization –
Narrowing the Field
1000s
of
IDEAS
CONCEPT
DEVELOPMENT
CONCEPT
MATURATION
D
O
T
100s of CANDIDATE
APPROACHES
M
CONCEPTS
ALTERNATIVES
MDD
AoA
L
P
CONCEPT
REFINEMENT
1000s
of
NEEDS
F
Candidate Solution Sets Characterization –
Expanding the Knowledge Base

AF Vision for Systems Engineering

- ***Disciplined, repeatable processes* from JCIDS CBA (pre-ICD) to AoA that result in Concept Characterization and Technical Descriptions (CCTD)**
  - **Inform decision makers on technical feasibility of prospective concepts for materiel solutions**
  - **Initial integrated risk assessment addressing both operational and programmatic issues**
- **Support realistic program formulation through application of early Systems Engineering**
  - **Robust and disciplined up-front technical planning**
  - **Solid technical foundation for the future program**
  - **Reduce the chances of poorly planned concepts emerging from AoA with relatively high rankings**

Clear, Actionable Policy & Process

Recent Early SE Guidance

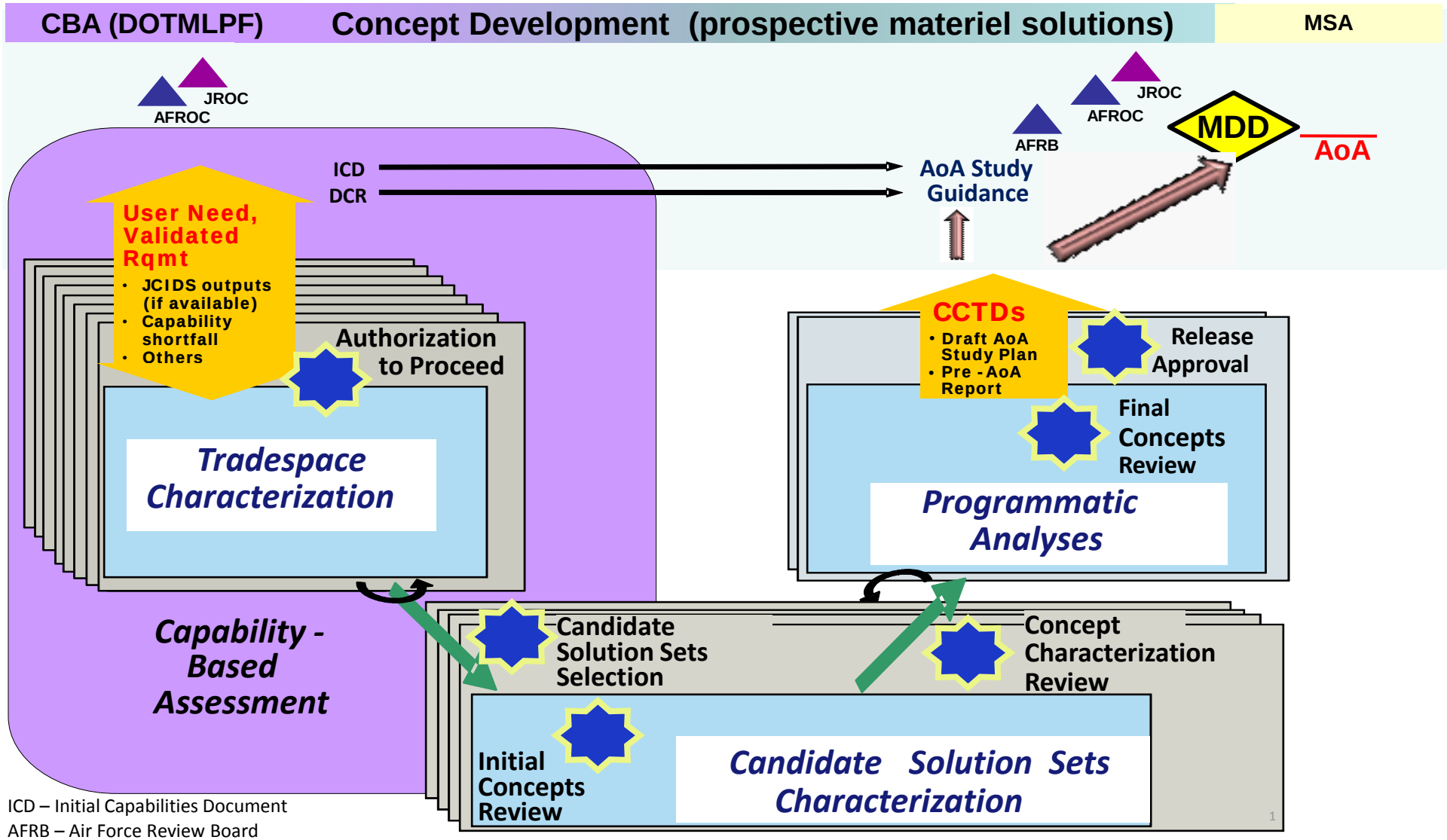
- **Guidance Memo: Early Systems Engineering Planning Documentation and Concept Characterization and Technical Description (CCTD) Implementation, SAF/AQR, 19 Dec 08**
  - **Establishes requirements for pre-Milestone A technical planning and concept development**
- **Guidance Memo: Organizational Systems Engineering Plan Implementation, SAF/AQR, 19 Dec 08**
  - **Incorporates the CCTD memo amplifying the need to "ensure pre-program SE processes are incorporated into organizational Systems Engineering Plans"**
- **Early Systems Engineering Guidebook, SAF/AQR, Mar 09**
  - **Provides first definition of a CCTD**

