# *Headquarters U.S. Air Force*

*Integrity - Service - Excellence*

# Early Systems Engineering – A Level of Analytical Fidelity to Support MDD and MS A Decisions

## "Risk, Trade Space, and Analytics in Acquisition"

**MORS Workshop**

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# DP underpins pre-acquisition CBP

## Early SE enables the technical elements of DP

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CAPABILITIES-BASED PLANNING

AFROC ICD

AoA Study Guidance

AFRB DCAPE MDD

AFRB RCT A

AoA Study Plan

AFROC

AoA Materiel Solutions Analysis

Tech Dev

Concept Evolution

**INPUTS**

- Capability gaps and shortfalls identified during CBA
- Technology opportunities
- Leadership direction

**OUTPUTS**

*Data to technically inform / support SAE recommendations at MDD, AoA, and Milestone A*

SE-based approach

TRADE SPACE CHARACTERIZATION

CAPABILITY DECOMPOSITION / ANALYSIS

TRADE SPACE EXPLORATION

TRADE SPACE REFINEMENT and CONCEPT EXPLORATION

1

IMPLEMENTATION ANALYSIS

5

OVERALL ASSESSMENT

4

PROGRAMMATIC ANALYSIS

VERIFICATION ASSESSMENT

3

ARCHITECTURE CHARACTERIZATION

2

SYSTEM INTEGRATION

SYSTEM CHARACTERIZATION

CANDIDATE SOLUTION SETS CHARACTERIZATION

EARLY SE "EXAMINATION POINTS"

1- Candidate Solution Sets Selection
2- Initial Concepts Review
3- Concept Characterization Review
4- Final Concepts Review
5- Release Approval

Disciplined, analysis-based decision support

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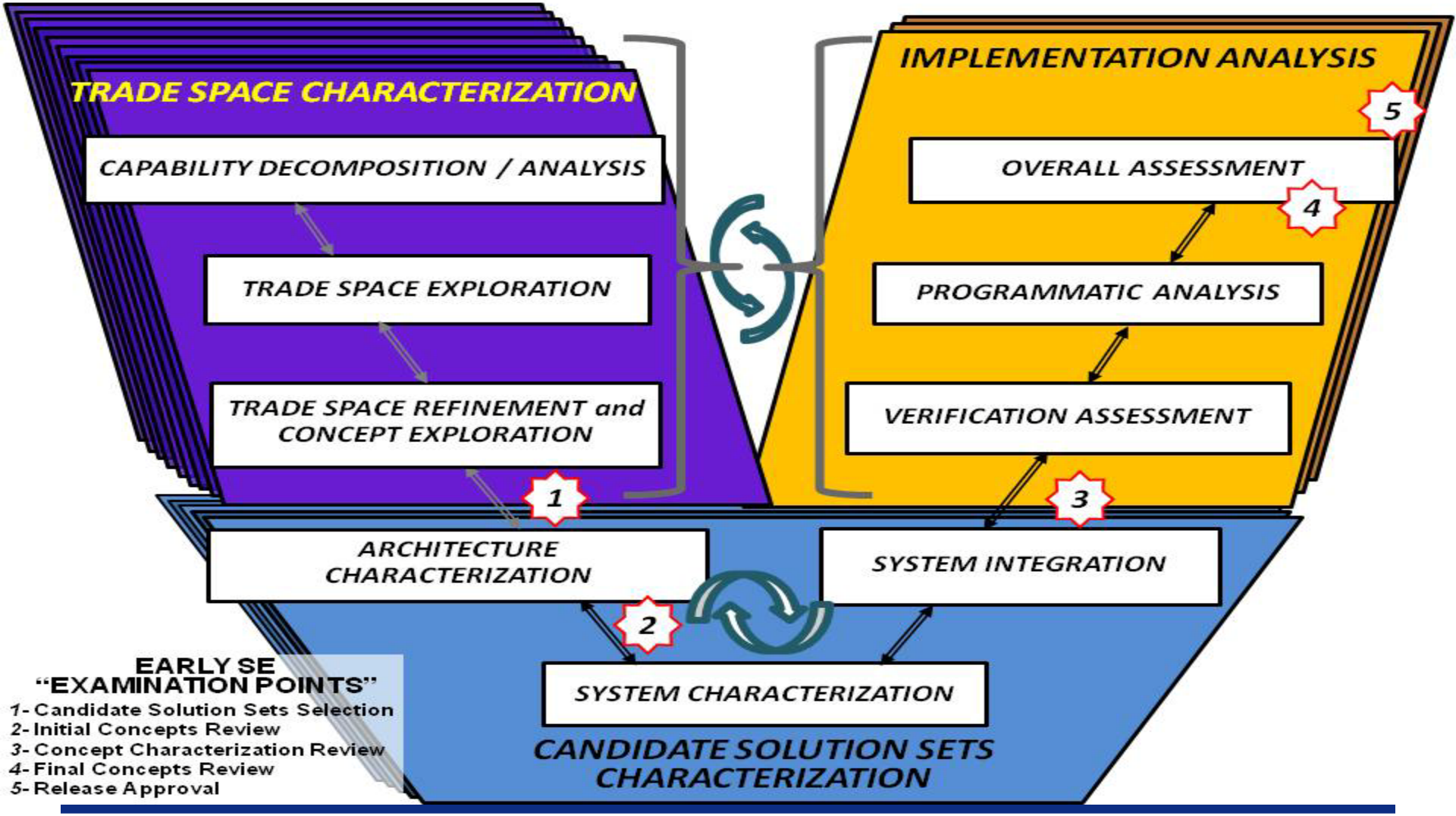
# Early SE "V"

