

Enterprise Capability Assessment and Prioritization

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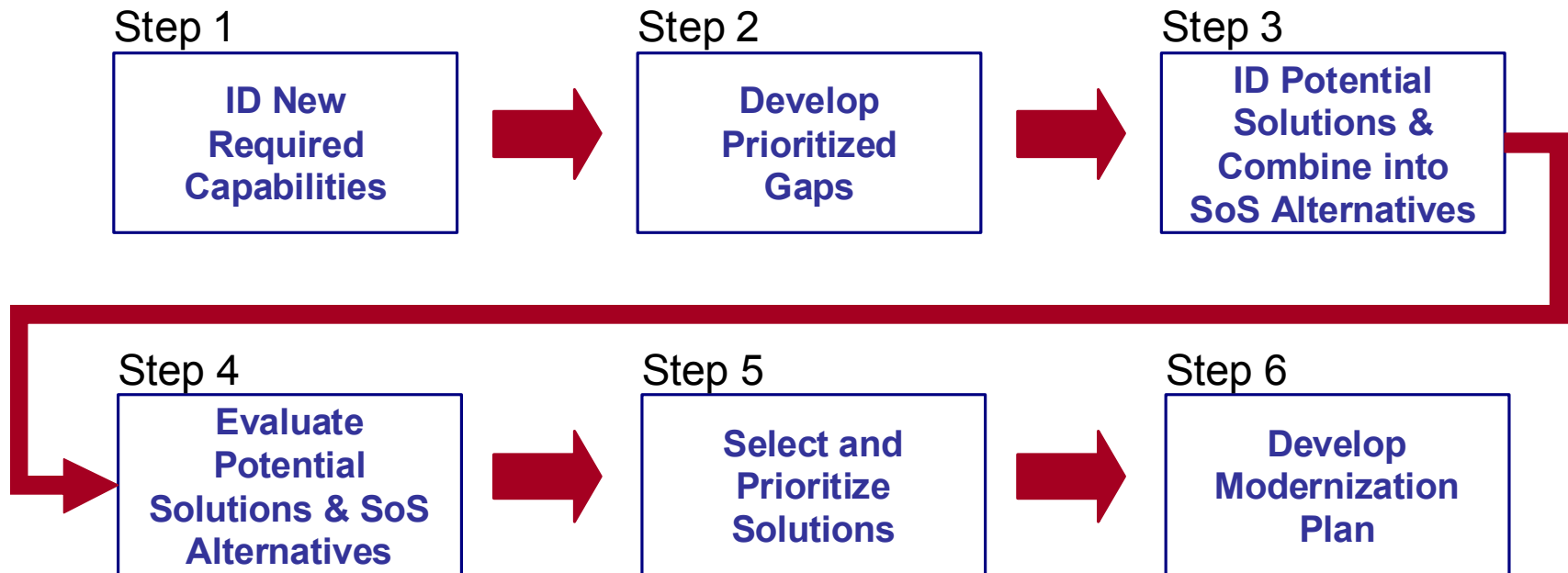
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Mission Accomplishment

- An enterprise has existing capabilities
 - Physical resources
 - Skilled personnel
 - Organizational knowledge (policies, tactics & procedures)
- Required capabilities
 - Create value for the enterprise
 - Core competency when effectively integrated
- Integration of capabilities under the right circumstances may be a SoS
- Factors impacting desired level of performance

