Systems Engineering Influence on Life Cycle Cost

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ODDR&E/Systems Engineering

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Bottom Line Up Front

- **Systems Engineering is responsible for early trades and analysis to influence system effectiveness and affordability**
- **Mandatory Sustainment Key Performance Parameter (KPP) and Key System Attributes (KSA)**
  - Materiel Availability KPP
    - Materiel Reliability KSA
    - Ownership Cost KSA
- **SE Design Considerations**
  - Maintainability
  - Open Systems Design
  - Corrosion Prevention and Control
  - Technical Data Planning
  - Parts Management, to include DMSMS
  - Quality and Producibility
  - Human Systems Integration
  - Standardization

Systems Engineering Influence on Life Cycle Cost (LCC)

Agenda:

- **Background - Life Cycle Cost (LCC)**
- **The SE Design Influences on LCC**
- **Best Practices to implement the Design Influences**

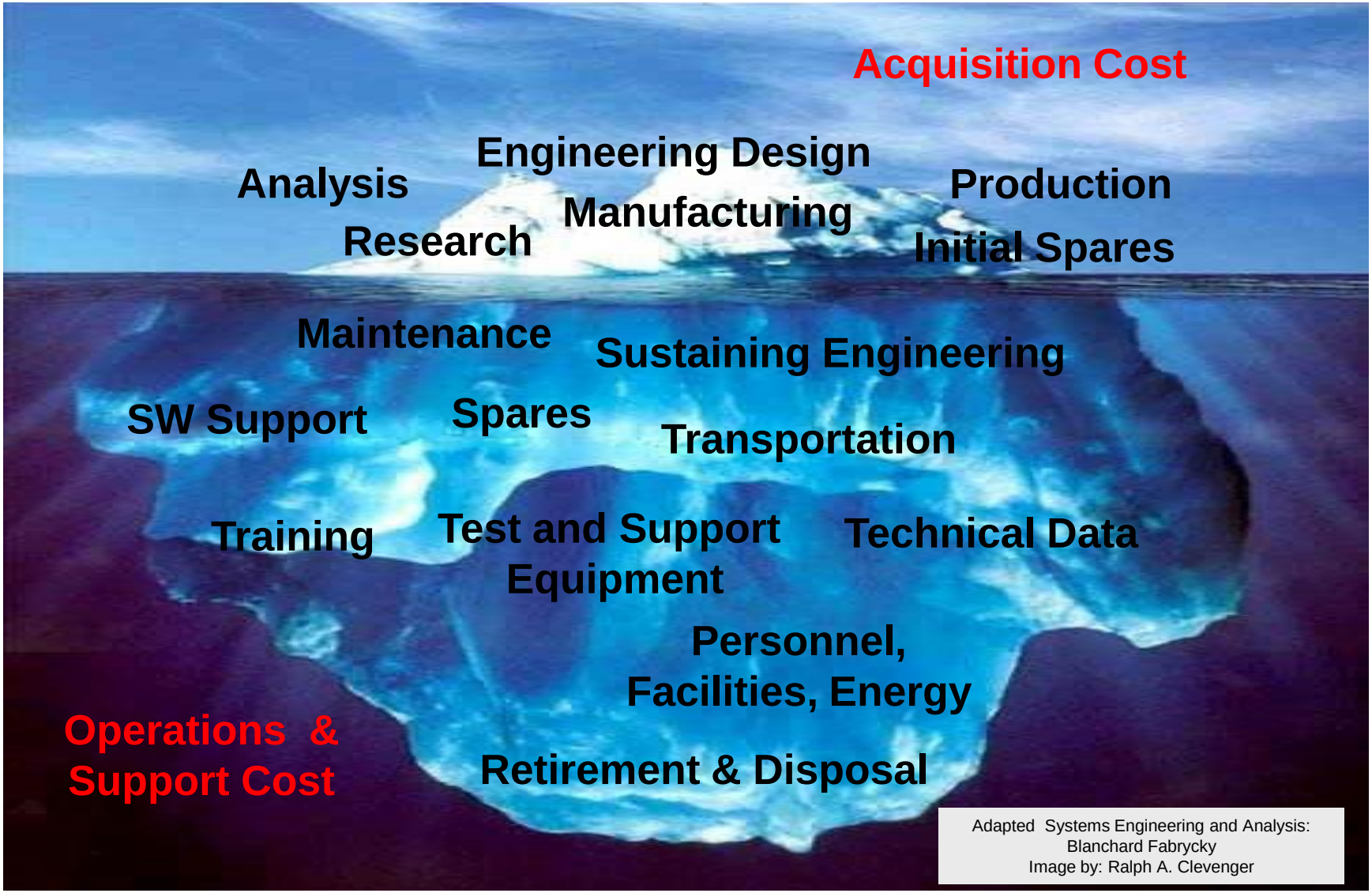
Current Life Cycle Cost Policy

DoD Directive 5000.01, 4.3.4: "*… Every PM shall establish program goals for the minimum number of cost, schedule, and performance parameters that describe the program over its life cycle. "*

