Carnegie Mellon
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A Process-Oriented (Practical) Approach to Program Office Systems Engineering Management Using the CMMI-AM as a Guide

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Report Documentation Page

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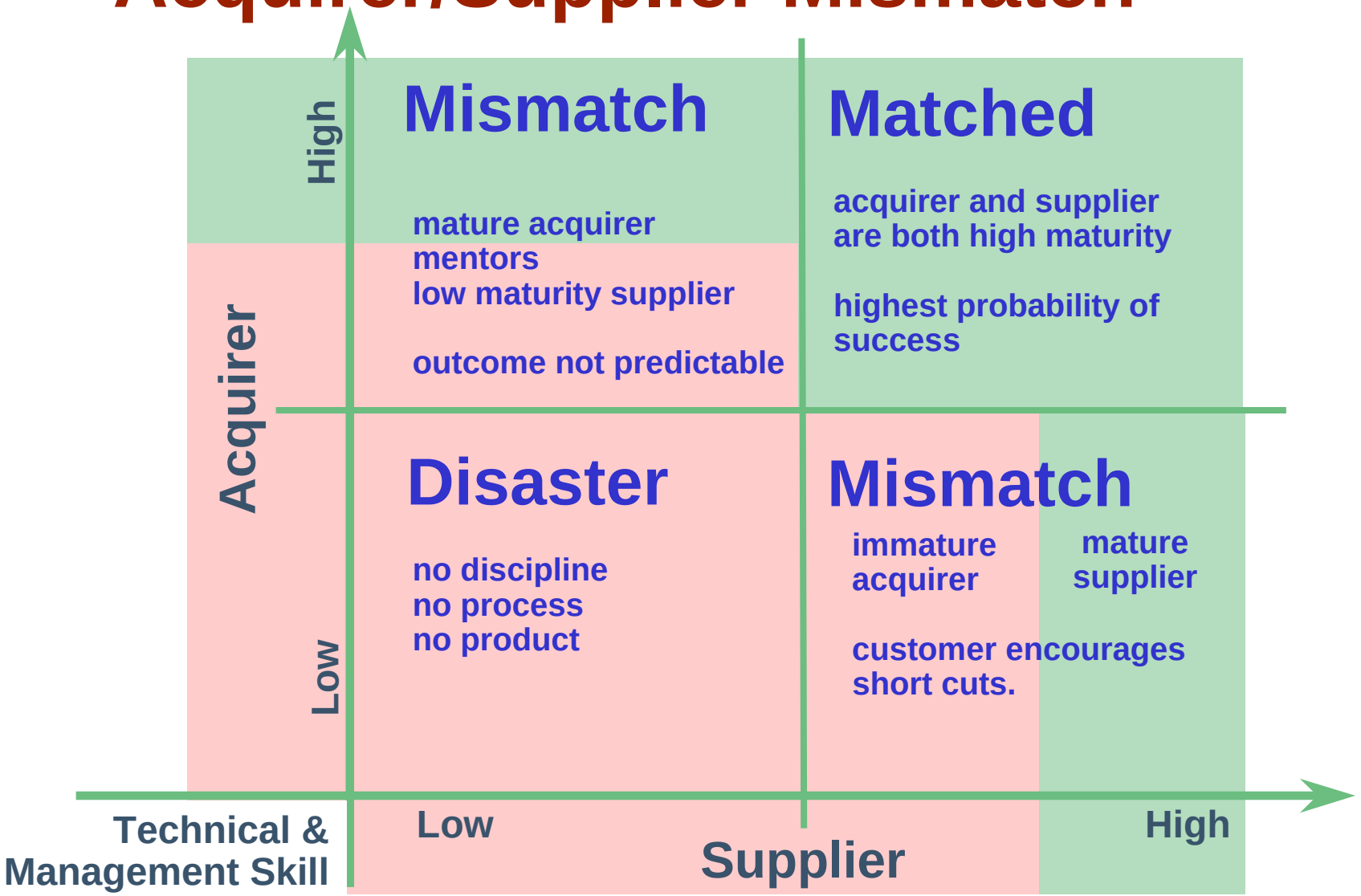
This presentation has been updated to reflect recent work in progress

Agenda

- Process Improvement in the Program Office
- Program Office System Engineering Activities
- MMA Program Context
- Program Office Documentation Hierarchy
- Program Office System Engineering Planning
- How Did We Integrate Processes with the SEMP?
- OSD Guidance
- Lessons Learned

