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Alternative Designs for a Joint Command,  
Control, Communications, Computers, and  
Intelligence (C4I) Capability Certification  
Management (JC3M) System / 13th ICCRTS

Miller, Gregory A.

Monterey California. Naval Postgraduate School

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# Alternative Designs for a Joint C4I Capability Certification Management (JC3M) System

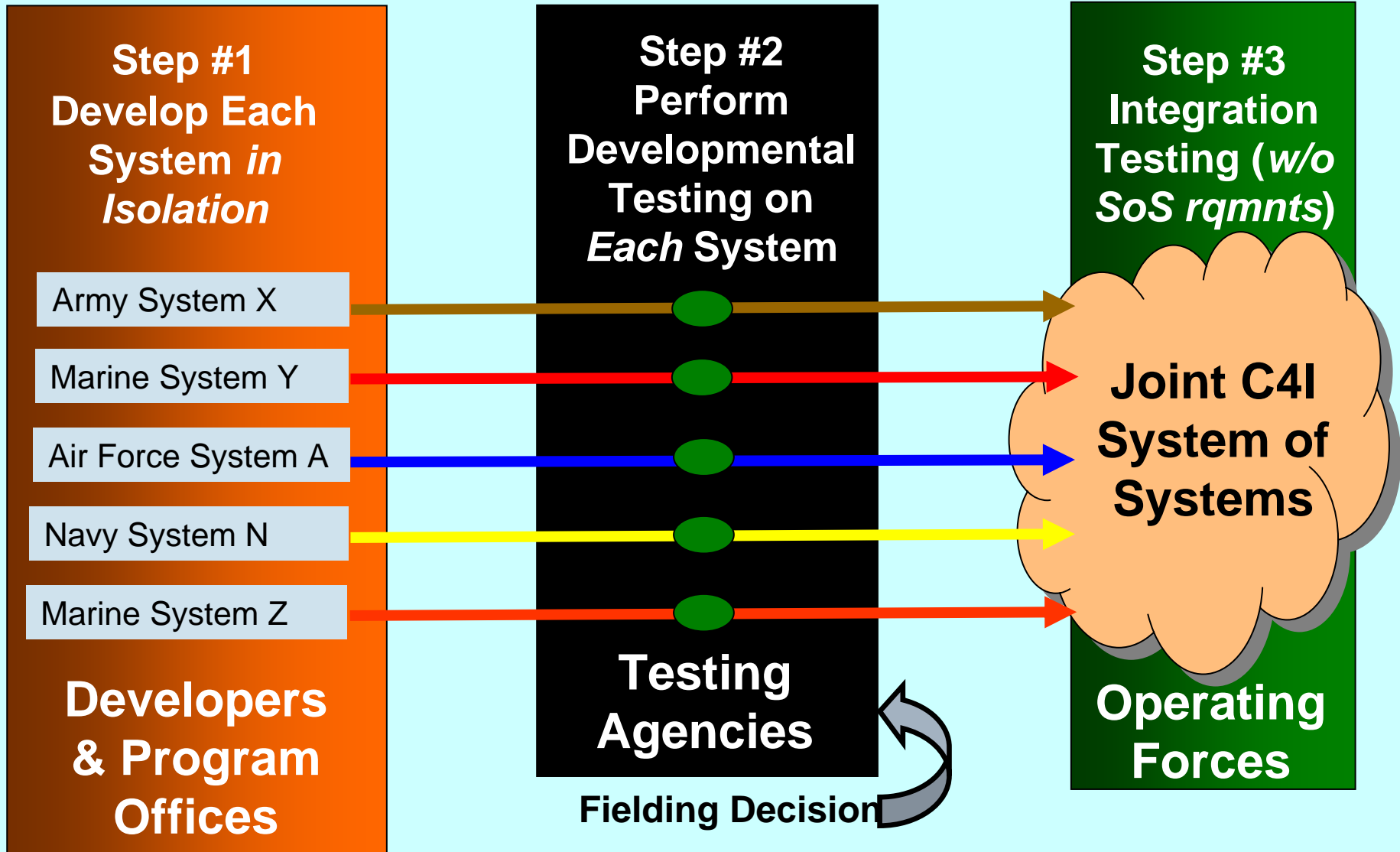
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A Student Project

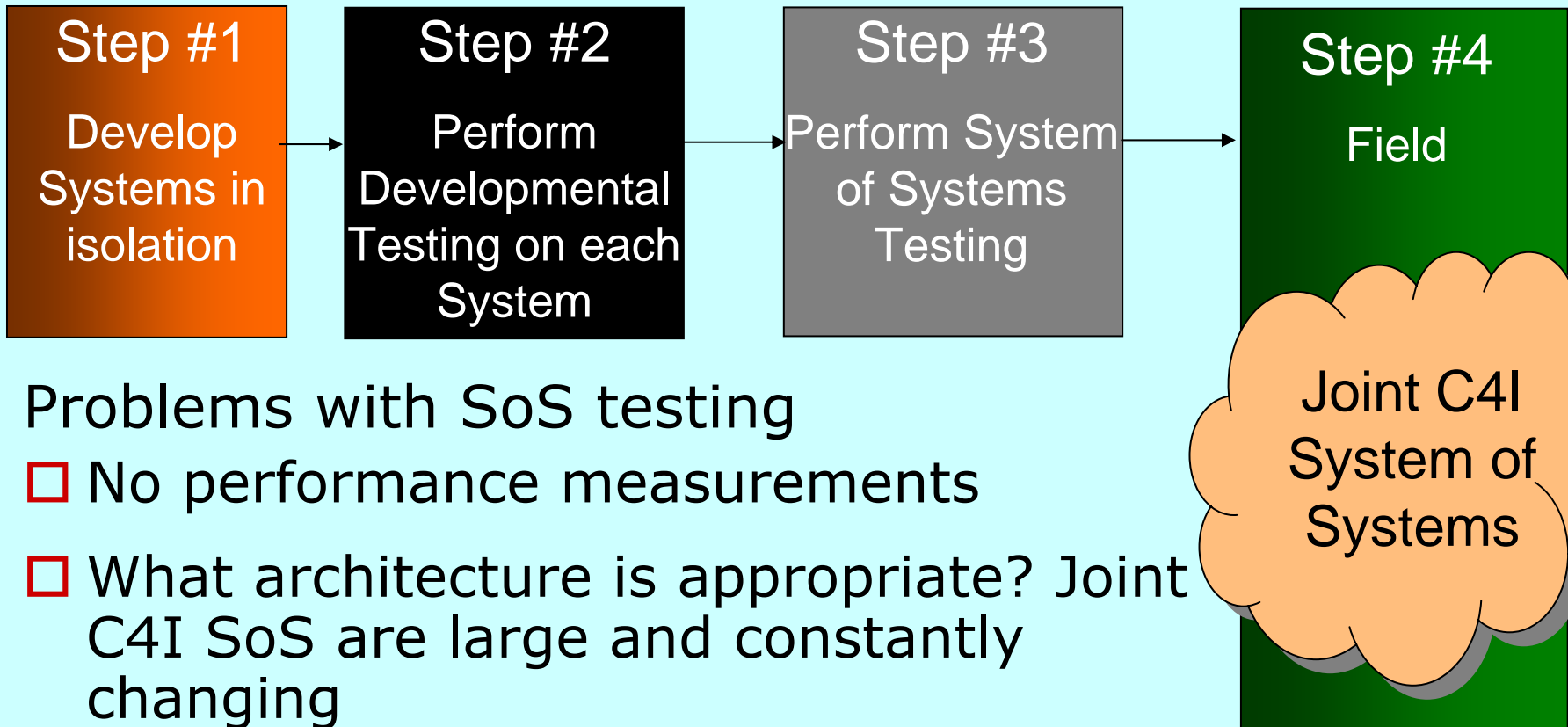
Gregory A. Miller  
Naval Postgraduate School  
Monterey, CA