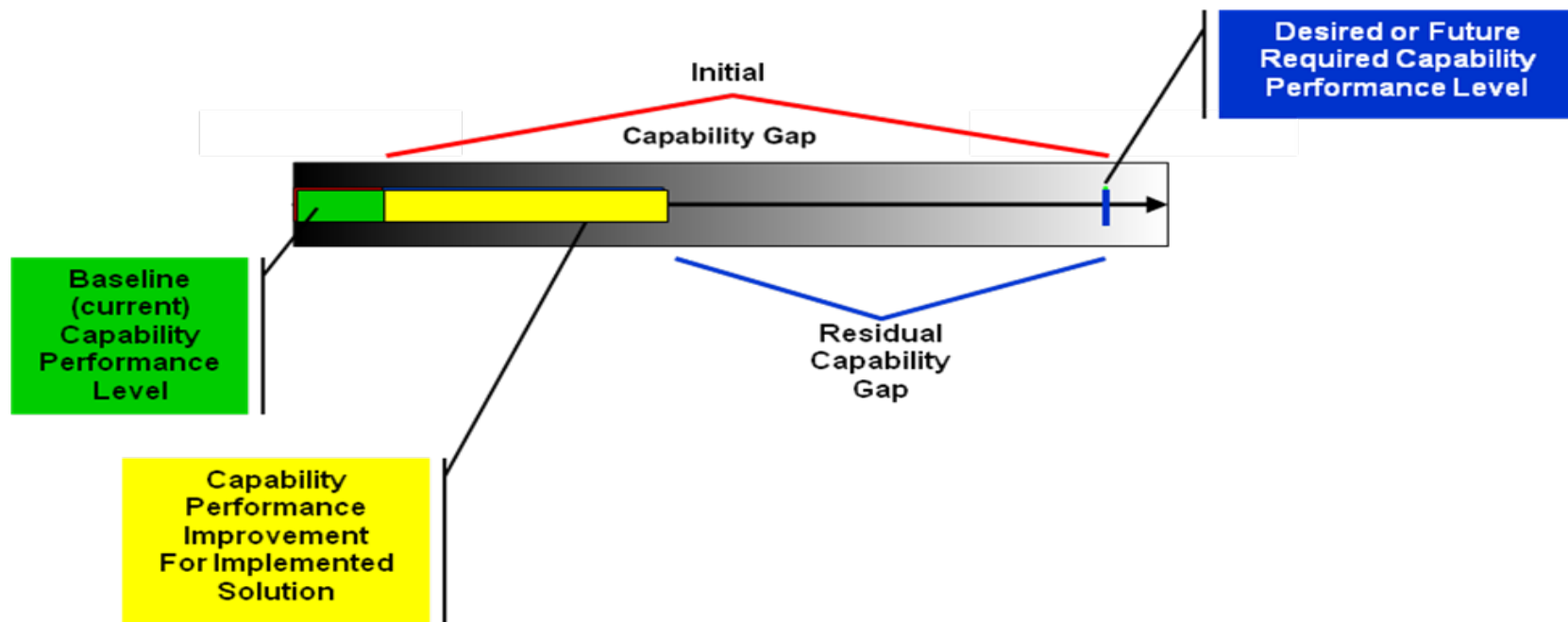
Systematic Six-Step Process



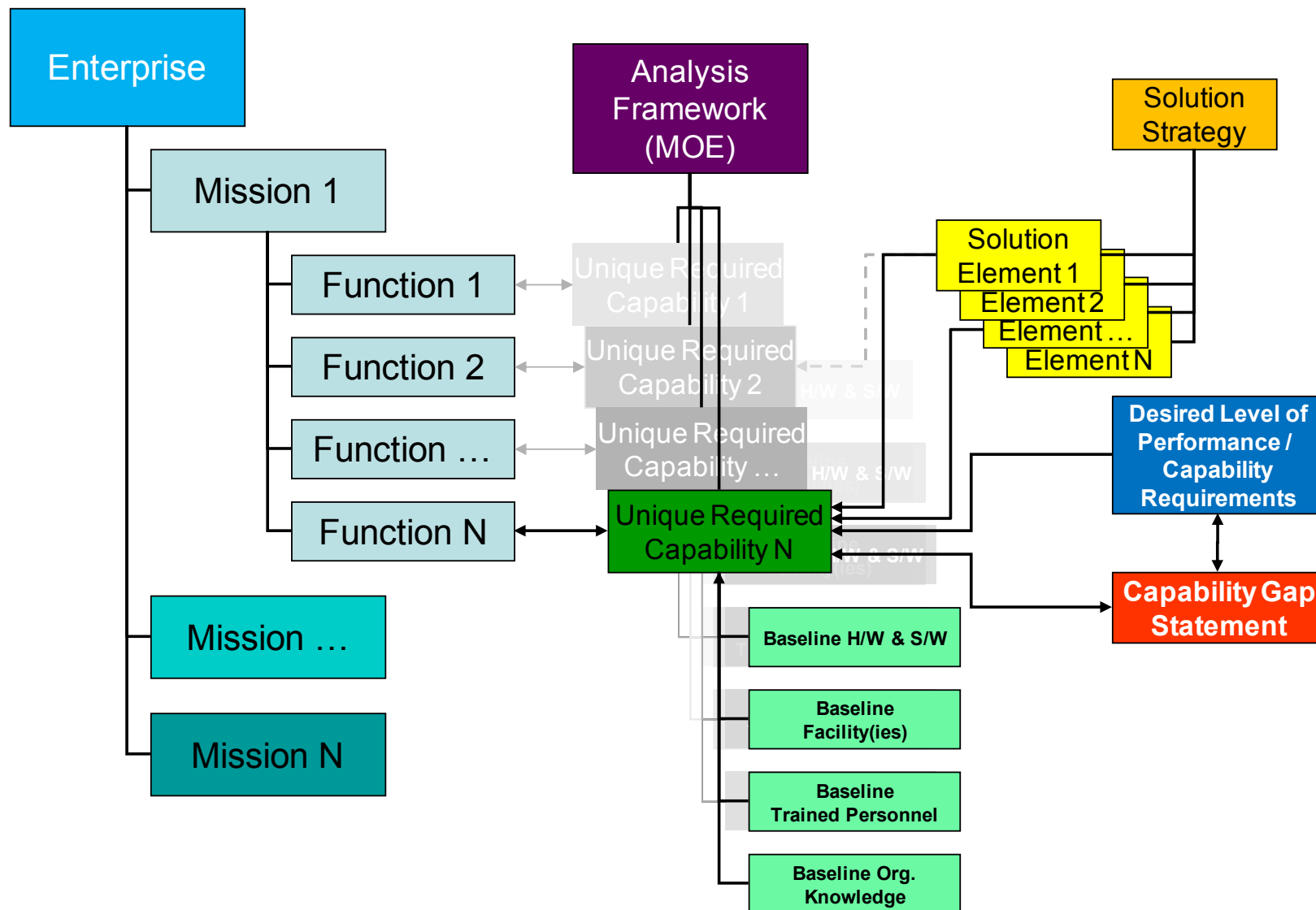
Challenge to Overcome

- Ability to identify and measure capability gaps
 - In order to more effectively adapt to changing conditions
 - Improve performance toward completing the mission
- What we learned:
 - Can't move forward without knowing where you are
 - Must accurately identify and prioritize required capabilities and gaps
 - Technology and non-technology based solutions
 - Impact must be measured – positive and negative
 - Finite resources make ranking solutions essential
- What's needed:
 - Analysis framework in the context of a mission
 - Organizing and representing the challenge/problem
 - Common language

