Carnegie Mellon
Software Engineering Institute

Pittsburgh, PA 15213-3890

Use of CMMI® in Acquisition Environments

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Tutorial Agenda

Introduction

Part 1: Using CMMI to Encourage Good Contractor Practices

Part 2: Using CMMI-AM to Improve Acquisition Practices

Introduction

Lack of acquisition guidance is a major concern for projects involved in the acquisition and sustainment of systems, including software-intensive systems. Over the past decade, much of the headquarters and field-level acquisition guidance for systems and software acquisition and sustainment has been rescinded, simplified, or reduced in scope such that only minimal acquisition-related guidance remains in many acquisition areas.

This reduction of guidance has occurred as system complexity and the software contribution to overall system functionality rises to unprecedented levels.

Congressional- and DOD-level guidance continues to emphasize software acquisition process improvement, including the measurement of process performance by acquisition organizations

The goal of this tutorial is to define effective and efficient acquisition practices, both directed internally toward the acquisition project and directed externally toward the monitoring and control of the selected supplier(s). These practices are intended to provide a basis for acquisition process discipline while balancing the need for agility.

Tutorial Agenda

Introduction

Part 1: Using CMMI to Encourage Good Contractor Practices

Part 2: Using CMMI-AM to Improve Acquisition Practices

Problem Statement

Many DoD contractors claim high Maturity Levels (3 and above) as measured by the Capability Maturity Model Integration, yet from the perspective of acquisition program managers on some high visibility *individual programs*, for various reasons, individual teams are not executing to the level claimed in proposals.

Example Program

Background

Large DoD program with multiple, geographically dispersed engineering locations.

Multi-contractor teams (10+) using different processes.

Several million lines of code.

Systems engineering challenges.

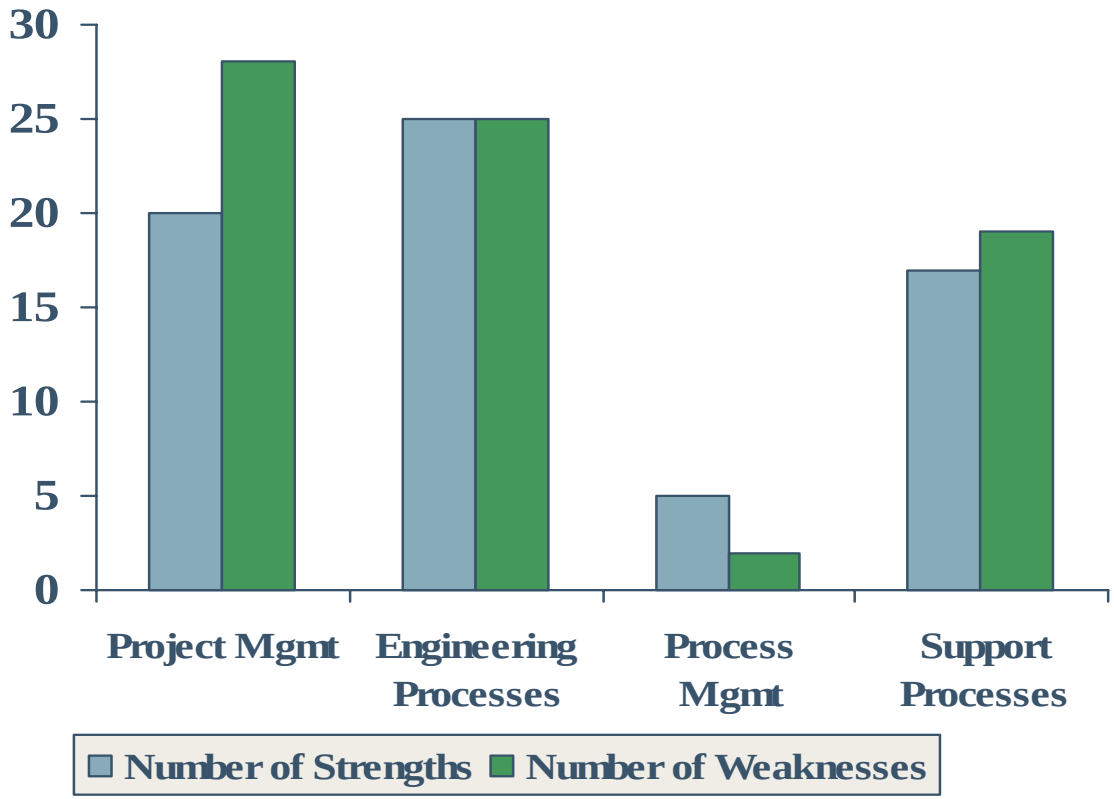
Combination of legacy, re-use, COTS integration and new development.