Paper 046

# Motivation: Acquisition system & SoS integration needs



# Current SoS Testing and Fielding



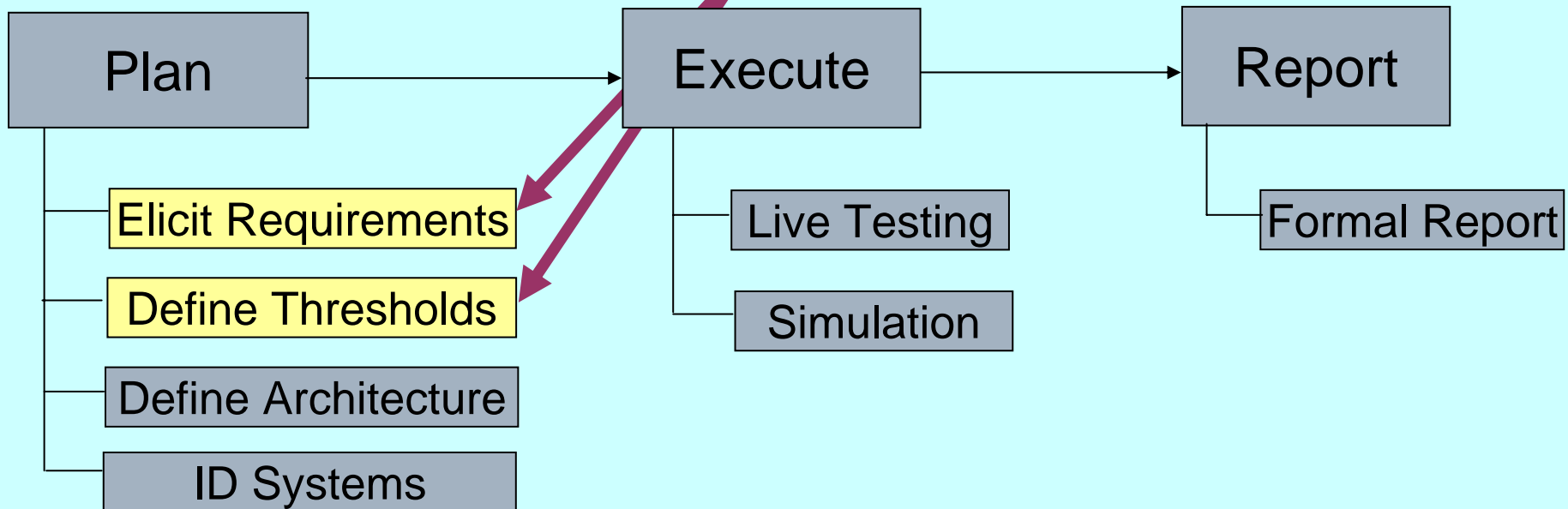
## Problems with SoS testing

- ❑ No performance measurements
- ❑ What architecture is appropriate? Joint C4I SoS are large and constantly changing
- ❑ Testing every SoS function is impossible
- ❑ Hard to determine what failure is since quality of service requirements change

# What is the Real Problem?



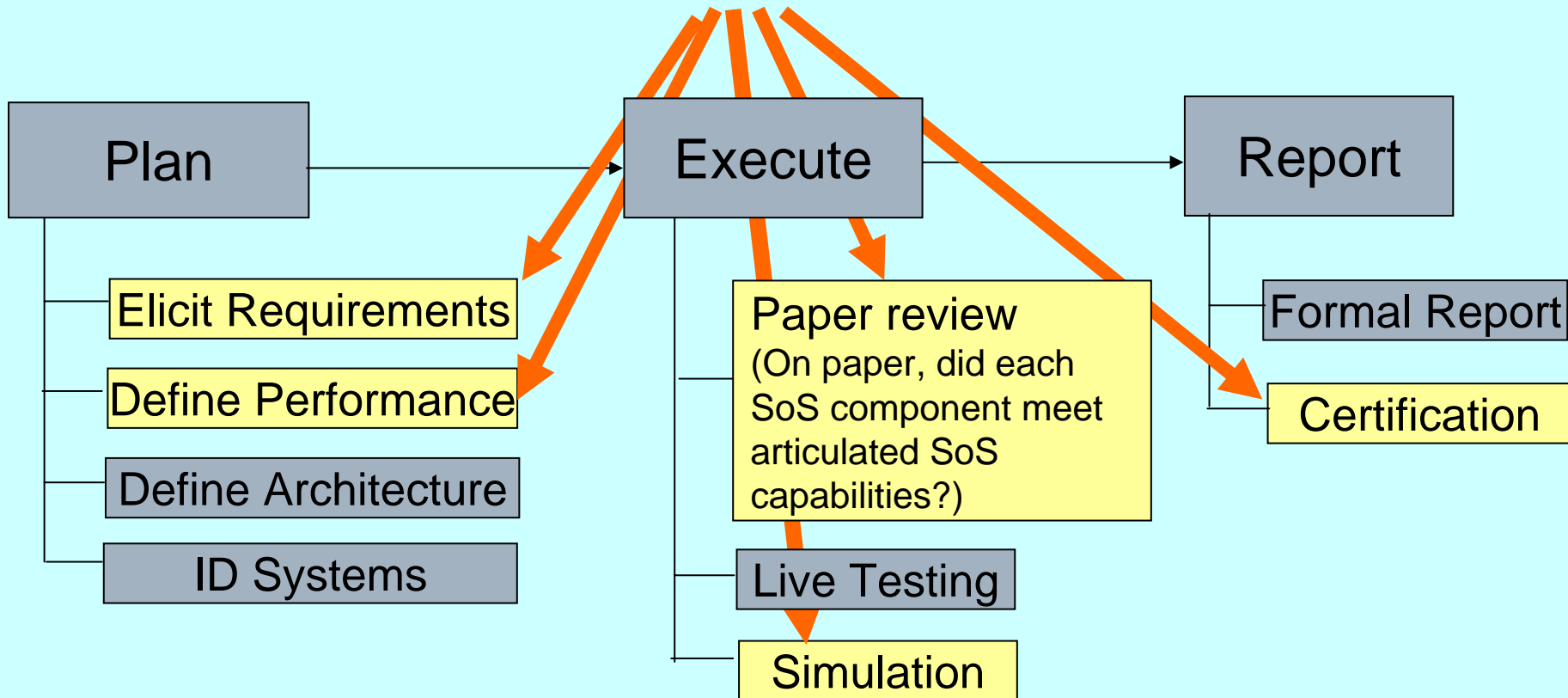
Is it that DoD does not define performance measures for Joint C4I SoS?