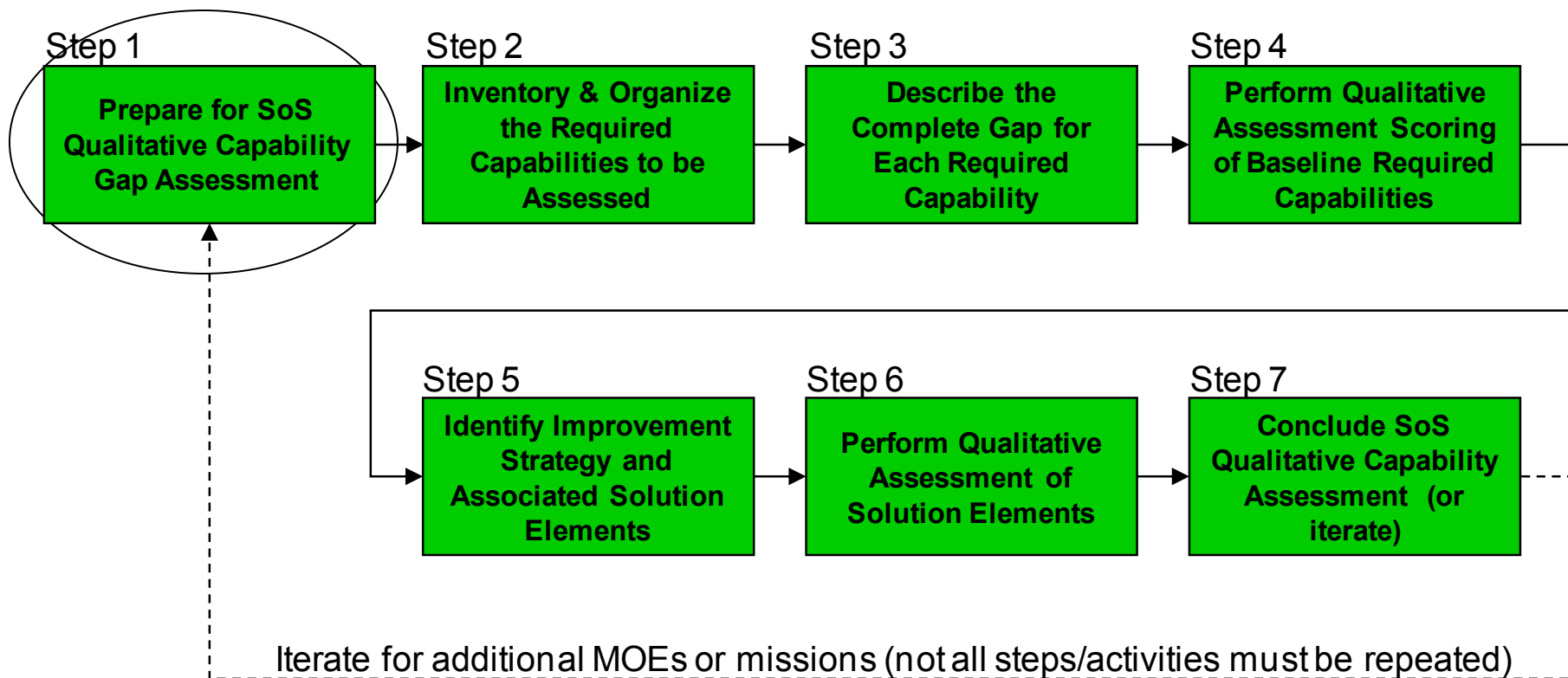
Notional Depiction of Capability Gaps



Notional Context for Enterprise Capability Gap Assessment



Suggested approach for SoS Qualitative Capability Gap Assessment



Example Criteria for Scoring Capability

Effectiveness Score Guidance

5. The ability to perform or provide the unique capability meets objective requirements.**
4. The ability to perform or provide the unique capability meets threshold requirements**
 Materiel solutions employed within the BCT need only evolutionary improvement or broader fielding to fill remaining gap.
3. The ability to perform or provide the unique capability does not meet threshold requirements** - Supplementary materiel solutions are needed to satisfy the desired threshold level of performance. These supplementary materiel solutions exist, but require integration into the BCT.
2. The ability to perform or provide the unique capability does not meet requirements** and cannot be adequately improved or supplemented. A revolutionary materiel solution change is needed to replace the current materiel solution.
1. There are no materiel solutions present to perform this unique capability. A new materiel solution must be developed and incorporated.

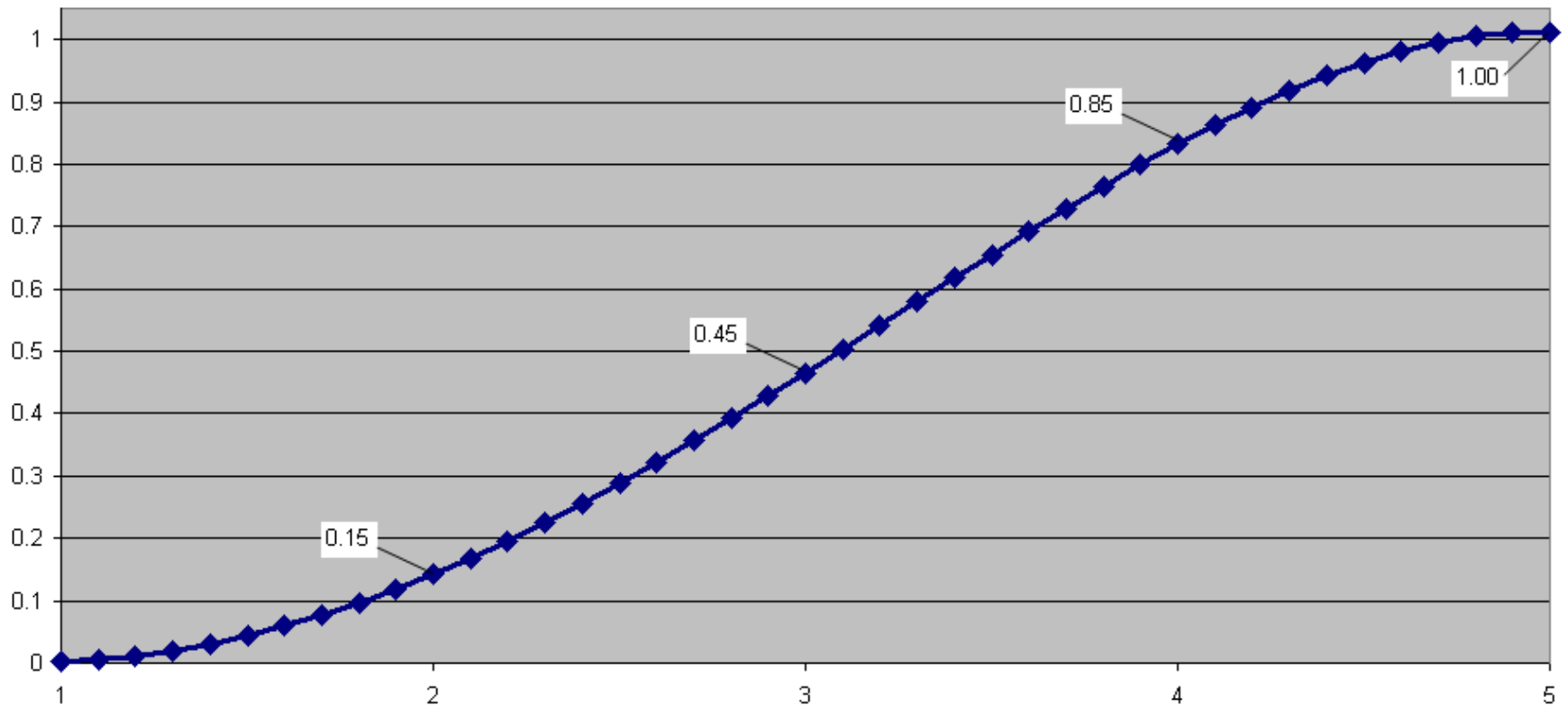
**The term "requirements" as used here refers to the future set of requirements (as envisioned) that must be met for the Current Force BCTs to be interoperable with and fight along side the FCS BCT in the year 2015.