All contractor sites are Maturity Level 3 or higher.

18 months after contract award, the program office conducted a CMMI “Class B” appraisal on the team.

Example Program

Appraisal Output



Project Mgmt Processes
- Project Planning
- Project Monitoring & Control
- Integrated Project Mgmt
- Risk Management

Engineering Processes
- Requirements Mgmt
- Requirements Definition
- Technical Solution
- Product Integration
- Verification (Peer Reviews)

Process Mgmt
- Organizational Process Focus
- Organizational Process Definition

Support Processes
- Measurement & Analysis
- Product and Process Quality Assurance
- Configuration Mgmt
- Decision Analysis

Example Program

Issues Identified 1

PROJECT MANAGEMENT

- Lack of project plans or having only incomplete, conflicting or out of date project plans
- Ineffective use of Integrated Master Schedule as basis for planning/tracking status across program
- Undefined engineering and management processes on program
- Inability to track and manage actions to closure
- Inadequate cost estimation processes, methods, data and tools
- Inadequate staffing and training project personnel
- Tracking dependencies between or across teams not defined
- Managing project data ad hoc
- Inability to proactively identify and manage risks

ENGINEERING

- Lack of understanding of the program's requirements
- Inability to trace requirements to architecture/design or to test plans/procedures
- Poor linkage of functional and performance requirements
- Inconsistent requirements management at different levels
- No criteria for making architectural/design decisions among alternatives
- Not capturing entire technical data package (requirements, design and design rationale, test results, etc)
- Efficiency of design process/methods in question
- Late definition of integration and test procedures

Example Program

Issues Identified 2

SUPPORT

Difficult to identify items in configuration management baselines

Lack of ability to manage individual “versions” in incremental development

Inability to effectively managing changes to work products throughout lifecycle

Not conducting audits to establish/ensure integrity of baselines throughout incremental engineering and development

Inefficient change management process (cycle time, volume of changes)

Roles/responsibilities of change control boards not defined

Quality Assurance audits of products and processes not consistent

QA involvement in system and software engineering processes not consistent

No metrics to manage engineering activities (outside of cost/schedule data)

Example Program

Results

Early and periodic Class B appraisals using CMMI identified risks to program success

Identified risks were assigned to contractor, to acquirer, or both based upon who was best able to mitigate them.

Many risks were managed jointly and cooperatively between the contractor and the acquirer

Identification of and attention to risks early in the program life cycle led to the ultimate success of the program.

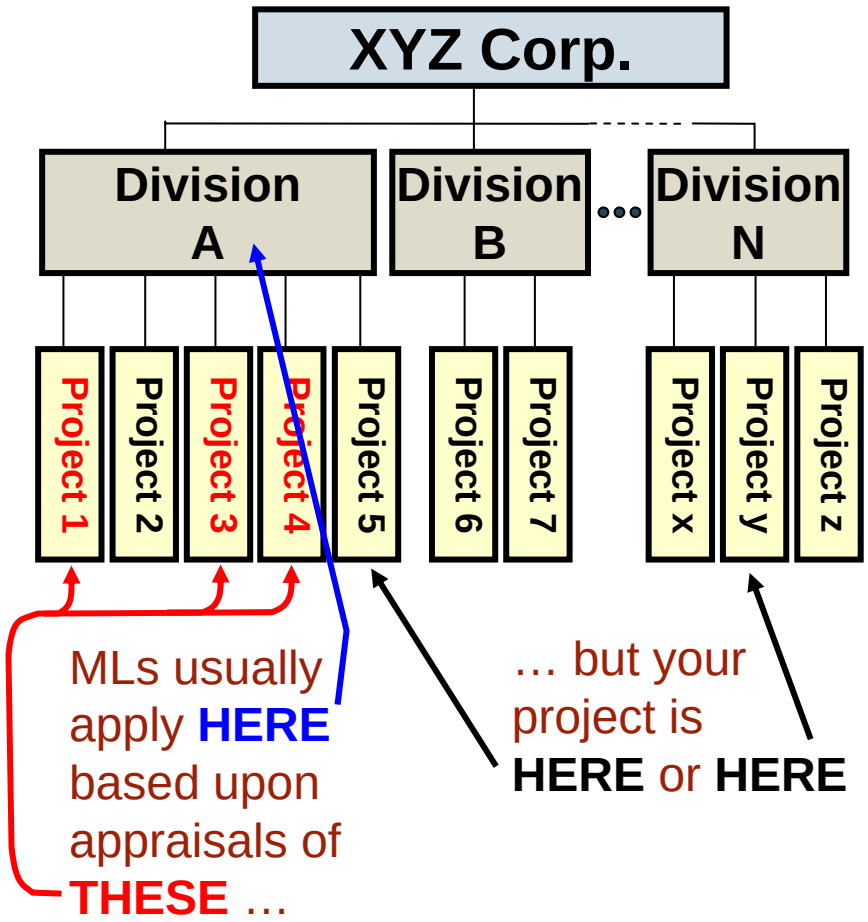
High Maturity Organizations ⊘ High Maturity Projects ?