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# Trade Space Characterization

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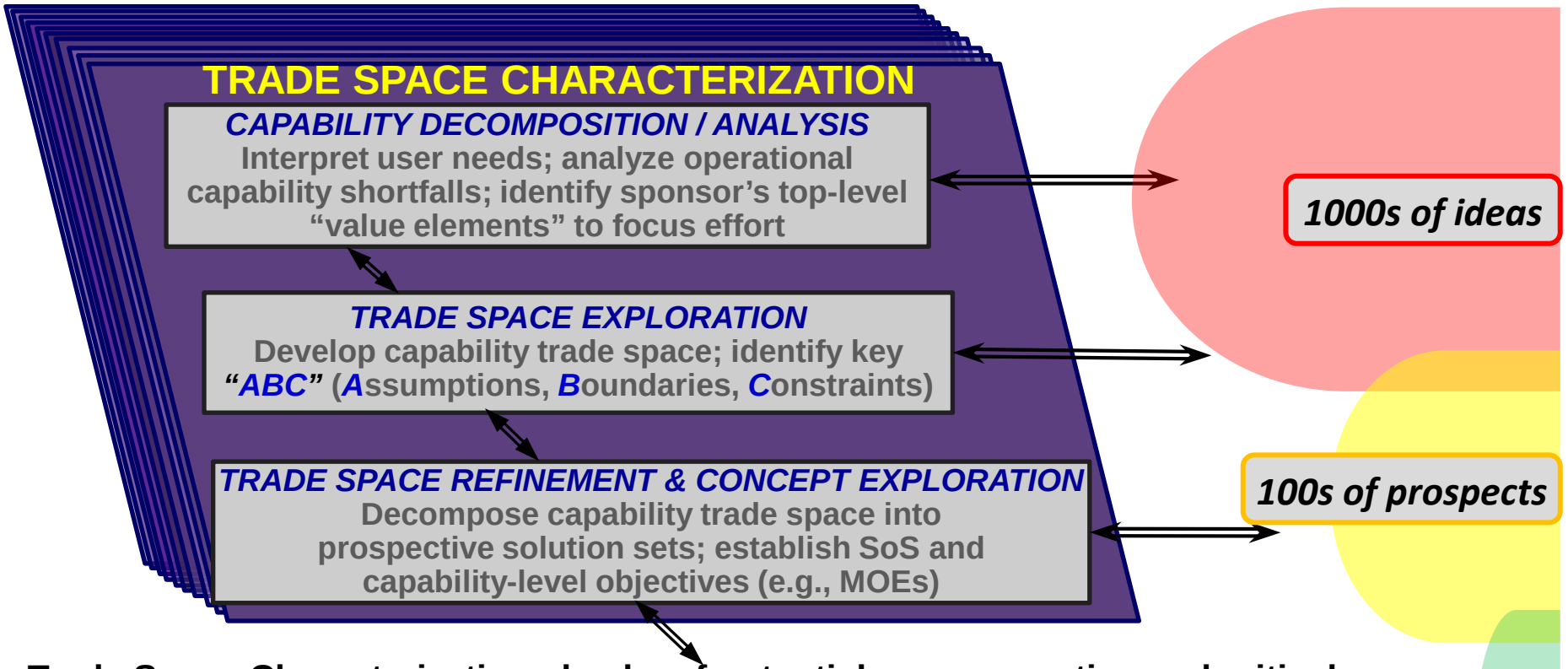


