

Air Force Material Command



Life Cycle Approach to Maintenance Planning

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Purpose

Discuss the challenge of an effective "cradle-to-grave" reliability, availability, & maintainability (RAM) strategy and typical associated metrics



Overview

- Background
- Key Policies
- Acquisition Initiatives
- Sustainment Initiatives
- Challenges



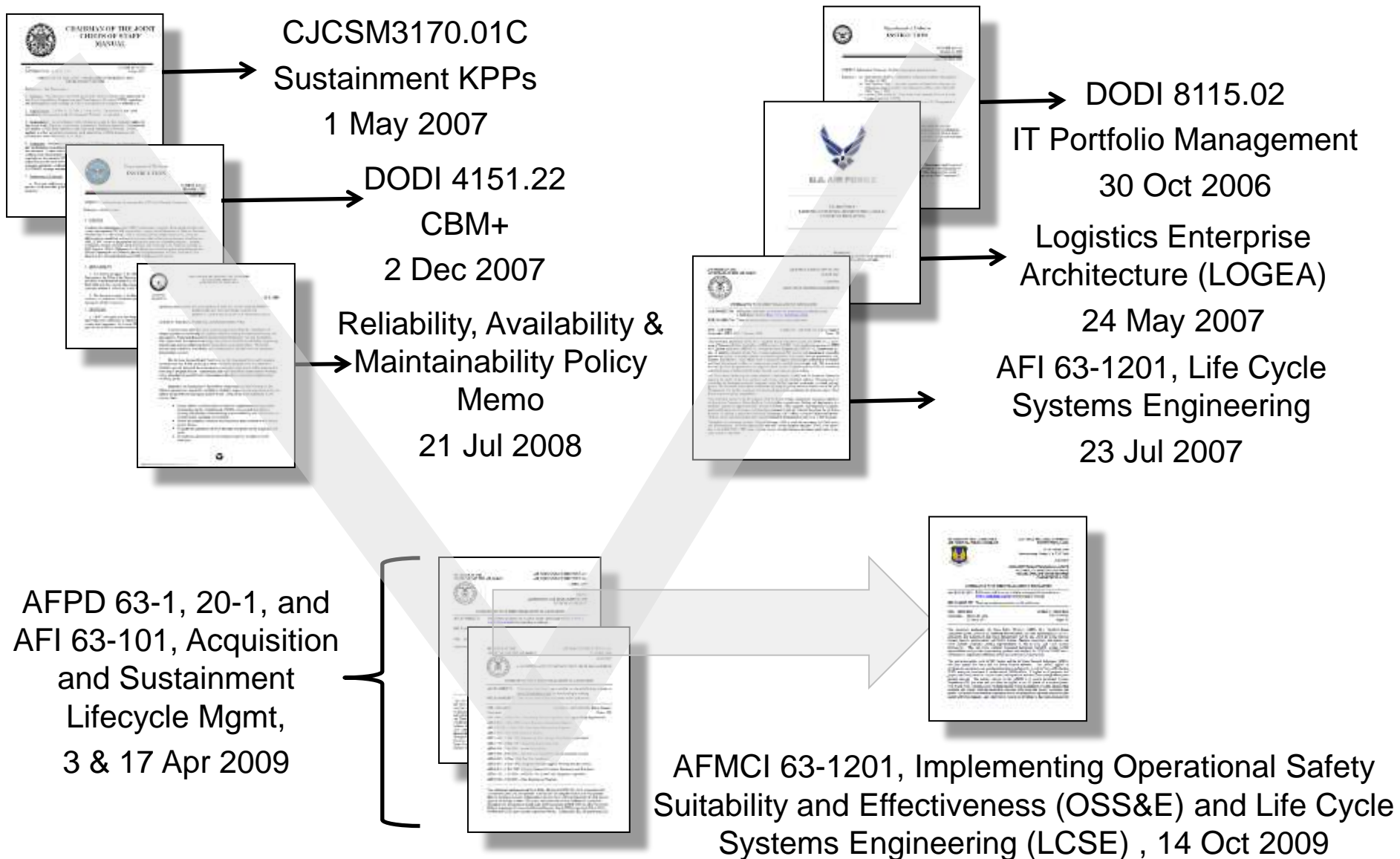
Background

RAM challenges with Military Systems

- **Poorly defined or unrealistically high RAM requirements**
- **Lack of priority on achieving R&M**
- **Too little engineering for RAM**
 - Inadequate lower level testing at component or subcomponent level
 - Reliance on predictions instead of conducting engineering design analysis
 - Failure to perform engineering analyses of commercial-off-the-shelf (COTS) equipment
 - Lack of reliability improvement incentives
 - Inadequate planning for reliability
 - Ineffective implementation of Reliability Tasks in improving reliability
 - Failure to give adequate priority to the importance of Integrated Diagnostics (ID) design influence on overall maintainability attributes, mission readiness, maintenance concept design, and associated LCC support concepts



Policy Flow Down





Key DOD Policies

- **DOD I 4151.22, Condition-Based Maintenance Plus (CBM+) – 2007**

Services shall:

- ...pursue CBM+ solutions to sustain and maintain the inherent capabilities of new and fielded equipment
- Ensure reliability analyses are implemented, including RCM
- Direct PMs to design, develop, demonstrate, deploy, and sustain equipment in accordance with CBM+ guidance and procedures to achieve required materiel readiness at best cost

- **Young Memo: Reliability, Availability, and Maintainability (RAM) Policy – 2008**

- Understand and document user needs and constraints
- Design & redesign for RAM
- Produce reliable maintainable systems
- Monitor field experience and sustain RAM performance



DOD CBM+ Definition

..... “ the application and integration of appropriate processes, technologies, and knowledge-based capabilities to improve the reliability and maintenance effectiveness of DoD systems and components

..... uses a **systems engineering** approach to collect data, enable analysis, and support the decision-making processes