WHY?

Maturity Levels are good indicators of organizational *potential performance*.

They describe how the next project will *most likely perform* based on a sampling of existing projects.

Maturity Levels reside at the organizational level and are not an indication of how an individual project *is performing*.



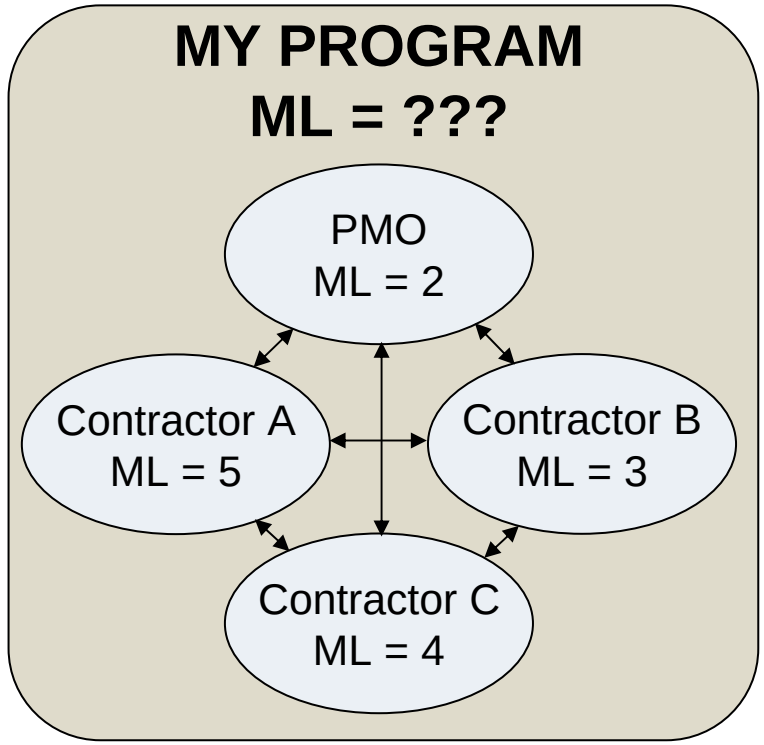
The Acquirer's Concern

During source selection:

- How capable is a *contractor team* to deliver an operational capability?

Ongoing:

- How well is *my program* performing?



Maturity Levels at the organizational level are **necessary but not sufficient** to provide answers to these questions at the program level.

Key Questions

Is the appraisal of the contractor's organizational maturity relevant to my project?

- Did the part of the organization executing my project participate in the appraisal?
- Did projects similar to mine participate in the appraisal?
- Are the appraised processes routinely used by the part of the organization executing my project?
- Are the appraised processes an integral part of the project execution, or are they an overlay on the "the real way the work gets done"?

The **BIG** question: What processes will really be used on **MY** project

Excerpt from Defense Acquisition Guidebook – *Source Selection*

4.2.5.2 Capability Reviews

Capability reviews … are a *useful tool* available *during source selections* to assess the offerors' capability in selected critical process areas. Capability reviews may be the appropriate means for evaluating *program-specific critical processes* such as systems engineering, software development, configuration management, etc. …

Getting the processes that you need

1. Identify the characteristics of the processes that you need on your project.
2. Include process evaluation as one of the source selection criteria.
3. Require the bidders to define in the proposal, the processes and the process outputs that they intend to use on the project.
4. During source selection, evaluate the bidder's processes w.r.t. the project's process needs using the SCAMPI method.
5. For the winning bidder, reference the proposed processes in the contract.
6. During contract execution, evaluate the contractor' compliance with the proposed processes.

