Designing and Assessing Supportability

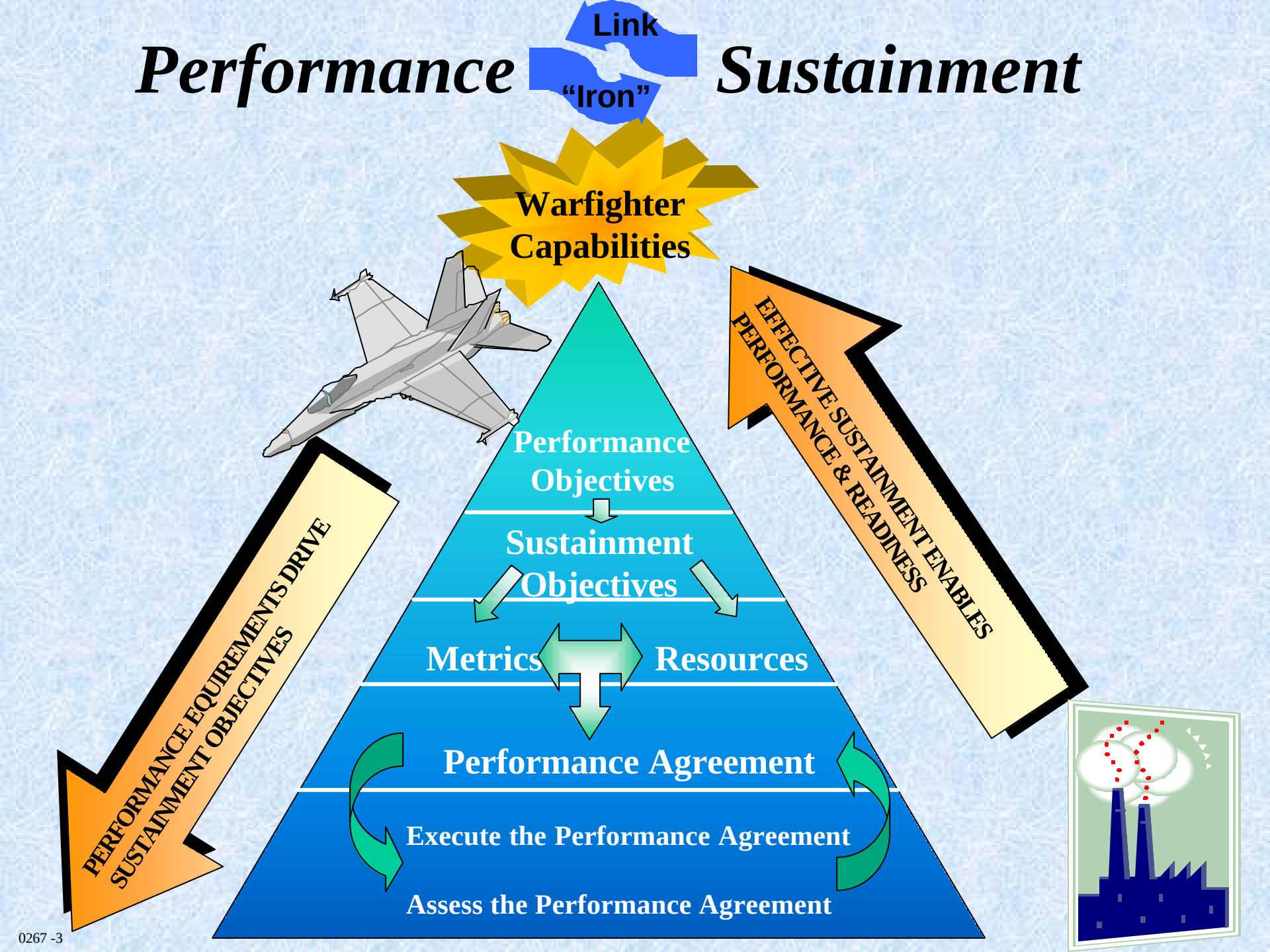
A Guide to Increase Reliability and Reduce Logistics Footprint

NDIA Systems Engineering Conference **23 October 2002**

The Evolving Acquisition Environment

- **DoD Acquisition Model and Policy is evolving**
- **Emphasis on early development and delivery of capability to the Warfighter**
- **Prompts Evolutionary Acquisition, Spiral Development**
- **Must work within the framework of rapid response, global engagement, and an agile and mobile force structure**
- **Intense pressure for systems that can PERFORM and are inherently RELIABLE**
- **Requires equal and early emphasis on *designed-in reliability***
- **And a continuing assessment of sustainment strategy to improve reliability and maintain optimum performance**

Performance Link "Iron" *Sustainment*



QDR Direction

- **Project and sustain the force with minimal footprint**
- **Implement performance-based logistics to compress the supply chains and improve readiness for major weapon systems and commodities**
- **Reduce cycle times to industry standards**

A Clear Mandate

Acquisition & Sustainment Policy

Total Life Cycle Systems Management (TLCSM)

Program Manager as Life Cycle Manager

Performance Based Logistics (PBL)

Buy Performance Outcomes

- More Reliable Systems
- Reduced Footprint

Guidance Needed

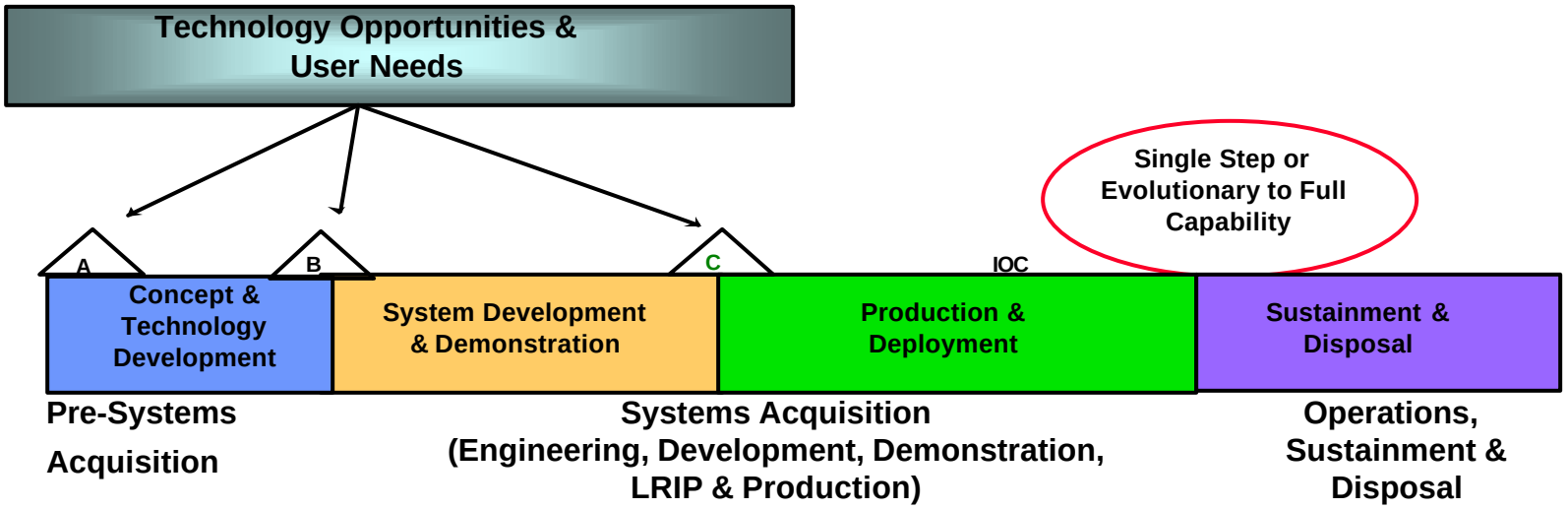
- Design it in
- Assess and Improve

Establish Reliability Assessment Criteria Government/Industry Participation

- **Designing in inherent reliability/maintainability**
  - *Incorporate System Design for Operational Effectiveness (SDOE) criteria into the systems engineering process*
- **Developing reliability assessment tools**
  - *Program application of SDOE and PBL tenets*
- **Structuring appropriate incentives to achieve and maintain ultra-reliability**
  - *Top level performance metrics*