Concept Characterization and Technical Description (CCTD)

- Essentially the "concept spec" or initial technical baseline
- Evolves into the Technical Requirements Document / System Requirements Document (TRD / SRD)
- Principal Elements:
  1. Mission / Capability Need Statement / CONOPS
  2. Concept Overview
  3. Trade Space Definition / Characterization
  4. Studies, Analyses, Experiments
  5. Concept Characterization / Design
  6. Program Characterization
  7. Risk Assessment
  8. DOT_LPF Implications
  9. Conclusions (Capability Description; Traceability to Need Statement)

Annex A, Early Systems Engineering Guidebook, 31 March 09

Using CCTD elements to support "Concept Maturity"



ICD – Initial Capabilities Document
AFRB – Air Force Review Board
DOTMLPF – Doctrine, Organization, Training, Materiel, Leadership & Education, Personnel, Facilities
DCR – DOT_LPF Change Recommendation
JROC / AFROC – Joint / Air Force Requirements Oversight Council

Lessons Learned Along the Way

- **Single AF leadership vision is essential**
- **CCTD construct will provide the basis for a formal technical analysis/assessment process to support MDD**
- **Development Planning efforts ongoing at Materiel Enterprise level -- CCTDs must "feed" these processes**
- **Engagement with MDA and D,CAPE is necessary to scope technical analysis expectations and efforts for each prospective program prior to its MDD**
- **We need an environment to develop collaborative solutions (user/materiel team/cost/others)**

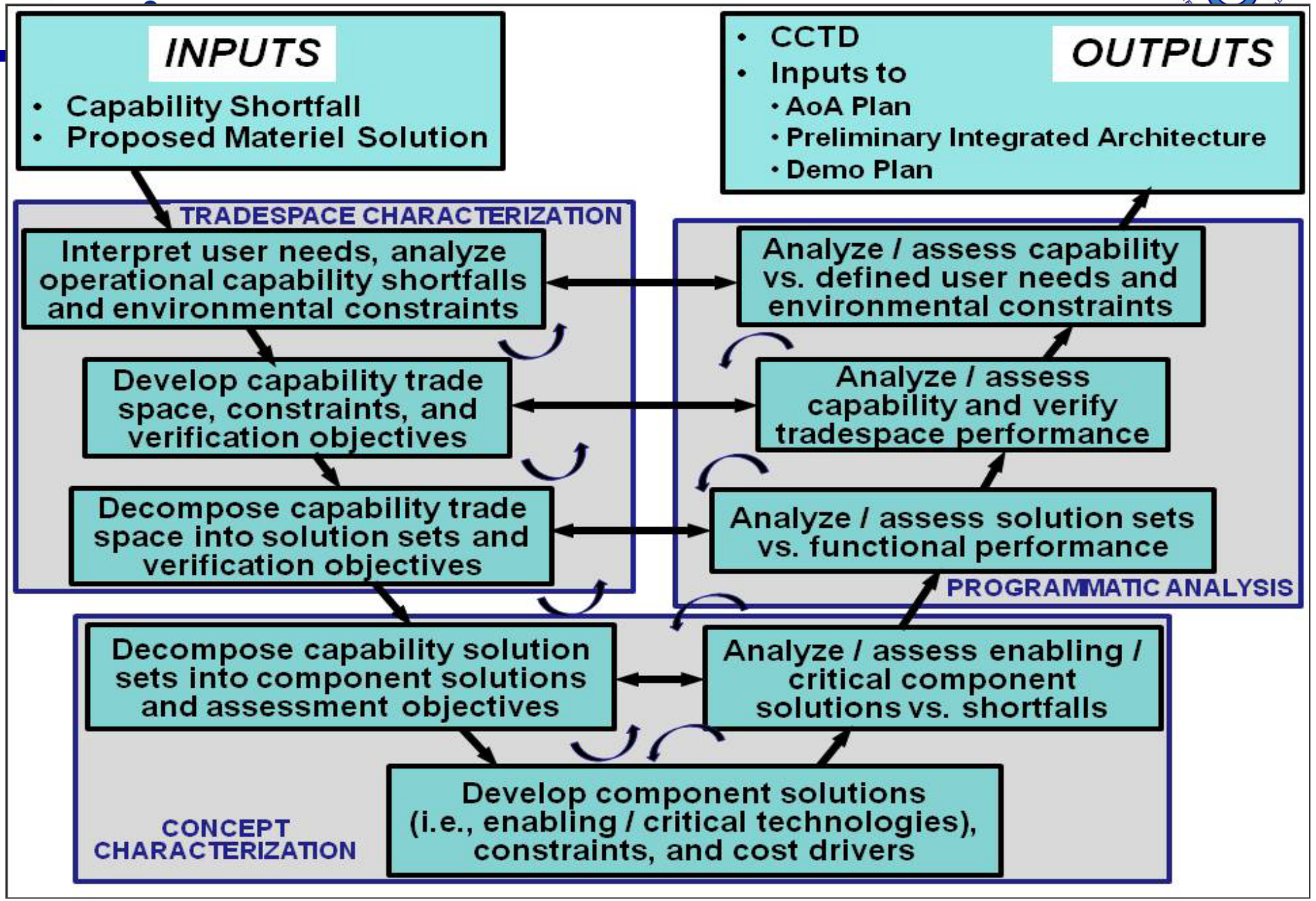
Collaborative SAF/AQR – Center for Systems Engineering Effort