DoD Directive 5000.01, E1.1.4. Cost and Affordability. *"All participants in the acquisition system shall recognize the reality of fiscal constraints. They shall view cost as an independent variable, and the DoD Components shall plan programs based on realistic projections of the dollars and manpower likely to be available in future years. To the greatest extent possible, the MDAs shall identify the total costs of ownership, and at a minimum, the major drivers of total ownership costs. The user shall address affordability in establishing capability needs."*

DoD Instruction 5000.02, E2.6.d.(*4*) *"An affordability determination results from the process of addressing cost during the requirements process and is included in each CDD using life-cycle cost or, if available, total ownership cost."*

The Life Cycle Cost Iceberg



Adapted Systems Engineering and Analysis:
Blanchard Fabrycky
Image by: Ralph A. Clevenger

Design for Affordability

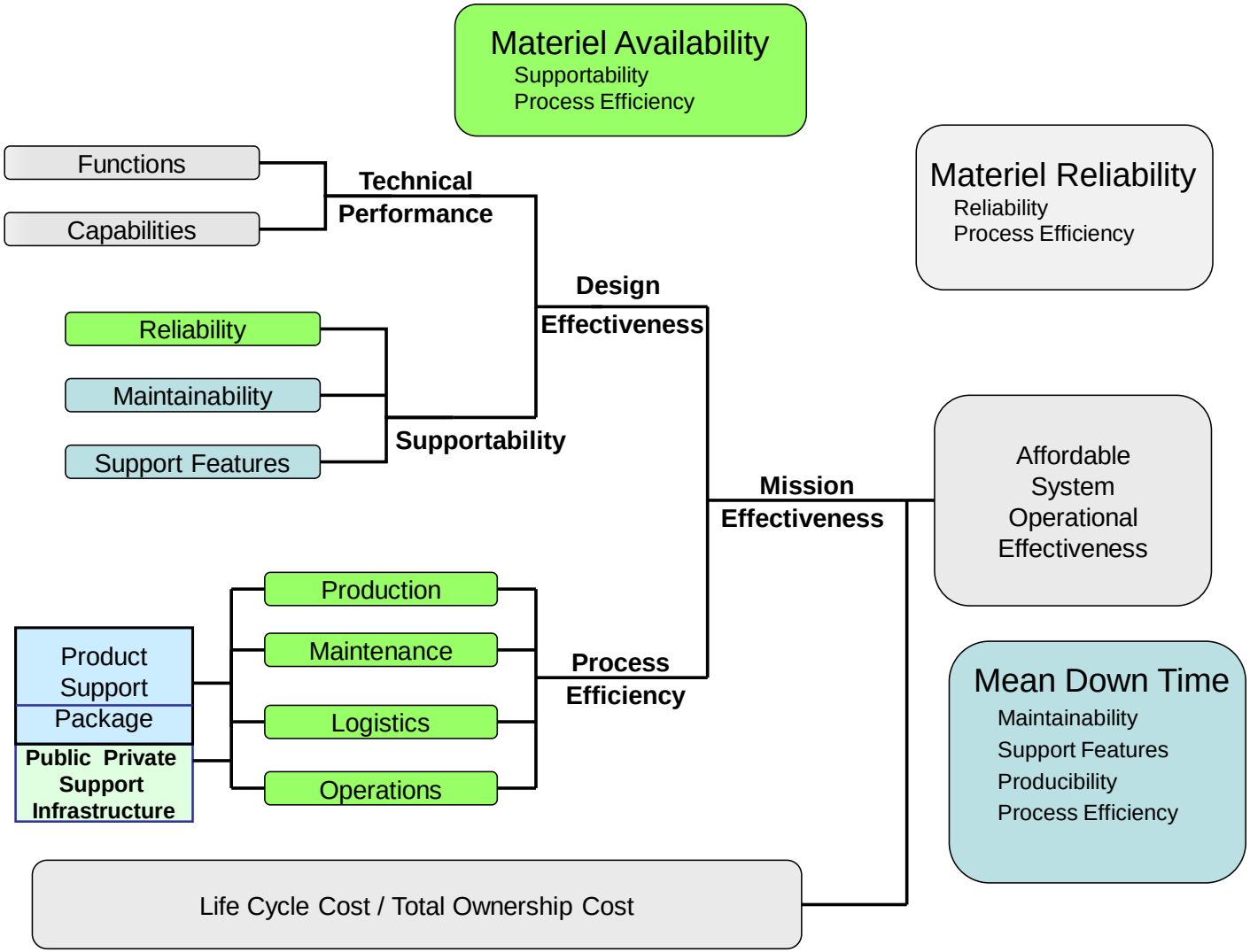
- **"Economic feasibility or affordability are characteristics of design and installation that impact budget constraints. An objective is to base design decisions on life-cycle cost, and not just system acquisition cost (or purchase price). Economic feasibility is dependant on the balanced incorporation of reliability, maintainability, human factors, supportability and other related characteristics of design."**