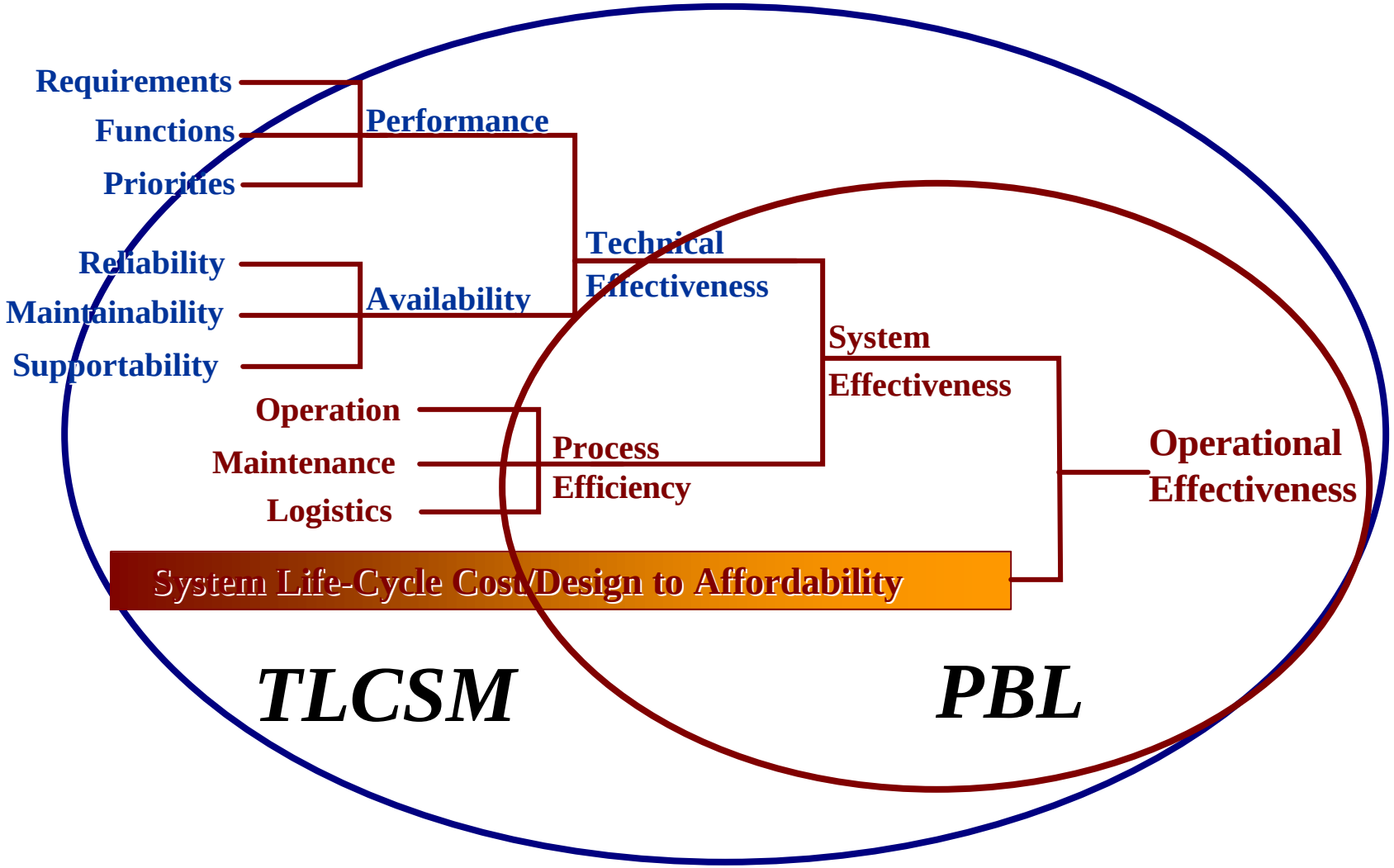
The Task: Develop PM Guidance

DoD 5000 Acquisition Policy

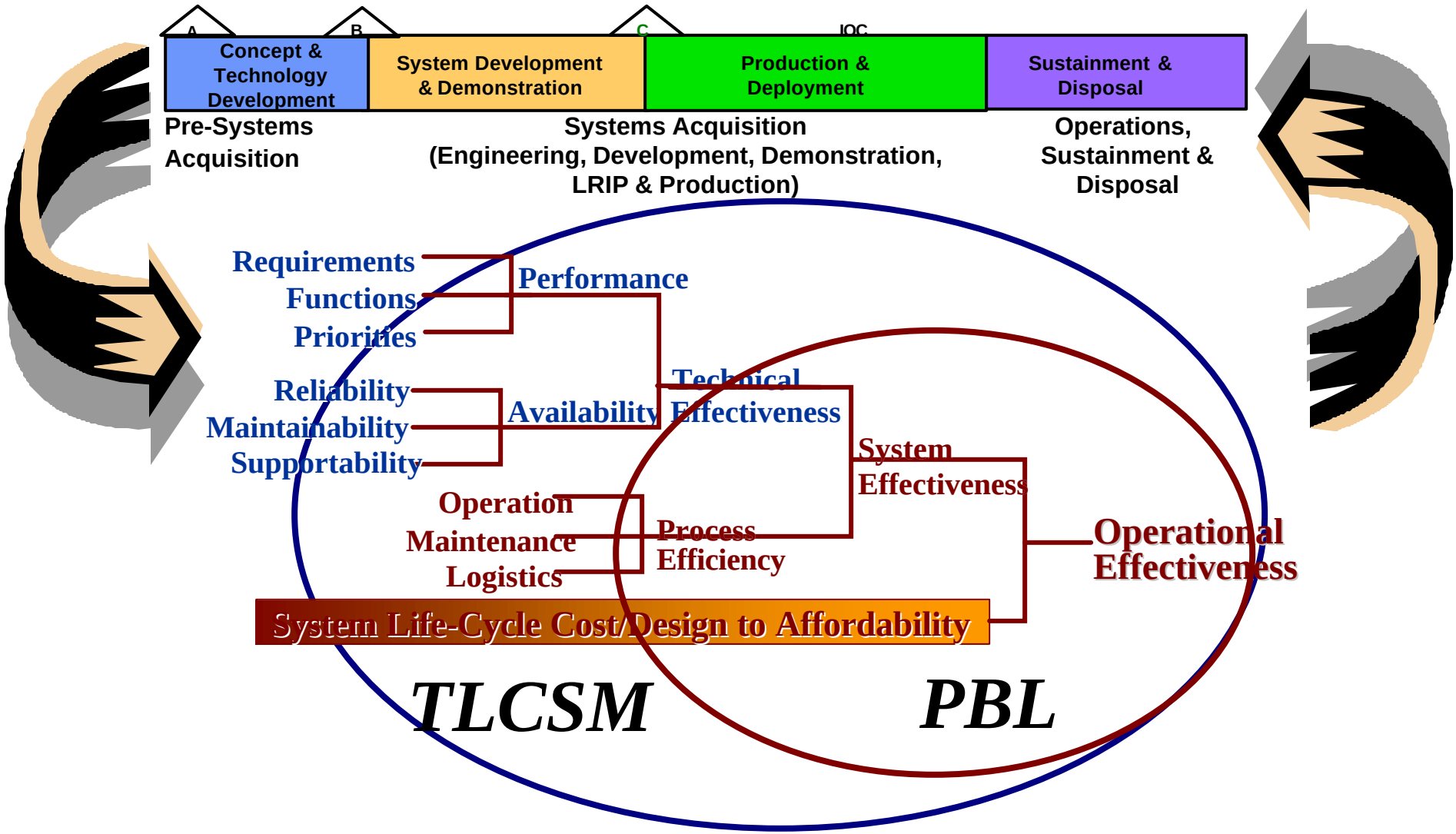


Logistics Transformation. Logistics transformation is fundamental to acquisition reform. Decision makers shall take all appropriate enabling actions to integrate acquisition and logistics to ensure a superior product support process. The Department shall strive for an integrated acquisition and logistics process characterized by constant focus on total cost of ownership; supportability as a key design and performance factor; and ***logistics emphasis in the systems engineering process***.

