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INCOSE AFFORDABILITY WORKING GROUP

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INCOSE AFFWG Vision

- This Affordability Working Group's goal is to enhance the Systems Engineering Affordability body of knowledge.
  - The scope is to advance the state of the practice for Systems Engineering for Affordability across the Life Cycle. This includes defining the relative value of the system across the Total Life Cycle based on desired System capabilities.

A Tale of Two Hummers

Standard Issue Army Hummer – M1123 without Armor

- **$92,200 Unit Cost**
- 18000 Miles Between Maintenance Actions
- No Warranty
- No Diagnostics

Joe's Hummer - COTS

- **$30,000 Unit Cost (fully loaded)**
- 30000 Maintenance Free Period
- 100,000 Mile Warranty
- Embedded Vehicle Diagnostics
- Remote Diagnostics and Reports

Problem - How do we get to Affordable Solutions?

AFFWG Problem Space and Approach

- Approaches for Analysis of the Variables that contribute to Systems Engineering Trade Space that effect "cost of function".
- Identifying and providing guidance for the relevant trades across the life cycle especially during the system definition timeframe that impact the system affordability.
- Exploring new operational or support concepts.
- Reuse or refurbishment of existing systems.
- Optimizing a system based on cost of capability.
- Modeling and simulation of architectures for variable cost-performance points.

Desired Outcomes and Products

- Documentation of approaches for Analysis of the Variables that contribute to Systems Engineering Trade Space that effect "cost of function" in our future Guidebook.
- New operational or support concepts.
- Reuse or refurbishment of existing systems.
- Optimizing a system based on cost of capability.
- Modeling and simulation of architectures for variable cost-performance points.
- Identifying and providing guidance (service) for the relevant trades across the life cycle especially during the system definition timeframe that impact the system affordability.
- Mapping of tailored activities with INCOSE SE Handbook and applicable standards.
- Supplements to the INCOSE SE Handbook
- Technical communication to INCOSE membership through papers, Insight, journals, webinars.

Initial Direction and Areas currently being explored

- Working Definitions in the Context of Systems Engineering for Affordability
  - **Affordability Engineering** *is a process that enables companies to reduce costs and improve value throughout the whole life cycle of a product by the use of cost and schedule estimating , technical performance, and risk information, especially at the conceptual design stage.*
  - **Systems Affordability** *is the ability to design a system with the outcome attributes of cost effective capability over the Systems complete life cycle.*
    - Design effectiveness captured in Measures of Capability (MoCs) – how efficient does the system do what it was designed for? At what Cost?
    - O&S effectiveness captured in Operational Availability (A_o) – is the system available for use or not? At what Cost?
    - Mission Effectiveness is a function of Ao and MoCs.

System Affordability = cost of System Mission Effectiveness Over Its Complete Life Cycle

Specification of Affordability

- Budget
  - Identify budget elements (e.g., Development, Operations and Support) for this system to be included in the affordability specification
  - Define time phased overall budget, *or*
  - Define time phased budget for each of the elements
- Required Capabilities
  - Identify required capabilities and time phasing for inclusion of each of the capabilities
- Required Capabilities Performance
  - Identify required Measures of Effectiveness (MOEs) for each of the capabilities
  - Define time phasing for achieving each of the MOEs
  - Identify Measures of Suitability (MOSs)
  - Define time Phasing for achieving each of the MOSs

Affordability is specified at points in time by the required capability, associated performance and the budget constraint(s).

Trade Space Considerations The Variables required to determine Cost vs. Capability