Importance Score Guidance

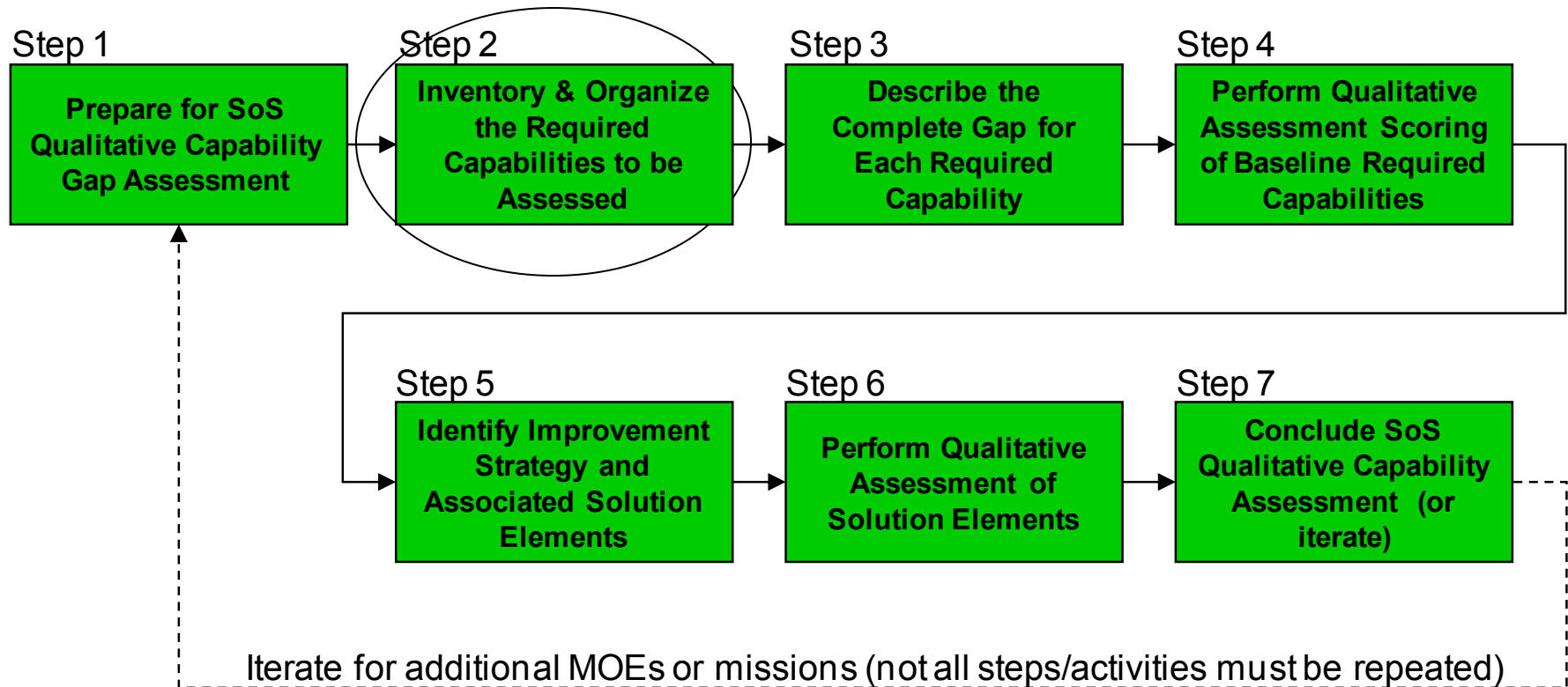
5. Unique capability is CRITICAL to BCT's mission effectiveness; mission cannot be successfully accomplished without the capability.
4. Unique capability is VITAL to BCT's mission effectiveness; BCT's mission still can be accomplished, however, its effectiveness in doing so is severely degraded without the capability.
3. Unique capability is IMPORTANT to mission effectiveness; BCT's mission can be accomplished, however, its effectiveness in doing so is significantly degraded without the capability.
2. Unique capability SUPPORTS mission effectiveness; BCT's mission can be accomplished, however, its effectiveness in doing so is noticeably or moderately degraded without the capability.
1. Unique capability FACILITATES or ENHANCES mission accomplishment; BCT's mission can be accomplished, however, its effectiveness in doing so is slightly or somewhat degraded without the capability.
0. Unique capability is NOT APPLICABLE to BCT's mission

Utility Function

Utility Curve - BCT Effectiveness
(nonlinear)