Acquirer/Supplier Mismatch



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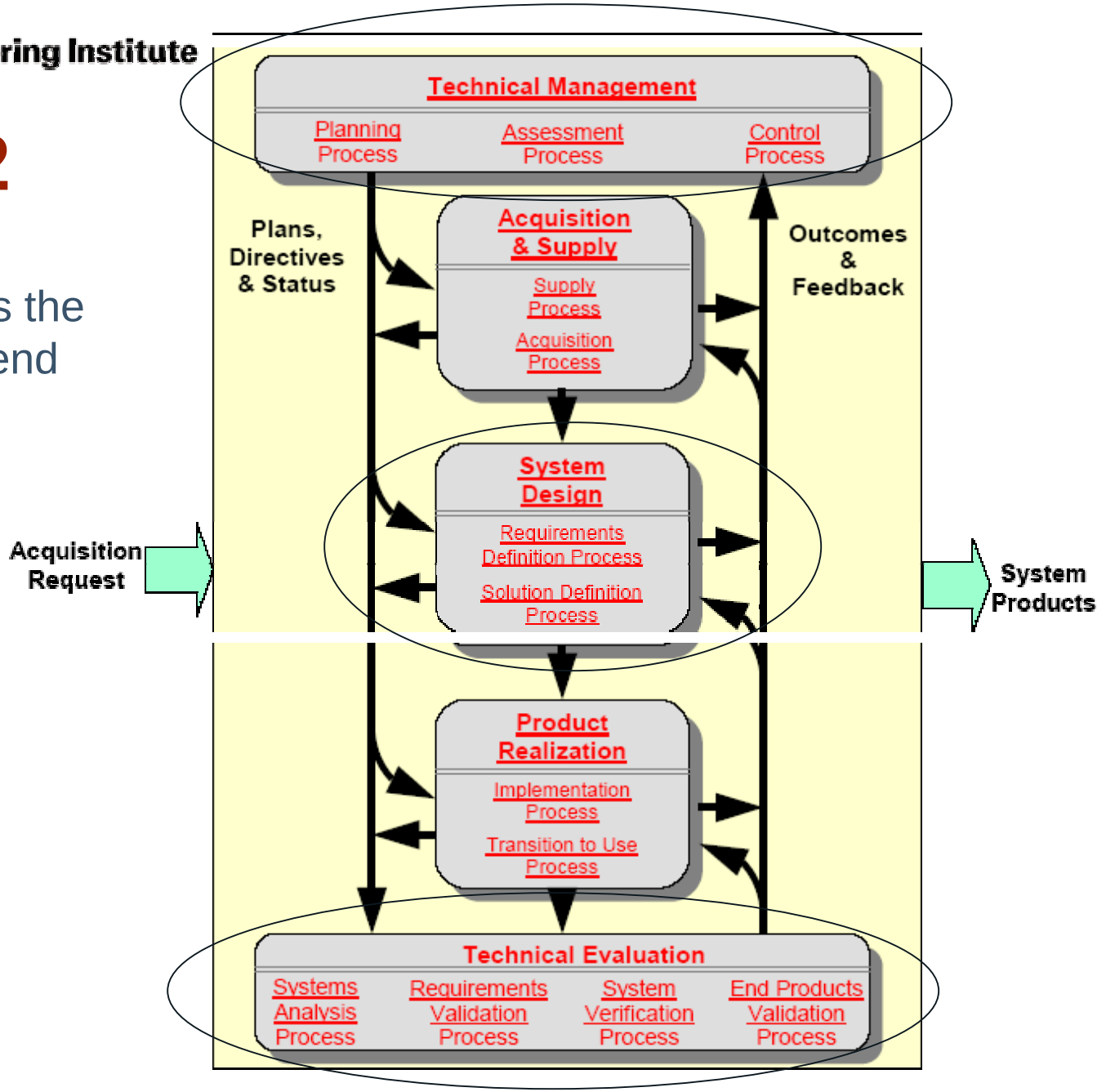
In what areas does the Program office spend its technical time?



PMO System Engineering Activities (Notional)

Review of Contractor Materials (CDRLs, IDE)

Participation on IPTs

Preparation of PMRs

Risk Management Activities

Probing Contractor Activities for Award Fees Determination

Facilitate Technical Reviews (Gov't only and Contractor)

Plan for Subsequent Years

Manage Government Furnished Property

Manage Functional Baseline

Plan for Spiral Development

Participation in Councils, Boards, and Working Groups

Manage Stakeholder Involvement

OSD System Engineering Focus

Date	Document	Key Points
February 20, 2004	Policy for Systems Engineering in DOD	• Develop a SEP that describes overall technical approach, including processes, resources, metrics, and applicable performance incentives. • Detail timing, conduct, and success criteria of Tech Reviews • Director, Defense Systems - review program SEPs (where AT&L is the MDA) as part of preparation for DAB reviews.
March 20, 2004	Implementing Systems Engineering Plans in DOD – Interim Guidance	• Address the integration of the technical aspects of the program with the overall program planning, SE activities, and execution tracking

Details of March 20 Guidance

- Processes to be applied, how they will be implemented and tailored, how they will support the technical & programmatic products required of each phase.
- Technical baseline approach: how developed, managed, and used to control requirements, design, integration, VER, and VAL. Discuss metrics (TPM) for the technical effort and how they will be used to measure progress.
- Timing, conduct, success criteria, and expected products of technical reviews. How they will be used to assess technical maturity, assess technical risk, and support program decisions. Updates to include results of completed technical reviews.
- How SE activities will be integrated within and coordinated across IPTs; how IPTs will be organized; what SE tools they will employ; resources, staffing, management metrics, and integration mechanisms; how SE activities are integrated in the program's overall integrated schedules.