Step 1: Identify Process Needs 1

Self-assessment of project needs by the PMO

- Based upon "Guidelines for using CMMI in Acquisition Programs" (draft)

CMMI Risk Worksheet Results

	Not Important			Important				Essential		
	1	2	3	4	5	6	7	8	9	10
Project Planning										
1.Establish Estimates	o	o	o	o	o	o	●	o	o	o
2.Develop a Project Plan	o	o	o	o	o	o	o	●	o	o
3.Obtain Commitment to the Plan	o	o	o	o	o	●	o	o	o	o
Project Monitoring and Control										
4.Monitor Project Against Plan	o	o	o	o	●					

Step 1: Identify Process Needs 2

Example

- Program is looking to select a Lead System Integrator for a complex, multi-year, development effort
- Program is concerned with the potential LSI's ability to:
  - manage risk
  - manage suppliers
  - plan and track the program
  - build an integrated team
  - develop an architecture
  - integrate the various components
- The program might want to explore the bidders proposed processes in these CMMI process areas: PP, PMC, IPM (with IPPD), ISM, RD, IT, RSKM, PI

Step 2: Source Selection Criteria

Don't just require organizational Maturity Levels

Include an evaluation of contractor-proposed processes as one of the factors for source selection.

Step 3: Require process proposals 1

RFP requires all bidders to propose the processes that they will use on this project.

Process proposals include

- a description of the process
- a list of the outputs / artifacts produced by the process.

Step 3: Require process proposals 2

RFP Language

L.X.X.X Product Development Capabilities

In support of the Management Factor evaluation, the Government intends to conduct an evaluation of the product development and management capabilities of the offeror team proposed for application on this project. The evaluation will involve methods and procedures tailored from the Software Engineering Institute (SEI) Standard CMMI[SM] Appraisal Method for Process Improvement (SCAMPI[SM]) Class X* Version 1.1 using Capability Maturity Model® Integration (CMMI[SM]) for Systems Engineering, Software Engineering, and Integrated Product and Process Development (CMMI-SE/SW/IPPD), Version 1.1. The offeror shall provide the SCAMPI documentation described in Attachment A of this RFP to support this evaluation. This documentation shall be provided in the proposal and will not be included in the page count limitations for the proposal.

*B or C depending on program needs

Step 4: Evaluate process proposals 1

Appraise the proposed processes using a SCAMPI-C method.

- SCAMPI-C is suitable for process appraisal based on document review.
- Use an authorized Lead Appraiser with acquisition experience
- Ensure the appraisal team is trained and experienced

Perform a gap analysis against the self-assessment of project needs established in Step 1.

- Gaps represent process-related risks to the project.

Step 4: Evaluate process proposals 2

If the program is of sufficient size, duration, or complexity, consider performing SCAMPI-Bs on the bidding "teams".

Use the continuous representation, select 3 to 7 process areas based on program risk.

Use an authorized Lead Appraiser with acquisition experience.

Ensure the team is trained and experienced.

Step 5: Contract proposed processes

Reference the proposed processes in the awarded contract.

- Don’t tell the contractor what processes to use.
  - That could shift performance liability to the PMO if the processes are found to be unsuitable for the project.
- Just tell the contractor to perform as proposed.

Step 6: Evaluate process compliance 1

Monitor the production of process-related artifacts

Perform one or more SCAMPI-B appraisals on key process areas to assess compliance to proposed processes

- Appraisal focus is on contract monitoring, not process improvement

Excerpt from Defense Acquisition Guidebook – *Contract Monitoring*

4.2.5.3 Capability Appraisals

… the program manager retains the right … to independently ***evaluate the process capabilities of the selected team*** prior to or immediately after contract award. … ***Periodic appraisals are encouraged as part of contract process monitoring activities***. … assessments are ***most valuable when they apply across the full program team, and not just one segment of the organization …***

Step 6: Evaluate process compliance 2

Contract Monitoring Guidelines

- Don't appraise Maturity Levels
- Use the SCAMPI-B method
- Include the entire program team (prime, subs, and the acquisition program office)
- Use the continuous representation, select process areas based on program risk (selection may evolve during program life).
- Use an authorized Lead Appraiser
- Ensure the team is trained and experienced
- Include contractor members on the appraisal team
- Use the results as the basis for collaborative risk mitigation and process improvement across program team

Benefits of Using the SCAMPI Family of Appraisal Methods

SCAMPI Class B and Class C appraisals are consistent with the SCAMPI Class A Method (same steps, use of PIIs, etc.) and:

- are led by an authorized team lead
- require team training
- focus on areas of risk to the program without an artificial focus on achieving “Levels”
- are repeatable
- follow a publicly vetted, documented, and easily accessible method

In the absence of a repeatable method with clear expectations on the part of the acquirer and contractor communities, “home grown” methods will emerge.