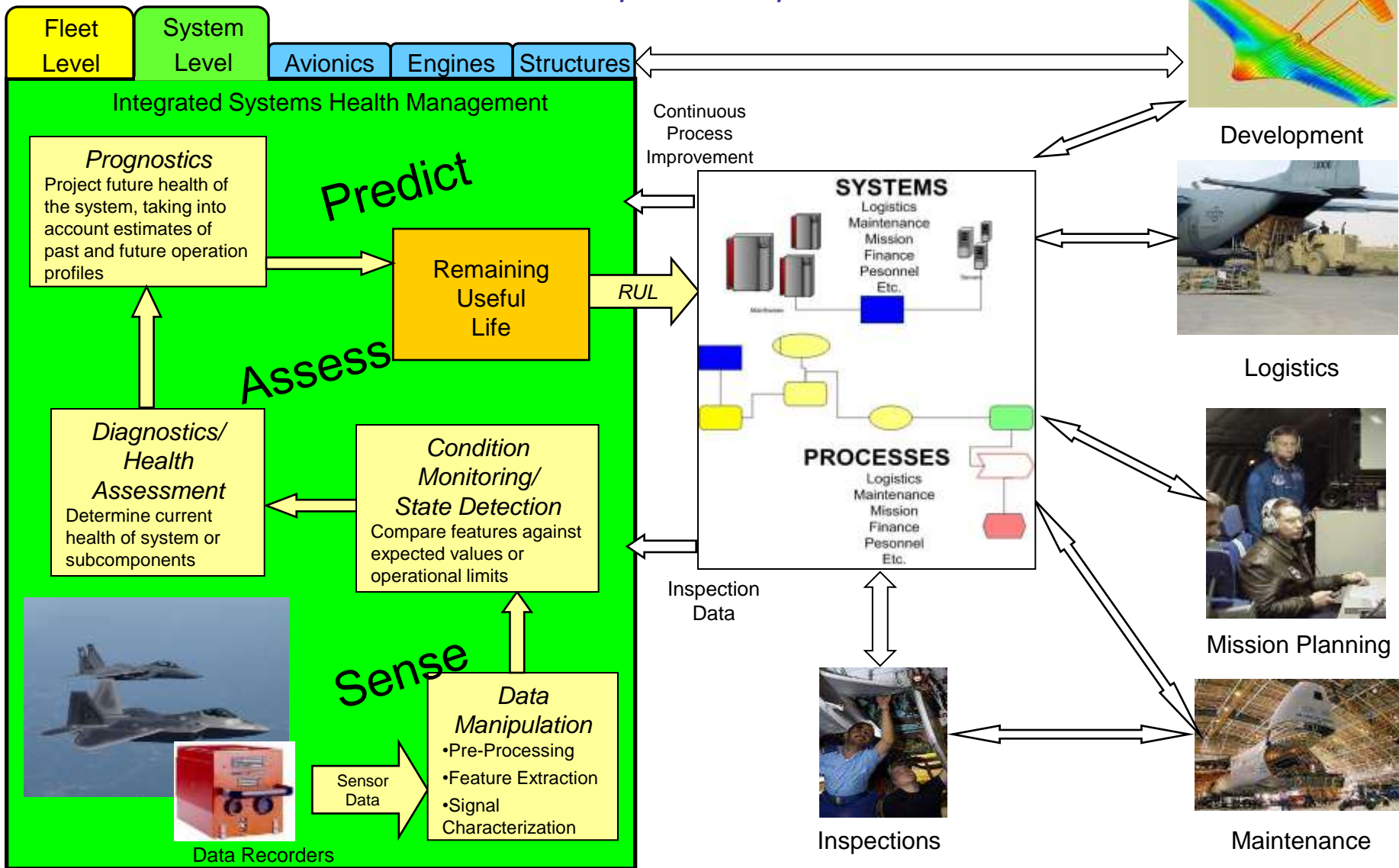
Ref: DoD CBM+ Guidebook

The AF CBM+ Strategy has always been to use legacy systems as test beds and feed lessons learned back to acquisition to improve design



AF "To Be" CBM+ Operational View

Feedback loops in place to allow continuous process improvement





Key AF Policies

- **AFI 63-101 Acquisition & Sustainment Life Cycle Management – 2009**
 - AF/A4/7 AND AFMC/CC will: Ensure Serialized Item Management (SIM), Reliability Centered Maintenance (RCM) and Condition Based Maintenance Plus (CBM+) concepts and functions are developed and implemented as applicable
 - PMs/SPMs will: Develop and implement, as applicable, Condition Based Maintenance Plus (CBM+) functions AND establish an effective quality management system to ensure product quality (e.g., design, manufacturing, performance, reliability, maintainability, and military flight operations) throughout the life cycle
 - PMs shall collect, report, and analyze sustainment metrics to measure program life cycle sustainment outcomes that satisfy the sustainment KPP/KSAs defined by the user in accordance with CJCSM 3170.01, as a minimum, include the following areas: availability, reliability, cost of ownership, and mean down time (MDT)



Key AF Policies

- **AFMCI 63-1201 Implementing Operational Safety Suitability and Effectiveness (OSS&E) and Life Cycle Systems Engineering (LCSE) - 2009**
 - Implements AFI 63-101, AFI 63-1201 and System Engineering Plan (SEP) impacts resulting from Weapon Systems Acquisition Reform Act (WSARA, 2009)
 - Describes relationship between AF Systems Engineering Assessment Model (SEAM) the Defense Acquisition Guide Book (DAG) and AFI 63-1201
 - Directs SPMs to develop and implement an approach to continually assess, maintain, or improve a system's reliability, availability, maintainability and supportability



Acquisition Initiatives

- **ASC RAM Initiatives**

- **Process Guide For Systems Reliability, Planning, Tracking, and Reporting**

- Defines an approach to improve weapon system reliability which aligns with the Office of the Secretary of Defense (OSD) vision to acquire reliable weapon systems that satisfy user needs with measurable improvements to mission capability at a fair and reasonable price.