FY03 NDAA Section 804 (Dec 02)

Services/departments shall *establish programs to improve the <software> acquisition process* … 120 days after enactment

Program Requirements

- Documented process for planning, requirements development and management, project management and oversight, and risk management
- Metrics for performance measurement and continual process improvement
- A process to ensure adherence to established process and requirements related to the acquisition of software

ASD(C3I) and USD(AT&L):

- Prescribe uniform guidance for implementation across DoD
- Assist services/departments by:
  - Ensuring source selection criteria include past performance and the maturity of the software products offered by potential sources
  - Serving as a clearinghouse for best practices in software development and acquisition in both the public and private sectors

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Multi-mission Maritime Aircraft

Purpose of Multi-mission Maritime Aircraft (MMA) Program

To recapitalize the capabilities currently provided by the P-3 aircraft systems

The P-3 aircraft provides the USN with blue water and littoral Undersea Warfare (USW) capabilities, and performs armed intelligence, surveillance and reconnaissance functions

Transformation

Sea Power 21

- Right availability at the right cost
- Fleet transformational training objectives
- Innovative logistic solutions
- Open Systems Architecture

Sea Shield

- Persistent ASW
- ASUW

FORCEnet

Sea Basing

Sea Strike

- ISR
- Common Undersea Picture (CUP) provider

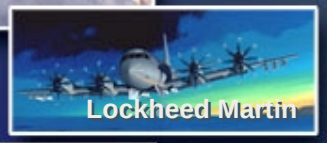
ASUW-Anti-surface Warfare
ASW-Anti-submarine Warfare
ISR-Intelligence, Surveillance, & Reconnaissance

Program Snapshot

20 Mar 00 (A) — 11 Jan 02 (DR) — 28 May 04 (B) — FY10 (C)

Concept and Tech Development		System Dev and Demonstration		Production and Deployment		
Concept Exploration	Component Advanced Development	System Integration	System Demonstration	Low Rate Initial Production (LRIP)	Full Rate Production (FRP)	Operations and Support

FY00-02: Concept Exploration



BAMS-UAV and Global Hawk maritime demo

FY02-04: Component Advanced Development

- Multiple contracts awarded for MMA system
  - Defined MMA system architecture
  - Validated operational requirements document (ORD)

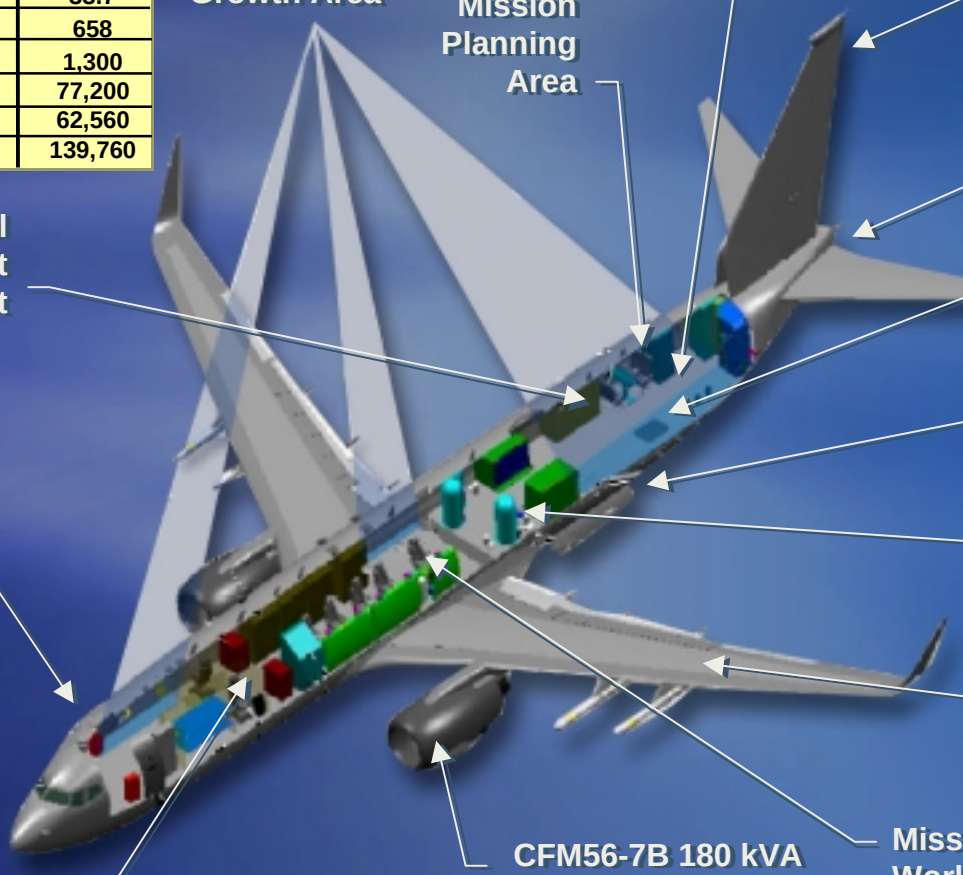
FY04-13: System Development and Demonstration

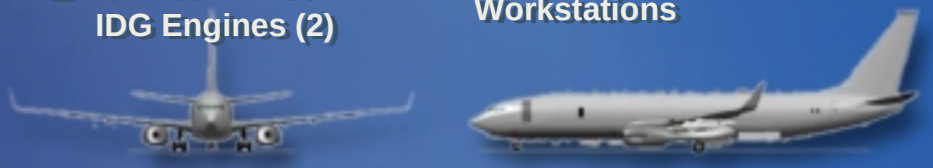
- Single contract awarded for MMA system
  - Design, development and test MMA system
  - Ground, flight, live fire test articles

MMA SDD contract awarded to Boeing for the 737 MMA on 14 June 2004

Layout

	737-800ERX MMA	P-3C
Length (ft)	129.5	116.7
Span (ft)	117.2	99.7
Height (ft)	42.1	33.7
Useable Floor Area (ft^2)	1018	658
Wing Area (ft^2)	1,341	1,300
Max ZFW (lb)	146,600	77,200
Max Fuel (lb)	75,058	62,560
MTOW (lb)	184,200	139,760