AF Path Ahead

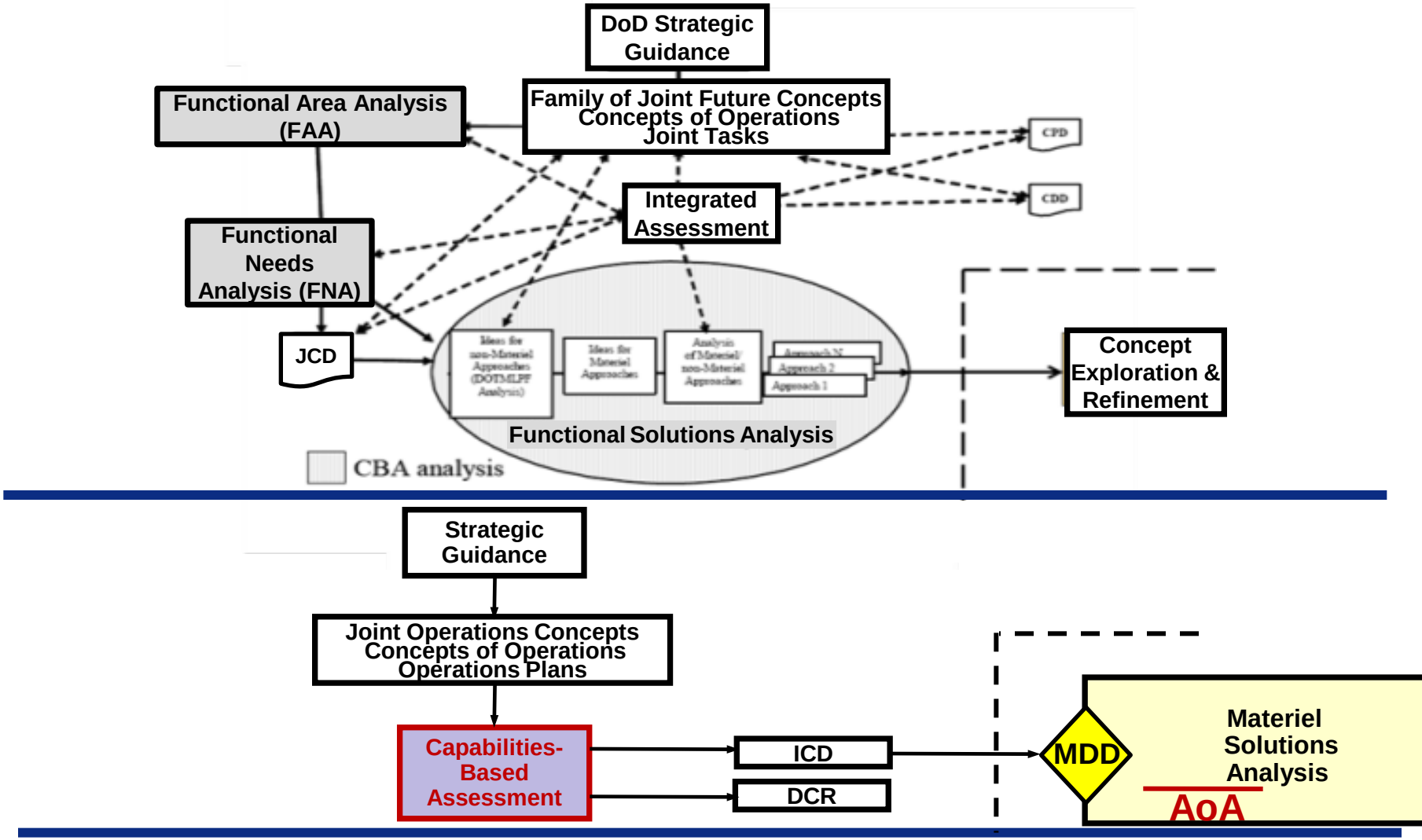
- **Institutionalize CCTD process across five Product Centers – *CURRENTLY IN WORK***
- **Clarify CCTD descriptions; develop Guidebook**
  - **Simplify implementation**
  - **Provide template for authors to follow**
- **Update Early SE Guide – set and enforce policy**
- **Flesh out "Collaborative Development Centers" concept for use across all Product Centers**
- **Address resource requirements**