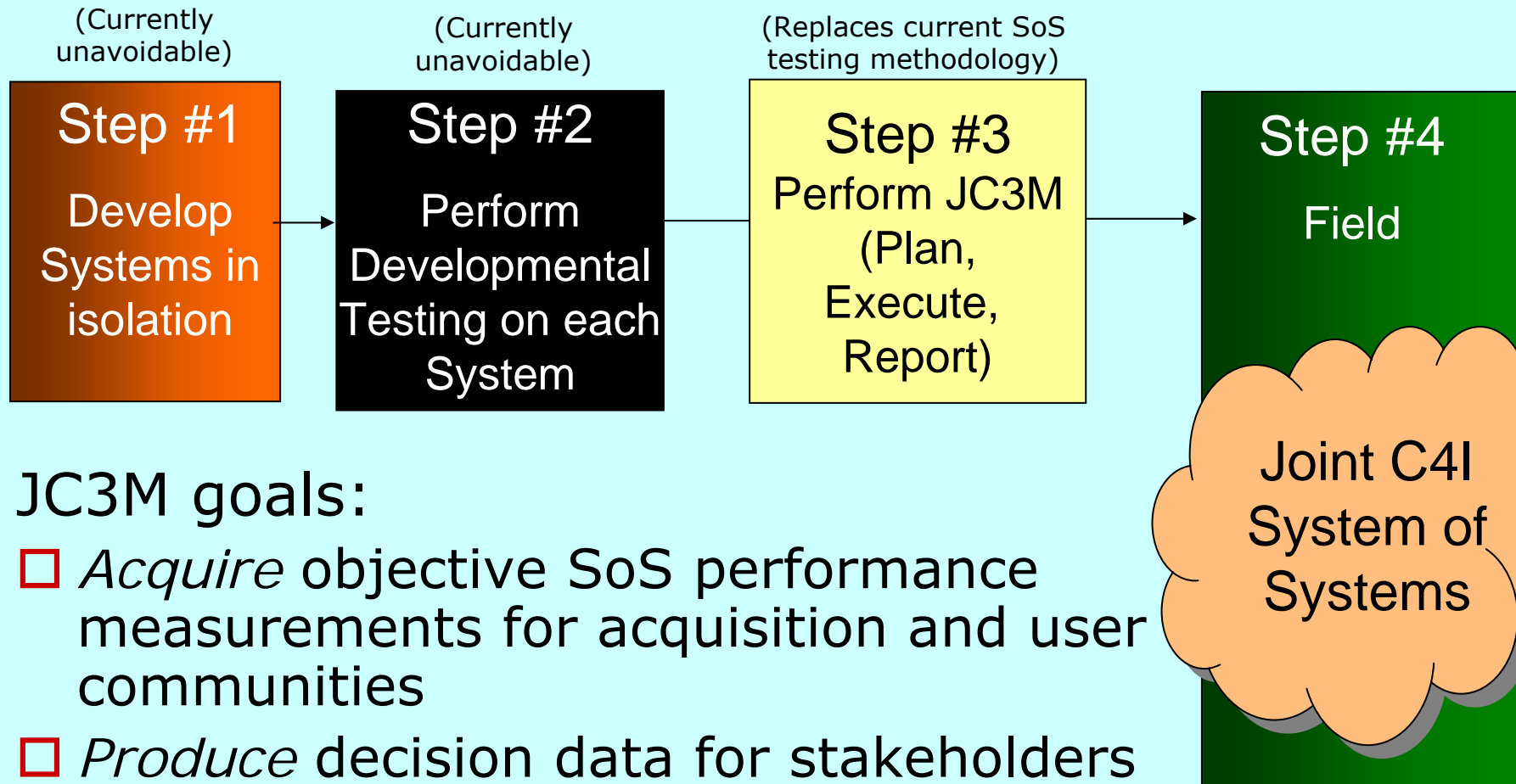
# What's the Solution?



Develop a System that articulates SoS capabilities, determines whether SoS as a whole supports these capabilities, and reports the results



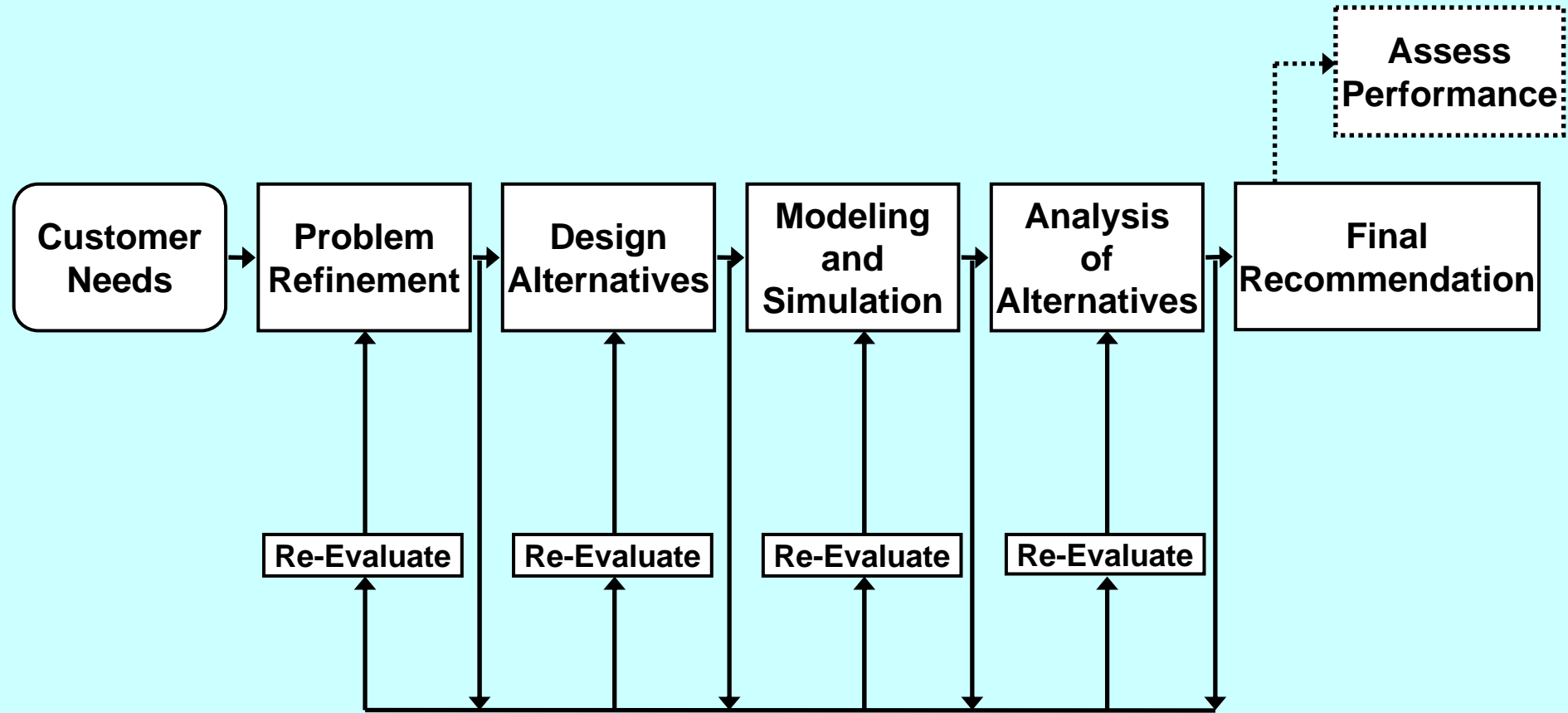
# JC3M in Testing and Fielding



## JC3M goals:

- ❑ *Acquire* objective SoS performance measurements for acquisition and user communities
- ❑ *Produce* decision data for stakeholders
- ❑ *Provide* confidence in SoS performance for users