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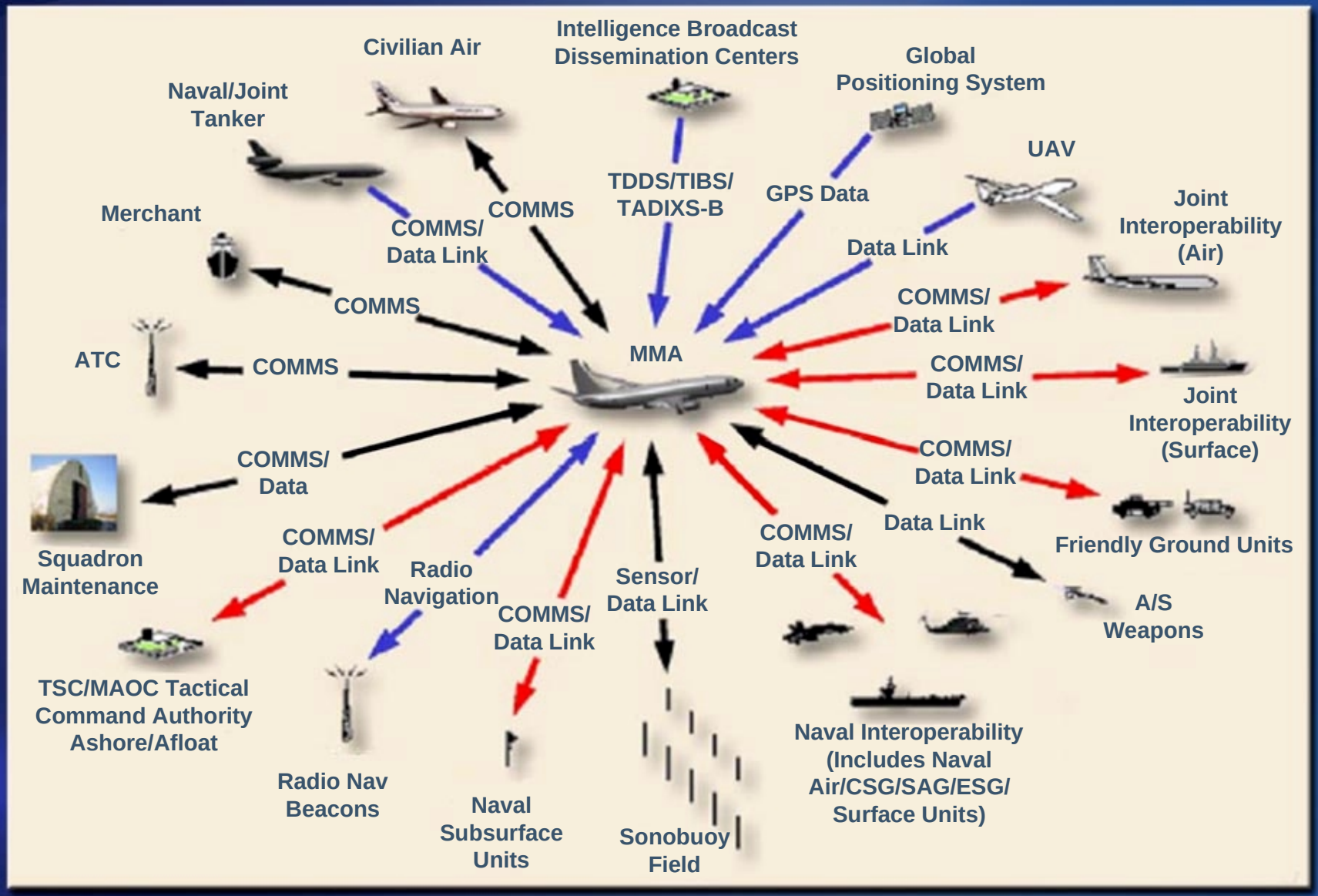
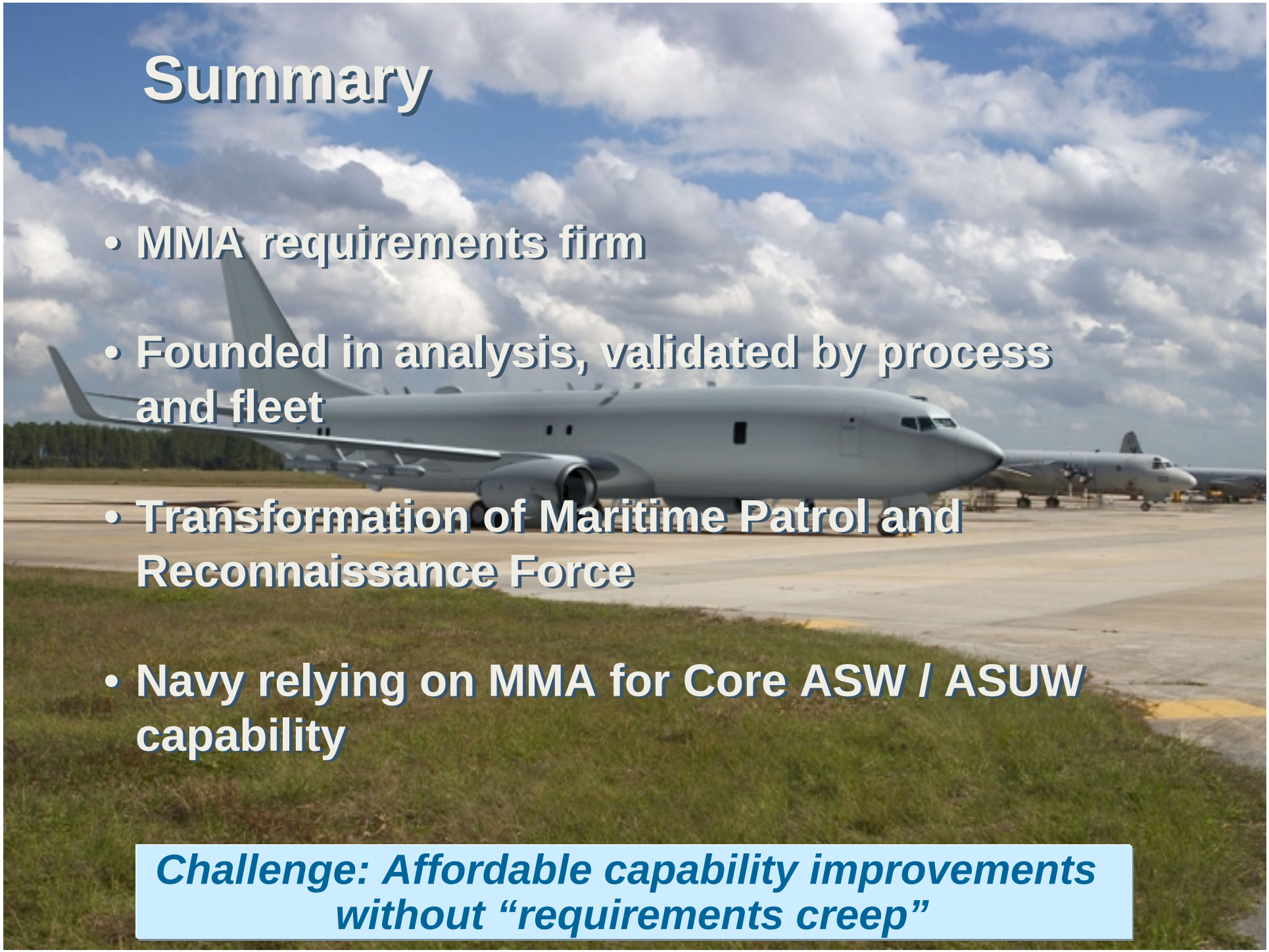
Interoperability