Systems Engineering and Analysis, Ben Blanchard & Wolter Fabrycky

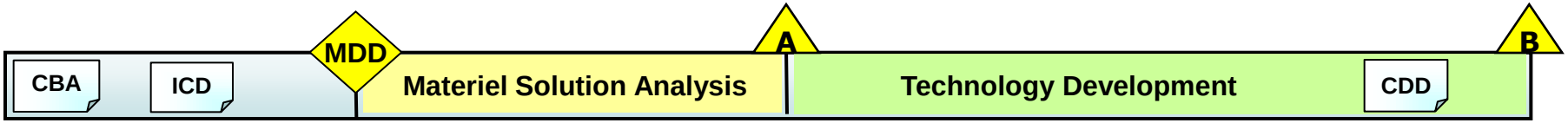
Defense Acquisition Guidebook (DAG) Design Considerations

Achieving the "best value" solution is an iterative task performed within the framework of Systems Engineering.

Affordable Systems
SE Design Considerations DAG 4.4



Development Planning and Early SE Critical Activities Influence LCC



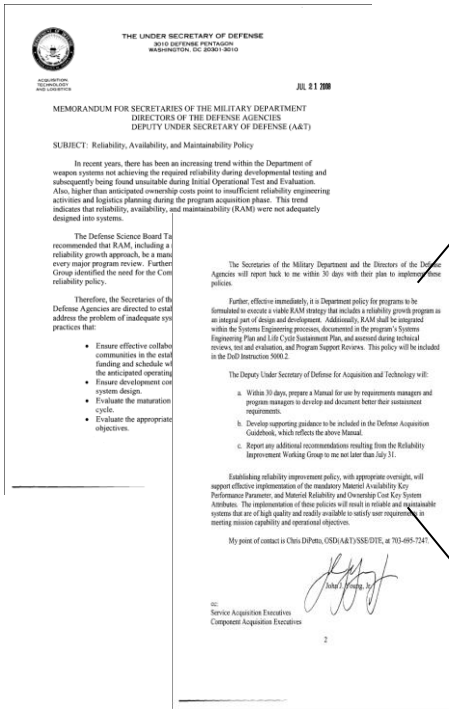
SE Input to MDD	CONOPS
	Awareness of Strategic Context
	Engagement with S&T Engagement with JCIDS
Engagement in AoA	Guidance
	Plan
	Analysis Activity
	Report
Engineering Analysis	Consideration of SOS/Interdependency, Interoperability Context
	SEP for Milestone A
	Input to TDS (CTE, CPI), TES, CCE
	SE in TD Contract Requirements
	Tech Reviews (ASR, Early SE Requirements)