- Trade Space Characterization checks of potential programmatics and critical portfolio considerations (essentially the "1000s-to-100s" filter) include, *e.g.*,
  - > Affordability
  - > Industrial base adequacy
  - > Technology maturation timelines
  - > Architecture/SoS Requirements
- "ABC" have to be relevant to Value Elements as they represent the basis of MOEs
- Further investigations against capability objectives provide the "100s-to-10s" filter

# Candidate Solution Sets Characterization

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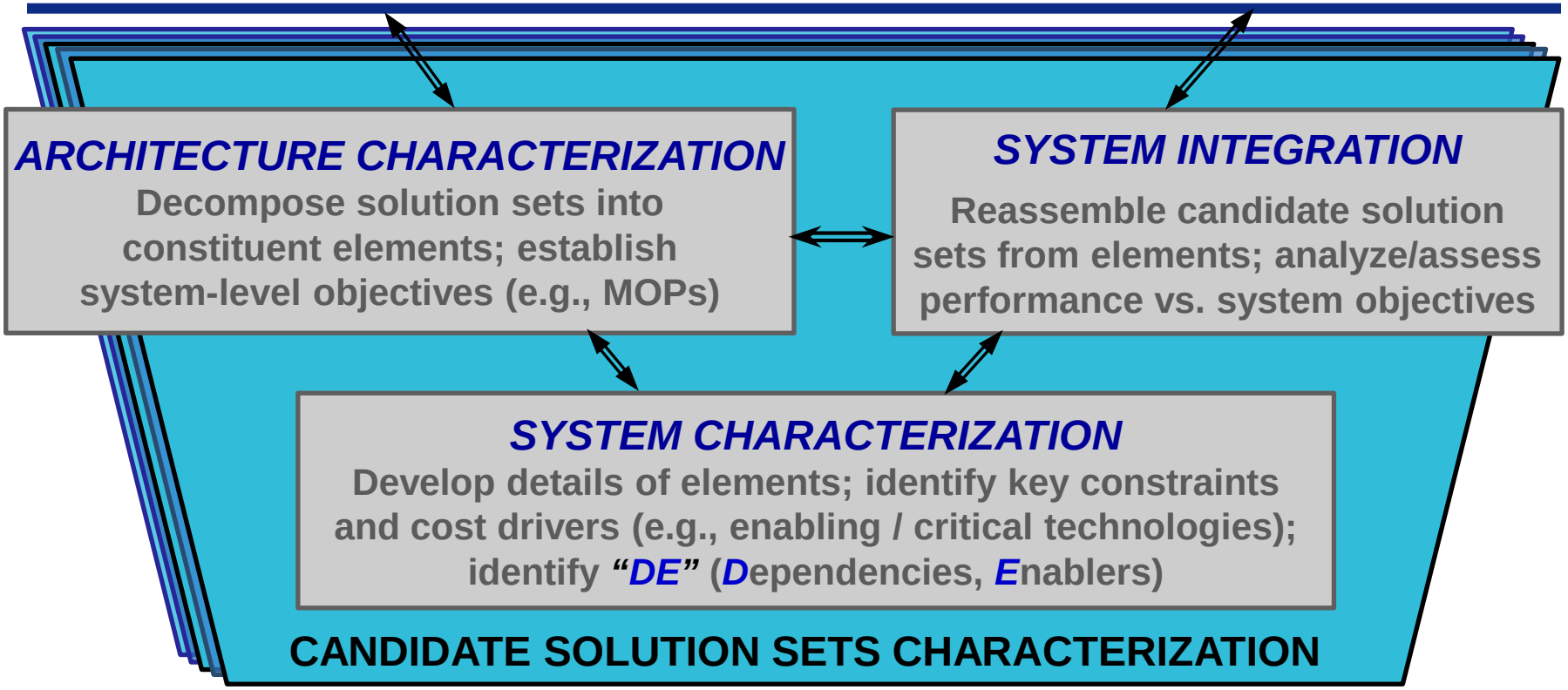


- **Detail work inside Candidate Solution Sets Characterization should focus on concepts with a reasonable chance of timely maturation (the "10s of reasonable approaches")**
- **The "DE" should include things that have historically led to significant program issues when not given sufficient or timely consideration, *e.g.*,:**
  - **> Key interfaces (*e.g.*, data and comm systems)**
  - **> Configuration management at SoS level**
  - **> Intelligence inputs**
  - **> Basing / support infrastructure**