Summary

- MMA requirements firm
- Founded in analysis, validated by process and fleet
- Transformation of Maritime Patrol and Reconnaissance Force
- Navy relying on MMA for Core ASW / ASUW capability

Challenge: Affordable capability improvements without "requirements creep"

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Recent OSD Guidance

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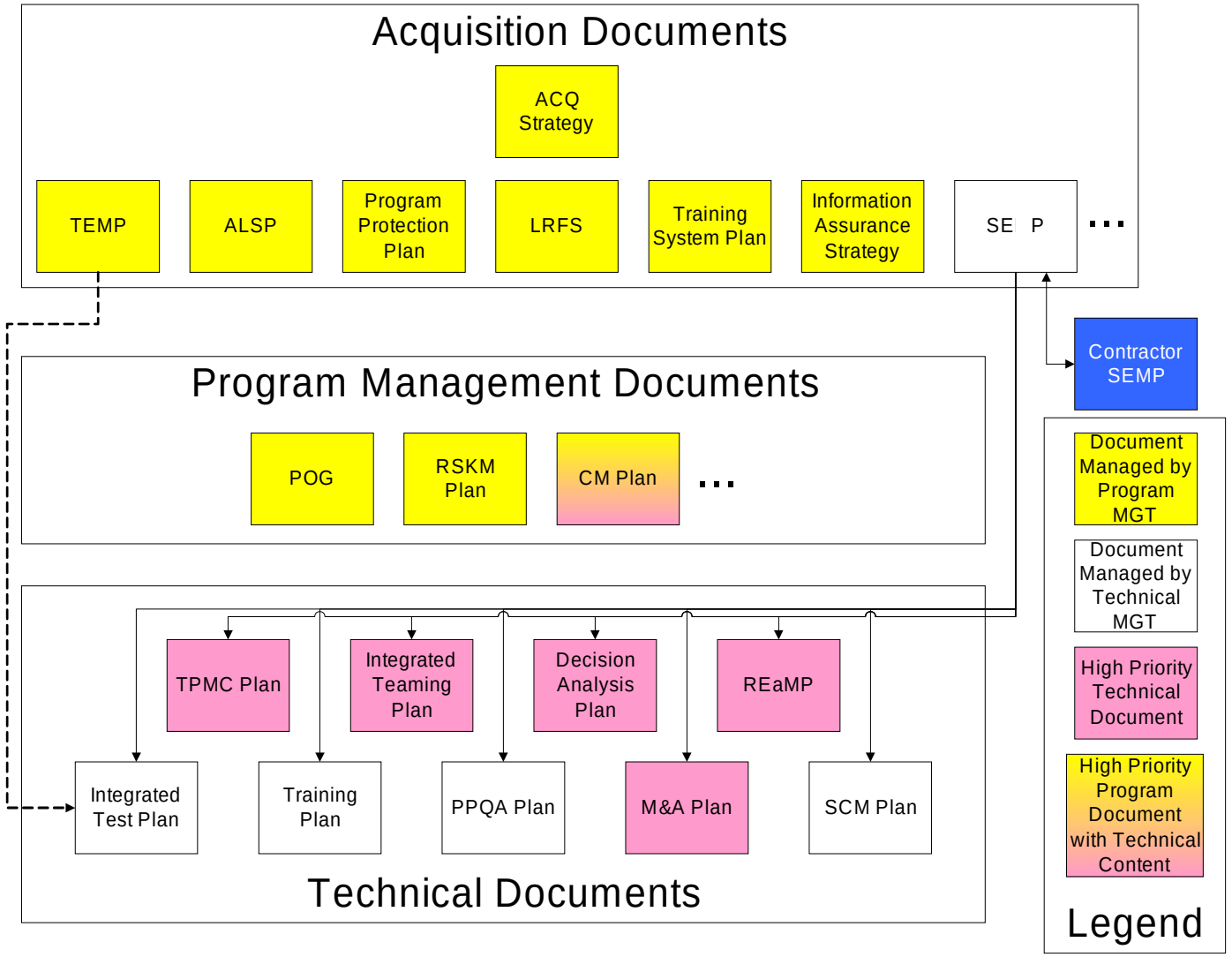
MMA Document Hierarchy