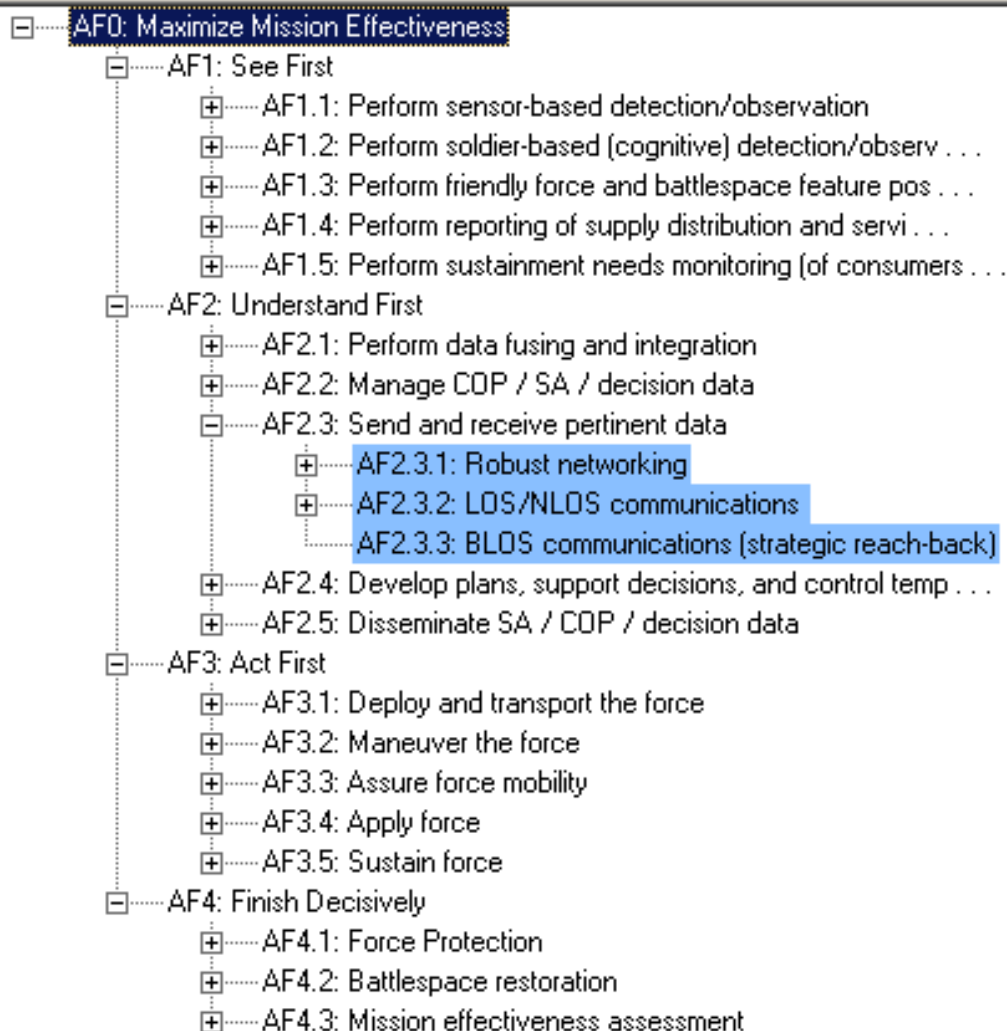


Suggested approach for SoS Qualitative Capability Gap Assessment

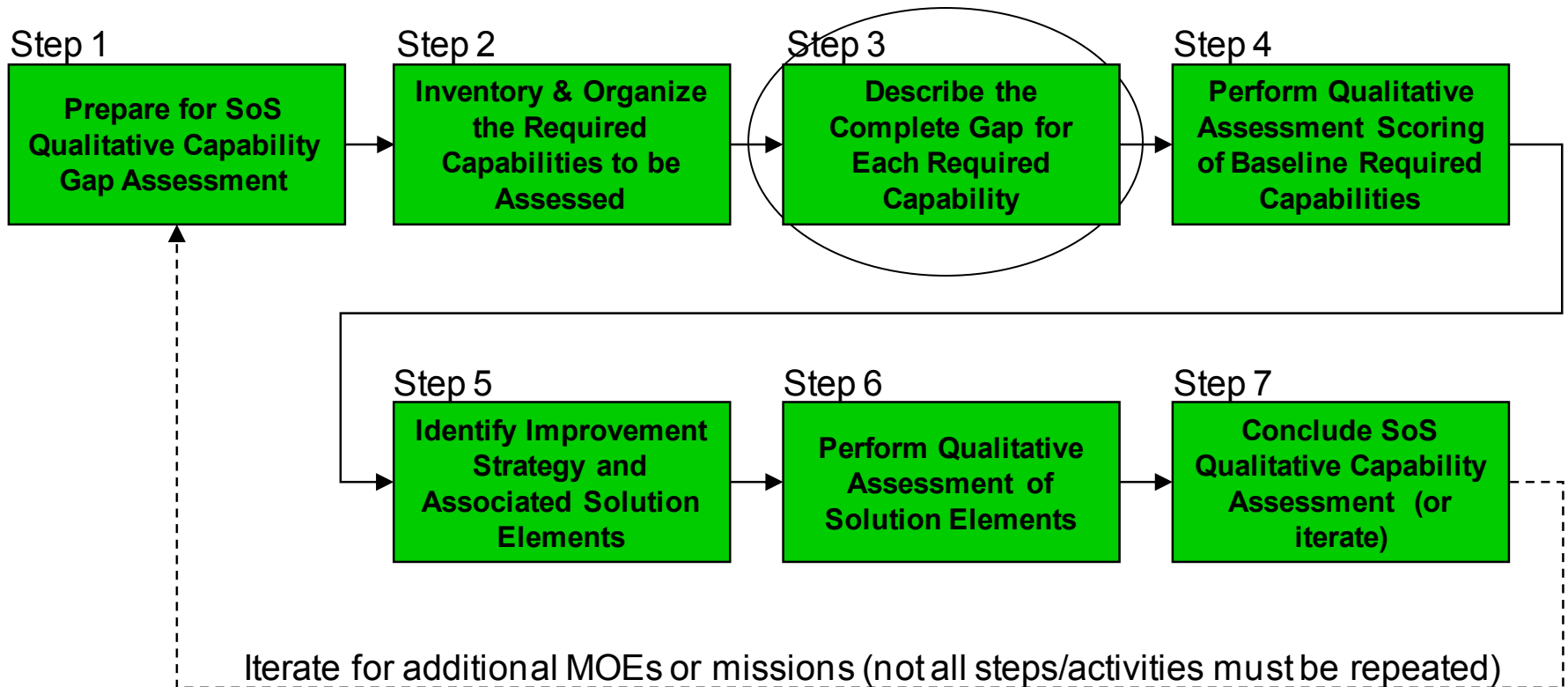


Analysis Framework

Analysis Framework Hierarchy:



Suggested approach for SoS Qualitative Capability Gap Assessment



Gap Statement Association and Traceability in GRIP

GAP Relationship & Integration Planning Tool - SCORING UTILITY

GRIP - SCORING UTILITY

Mission: SSC-Mid Intensity (Disabling) Alternative: Baseline

Selected Node Data | Node Management | Weighting | Scoring Analysis | Notes/Scoring Rationale | Mission

USG: quant impro comm intero surviv (i.e., mobil

BCT Gap Statement (reformulated from CNA capability gaps)

CG ID	CG Text	RC ID	RC Text
CG145	P p ai oi	RC1.2	T u
CG148	lr c	RC1.7	T lr lr
CG150	P in in tc	RC1.7	T lr lr
CG189	L st ei pi	RC3.4	A w in c

Original CNA capability gap statements

Required Capabilities (from JFCs) associated with original CNA capability gap statements

AF0: Maximize Mission Effectiveness

AF1: See First

AF1.1: Perform sensor-based detection/observation

AF1.1.1: Chemical threat (i.e., TIC/TIM) detection an

AF1.1.2: Biological threat detection and identification

Metrics

CDD/Specifications

OBA 2009

OBA 2019

USG: USG61 (CNA: 913)

USG: USG144 (CNA: 1015)