QUESTIONS ?

SE "V" Diagram for Concept Development



Joint Capabilities Integration & Development System
CJCS 3170 Changes (Feb 09)



Concept Characterization and Technical Description (CCTD)

Early Systems Engineering Guidebook, Annex A, dated 31 March 2009

1.		Mission / Capability Need Statement / CONOPS
2.		Concept Overview
3.		Trade Space Definition / Characterization
	3.1	Top-Level Architecture
	3.2	Principal Interfaces
	3.3	Operating Regime
	3.4	Key System Parameters
4.		Studies, Analyses, Experiments
	4.1	Parametric Studies (*e.g.*, weight, power, cooling, throughput)
	4.2	Analyses (*e.g.*, HSI considerations, supportability concepts)
	4.3	Experiments
	4.4	Conclusions
5.		Concept Characterization / Design
	5.1	Common Analysis Assumptions
	5.2	Operating Regime
	5.3	Interfaces / Interoperability / System-of-Systems Approach
	5.4	Critical Subsystem Design and Sizing
	5.5	Supportability / Sustainment Features
	5.6	Configuration Summary
	5.7	Analysis Results
	5.8	Concept Design Conclusions (Capability Description)
6.		Program Characterization
	6.1	Critical Technologies
	6.2	Technology Maturation Approach
	6.3	Test & Evaluation / Verification & Validation Approach
	6.4	Prototyping Approach
	6.5	Manufacturing / Producibility Approach
	6.6	Sustainment / Supportability Approach
	6.7	Schedule Assumptions
	6.8	Cost Analysis Assumptions
	6.9	Cost Estimates
7.		Risk Assessment
8.		DOT_LPF Implications
9.		Conclusions (Capability Description; Traceability to Need Statement)

Updated CCTD Content (from 5-6 Aug Concept Maturity Workshop)

1.		**Mission/Capability Need Statement/CONOPS (MOEs)**
	1.1	Stakeholders
2.		**Concept Overview (OV-1)**
3.		**Trade Space Characterization**
	3.1	Scope
	3.2	Assumptions and Constraints
	3.3	Interfaces
	3.4	Operating Environment (Draft Enabling CONOPS,
	3.5	Key Parameters / Attributes / MOPs
	3.6	Compliance Issues
4.		**Evaluation (Studies, Analyses, Experiments)**
	4.1	Common Assumptions & Methodologies
	4.2	Parametric Studies
	4.3	Analyses
	4.4	Experiments
	4.5	Modeling & Simulation (and Associated Data)
	4.6	Evaluation Results
	4.7	Conclusions
5.		**Concept Characterization / Design**
	5.1	Design Description & Variants
	5.2	Concept of Employment
	5.3	Architecture Considerations (Interfaces/Interoperability/SoS Approach/Integration)
	5.4	Critical Design Constraints
	5.5	Critical Technology Elements
	5.6	Supportability / Sustainment / Logistics Features
	5.7	Cost Drivers
	5.8	Required Enabling Capabilities (Human Systems Integration [HSI], communications, intelligence, etc)
6.		**Program Characterization**
	6.1	Critical Technologies (including S&T needs / feed-forward)
	6.2	Technology Maturation Approach
	6.3	T&E/V&V Approach
	6.4	Prototyping Approach
	6.5	Manufacturing / Producibility Approach
	6.6	Sustainment / Supportability Approach
	6.7	Other Relevant Considerations (intel, HSI, security, etc.)
	6.8	Schedule Assumptions/ethodologies (IOC from ICD)
	6.9	Cost Analysis Assumptions and Methodologies
	6.10	Cost Estimates
7.		**Risk Assessment and Decision-Certain Consequences**
	7.1	Operational Risk
	7.2	Program Risk
	7.3	Technology Risk
8.		**DOT_LPF Implications and other interdependencies**
9.		**Conclusions (Capability Description; Traceability to Need Statement)**