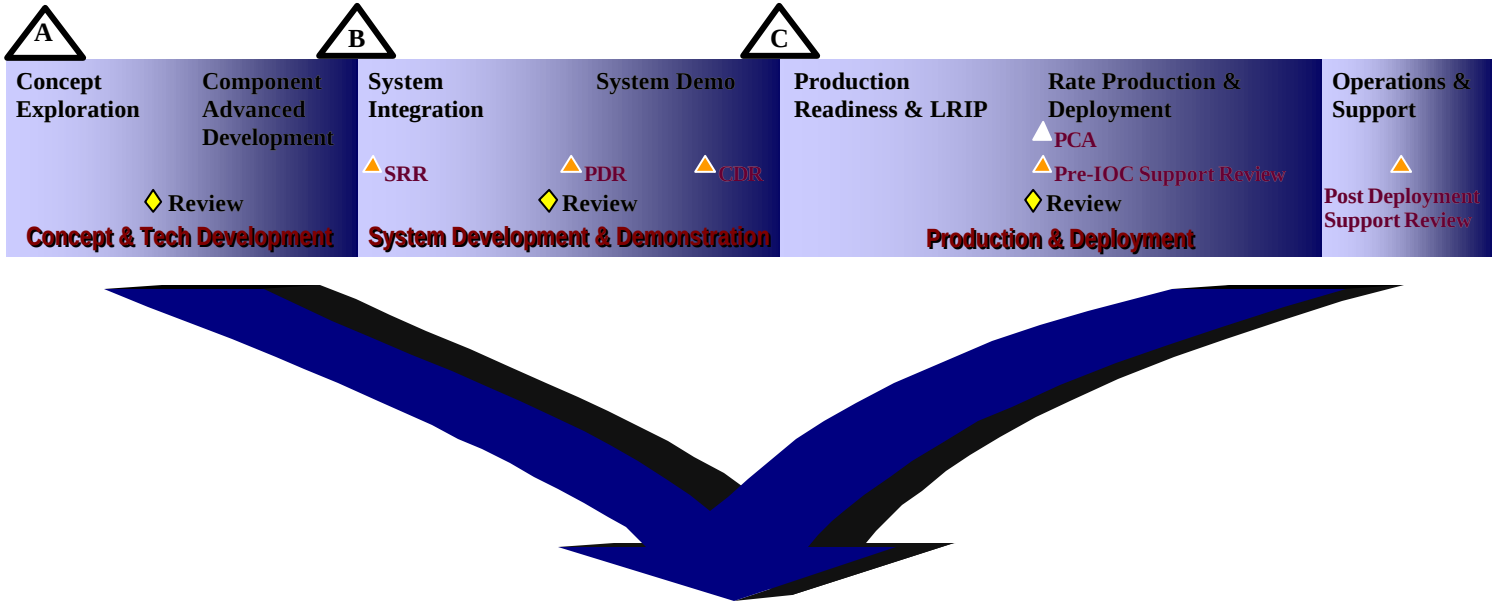
Components of System Operational Effectiveness



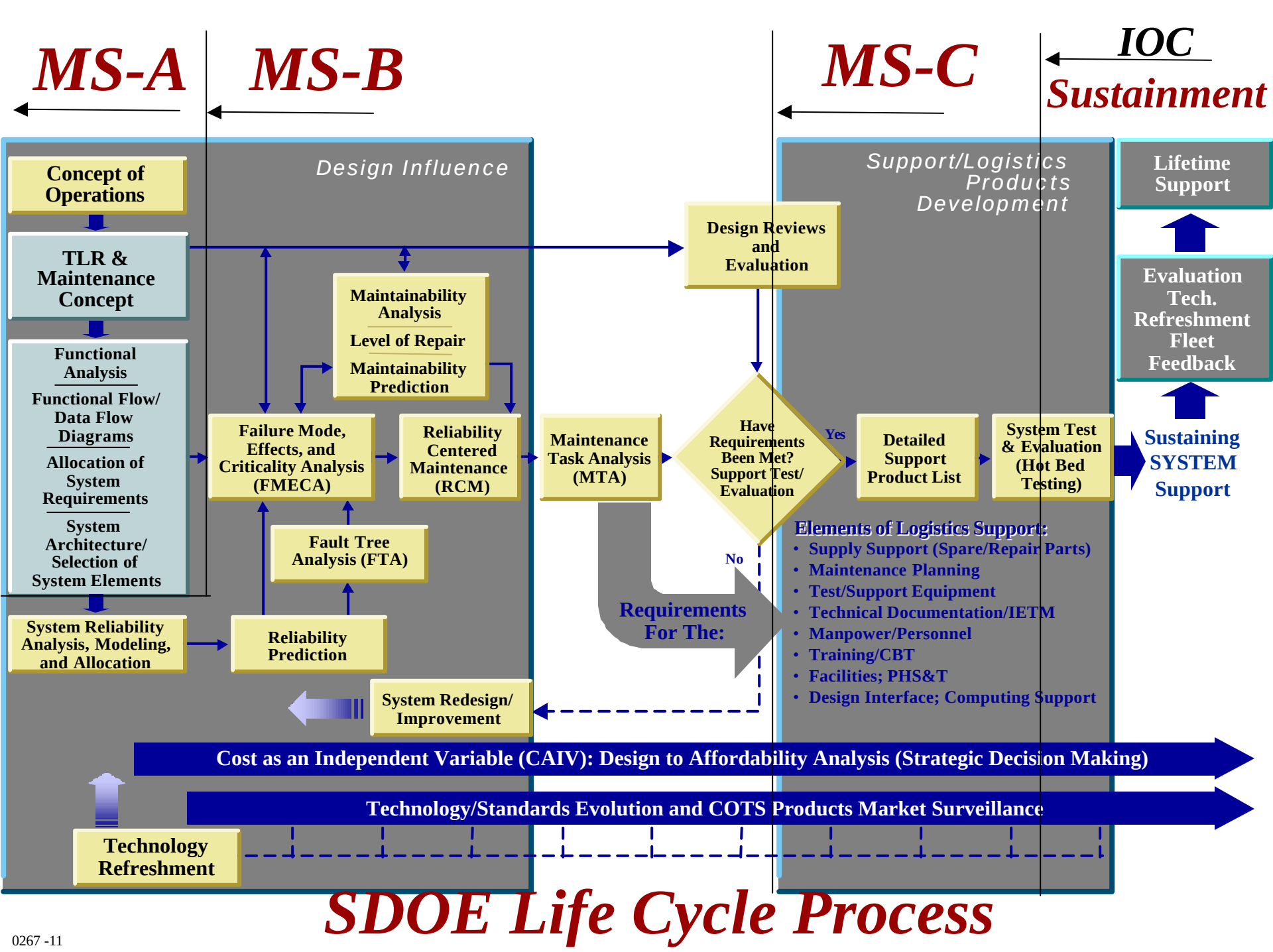
SDOE Applied Across the Breadth of the 5000 Model



The Guide Framework

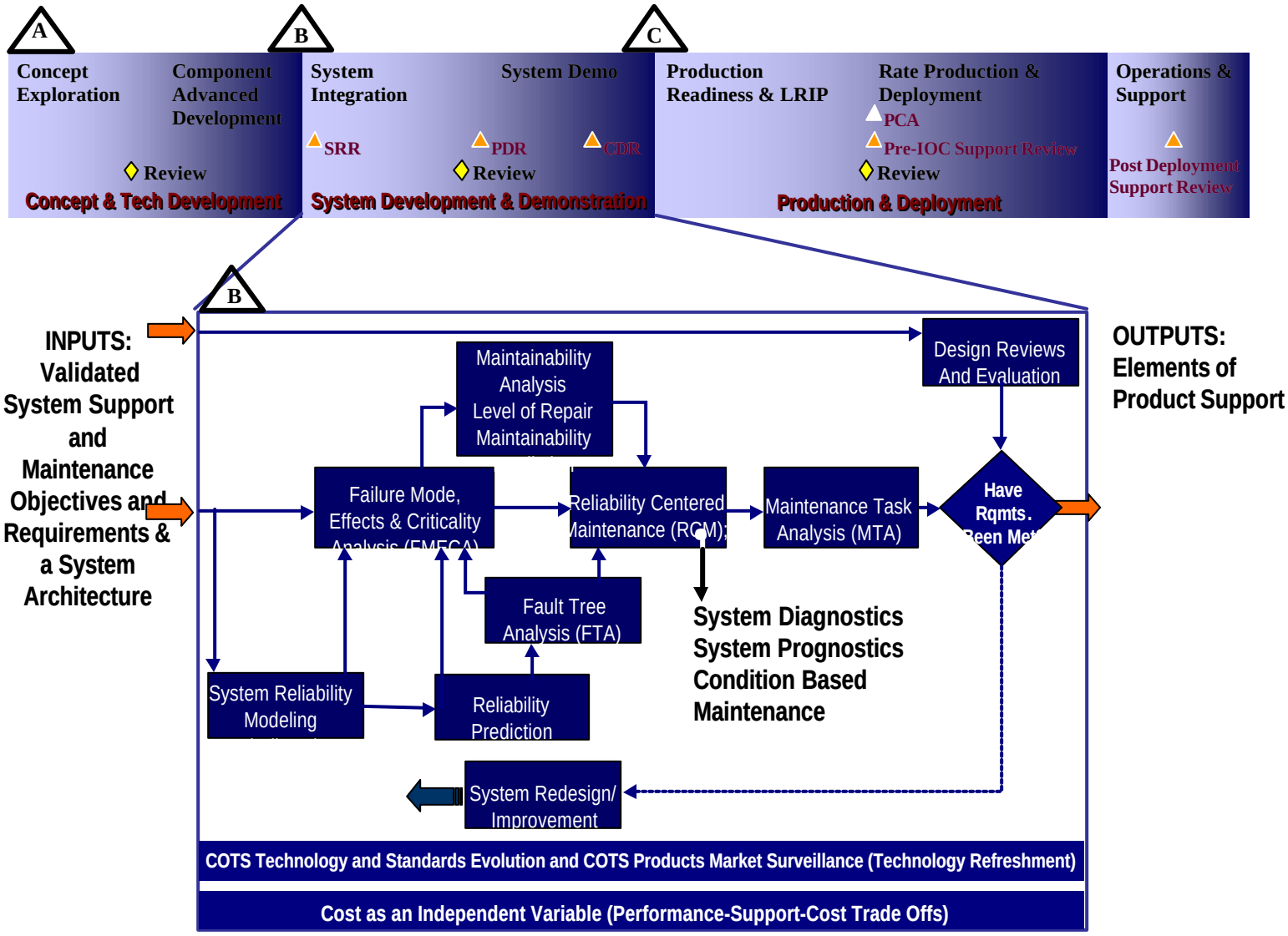


- *Address each Phase*
- *Show application of SDOE concepts*
- *Establish objectives for key Logistics/Supportability Criteria*
- *Provide framework for assessment of Design for Supportability*