AF1.1.3: Radiological threat detection

AF1.1.4: Nuclear threat detection

AF1.1.5: Explosives (high yield; mass effect) threat de

AF1.1.6: Mine detection (as deployed; conventional r

AF1.1.7: Other explosive threat detection (as deploye

AF1.1.8: Detection of enemy platforms (MGV, UGV, t

AF1.1.9: Enemy UAV / low flying objects detection-p

AF1.1.10: Enemy dismounted soldier detection-positi

AF1.1.11: Intelligence, surveillance, and reconnaiss

AF1.1.12: Direct fire detection

AF1.1.13: Indirect fire detection

AF1.1.14: Laser / microwave / other EM detection

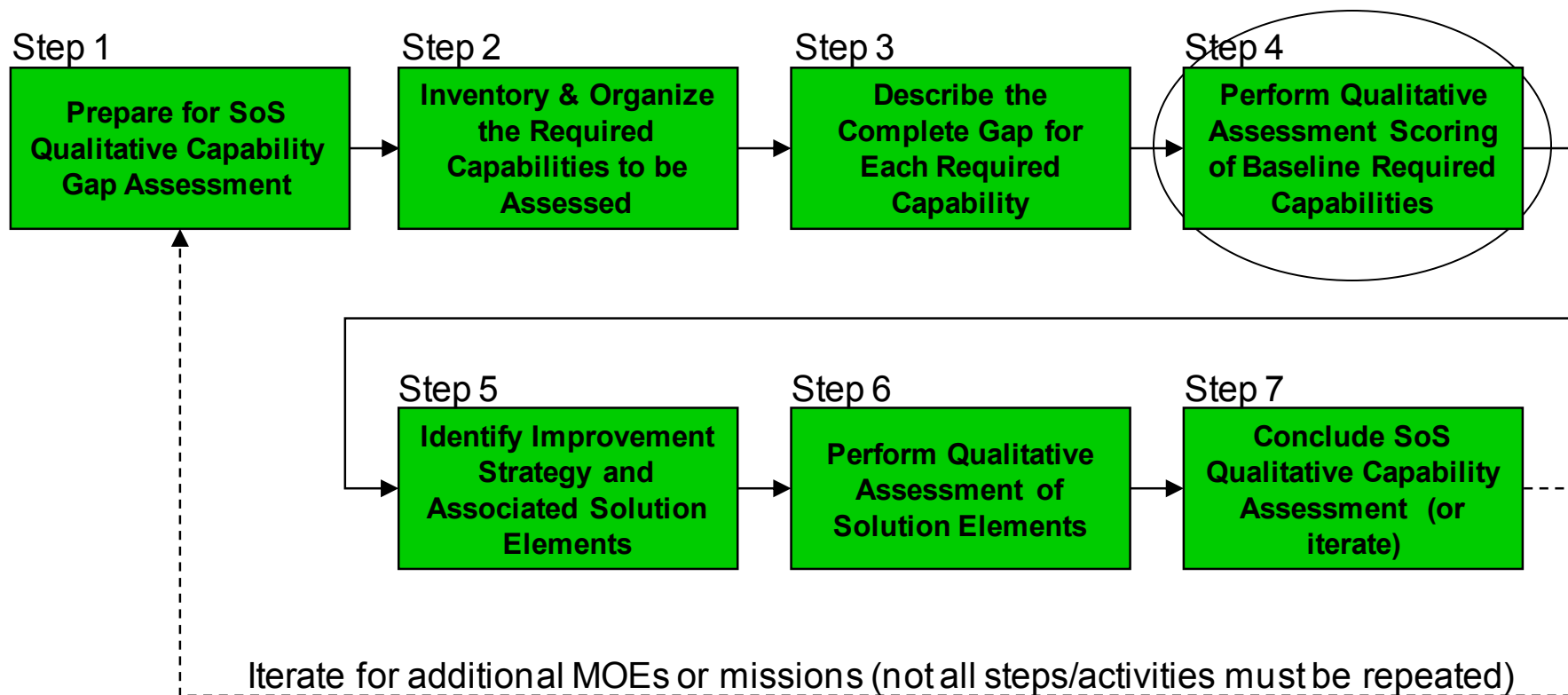
AF1.1.15: Unexploded ordnance detection

AF1.1.16: Chemical warfare agent (CWA) detection

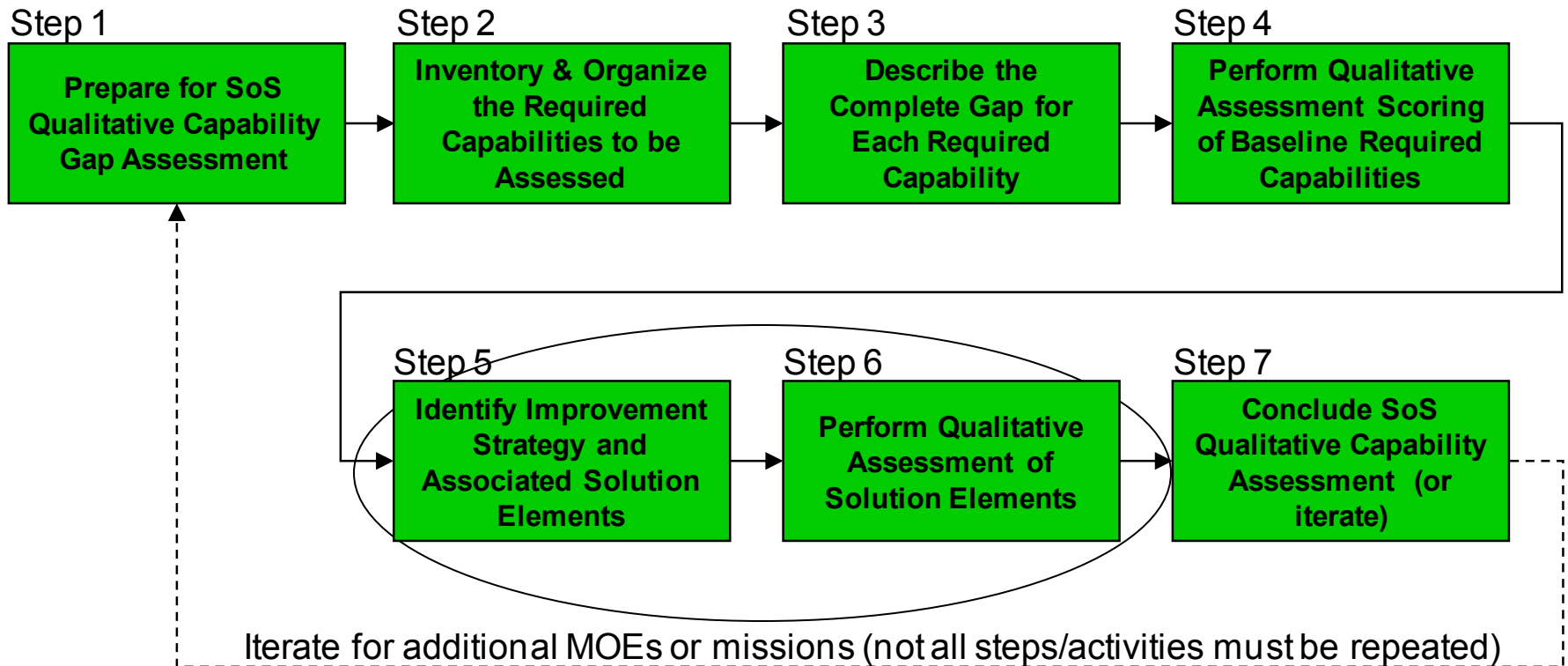
Select Mission: SSC-Mid Intensity (Di) Select Scoring Alternative: Baseline Tree Display Options: Unique Capability Nodes

Expand Tree Collapse Tree Percent Complete: 98.7%

Suggested approach for SoS Qualitative Capability Gap Assessment



Suggested approach for SoS Qualitative Capability Gap Assessment



Solution Element Association and Scoring of Impact on Capability

GAP Relationship & Integration Planning Tool - SCORING UTILITY

GRIP - SCORING UTILITY

Mission: SSC-Mid Intensity (Disabling) Alternative: Materiel Only

- AF3.3.4: Other explosive threat (e.g., IEDs, booby traps)
- AF3.3.5: Unexploded ordnance (UXO) disposal or deactivation
- AF3.3.6: Obstacle clearing, breaching, and/or crossing
- AF3.3.7: Obstacle clearing, breaching, and/or crossing
- AF3.3.8: Counter-sniper / counter-defiladed position
- AF3.4: Apply force
 - AF3.4.1: Ground combat platform direct-fire lethality - KE
 - AF3.4.2: Ground combat platform direct-fire lethality - HE
 - AF3.4.3: Ground combat platform tactical direct-fire non-lethal
 - AF3.4.4: Ground combat platform tactical direct-fire non-lethal
 - AF3.4.5: Dismounted soldier tactical direct-fire lethal
 - AF3.4.6: Dismounted soldier tactical direct-fire non-lethal
 - AF3.4.7: Precision munitions
 - AF3.4.8: BLOS cooperative engagement (sensor/shoot)
 - AF3.4.9: Combat aviation support
 - AF3.4.10: Ground combat platform indirect-fire lethality
 - AF3.4.11: Ground combat platform tactical indirect-fire non-lethal
 - AF3.4.12: Dismounted soldier tactical indirect-fire lethal
 - AF3.4.13: Dismounted soldier tactical indirect-fire non-lethal
- AF3.5: Sustain force
 - AF3.5.1: POL and water distribution
 - AF3.5.2: Standard supplies distribution (port to foxhole)
 - AF3.5.3: Fulfillment of sustainment demands - materiel
 - AF3.5.4: Aerial resupply (airlift)
 - AF3.5.5: Pulsed sustainment