# Systems Engineering Process



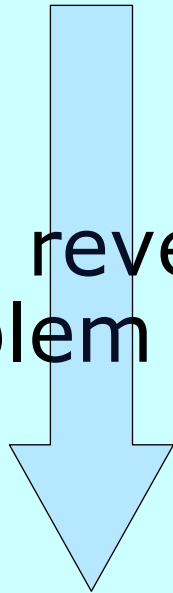


# Revised Problem Statement

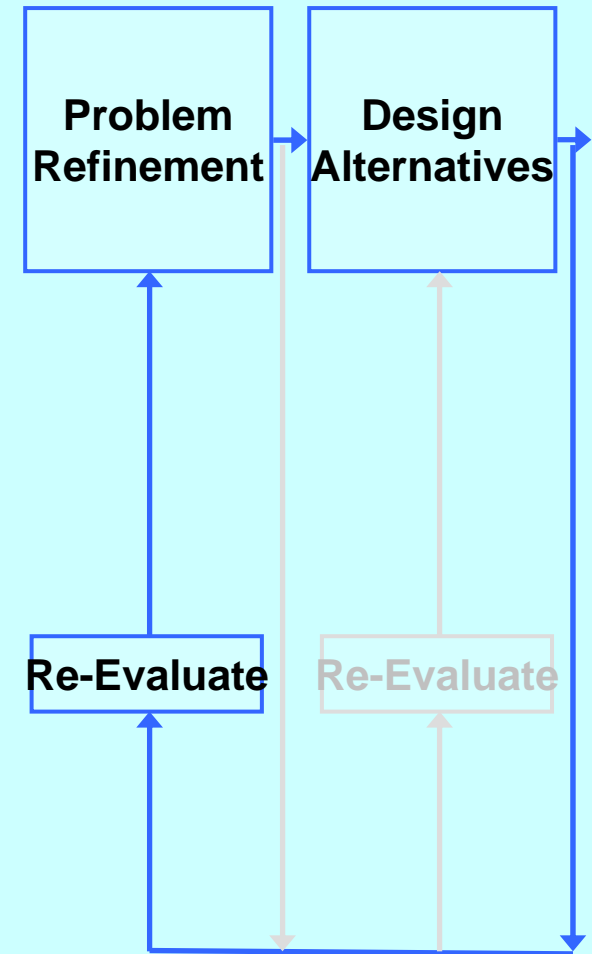


- Original problem focus:
  - Define Threshold Values

- Research revealed the true problem ...



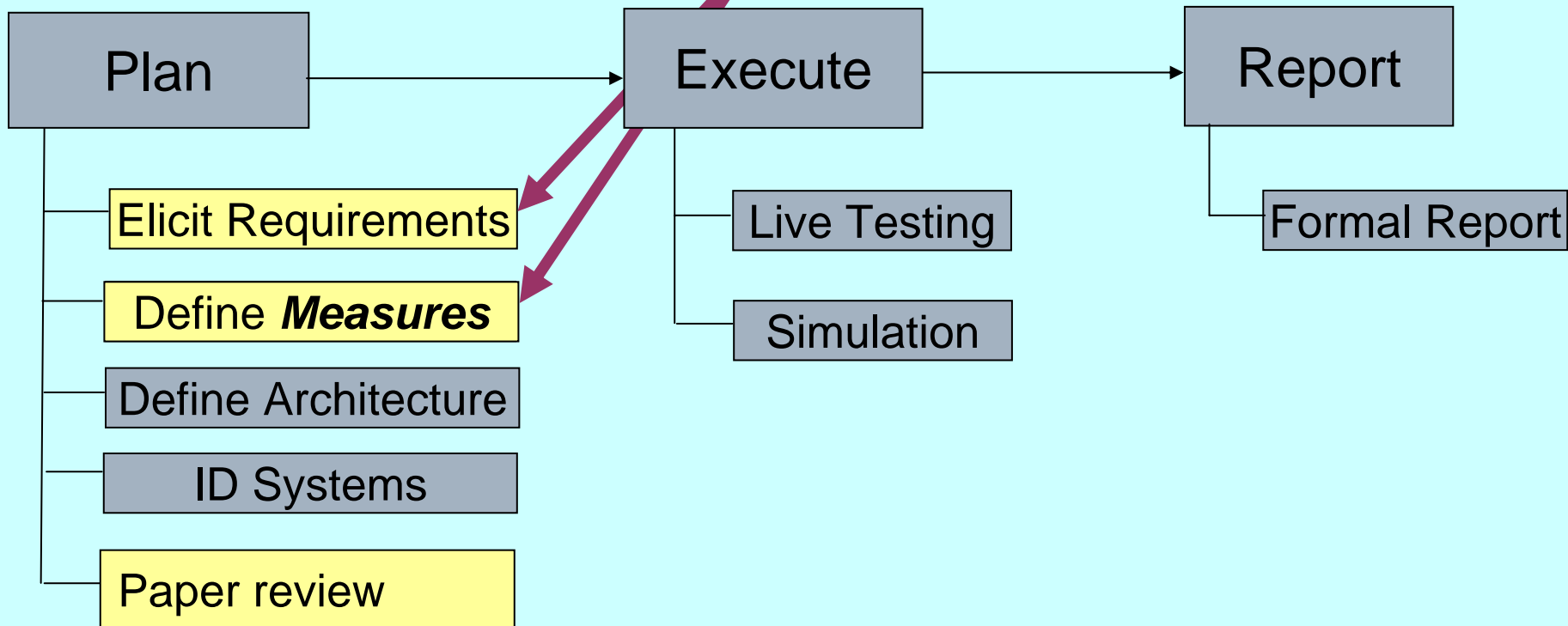
- Refined problem focus:
  - Define measures to be evaluated



# Revised Problem



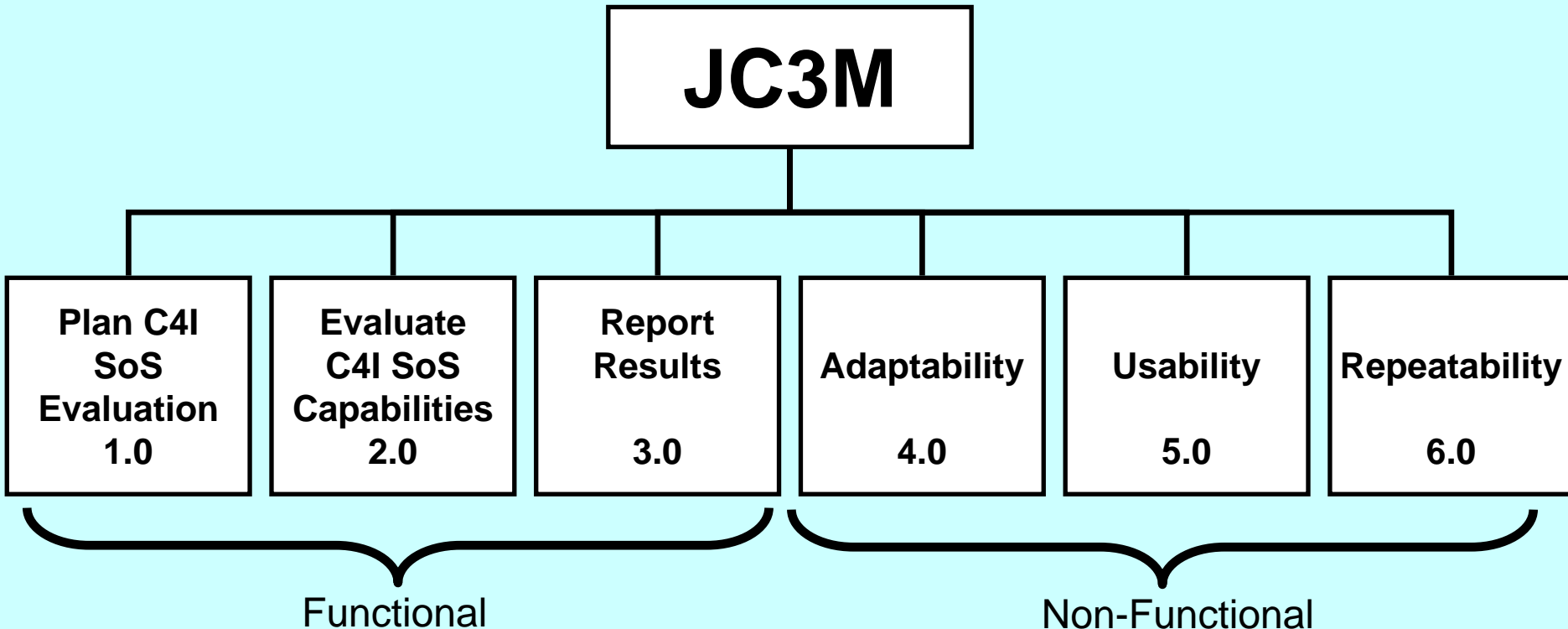
Define performance measures for Joint C4I SoS