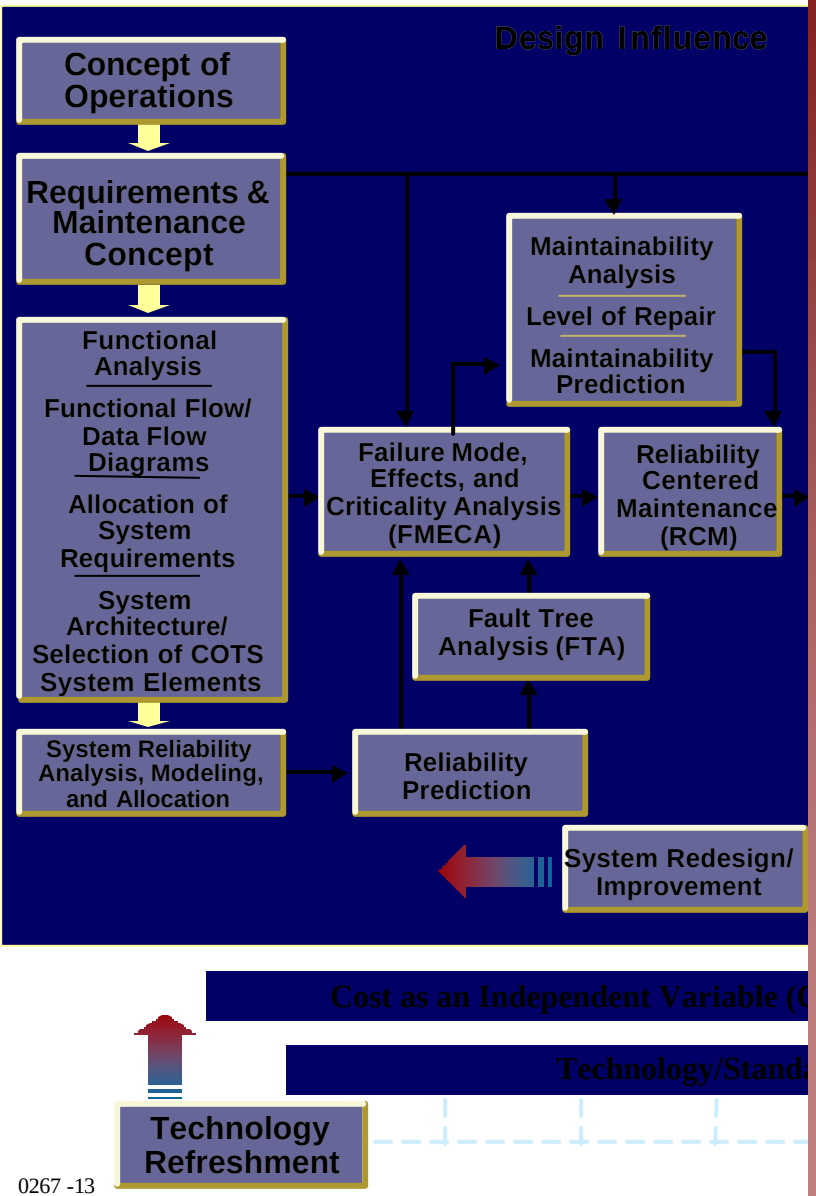


SDOE Life Cycle Process

Milestone B Detail



Reliability, Maintainability, and Supportability Engineering Process



Reliability Tasks:

- **Concept of Operation Definition/Mission Profile/Design Reference Mission**
- **Reliability Requirements Analysis and Allocation**
- **Reliability Modeling and Analysis**
- **Reliability Prediction**
- **Failure Mode, Effects, and Criticality Analysis**
- **Fault Tree Analysis**

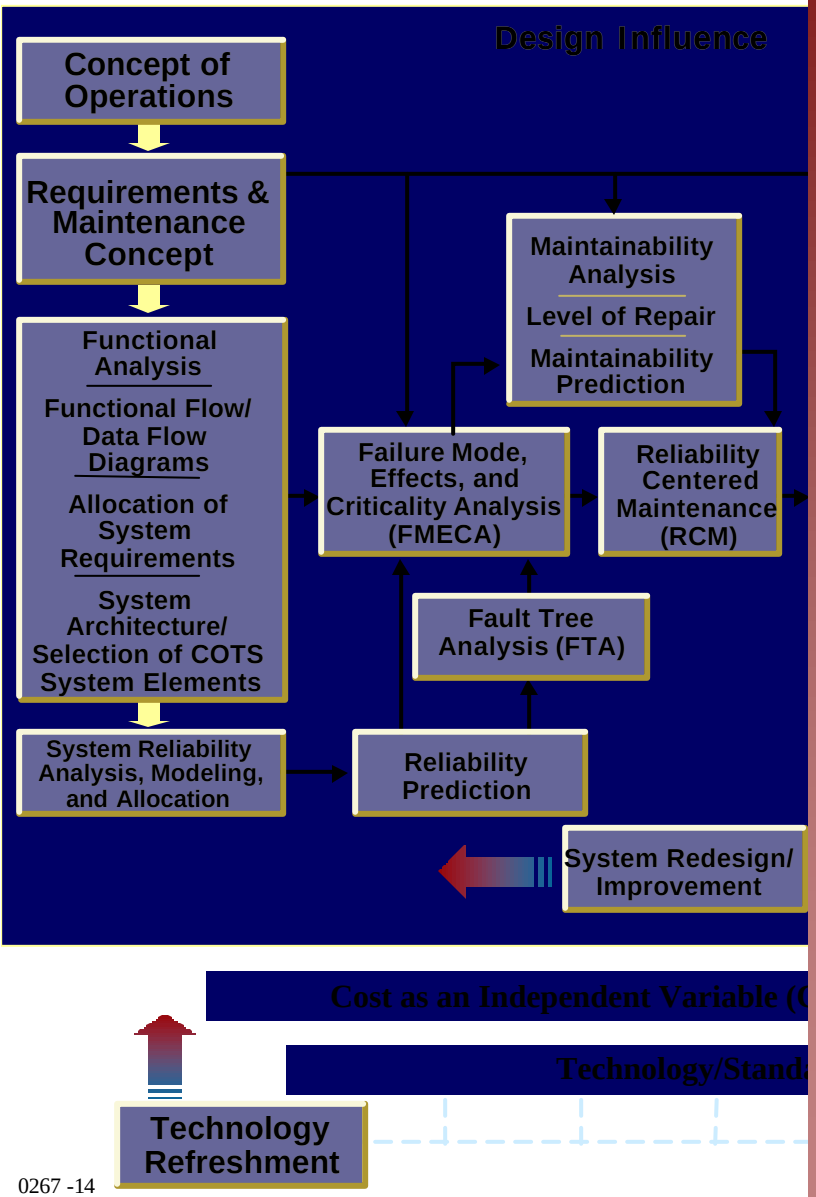
Reliability

Maintainability

Supportability

- **Redundancy**
- **Reconfigurability**
- **De-Rating**
- **System Criticality Assessment**
  - **Single Points of Failure**
  - **Degraded Modes of Operation**
- **Metrics**
- **Tools**

Reliability, Maintainability, and Supportability Engineering Process



Maintainability Tasks:

- System Maintenance Concept Definition
- Failure Diagnosis/BIT Requirements
- Maintainability Modeling and Analysis
  - High Level Maintenance and Repair Philosophy
  - Maintainability Requirements Analysis & Allocation
  - Identification of LRUs
- Maintainability Prediction
- Reliability Centered Maintenance
- Human Factors/Accessibility Analysis