# Implementation Analysis

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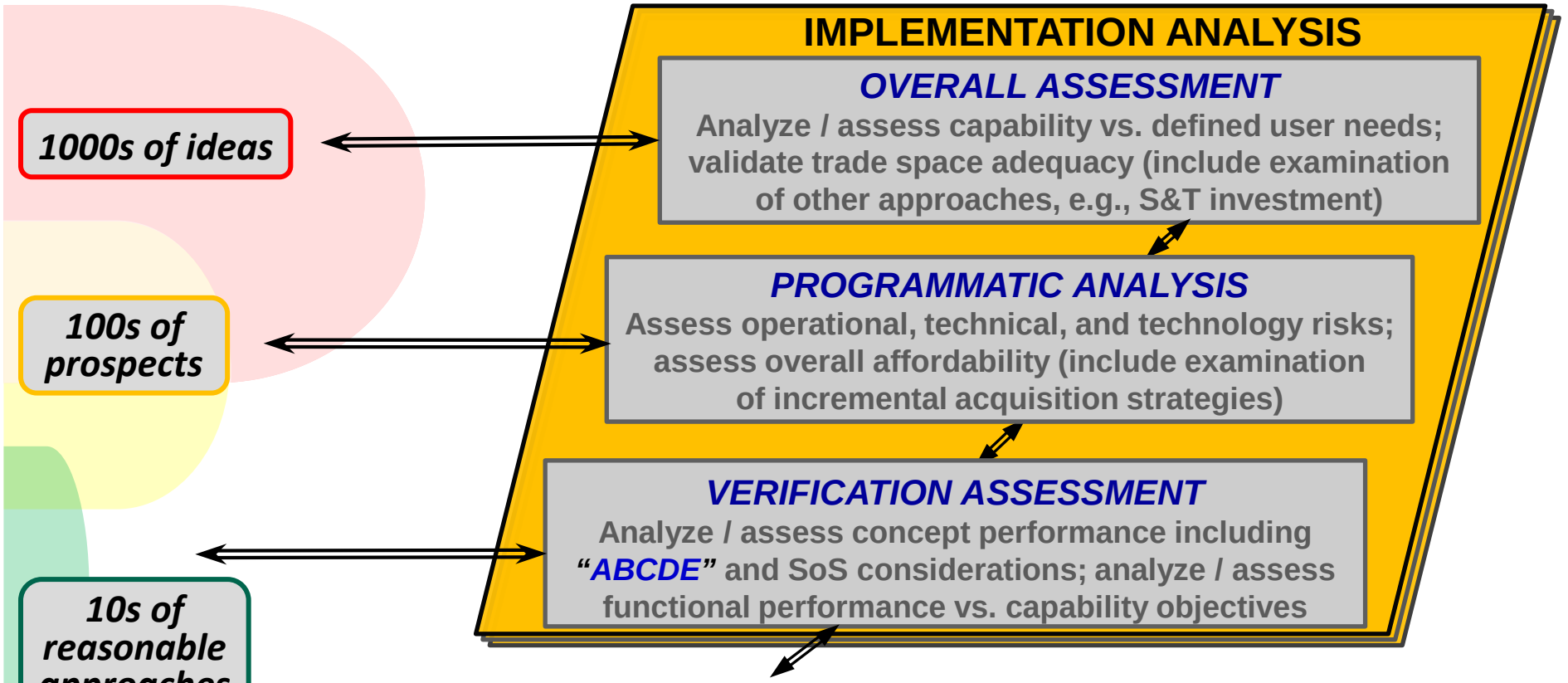


- "Trade space adequacy" is critical to DCAPE approval … a good plan sets AoA up for success
- "Assessments vs capability objectives" reflect the growing knowledge base of the select few candidate approaches
- Moving up the block does NOT mean revisiting the 100s and 1000s