- **Weapon Systems Integrity**

- Ensures accomplishment of weapon system integrity are consistent with the paragraphs provided in AFPD 63-1 and similarly through the implementation of OSS&E as called forth in AFI 63-1201 and AFMCI 63-1201.



Lifecycle Sustainment Outcome Metrics

- **Materiel Availability**

- A measure of the percentage of the total inventory of a system operationally capable (ready for tasking) of performing an assigned mission at a given time, based on materiel condition.

- **Materiel Reliability**

- A measure of the probability that the system will perform without failure over a specific interval. Generally expressed in terms of a mean time between failure.

- **Mean Down Time**

- The average Total Downtime required to restore an asset to its full operational capabilities. Includes time from reporting of an asset being down to the asset being given back for operations/production. Modified to mission capable for A/C.

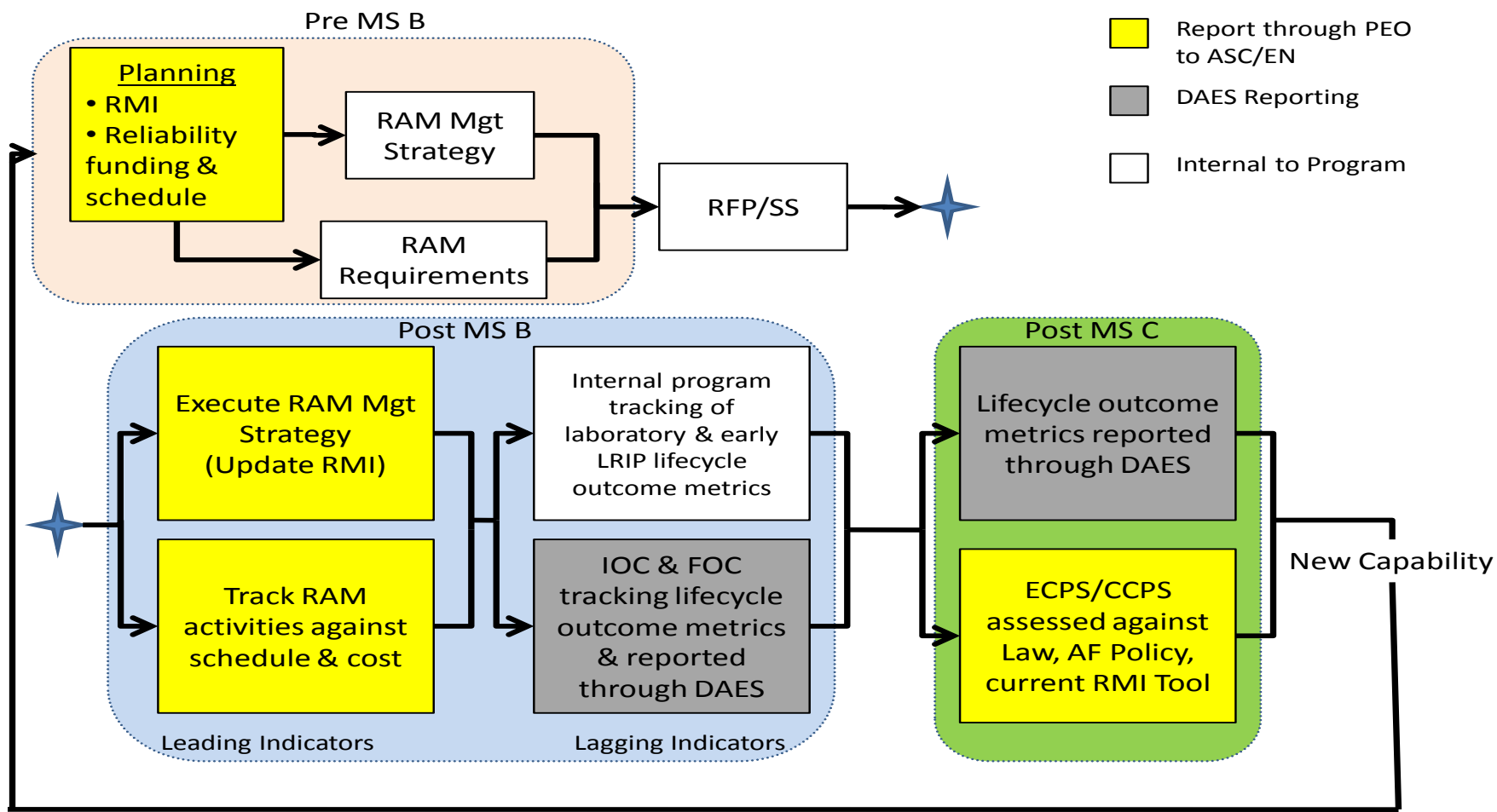
- **Ownership Cost**

- Provides balance to the Sustainment solution by ensuring that the Operations and Support costs associated with materiel readiness are considered in making decisions.

“The goal for these 4 material readiness outcomes should be established early in the concept decision process, refined throughout the design development process, and then carried through as program baseline goals until system retirement.” Bell Memo, 2007



Flow diagram System Reliability Analysis, Planning, Tracking and Reporting (RAPTR)





Sustainment Initiatives

- **Aircraft Availability Improvement Program (AAIP)**
 - AF wide base lining and tracking of Sustainment KPPs/KSA per AF I 63-101
 - Managed at AFMC by the Director of Logistics & Sustainment
 - Required for all non-development programs
 - Development programs must have AAIP strategies documented in the Life Cycle Management Plan (LCMP) by M/S C
 - Additional Sustainment Metric calculation and LCMP guidance can be found in AFPAM 63-128