Primary System functionality

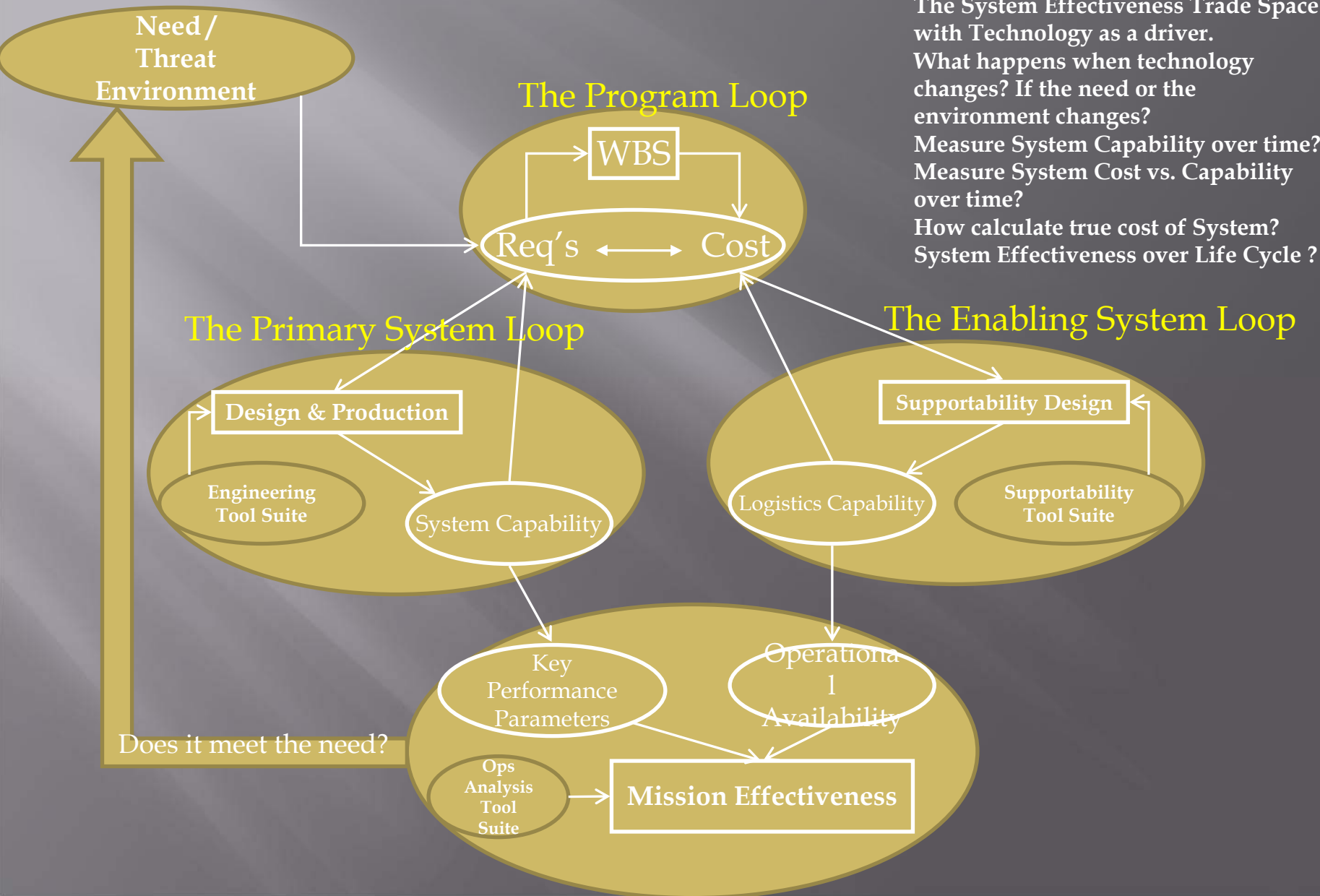
TOC as measurement

Enabling System Functionality

External and Temporal Boundary Variables

System Effectiveness = Cost of System Mission Capability over its Life Cycle

System Affordability / Mission Effectiveness Trade Space



The System Effectiveness Trade Space with Technology as a driver.
What happens when technology changes? If the need or the environment changes?
Measure System Capability over time?
Measure System Cost vs. Capability over time?
How calculate true cost of System?
System Effectiveness over Life Cycle ?