# Fitting It All Together

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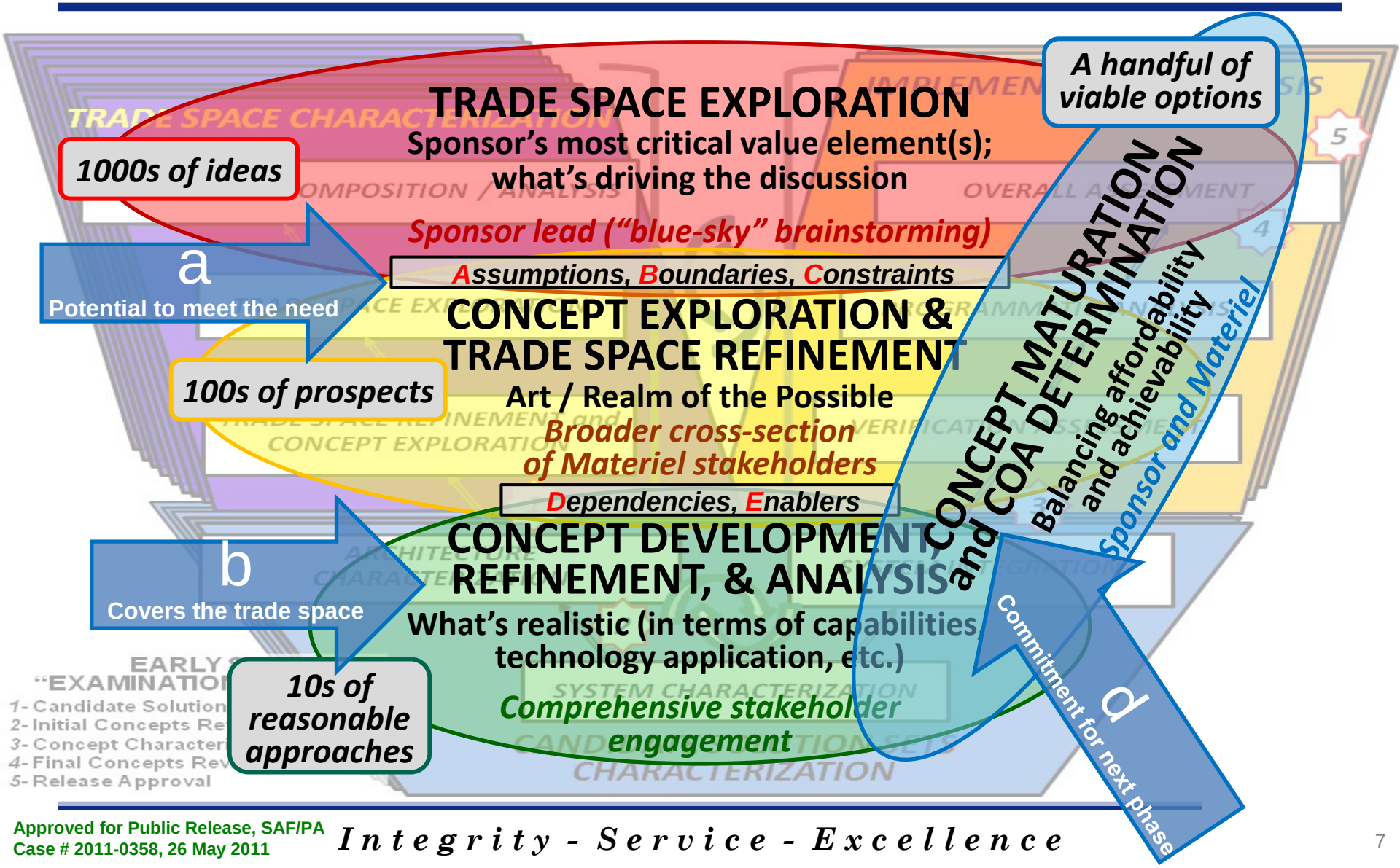

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# CCTD Content Supports MDD Information Needs

## 1. Mission / Capability Need Statement / CONOPS (MOEs)

- Stakeholders

## 2. Concept Overview (OV-1)

## 3. Trade Space Characterization

- Scope
- Assumptions and Constraints
- Interfaces
- Operating Environment (Draft Enabling CONOPS)
- Key Parameters / Attributes / MOPs
- Compliance Issues

## 4. Evaluation (Studies, Analyses, Experiments)

- Common Assumptions and Methodologies
- Parametric Studies
- Analyses
- Experiments
- Modeling & Simulation (and associated data)
- Evaluation Results
- Conclusions

## 5. Concept Characterization/Design

- Design Description & Variants
- Concept of Employment
- Architecture Considerations (Interfaces / Interoperability / SoS Approach / Integration)
- Critical Design Constraints
- Critical Technology Elements
- Supportability / Sustainment / Logistics Features
- Cost Drivers
- Required Enabling Capabilities

## 6. Program Characterization / Implementation Analysis

- Critical Technologies (including S&T needs / feed-forward)
- Technology Maturation Approach
- T&E / V&V Approach
- Prototyping Approach
- Manufacturing / Producibility Approach
- Sustainment / Supportability Approach
- Other Relevant Considerations
- Schedule Assumptions / Methodologies
- Cost Analysis Assumptions and Methodologies
- Cost Estimates

## 7. Risk Assessment and Decision-Certain Consequences

- Operational Risk
- Technology Risk
- Program Risk

## 8. DOT_LPF Implications and other Interdependencies

## 9. Conclusions (Capability Description / Traceability to Need Statement)

- A – Potential to meet the need
- B – Covers the trade space (this, more accurately, is the subjective sum of all concepts presented at the MDD)
- C – What can be done in the interim
- D – Plan to support and fund the next phase of analytic, engineering, and programmatic activities - sponsor

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