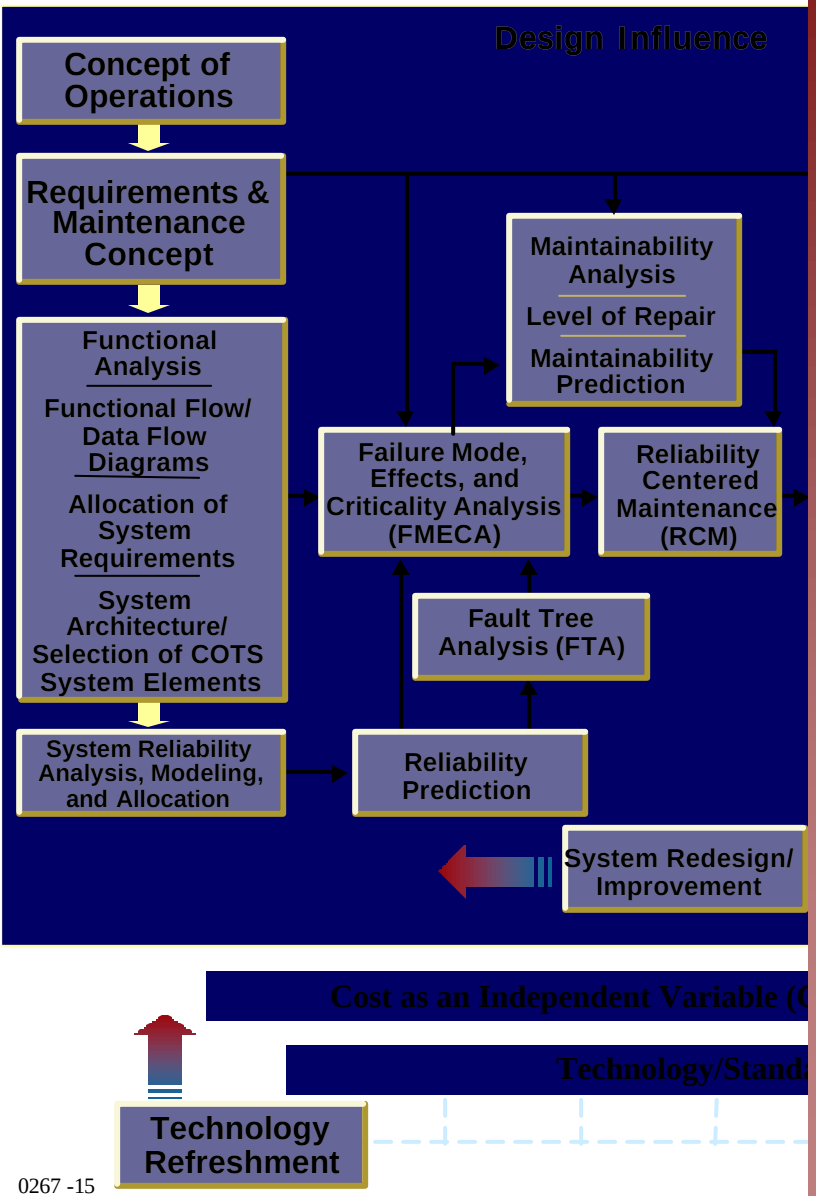
Reliability

Maintainability

Supportability

- Maintenance Concept
- Accessibility
- Performance Monitoring and Fault Localization
  - Built-In Test Coverage
  - System Modularity/De-Coupling
  - Condition and Usage Monitoring
- Metrics
- Tools

Reliability, Maintainability, and Supportability Engineering Process



Supportability Tasks:

- **Support Concept of Operations**
- **Analyzing the System From Commonality Perspective**
- **System Component Interchangeability**
- **Compliance With Open Systems**
- **Analysis of HMI vis-à-vis Training (Greater Commonality)**
- **Analysis of Vendors from Maturity & Stability Perspective**
- **Technology Analysis From a Proprietary and Maturity Perspective**
- **Application of Multi-Media Techniques, Information Technology, and Instructional Technology**

Reliability

Maintainability

Supportability

- System Commonality
  - Physical Commonality
  - Operational Commonality/ HMI Standardization
  - Functional Commonality
- Standard Parts
- Standard Tools/Equipment
- Intuitive User Interface
- COTS/GOTS Selection and Assessment
  - Open/Popular System Standards Compliance
  - Multiple Vendors
  - Technology Maturity
- Metrics
- Tools

Post Milestone C Process

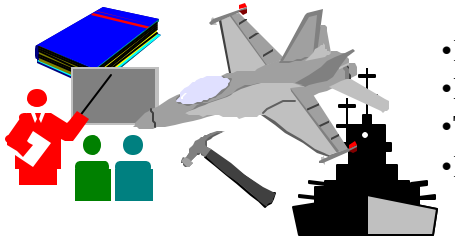
Continuous Sustainment Assessment and Improvement

Feedback /Monitor Weapon System

- Cost / Readiness Data
- EI/TPDR Requests
- Config Mgmt Data
- Fleet Requests
- Age Exploration

Corrective Action

- Change Configuration
- Change Maintenance Concept
- Improve Support Resources
- Restrict Operations
- Issue Bulletin
- Disposal
- Acquire 2nd Source



- Inventory
- Manpower
- Tech Data
- Infrastructure

Identify Improvement

- Degrader Analysis
- Total Cost Analysis
- Trigger Based Analysis
- Technology Opportunity

Determine Root Cause

- EI
- Exploratory Bulletin
- Design Evaluation
- Material Analysis

Determine Resolution

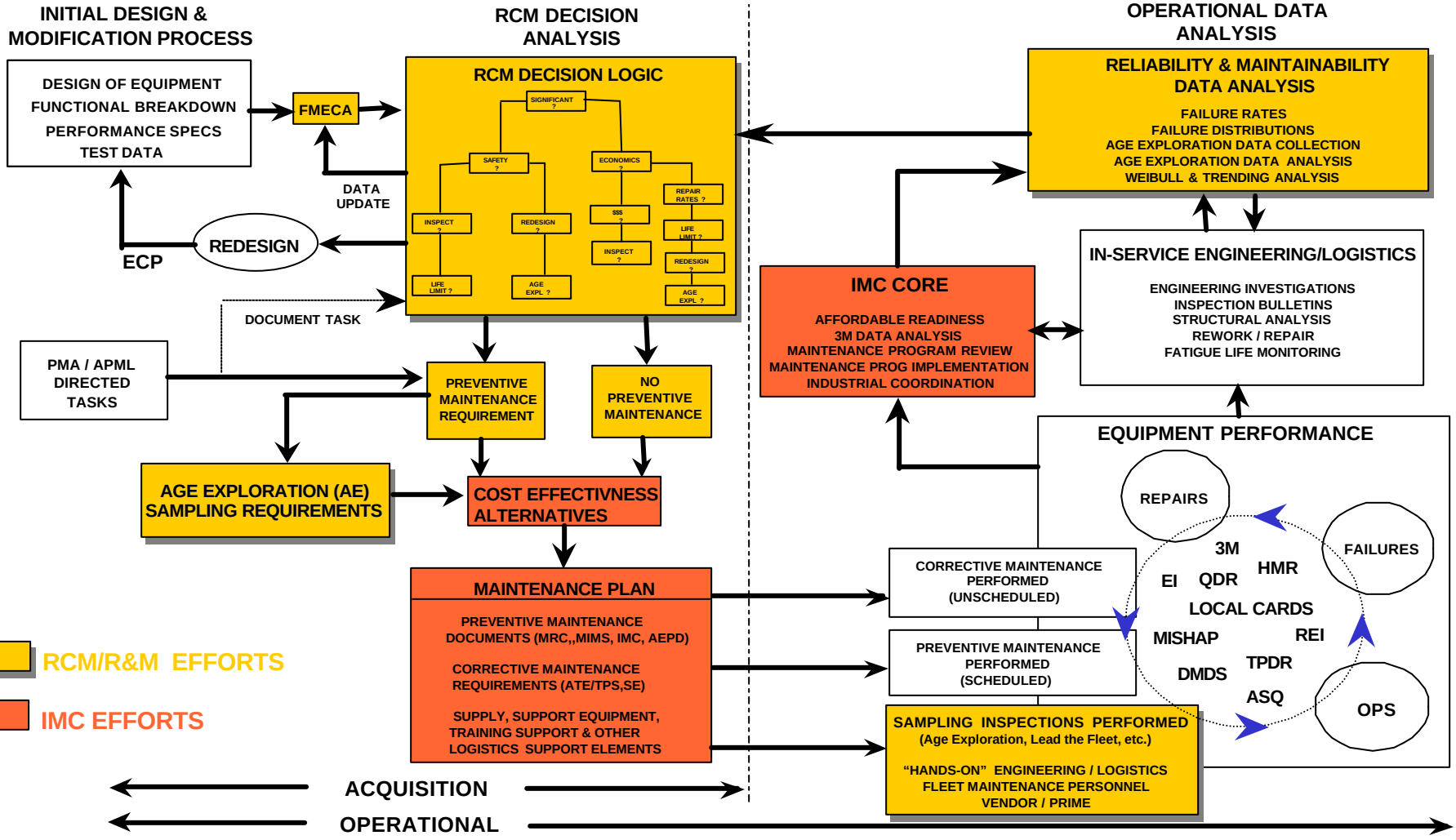
- RCM Analysis
- Maintenance Trade Analysis
- LECP Analysis
- Testing / Simulation