System Affordability V

Open

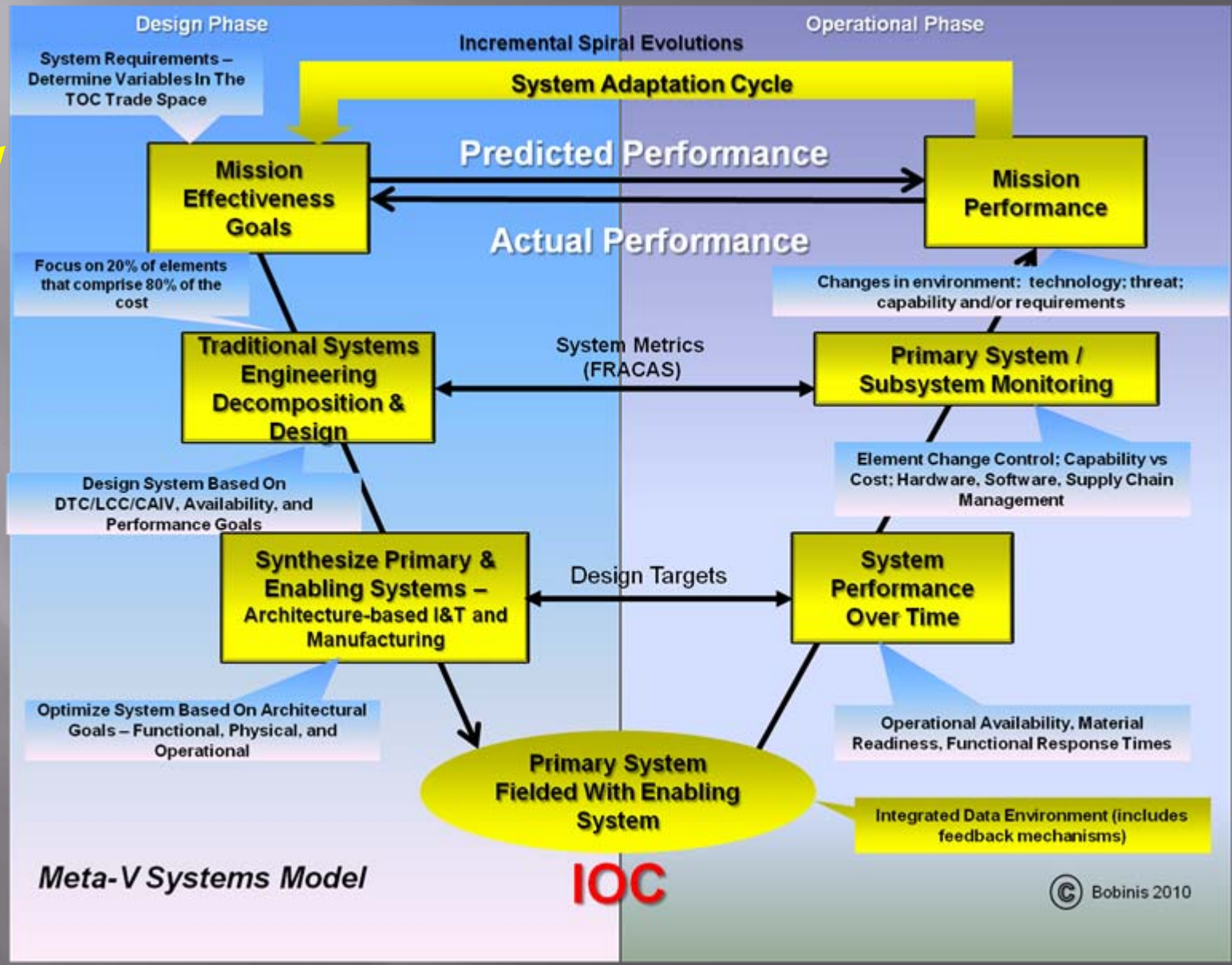
Evolutionary

Manageable

Affordable

Agile

Adaptable



INCOSE AFFWG Contact

- AFFWG Co-Chairs:
  - Joe Bobinis, Lockheed Martin
  - Taki Turner, Boeing
- INCOSE Connect address:
  - https://connect.incose.org/tb/SEsupport/affordability/default.aspx
- Number of Members: 36
  - Representing:
    - DoD Contractors and Customers
    - Commercial Industry
    - International DoD