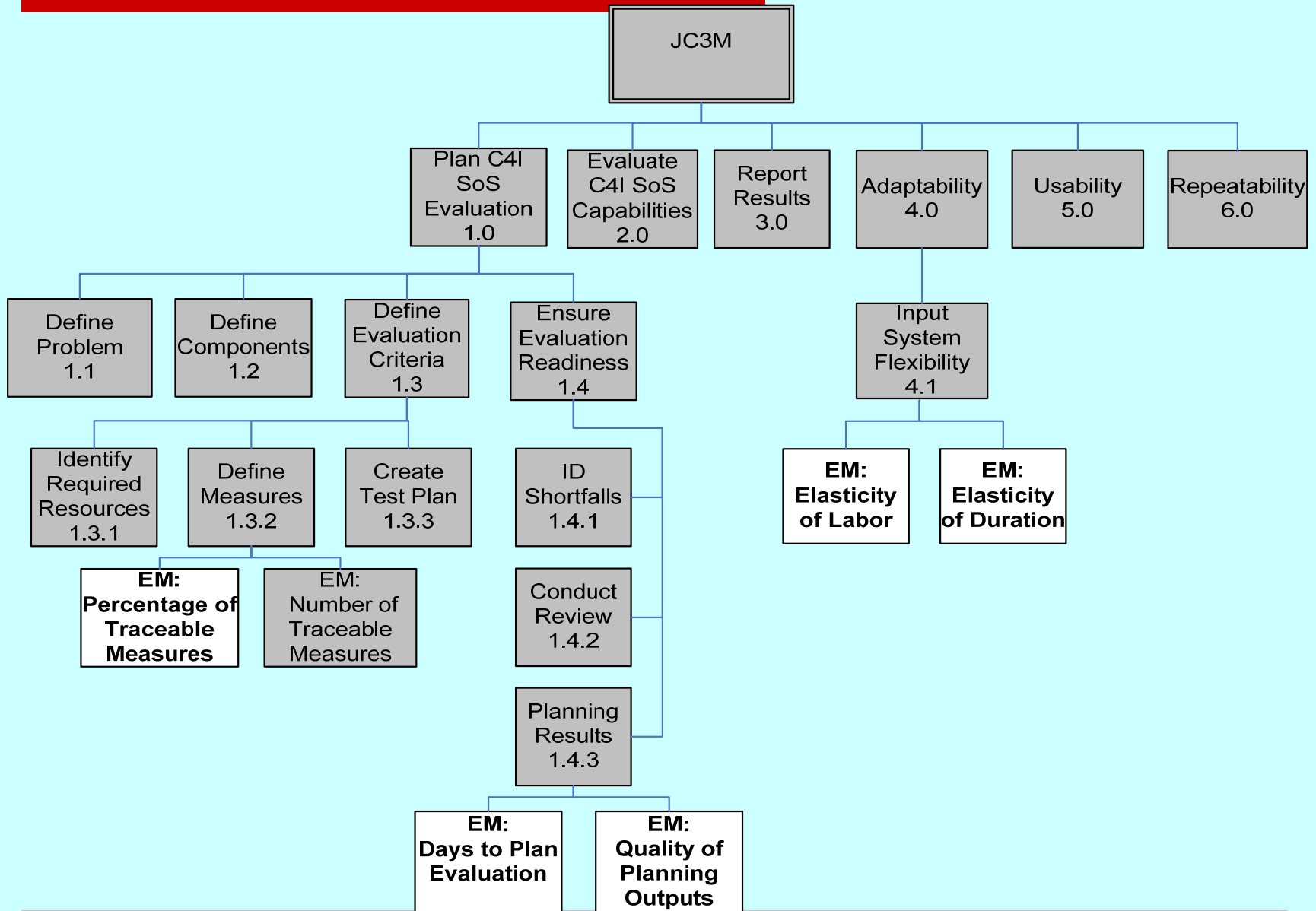
# JC3M Value Hierarchy



- ❑ Developed from refined problem statement
- ❑ Based on stakeholder analysis



# JC3M Value Hierarchy



# Alternatives

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FEDOS

MC3T

JTEM -CTM

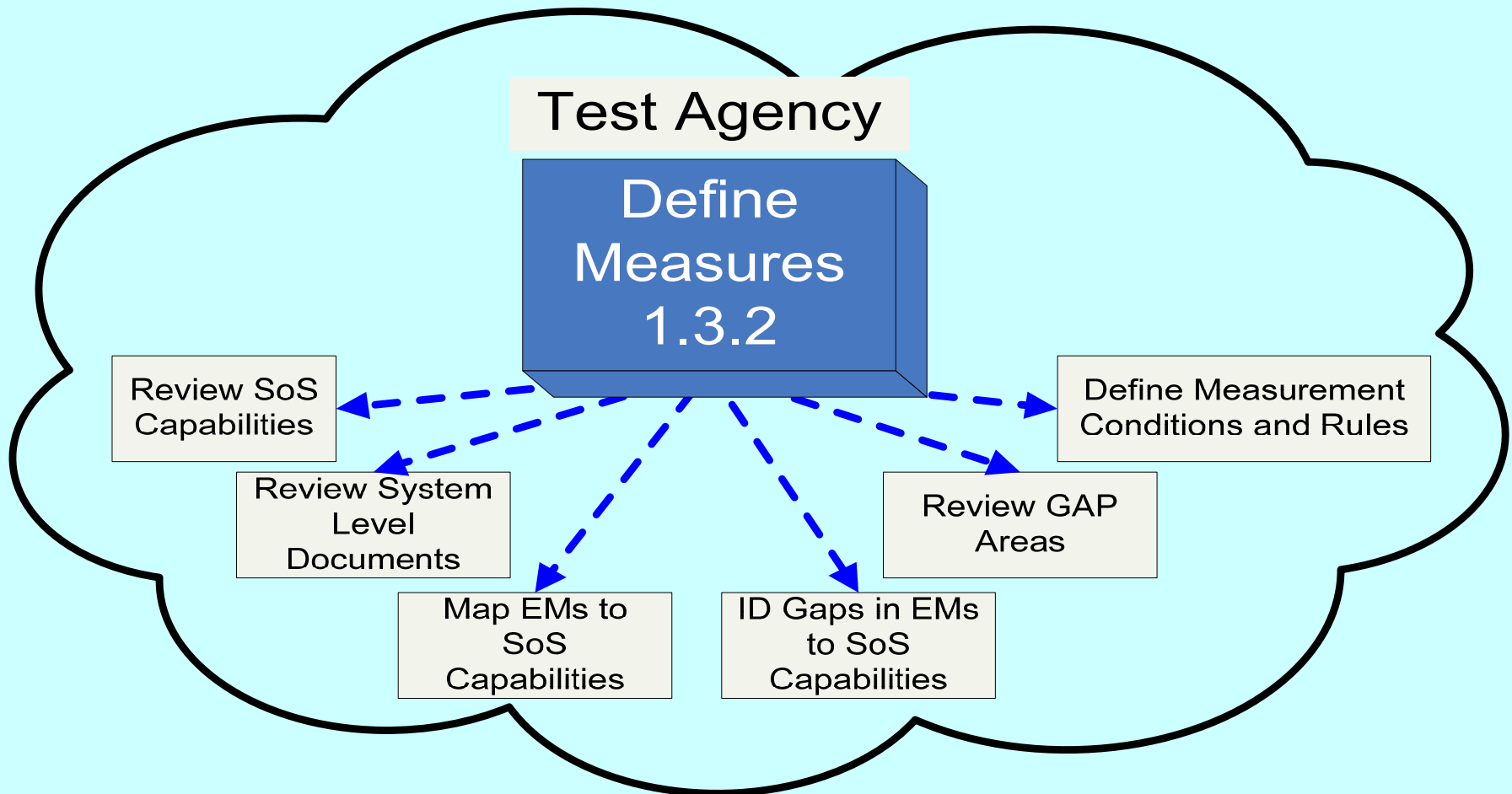
Alternative #1

Alternative #2

# Alternative #1



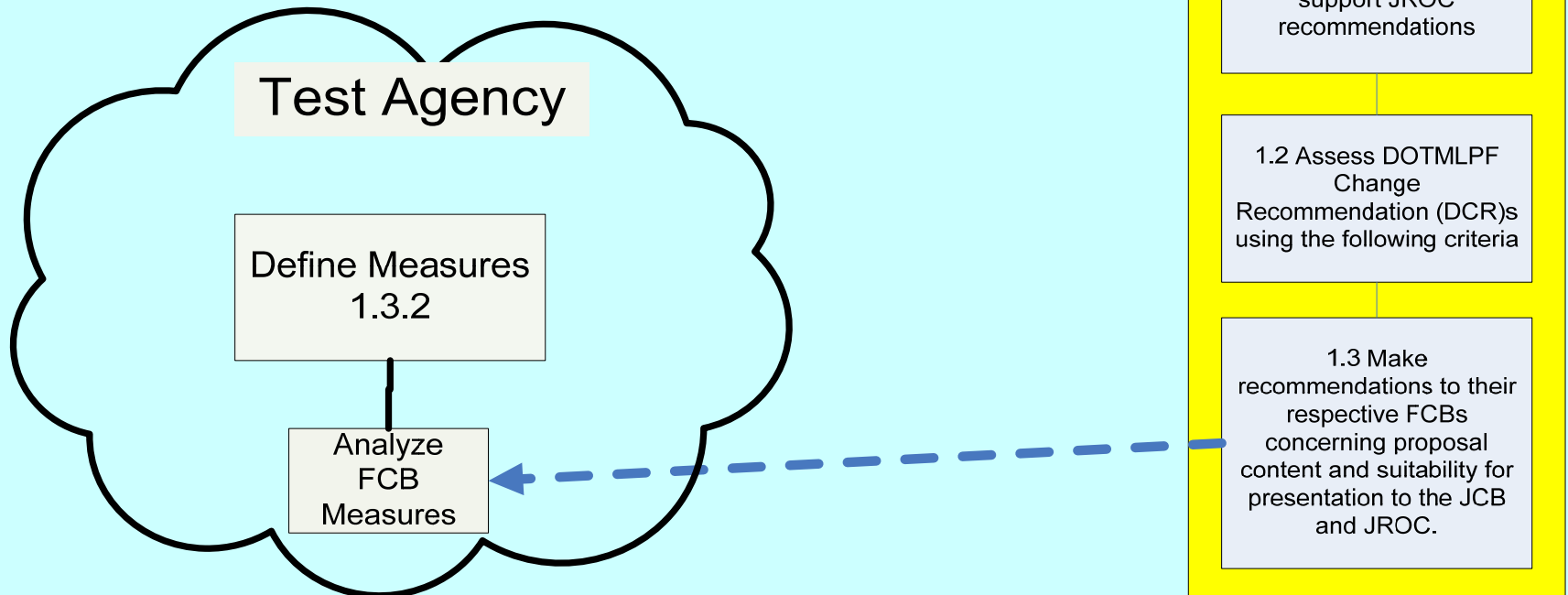
## "System Capabilities Review (SCR)"