The Way Ahead

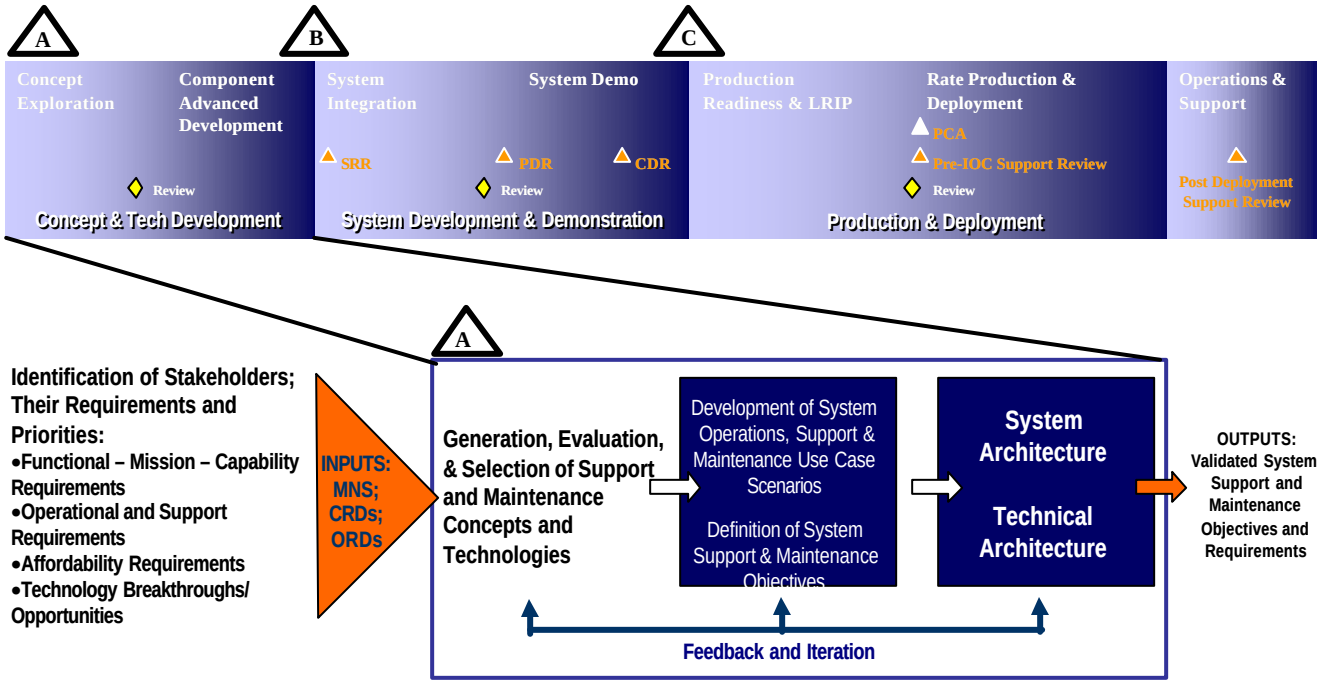
- **Milestone Interim Guidance Memo (AT&L Signature)**
- **NDIA Supportability Committee**
  - Comments due to OSD by 8 November
- **OSD Service Review (outline)**
  - Comments due to OSD by 8 November
  - Draft distributed for comments 5 December
  - Comments due to OSD by 9 January 03
  - OSD (LPP) review/assess/incorporate comments
  - Staff w/service components & OSD
- **Product Support Guide Update February 2003**

Back-Up

RCM-based Sustained Maintenance Planning



Milestone A Detail



A Tool for Program Offices

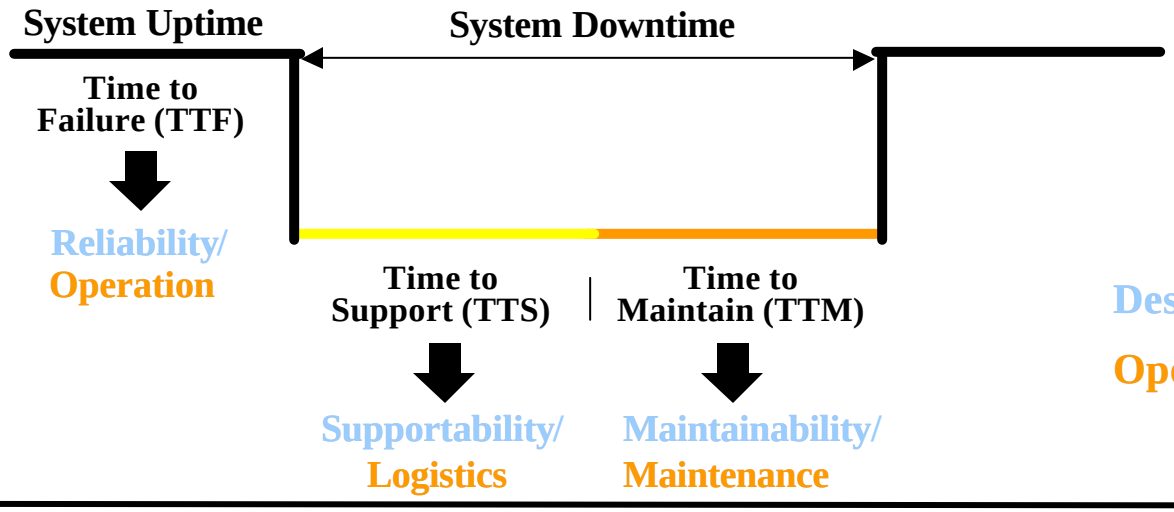
- **Provides guidance on implementation of DoD 5000 Product Support Policy**
  - Translates concepts of Product Support Initiatives
  - Methodology for Implementing PBL
  - ***Designing and Assessing Supportability***
- **Features:**

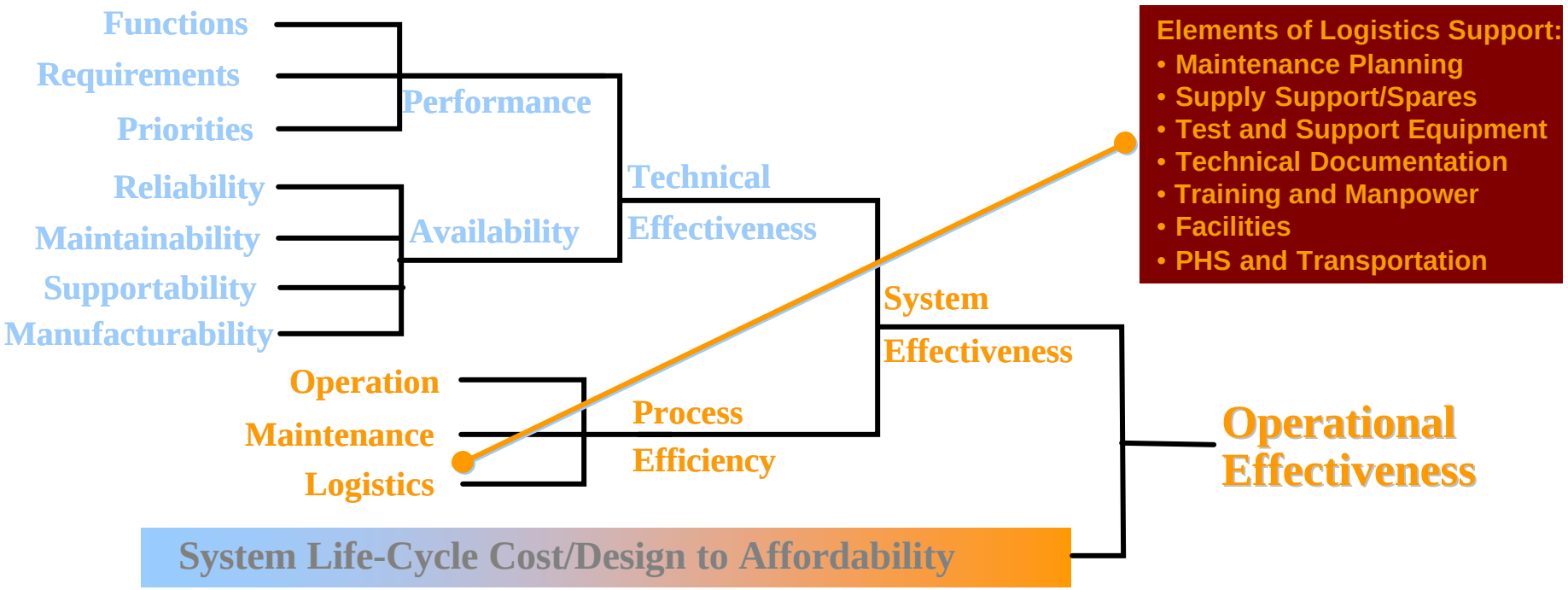
Chapter 1: New Directions in Product Support
Chapter 2: Implementing PBL
Chapter 3: Buying Performance
Chapter 4: Designing and Assessing Supportability
Appendix A: RTOC Pilot Programs
Appendix B: Tools and Databases
Appendix C: DoD and Service Guidance
Appendix D: Statutory Requirements