Summary

Maturity Levels alone do not provide the information an acquirer needs to determine:

- How capable is a *contractor team* to deliver an operational capability?
- How well is *my program* performing?

Acquirers need a simple, actionable set of guidelines on how to use the CMMI framework (models and appraisal methods) to help reduce program risk.

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Use of CMMI® in Acquisition Environments

Part 2: Using CMMI-AM to Improve Acquisition Practices

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Using CMMI-AM to Improve Acquisition Practices- Contents

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Using CMMI-AM to Improve Acquisition Practices

Module 1:
Background

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Module 1 Agenda

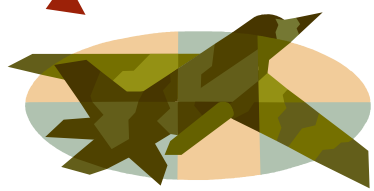
The State of Acquisition Practices

Capability Maturity Model Integration

What is "Acquisition"

Operational Need

Question: What are the key activities that you perform when you acquire systems?



The State of Acquisition Practice 1

The agencies assume the partnership arrangement absolves them of all acquisition management responsibilities…"

Virtually all (Air Force) software-intensive systems suffer from difficulties achieving cost, schedule, and performance objectives.

"I'd rather have it wrong than have it late." A senior manager (industry)

"The bottom line is schedule. My promotions and raises are based on meeting schedule first and foremost." A program manager (government)

Lack of robust systems engineering practices identified as critical factor in SBIRS-High problems. Lt. Gen. Brian A. Arnold, USAF, CDR, USAF/SMC

The State of Acquisition Practice 2

Is There an Acquisition Crisis?

Investigation of one acquisition program showed:

- System complexity and the program's lack of experience in procuring major systems caused serious cost growth.
- Program lacks systems engineering and program management expertise.
- Absence of requirements stabilization process.
- Program management does not enforce timely milestones, timelines, and deliverables.
- Program's lack of process control made assessment of technical risk impossible.
- Program's lack of short- and long-term budget tracking makes cost assessment nearly impossible.
- Program does not manage risk.