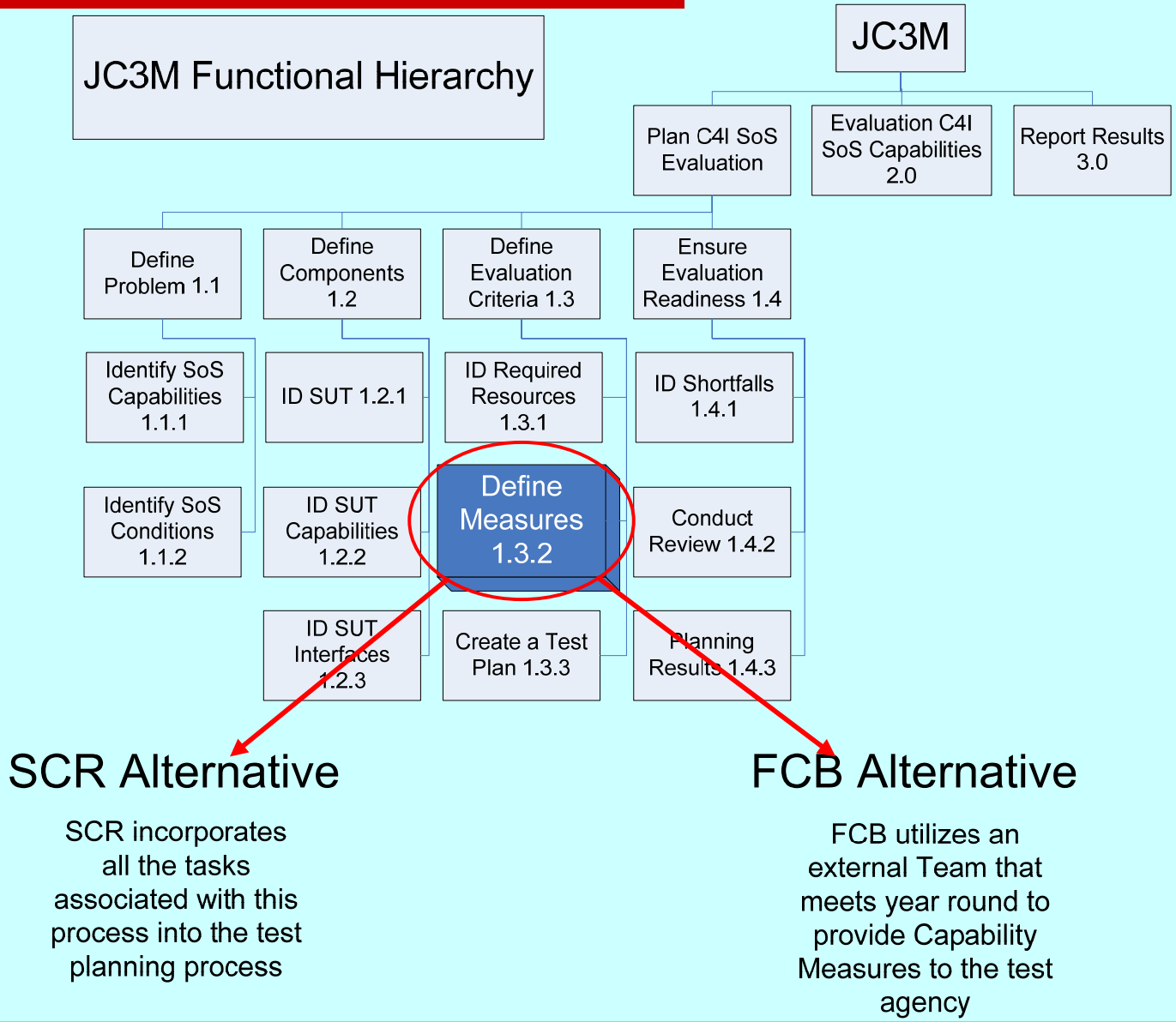
# Alternative #2



## “Functional Capability Board (FCB)”



# Differences





# Alternatives Summary

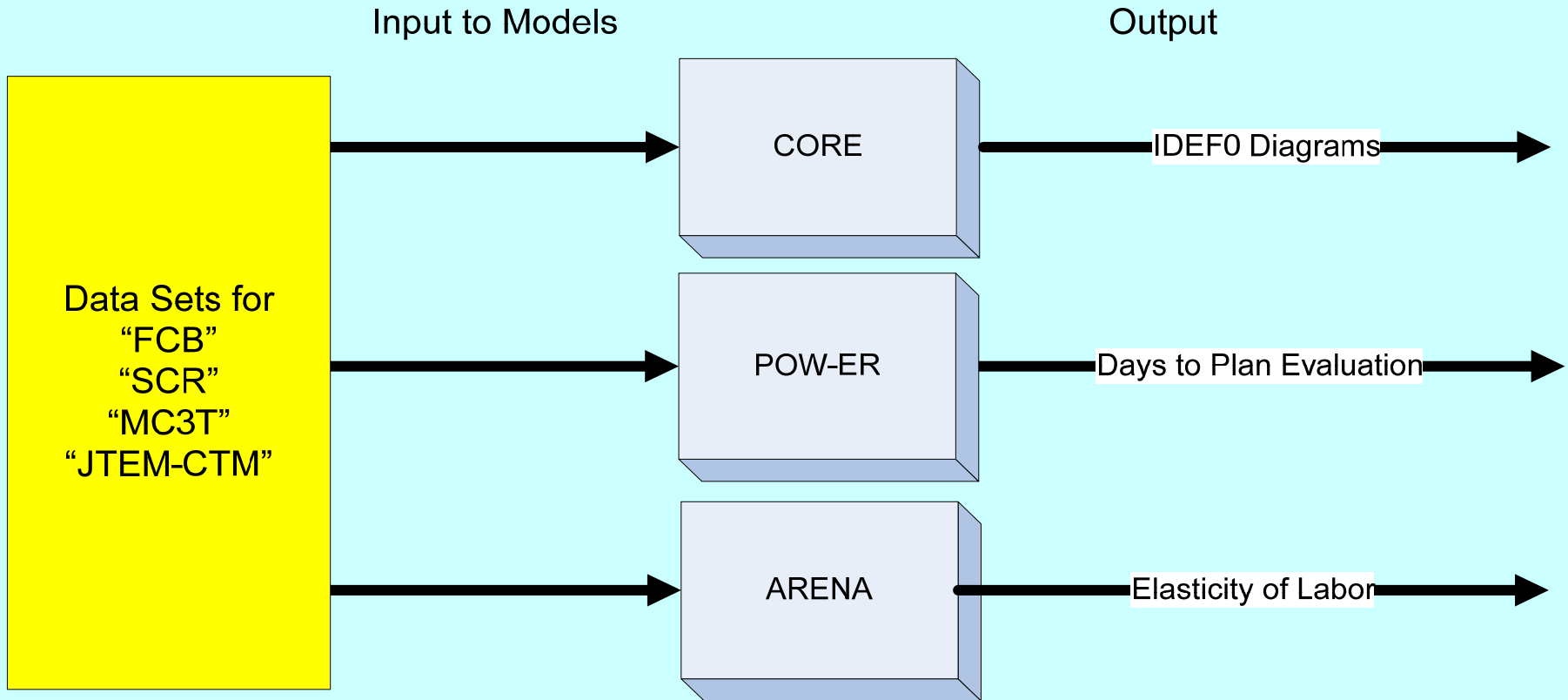


	Personnel	Use	Scope	Measures
<b>FEDOS</b>	Internal	Past	Service <b><u>test</u></b>	<b><u>Stakeholder agreement</u></b>
<b>MC3T</b>	Internal + External	Proof of concept	Service system <b><u>certification</u></b>	Doctrine developers & stakeholders
<b>JTEM CTM</b>	Internal	Model	Joint <b><u>Mission Effectiveness</u></b> Assessment	Doctrine, System documentation
<b>SCR</b>	Internal	Proposed	<b><u>Joint</u></b> capability assessment	Doctrine, System documentation
<b>FCB</b>	Internal + External	Proposed	<b><u>Joint</u></b> capability assessment	<b><u>C4I SME panel</u></b>