Aircraft Availability Measures

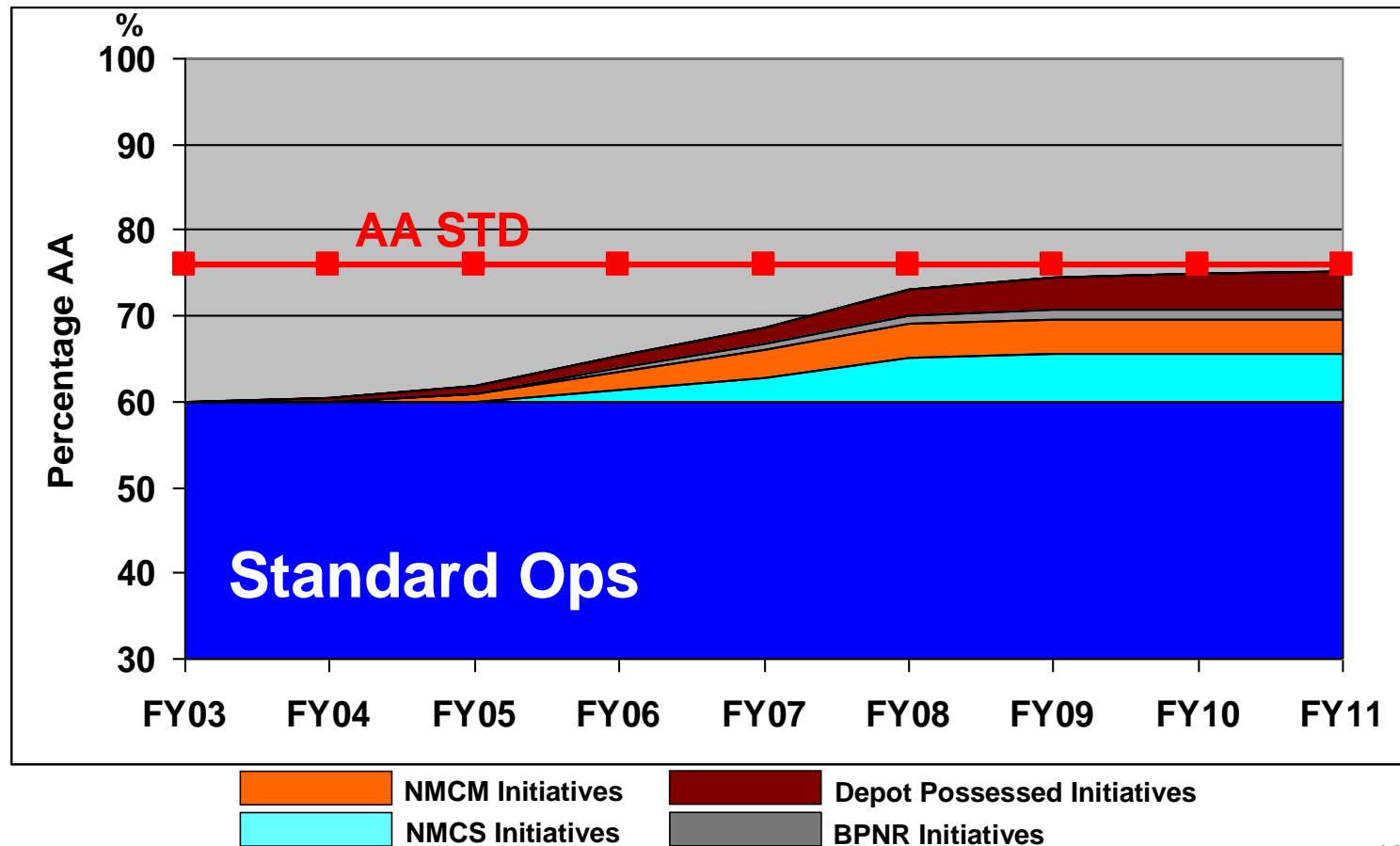
- **Mission Area Enterprise View**
 - Dashboard Format based on Aircraft Availability (AA) for MDS
- **Weapon System Drill-Down from Mission Area Enterprise View**
 - **Depicting all categories of AA metric**
 - AA – Aircraft Availability
 - NMCS – Not Mission Capable-Supply
 - NMCM – Not Mission Capable-Maintenance
 - NMCB – Not Mission Capable Both
 - UPNR – Unit Possessed Not Reported
 - Depot
 - **Two Bar Charts**
 - Multi-Year trend (Actual vs. Target)
 - Current fiscal year-to-date Non-Availability categories (Actual vs. Target)
- **Data Source**
 - **Logistics, Installation, and Mission Support – Enterprise View (LIMS-EV)**
 - Quarterly assessments