Designing and Assessing Supportability (Ch 4)

- Purpose
- DoD 5000 Acquisition/Life Cycle Model
- System Design for Operational Effectiveness
  - Link 5000 model with the SDOE Model
- Assessment
  - Milestone A, B, C, Pre IOC, & Sustainment
    - Services will conduct Pre IOC & Sustainment Reviews
- SDOE Process and Application Throughout the Life Cycle

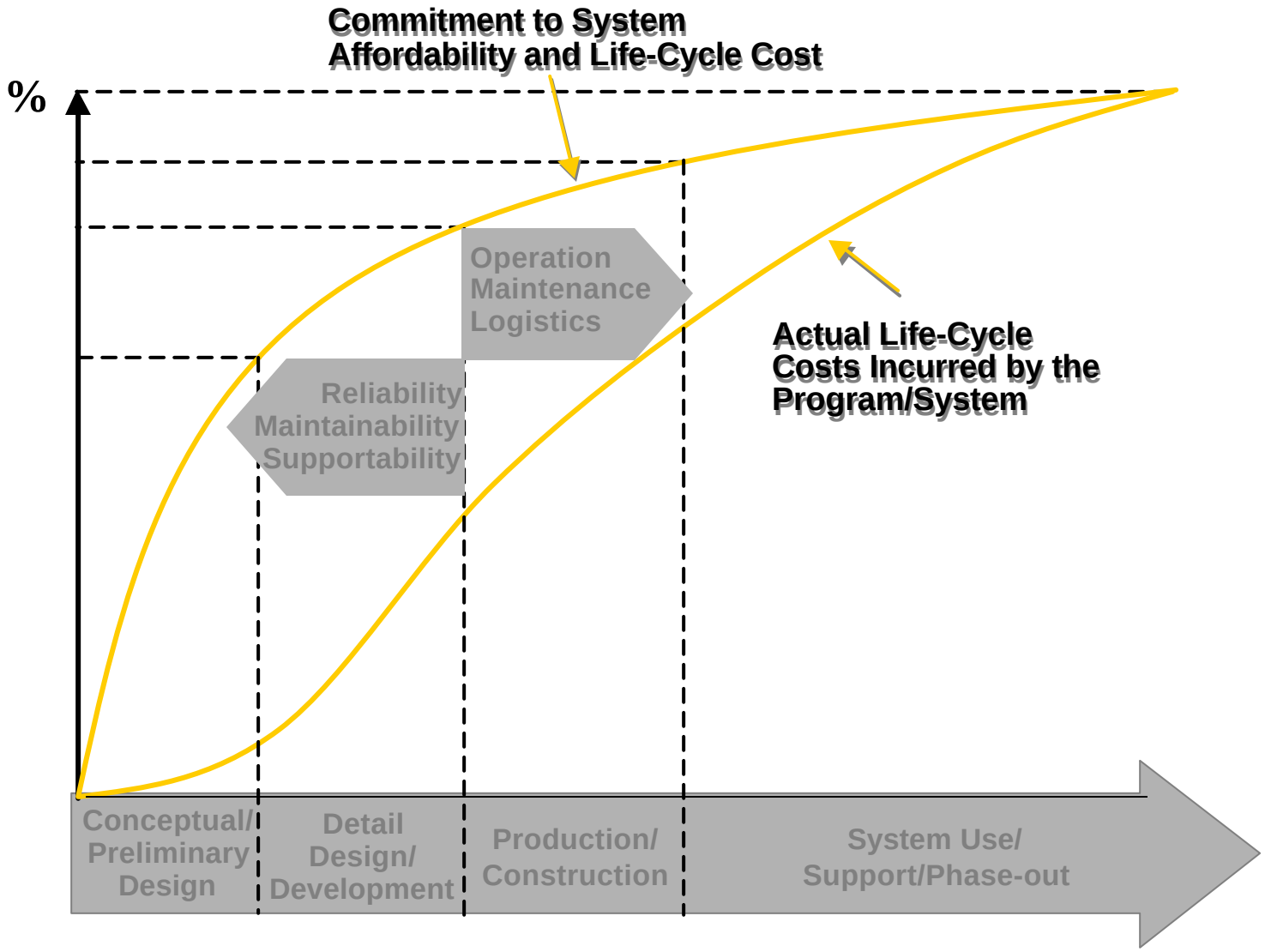
System Operational Effectiveness





Systems Engineering & System Support:

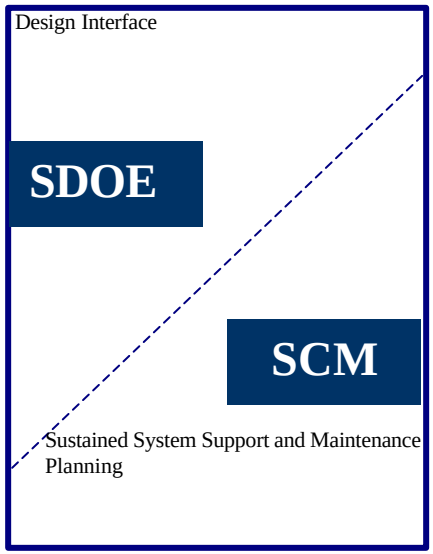
A "Cause-and-Effect" Dependency



Systems Engineering & System Support:
A "Cause-and-Effect" Dependency

Design for Support

- **Product Support Strategy Development**
  - **Develop/Implement PBL Plan**
- **Requirements Generation**
  - **R, M, S, Diagnostics, Prognostics**
- **Requirements Determination**
- **Application of the Systems Engineering Process**
- **TOC Assessment**
- **Develop and Implement PBL Plan**
- **Establish Maintenance and Support Plan – Determine Maintenance and Support Requirements**
- **Deliver Support to Operational Sites**