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MMA SEP Outline

Introduction

Reference Documents

Systems Engineering Process Plan (SEPP)

Technical Team Organization

Technical Planning and Control

Technical Reviews

Program Reviews

Spiral Development/Technology Transition

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Ex.: Systems Engineering Process

Inputs

Requirements Analysis

Functional Analysis / Allocation

Synthesis

System Analysis

Verification and Validation

Outputs

Ex.: Use of Annotated Outline

PERFORMANCE MEASUREMENT AND ANALYSIS

Earned Value Management

Discuss the EVM contractual requirements we've placed on the vendor. Explain that a cost account manager (CAM) counterpart matrix will be established at the IBR.

Describe the technical approach to determining the vendor award fee.

Describe how the government team will monitor progress against their IMP / IMS and make decisions based on status (control). Refer to the Decision Analysis and Resolution process and Technical Management Processes sections of Appendix A as appropriate.

Technical Performance Measures

Identify the TPM philosophy for MMA and identify the candidate TPMs. Use the data from VSEMP 4.4

Technical Metrics

Identify and expand upon the goal of having technical metrics at the cost account level to augment the earned value data coming from the contractor EVMS. Identify the types of technical metrics we plan to use. Specifically discuss SW metrics. Grab the SW metrics chart from the CAD Software Development Plan CDRL. For metrics related to execution of the Government team processes and IMP / IMS, refer to the Measurement and Analysis process section of Appendix A.

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SEP Process Definition Outline

Conceptually use process definitions as SOWs for future sub-tier plans

Use interview technique to identify "To Be" process state

Use a specific outline for the process definitions

Create diagrams that illustrate the relationships between the processes

Explicit identification of generic characteristics (measures, configuration management items, reports, training)

Use of the CMMI-AM as a set of practices that represent the PMO

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MMA Process Mapping to CMMI-AM

MMA SEP Processes
Technical Planning, Monitoring and Control
Solicitation and Contract Monitoring
Risk Management
Integrated Teaming
Requirements Development and Management
Integrated Testing
Measurement and Analysis
Configuration Management
Decision Analysis and Resolution
Training
Product and Process Quality Assurance

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Generic Process Outline

Introduction

Process Description (with Context Diagram)