The State of Acquisition Practice 3

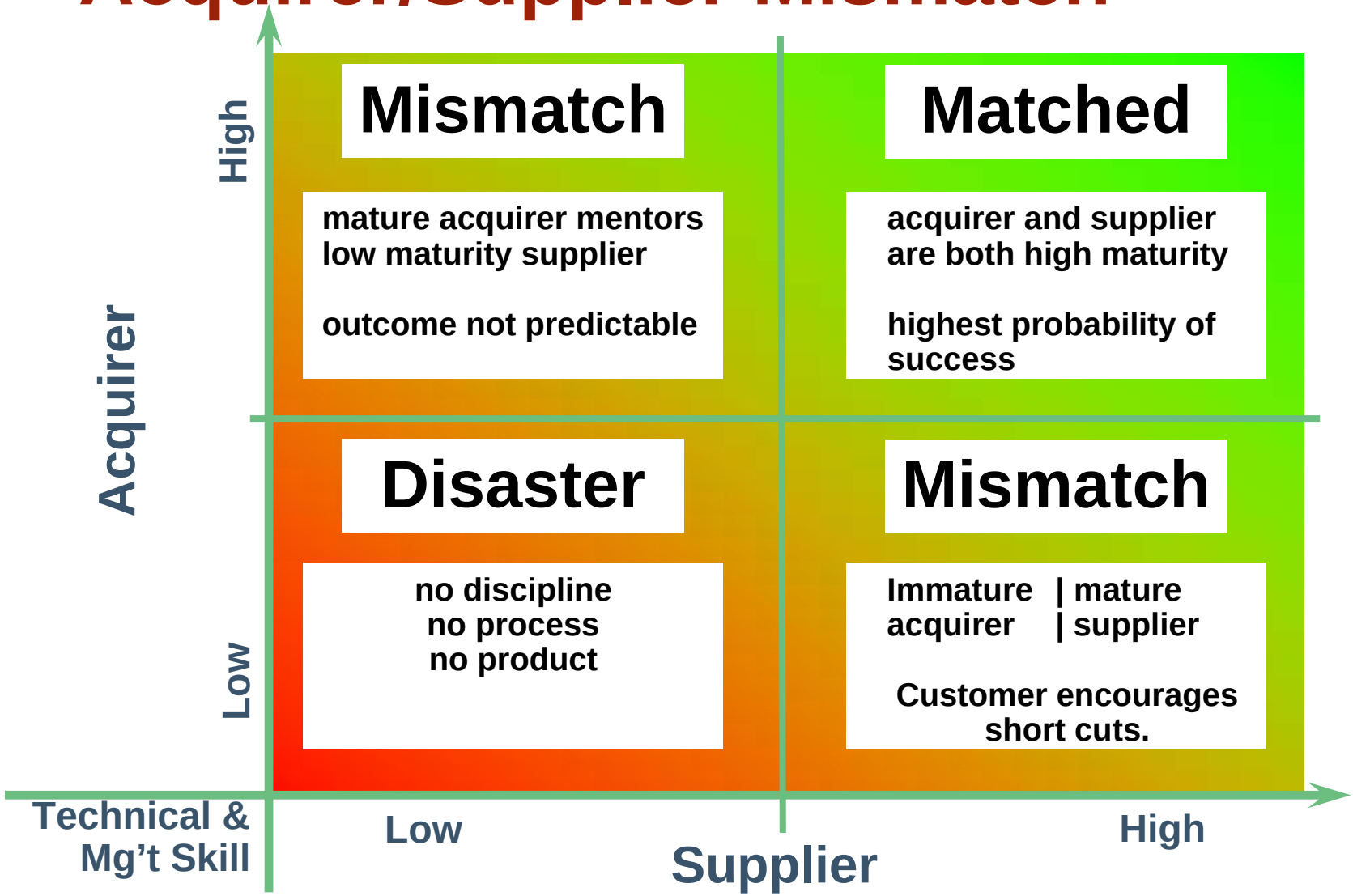
What's the Problem?

There are many. Among them,

- Evidence shows that an **acquirers management processes** and practices and resultant decisions can have a **negative impact** on the development processes of the supplier
- A **mismatch** in Acquirer/Supplier in terms of associated process capability and maturity can have **unpredictable** and even **disastrous results.**