*Reference DAG Sections 4.3.1 and 4.3..2

Prototyping & Risk Reduction	Prototyping (Technology and Design)
	CTE TRL Maturation
	Trade Studies
	SE Support for Technology Risk Reduction
	Oversight of Competitive Designs
	Risk Assessment
Input to Acquisition/ Planning, CARD, Budget & Other	SE in Contract Requirements
	SE into the PDR Report to MDA, Acquisition Strategy, TEMP, CARD, and ICE
Evidence of Strong SE Activity	PDR and PDR Report and Assessment
	Technical Reviews up to and including PDR
	Systems Engineering Plan
	Strong Reliability, Availability and Maintainability – Cost (RAM-C)
Inputs to Requirements	System Requirements Definition
	RAM and Sustainability
	Requirements Traceability Matrices
	Translation of Requirements to Contract
	Capability Development Document (CDD)

RAM Policy Memo

The July 2008 Reliability, Availability, and Maintainability Policy Requires RAM be integrated into the Systems Engineering process.



THE UNDER SECRETARY OF DEFENSE
3010 DEFENSE PENTAGON
WASHINGTON, DC 20301-3010

ACQUISITION, TECHNOLOGY AND LOGISTICS

JUL 21 2008

MEMORANDUM FOR SECRETARIES OF THE MILITARY DEPARTMENT
DIRECTORS OF THE DEFENSE AGENCIES
DEPUTY UNDER SECRETARY OF DEFENSE (A&T)

SUBJECT: Reliability, Availability, and Maintainability Policy

In recent years, there has been an increasing trend within the Department of weapon systems not achieving the required reliability during developmental testing and subsequently being found unsuitable during Initial Operational Test and Evaluation. Also, higher than anticipated ownership costs point to insufficient reliability engineering activities and logistics planning during the program acquisition phase. This trend indicates that reliability, availability, and maintainability (RAM) were not adequately designed into systems.

The Defense Science Board Ta
recommended that RAM, including a
reliability growth approach, be a manda
every major program review. Further
Group identified the need for the Com
reliability policy.

Therefore, the Secretaries of th
Defense Agencies are directed to estab
address the problem of inadequate sys
practices that:

- Ensure effective collabo
communities in the estab
funding and schedule wi
the anticipated operating
- Ensure development con
system design.
- Evaluate the maturation
cycle.
- Evaluate the appropriate
objectives.

The Secretaries of the Military Department and the Directors of the Defense Agencies will report back to me within 30 days with their plan to implement these policies.

Further, effective immediately, it is Department policy for programs to be formulated to execute a viable RAM strategy that includes a reliability growth program as an integral part of design and development. Additionally, RAM shall be integrated within the Systems Engineering processes, documented in the program's Systems Engineering Plan and Life Cycle Sustainment Plan, and assessed during technical reviews, test and evaluation, and Program Support Reviews. This policy will be included in the DoD Instruction 5000.2.

The Deputy Under Secretary of Defense for Acquisition and Technology will:

a. Within 30 days, prepare a Manual for use by requirements managers and program managers to develop and document better their sustainment requirements.

b. Develop supporting guidance to be included in the Defense Acquisition Guidebook, which reflects the above Manual.

c. Report any additional recommendations resulting from the Reliability Improvement Working Group to me not later than July 31.