# Fill in the blanks!

	Percentage of Traceable Measures	Days to Plan Evaluation	Quality of Planning Outputs	Elasticity of Labor	Elasticity of Duration
Alternatives	<b>EM #1: 1.3.2</b>	<b>EM #2: 1.4.3</b>	<b>EM #3: 1.4.3</b>	<b>EM #4: 4.1</b>	<b>EM #5: 4.1</b>
FEDOS					
MC3T					
JTEM - CTM					
FCB					
SCR	Offline Evaluation	POW-ER	Offline Evaluation	Arena	

# M&S Overview



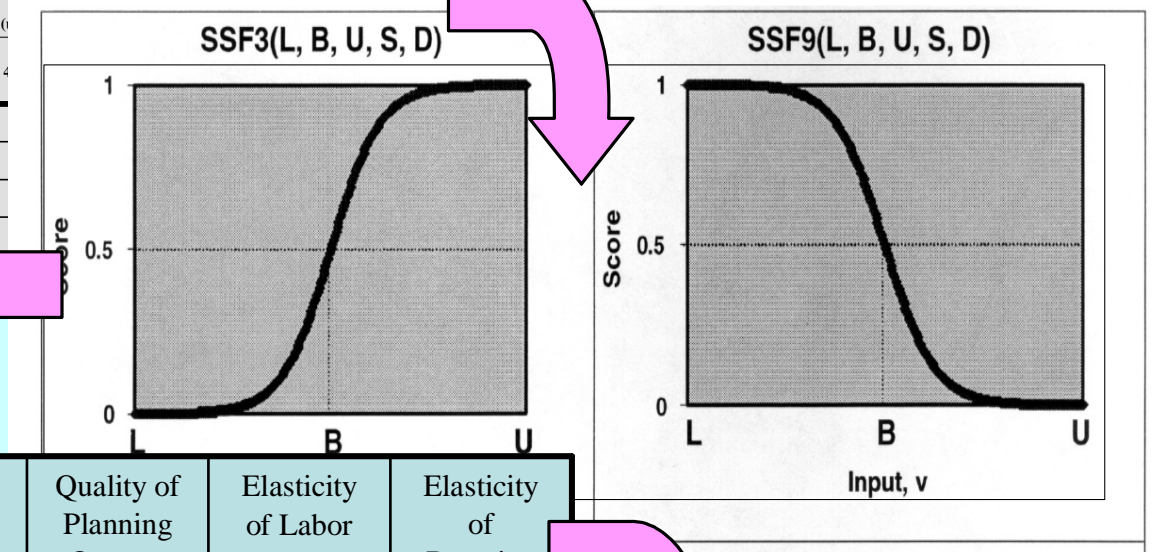
# Complete EM



	Percentage Traceable Measures %	Days to Plan Evaluation Days	Planning Output Quality Likert Scale 1-4	Labor Elasticity Unitless	Duration Elasticity Unitless
<b>Ideal Value</b>	<b>100%</b>	<b>Less is better</b>	<b>4 is Ideal</b>	<b>Less is better</b>	<b>Less is better</b>
FEDOS	0	140	3.17	0.87	0.87
MC3T	72	121	3.25	0.78	0.78
JTEM CTM	<b>92</b>	<b>73</b>	<b>3.42</b>	1.04	0.83
SCR	<b>92</b>	158	3.00	0.98	0.98
FCB	88	127	2.75	<b>0.72</b>	<b>0.72</b>