Selected Node Data

AF3.4.1: Ground combat platform direct-fire lethality - KE

Unique Capability Scores

Importance Factor: Baseline Effectiveness: Alternative Effectiveness: Scoring Guidance:

Unique Capability Solutions

Solution Name	Score	Domain	CDDs	Metrics	Variables	TRL
Solution Element 1	+0.6	M				
Solution Element 2	-0.5	M				
Solution Element 3	+1.2	M				
EXAMPLE DATA						

Associate Solution w/ UC Remove Solution From UC Solution Links

Decrease Increase Adjustment +1.3

Scoring Summary

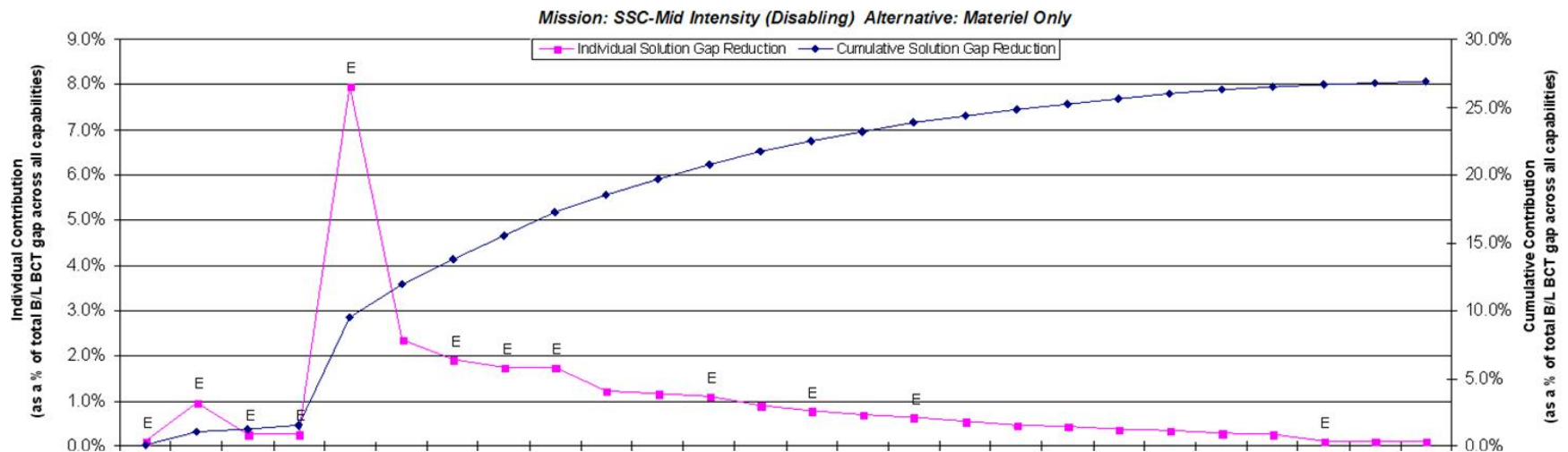
Effectiveness Score:	Converted Utility Score:	Opportunity Score:	Weighted Utility Score:	Normalized Imp. Factor:

Data Entry Complete ☒

Select Mission: SSC-Mid Intensity (Disabling) Select Scoring Alternative: Materiel Only Tree Display Options: Unique Capability Nodes

Expand Tree Collapse Tree Percent Complete: 82.1%

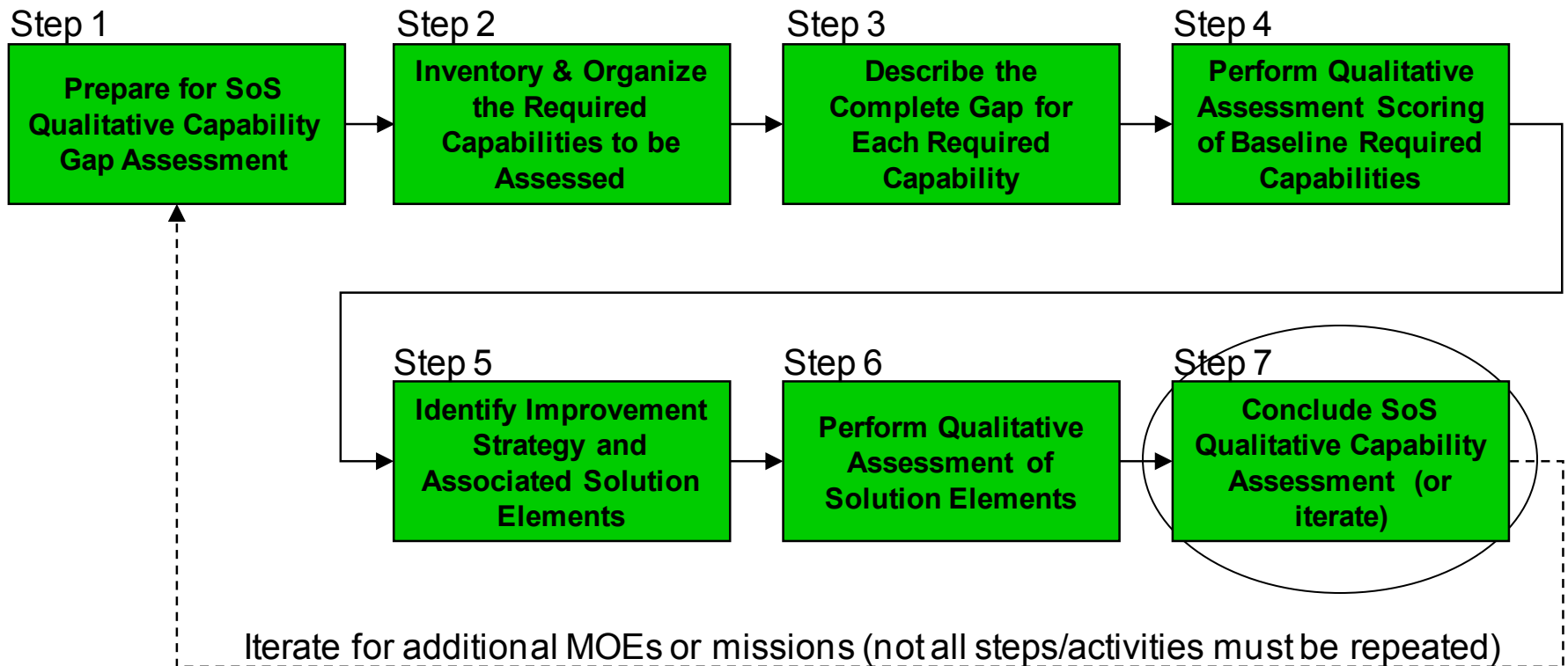
Solution Ranking Accounting for Precedence Relationships



Solution Elements →

Note: "E" denotes that this solution is an enabler for another solution in the chart.