Establishing reliability improvement policy, with appropriate oversight, will support effective implementation of the mandatory Materiel Availability Key Performance Parameter, and Materiel Reliability and Ownership Cost Key System Attributes. The implementation of these policies will result in reliable and maintainable systems that are of high quality and readily available to satisfy user requirements in meeting mission capability and operational objectives. My point of contact is Chris DiPetto, OSD(A&T)/SSE/DTE, at 703-695-7247.

cc:
Service Acquisition Executives
Component Acquisition Executives

2

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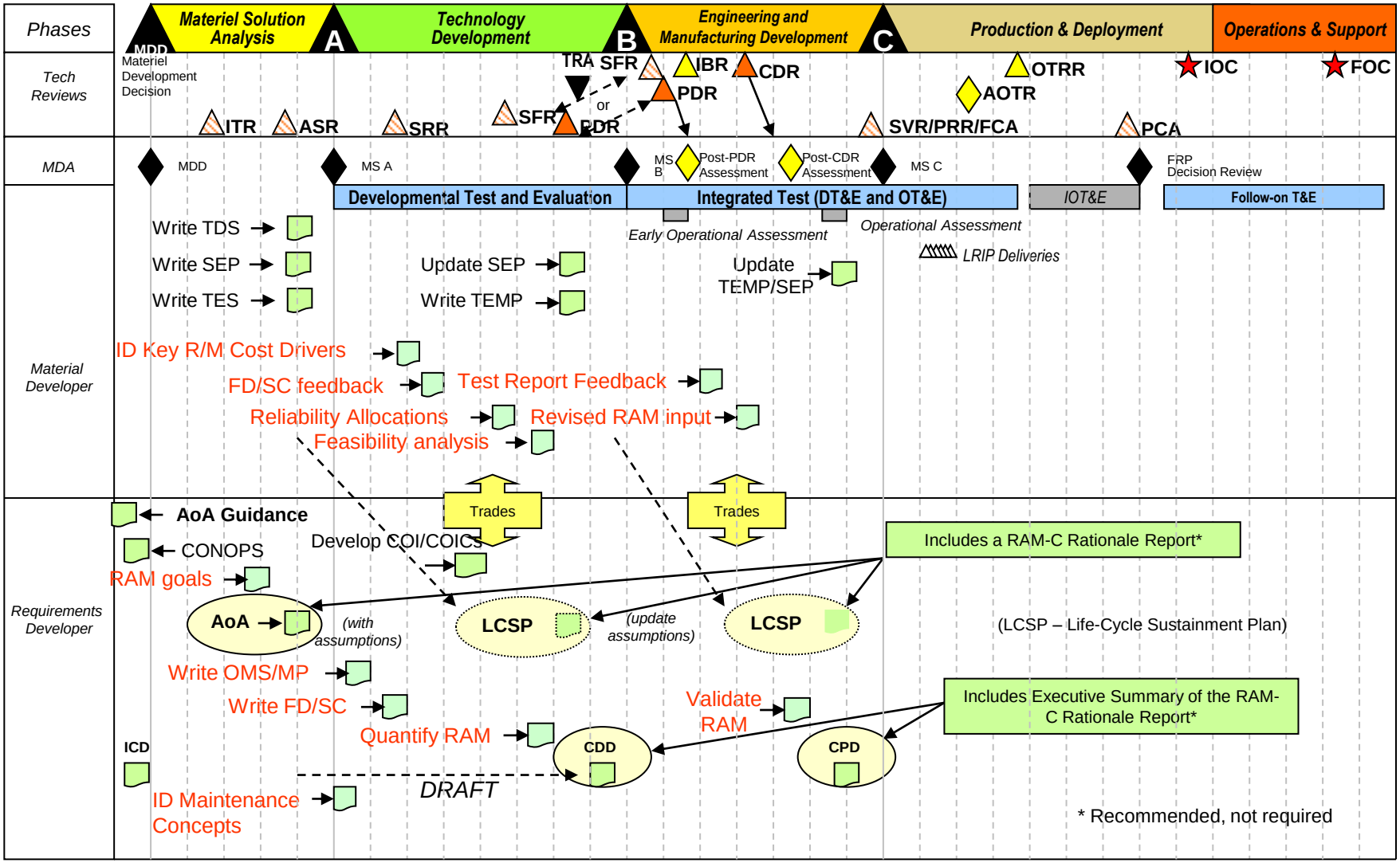
RAM-C Manual: Report Timeline



Cost Analysis Requirements Description (CARD) Outline (SE)

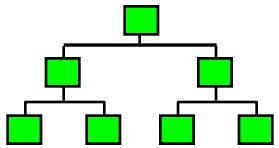
- System description and characteristics
- System suitability factors (Reliability/Maintainability/Availability)
- PM's assessment of program risk and risk mitigation measures
- System sustainment concept (Sustaining Engineering)
- Facilities requirements
- Security or program protection features
- Environment, safety, and occupational health considerations
- System milestone schedule
- Plans for system disposal

SE Influence on LCC Should/Will Cost

Pre Award

TECHICAL BASELINE

1. DEFINE THE WORK



WHAT?