And the challenges are increasing …

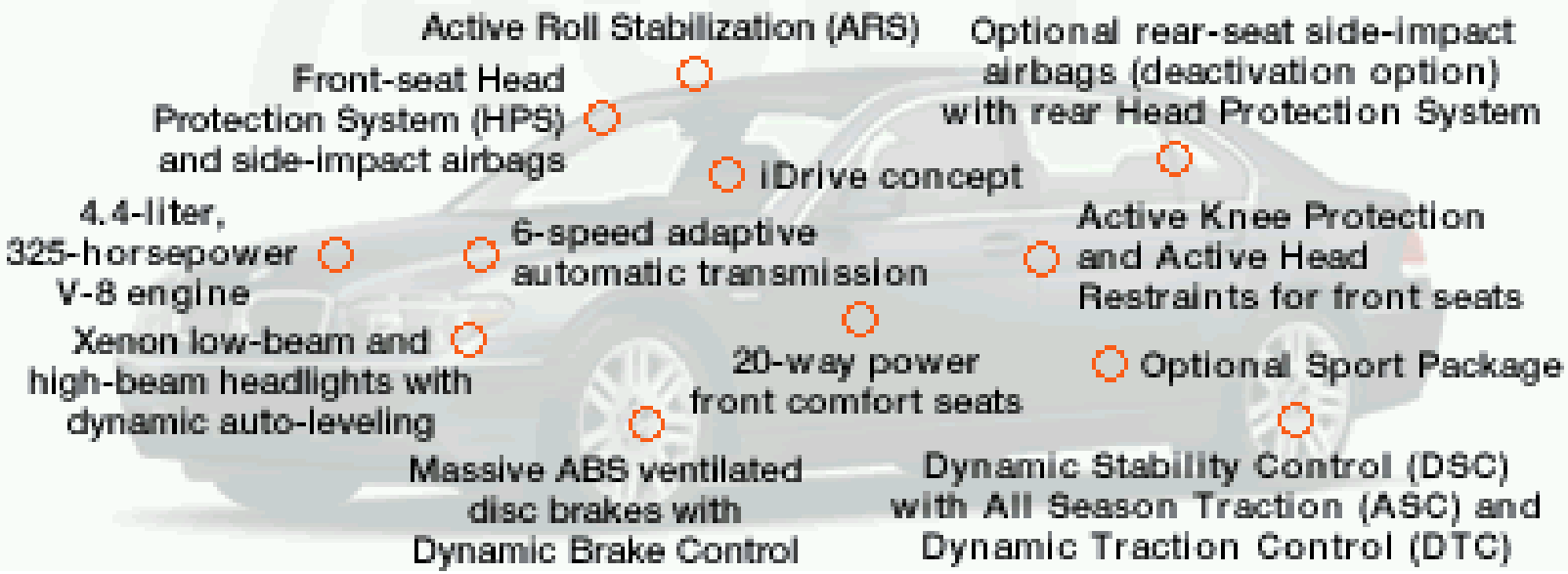
Acquirer/Supplier Mismatch



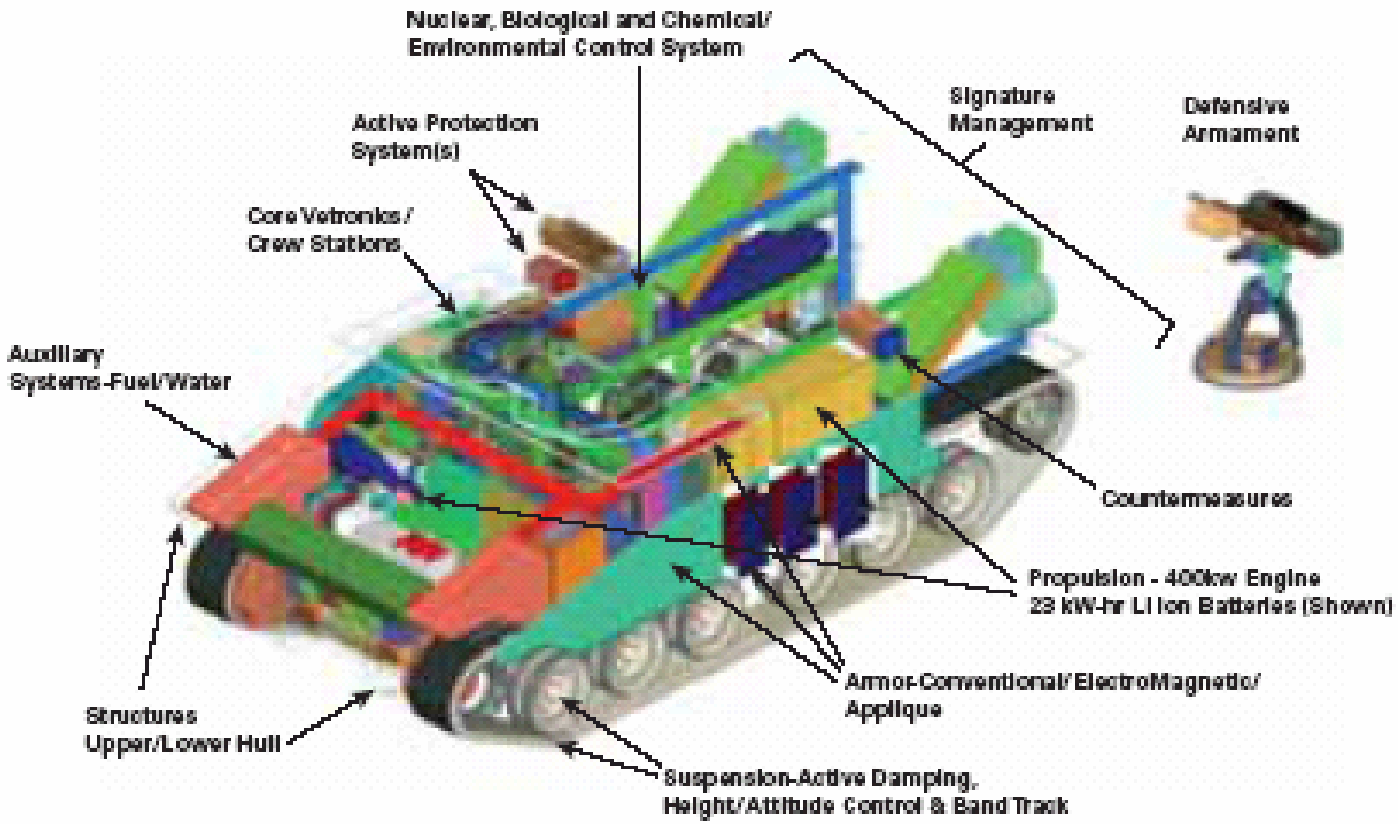
Complexity in Modern Systems

Many commercial products are the result of a complex mix of subcomponents engineered into a system