Aircraft Availability

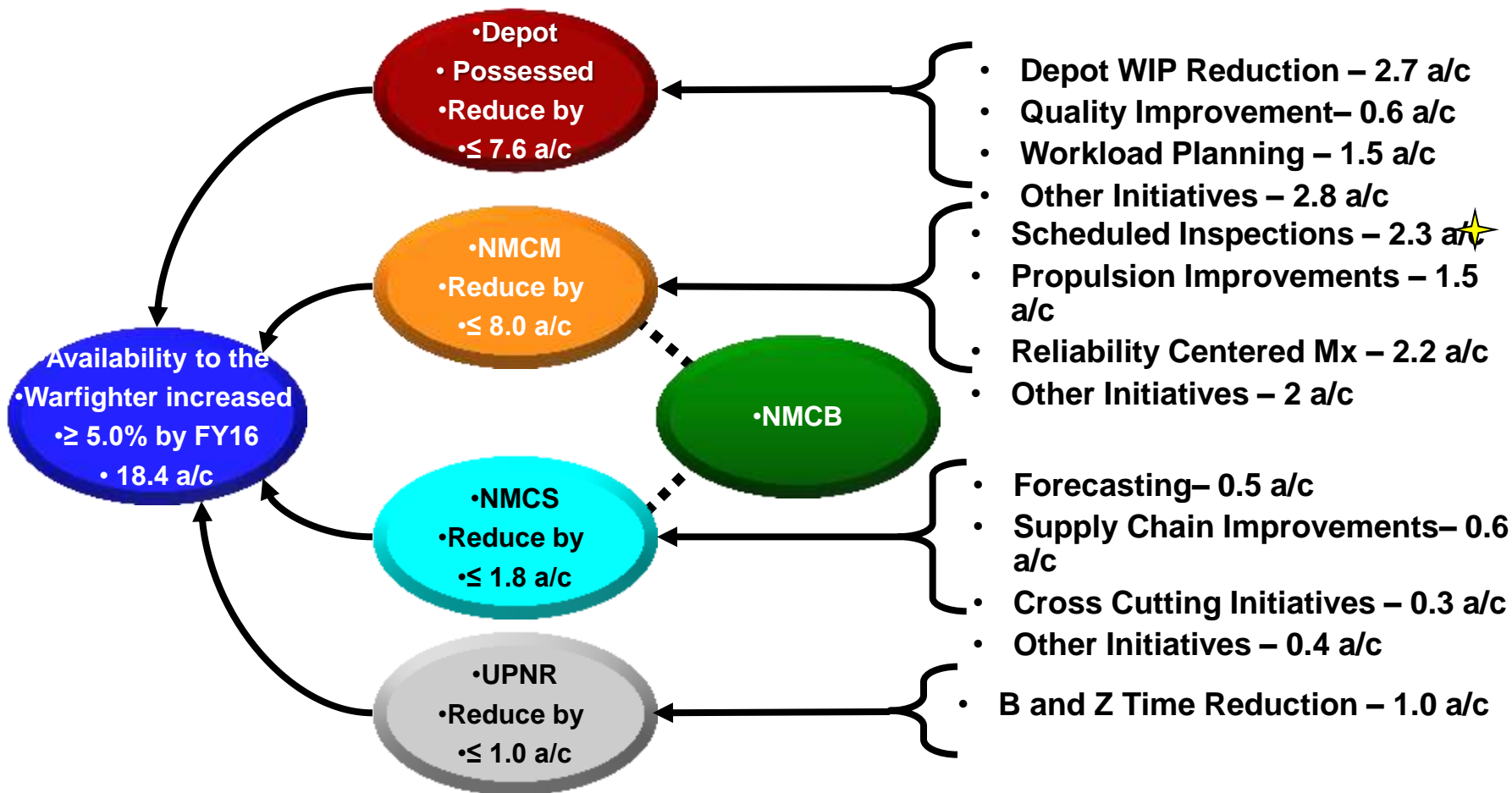


AA Slide #1 Aircraft Availability Glide Slope





AA Initiative Summary (FY11-16)





Challenges

- **Develop guidance delineating the relationships between CBM, RAM, Life Cycle Management and Systems Engineering**
 - Eliminate redundancies and enforce the most pertinent policies
 - Establish a functional organization responsible for looking across both acquisition and sustainment (ensure AF I 63-101 is functionally executable)
 - Ensure most critical policies are supported with resources/necessary tools
 - Provide guidance on priorities in a constrained financial environment
- **Lifecycle Management resources**
 - Product Data Acquisition (PDAQ) - Culture of “don’t buy data” needs to be replaced with a culture of “contract for or price data at each phase” or justify not doing so
 - Engineers need data and tools to support failure mode analysis, RCM, etc
 - Dedicated funding needed to support R&M initiatives (RTOC is insufficient)
 - Practitioners need guidance (checklists, decision trees, standard language, etc.)
 - Future ERP (ECSS) requires standardized data to deliver planned benefits
 - Document the high level effects and capabilities necessary to properly generate, manage, and protect Technical Information