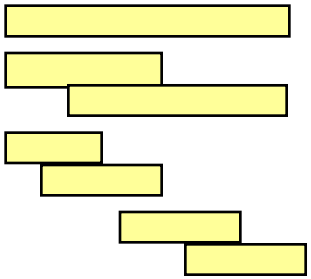
WBS
SOW

WHO?

RESPONSIBILITY
ASSIGNMENT MATRIX
WORK AUTHORIZATION
DOCUMENTS

SCHEDULE BASELINE

2. SCHEDULE THE WORK

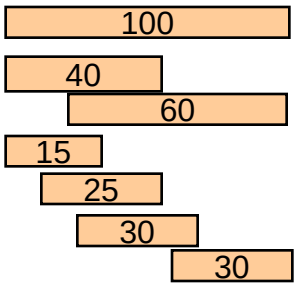


WHEN?

INTEGRATED MASTER SCHEDULE
CONTROL ACCOUNT SCHEDULES

3. ALLOCATE RESOURCES (Cost)

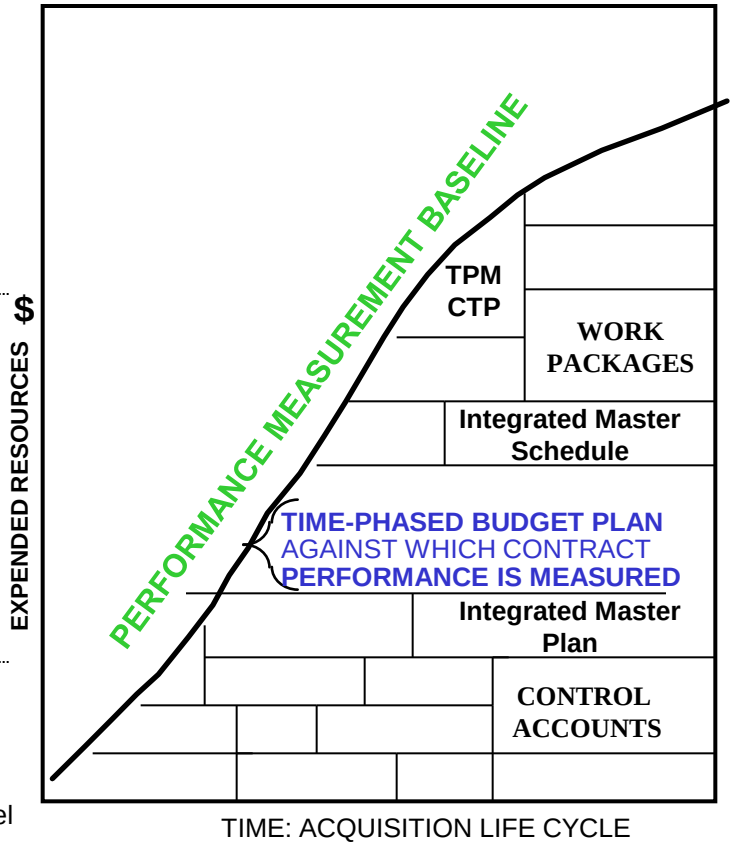
RESOURCE BASELINE



HOW MUCH?