# Value Modeling Overview

	Percentage of Traceable Measures (%)	Days to Plan Evaluation (Days)	Quality of Planning Outputs	Elasticity of Labor	Elasticity of Duration
<b>Ideal Value</b>	100%	Less is better			
FEDOS	0	140			
MC3T	72	121			
JTEM CTM	92	73			
SCR	88	127			
FCB	92	158			



	Percentage of Traceable Measures	Days to Plan Evaluation	Quality of Planning Outputs	Elasticity of Labor	Elasticity of Duration	Quality of Planning Outputs	Elasticity of Labor	Elasticity of Duration	Overall Utility (0 - 1)
<b>EM Weights</b>	<b>0.248</b>	<b>0.058</b>							
FEDOS	0.00	0.04	0.39	0.06	0.14				0.63
MC3T	0.02	0.05	0.39	0.07	0.16				0.71
JTEM CTM	0.24	0.06	0.40	0.04	0.15				0.89
SCR	0.24	0.02	0.37	0.05	0.10				0.79
FCB	0.22	0.05	0.34	0.08	0.18				0.87

Translation of raw measurements into a normalized set of weighted values that can be added.

# LCCE – Cost Summary



Alternatives	Life-Cycle Year					Total Cost (\$)
	1	2	3	4...9	10	
FEDOS	1,052,527	419,497	419,497	419,497	52,200	<b>5,010,706</b>
MC3T	1,169,414	525,537	525,537	525,537	52,200	<b>5,975,913</b>
JTEM-CTM	1,030,000	2,470,000	1,169,414	558,535	52,200	<b>6,972,824</b>
FCB	2,323,117	650,223	650,223	650,223	52,200	<b>8,127,101</b>
SCR	2,121,421	624,451	624,451	624,451	52,200	<b>7,719,232</b>

Interpretation: The delta between the highest and lowest LCCE  $\approx$  \$3M, which is not a significant sum over a ten year span.

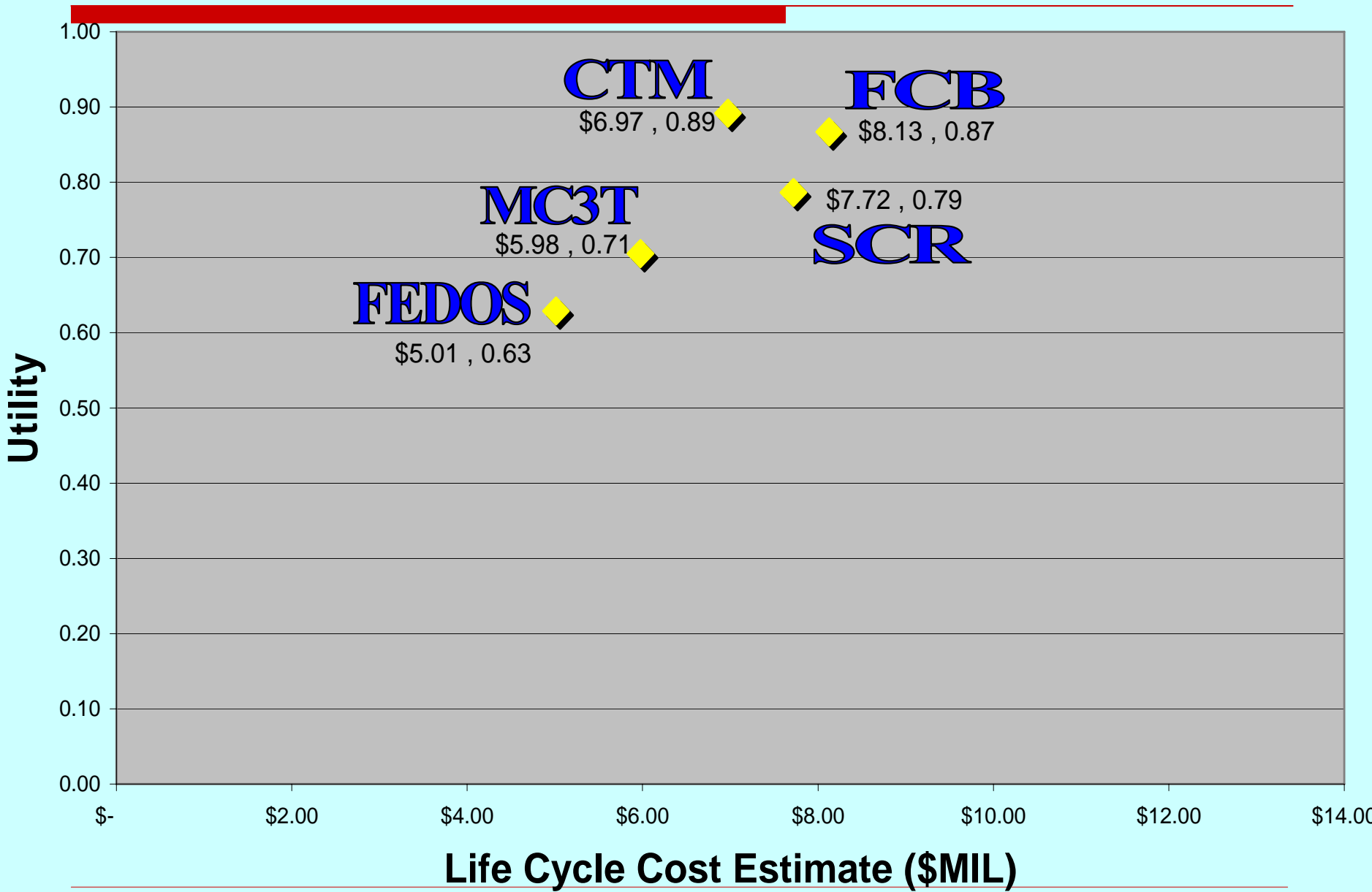
# Utility & LCCE



	Percentage of Traceable Measures	Days to Plan Evaluation	Quality of Planning Outputs	Elasticity of Labor	Elasticity of Duration	Overall Utility (0 – 1)	LCCE (\$ M)
FEDOS	0.00	0.04	0.39	0.06	0.14	0.63	5.01
MC3T	0.02	0.05	0.39	0.07	0.17	0.71	5.98
JTEM CTM	0.24	0.06	0.40	0.04	0.15	0.89	6.97
SCR	0.24	0.02	0.37	0.05	0.10	0.79	7.72
FCB	0.22	0.05	0.34	0.08	0.18	0.87	8.13

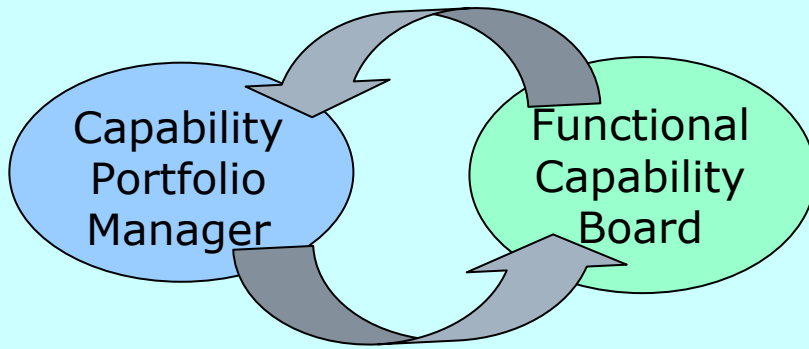


# LCCE vs Utility





# Way Ahead: 3 areas



Likelihood ↑