Activities

Technical Baseline and Programmatic Products

Decisions

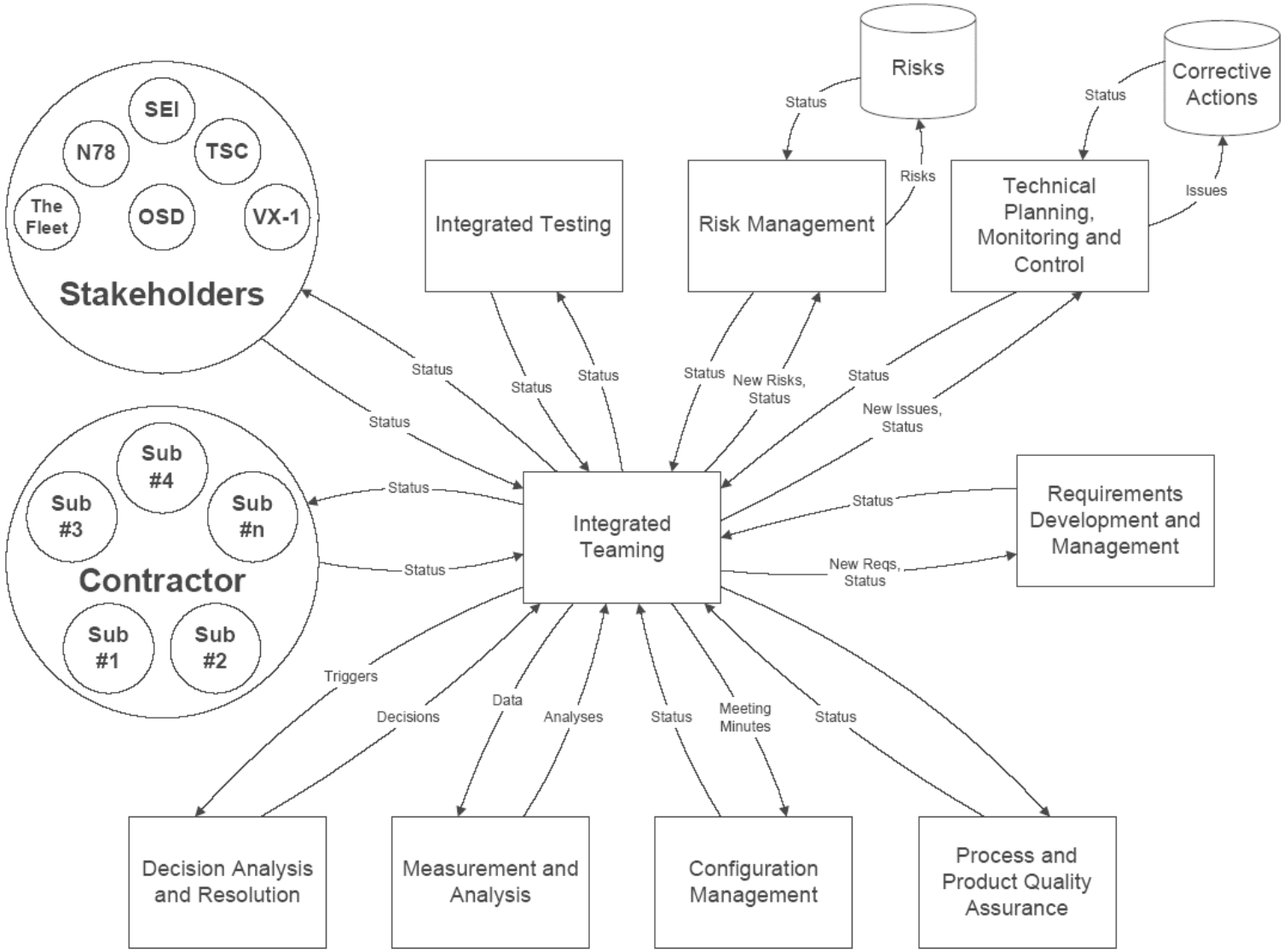
Communications

Configuration and Data Management

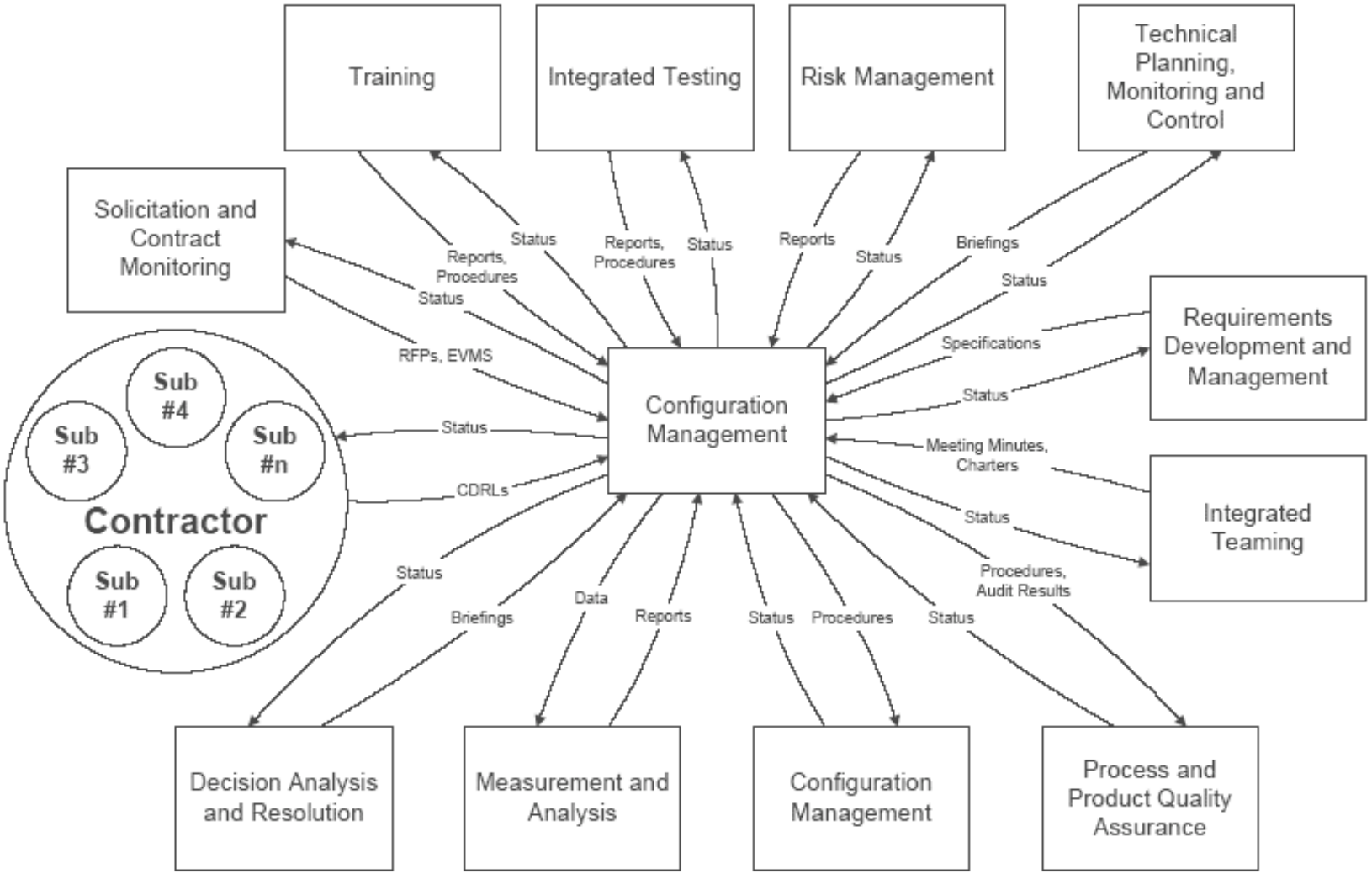
Metrics

Training

Ex.: Integrated Teaming – Context



Ex.: Support Process – Context



Ex. Integrated Testing – Activities

Task/Activity	Type	Responsibility	Sub-process?
Develop MMA Test Plans	Event	Team Leads	Yes
Conduct MMA Test Plan Readiness Reviews	Event	Team Leads	Yes
Attend Testing IPT Meetings			No
Prepare Facilities Plan	Event	Team Leads	Yes
Develop TEMP		Testing Lead	No
Evaluate CDRLs		Team Leads	Yes
Attend Milestone Reviews	Event	APMSE	No
Conduct Product Evaluations			Yes
Establish and maintain the testing schedule		Team Leads	No

Ex.: Solicitation and Contract Monitoring – Metrics

Measurement	Source	Frequency	Analysis Method
Government Quality	Solicitation and Source Selection Preparation and Execution	As Occurring	Survey Bidders and Source Selection Team Members
Contractor Quality	CDRLs and other Work Products	As Occurring	Comparison to DID, Audit Work Products
Government Timeliness	Adherence to Contract Schedule, CDRL Reviews	As Occurring	Compare delivery/review dates to due dates
Contractor Timeliness	Adherence to Contract Schedule, CDRL Deliveries	As Occurring	Compare delivery dates to due dates
Customer (Govt.) Satisfaction	PMRs	Quarterly	Satisfaction Ratings
Contractor Satisfaction	PMRs	Quarterly	Satisfaction Ratings (?)
Number of Bidders' questions to RFP	Contract Bids	As Occurring	Comparison to RFP

Ex.: Technical Planning, Monitoring and Control – Communications

Name	Frequency	Type
IMP	Continuous	MS Excel
IMS	Continuous	MS Project (or Sigma)
Corrective action list	Weekly	MS Excel
Systems Engineering Coordination	Weekly	Meeting
MMA Core Team Coordination	Weekly	Meeting
MMA Leadership Coordination	Weekly	Meeting
Task descriptions	A/R	e-mail
Team (and Sub-Team) Coordination	Weekly	Meeting
IPT Coordination	Weekly	Meeting
Status information put into IDE	Weekly	MS Word
Relevant stakeholders input and review	Continuous	MS Word or email
Critical path in IMS	Weekly	MS Project

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Ex.: Integrated Testing – Configuration Items

Configuration Item	CM/DM	File Type	Expected Update?
Test Plan CDRLs	CM	MS Word	Based on government and supplier comments and reviews
Testing IPT meeting minutes	DM	MS Word	After each meeting
Review meeting minutes	CM	MS Word	After each review
Test Reports	CM/DM	MS Word MS Excel	After completion of testing effort
Coding Standards	CM	MS Word	Based on government and supplier comments and reviews

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New Guidance from OSD