WORK/BUDGET AUTHORIZATION
People, Facilities, Equipment & Materiel
CONTROL ACCOUNT PLAN

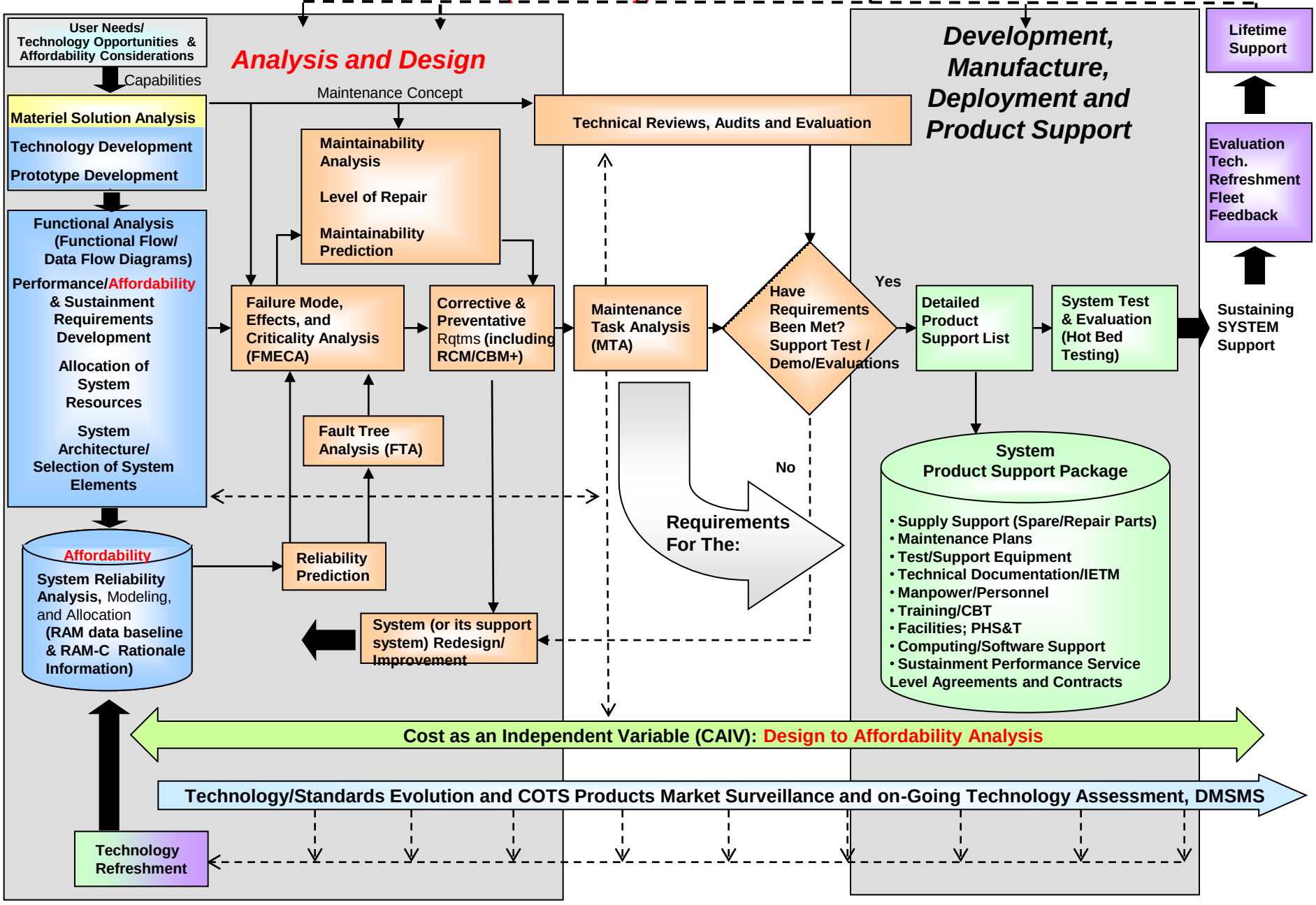
Post Award



Drive productivity through will cost/should cost management
Set shorter timelines and manage to them

Supportability Analysis Framework

Continuous KPP (Affordability) Assessment and Improvement



Summary – SE Influence on Life Cycle Cost (Affordability)

Systems Engineering is responsible for early trades and analysis to influence system effectiveness and Life Cycle Cost (affordability)

- **USD(AT&L): Target Affordability and Cost Growth**
- **Design for Life Cycle Cost (Affordability)**
  - Development Planning and Early SE
  - Mandatory Sustainment Key Performance Parameter and Key System Attributes
  - SE Design Considerations
- **Continuous LCC assessment and improvement**