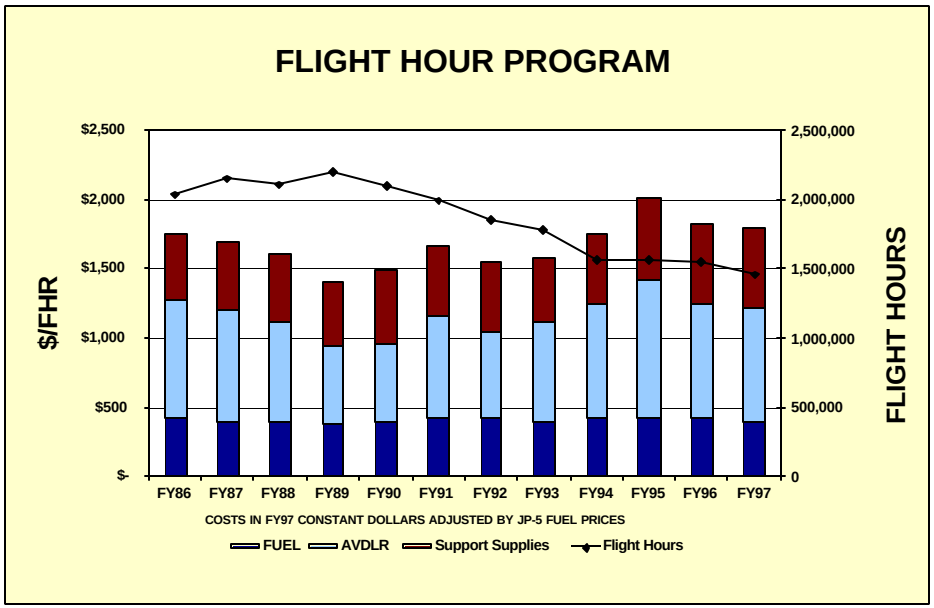


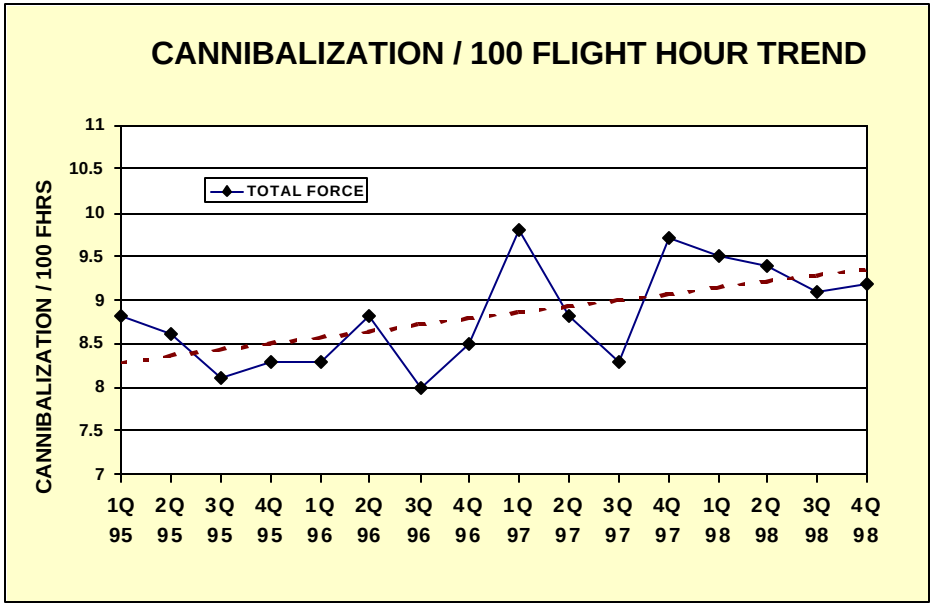
- **Field Program Management**
- **Maintain PBL Plan**
- **Logistics Elements**
- **Obsolescence/Technology Refresh**
- **Spares Re-Procurement**
- **Pulse of the Customer**
- **24/7 Contact**
- **Product Availability Analysis**
- **Operational Effectiveness**
- **Top Degraders & RCM/CBM Sustainment**
- **Affordability Analysis**
- **O&S Cost Assessments/DLR Cost & Avail.**
- **Safety – EI's, HMR's, and QDR's**

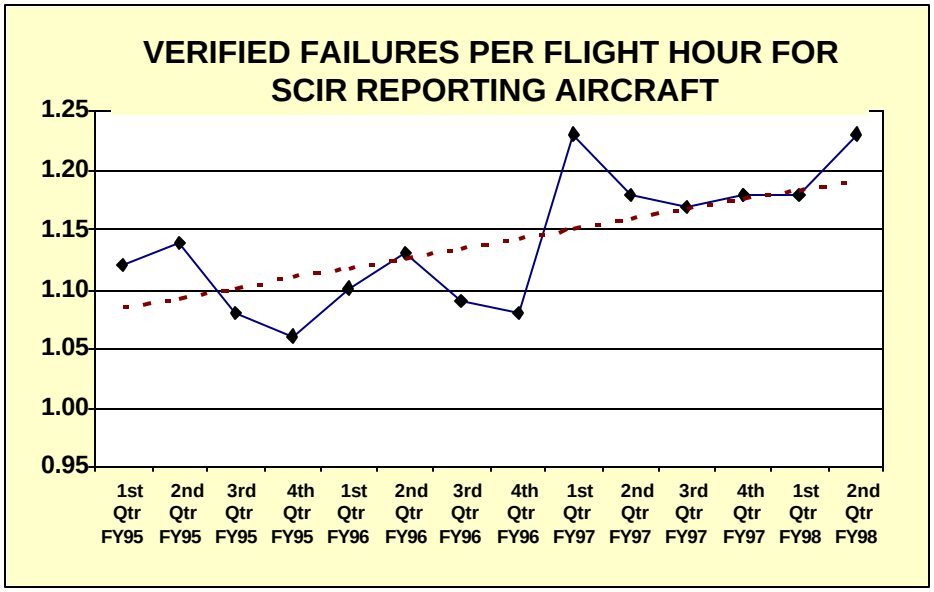
Support the Design

SDOE - System Design for Operational Effectiveness
SCM - Supply Chain Management

FLIGHT HOUR PROGRAM AND AGE RELATED IMPACTS

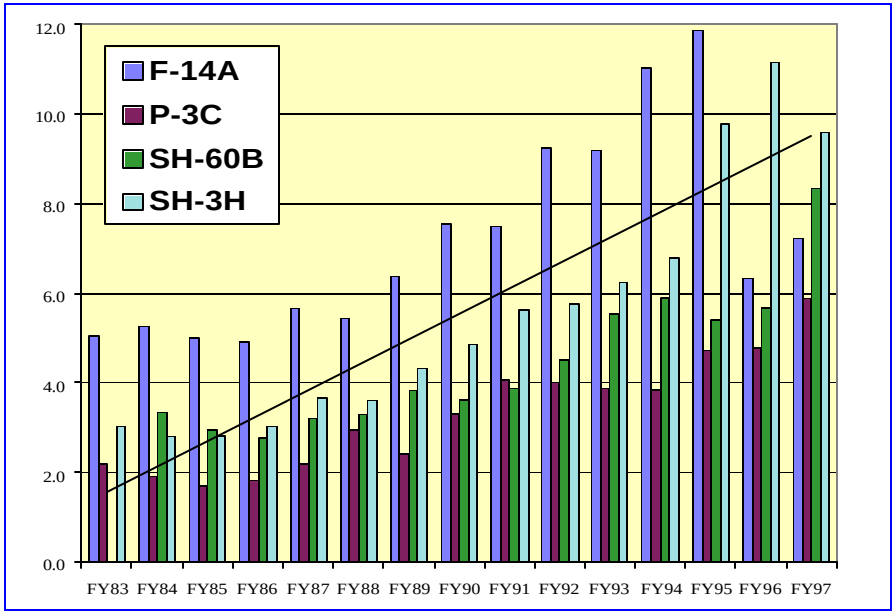


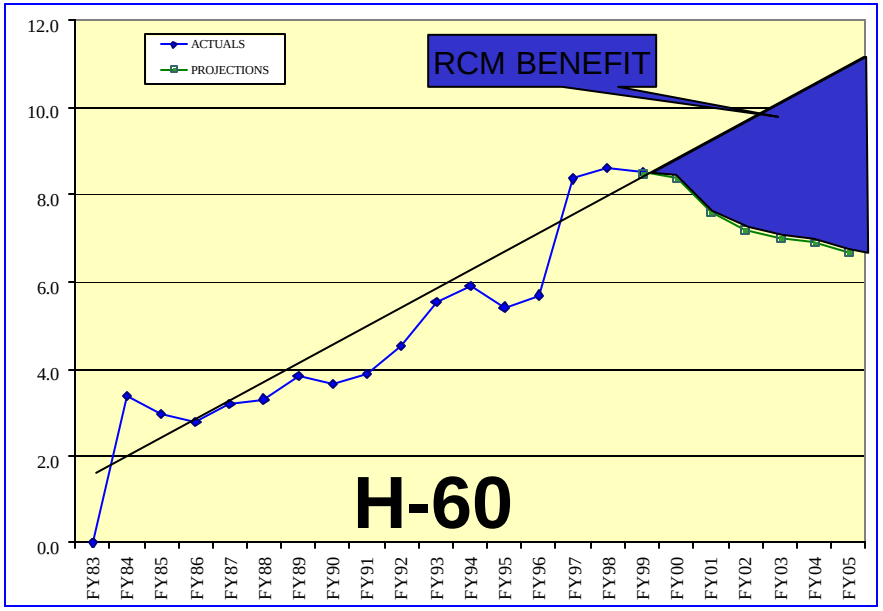




- **Fuel And Support Supplies Funding Flat Per Flight Hour For Period FY86-FY97; AVDLR costs increasing**
- **Increasing Failure Trends Drive AVDLR Shortfalls**
- **Increased Cannibalizations Occurring**

Inspection Trends





- **PROBLEM**
  - **"O" LEVEL INSPECTIONS INCREASING PER FLIGHT HOUR**
  - **AIRCRAFT AGING**
  - **INCREASED PHASED MAINTENANCE & SERVICE BULLETINS DRIVE ADDITIONAL SCHEDULED MAINTENANCE**
  - **INSPECTION HOURS PER FLIGHT HOUR HAVE DOUBLED OVER PERIOD**

- **FOCUSED H-60 RCM INVESTMENT WILL REDUCE INSPECTION HOURS PER FLIGHT HOUR BY 25%**

- **PRL INVESTMENT STRATEGY**
  - **INCREASE RCM APPLICATION TO ALL PLATFORMS**