Systems Engineering Application to Life Cycle Phases

- System Capabilities, Requirements and Design Considerations
  - Capabilities to be Achieved
  - Key Performance Parameters
  - Certification Requirements
  - Design Considerations
- SE Organizational Integration
  - Organization of IPTs
  - Organizational Responsibilities
  - Integration of SE into Program IPTs
  - Technical Staffing and Hiring Plan
- Systems Engineering Process
  - Process Selection
  - Process Improvement
  - Tools and Resources
  - Approach for Trades

New Guidance from OSD – 2

Systems Engineering Application to Life Cycle Phases

- Technical Management and Control
  - Technical Baseline Management and Control (Strategy and Approach)
  - Technical Review Plan (Strategy and Approach)

- Integration with Other Program Management Control Efforts
  - Acquisition Strategy
  - Risk Management
  - Integrated Master Plan
  - Earned Value Management
  - Contract Management

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Collaboration Mechanisms

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The SEP activity was new ground, not much legacy to draw on... led to prototyping and reevaluation of end state, and took longer than we wanted

The Program Office recognized the need for improvement, and worked with us shoulder to shoulder to develop the SEP... a different situation would have made this task very challenging

Ideally, the SEP should be an evolving document from an earlier program life-cycle... OSD guidance points future programs to create this document early in the life-cycle and evolve it as they proceed from milestone to milestone

Throughout the process OSD guidance was evolving… not an optimal condition

Be clear about the difference between Verification and Product and Process Quality Assurance

SEP Prep Guide V 0.90 Released 18 Oct 04 by OSD will help in evolution of document to include initial release for future programs

Recent Updates

Process Improvement Plan has been developed that supports the SEP

- Compelling reasons for process improvement
- Roles and Responsibilities
- Strategy, Activities, Resources, and Schedule
  - Implementation Schedule
  - Process Action Plan Skeleton
- MMA Program Context Information
- Plan Measures
- Plan Risks
- Plan Outputs
- Plan Communications

Plan Highlights

Plan scoped for five (5) years of implementation and improvement activity

Identified responsibility for three levels of organization:

- SE Process Steering group
- SE Process group
- Technical Working Group

Approximately three (3) process per year

Focused workshops are integral to the process action plans