For Additional Information

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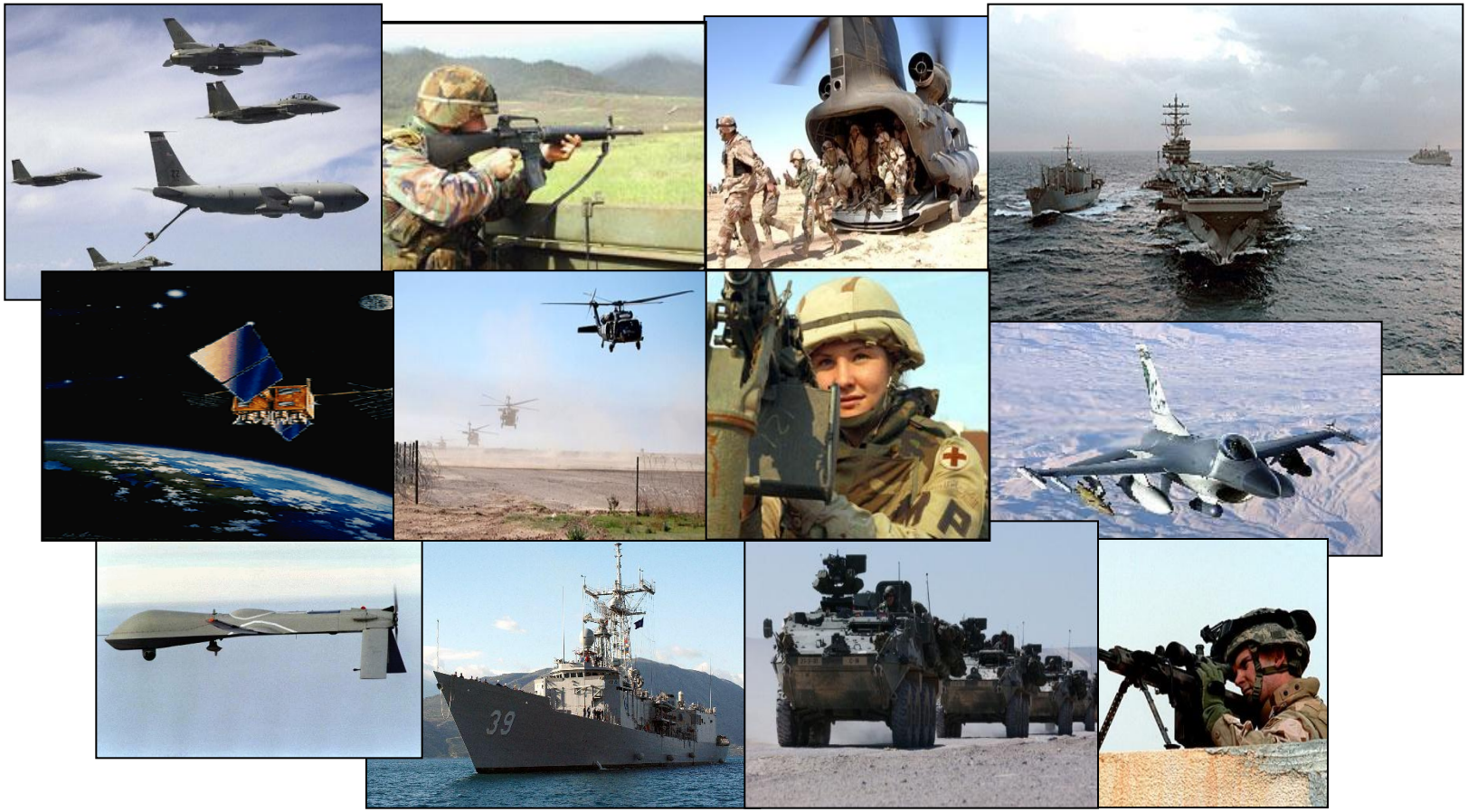
Systems Engineering: Critical to Program Success



Innovation, Speed, and Agility

http://www.acq.osd.mil/se