Suggested approach for SoS Qualitative Capability Gap Assessment



Accomplishments

- Successfully distilled the CNA RCs and capability gaps
- Developed an effective analysis framework
- GRIP facilitated the cross-correlation of data previously maintained separately
- Quality of work motivated SME participation without a tasker
- Workshops were very aggressive and productive
- Helped to shift the paradigm from platforms to the BCT (SoS) level
- Supported development of the Capabilities Description Document (CDD)
- Provided prioritized solutions based on gap closure while accounting for the critical enablers

Lessons Learned

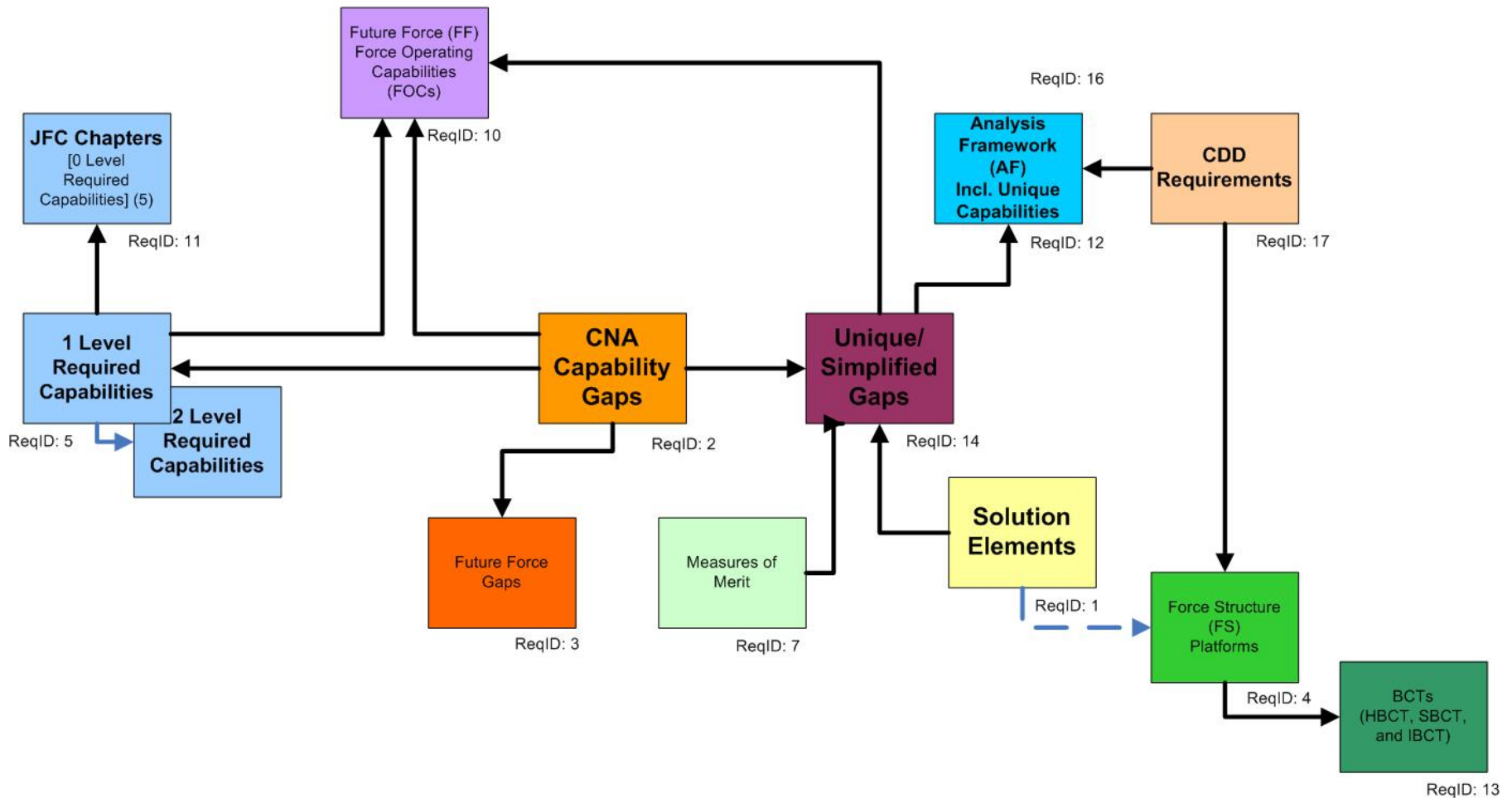
- Committed support & teaming
- Defining the mission
- Information updates
- Utility function
- Accounting for solution precedence relationships
- SoS level assessment results
- Workshops
- Tools

Conclusion

- This capability assessment and prioritization approach can be applied to almost any enterprise
- Provides the ability to:
 - Identify and measure capability gaps in the context of a mission
 - Evaluate and prioritize solutions
 - Produce analysis results to support a deliberate path forward
- GRIP
 - Cross-correlates and helps to integrate formerly disparate data
 - Enables aggressive and productive workshops
 - Contains the algorithms necessary to apply utility theory
 - Produces reports that underpin the enterprise's investment decisions

Back Up

Partial GRIP Data Relationship Schema



What is a System-of-Systems?

A System-of-Systems (SoS) is an assemblage of components which individually may be regarded as systems and possess three additional properties:

1. Operational independence of the components: If the System-of-Systems is disassembled into its component systems, the component systems must be able to operate independently. That is, the component systems fulfill customer or operator purposes on their own.
2. Managerial independence of the components: The component systems not only *can* operate independently, they *do* operate independently. Component systems are separately acquired and integrated, and maintain a continuing operating existence independent of the System-of-Systems.
3. Collective Behavior: The systems interact in a manner providing greater performance than the sum of the individual systems.

A SoS can be viewed as multiple systems, each capable of independent operations, but must interact in order to fulfill a global mission.

Understanding a System-of-Systems

- Key to understanding a SoS is the notion that a SoS performs a function not possible with any or all of the individual systems acting independently
- In this context, a SoS can be viewed as a collection of interdependent systems that are integrated to provide an enhanced capability
- The loss of individual systems within the SoS will degrade the performance or capabilities of the SoS
- However, individual systems within the SoS can provide a capability or function independent of the other systems within the SoS

System-of-Systems Attributes

Typical attributes that distinguish an assemblage of Systems as a System-of-Systems:

- Large trade space exploration/optimization
- High-degree of functional redundancies
- Extensive communications & data networks
- High-degree of interdependencies
- Typically includes a large number of individual systems