Most DoD weapon and information systems are *at least* this complex

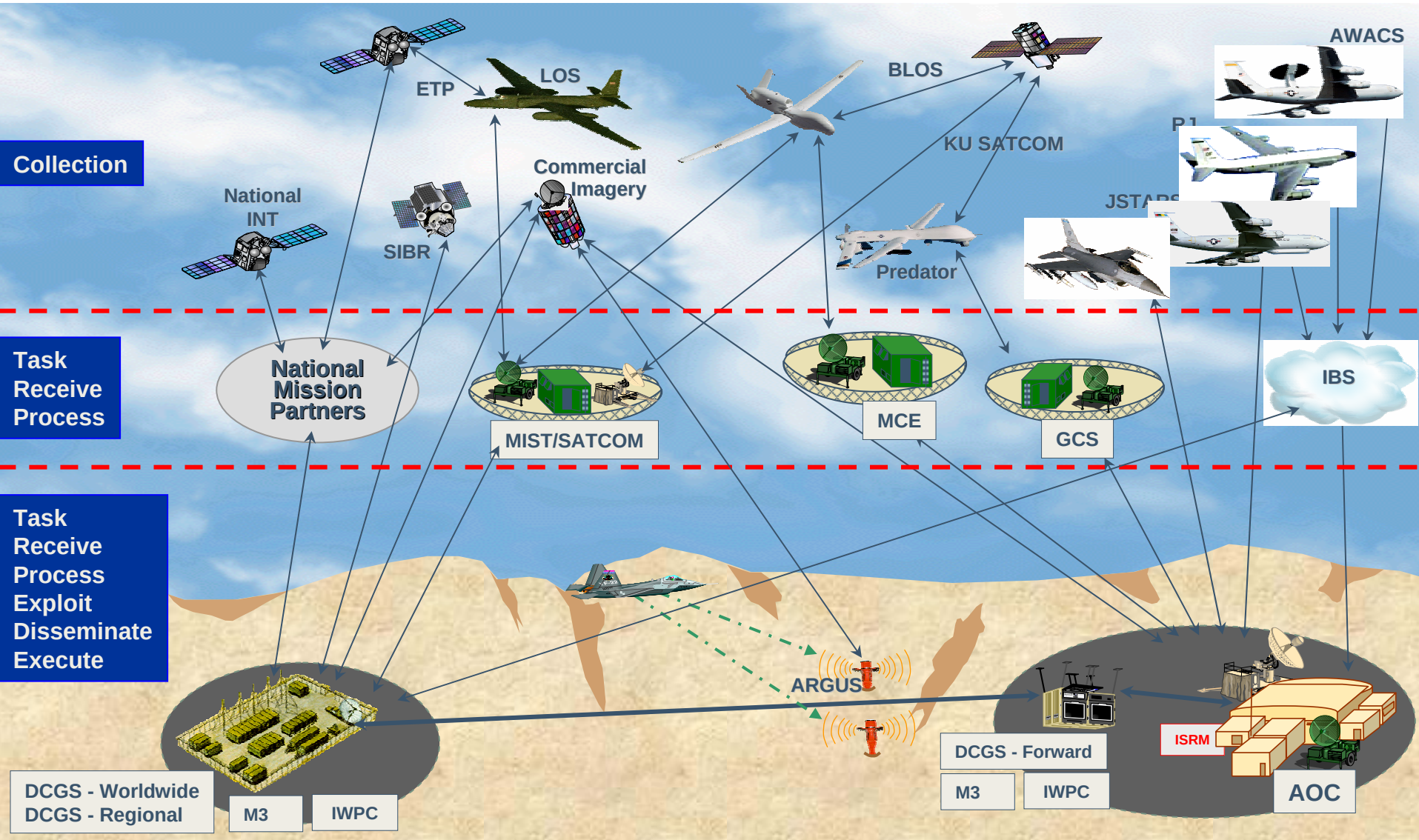


Weapon System Complexity

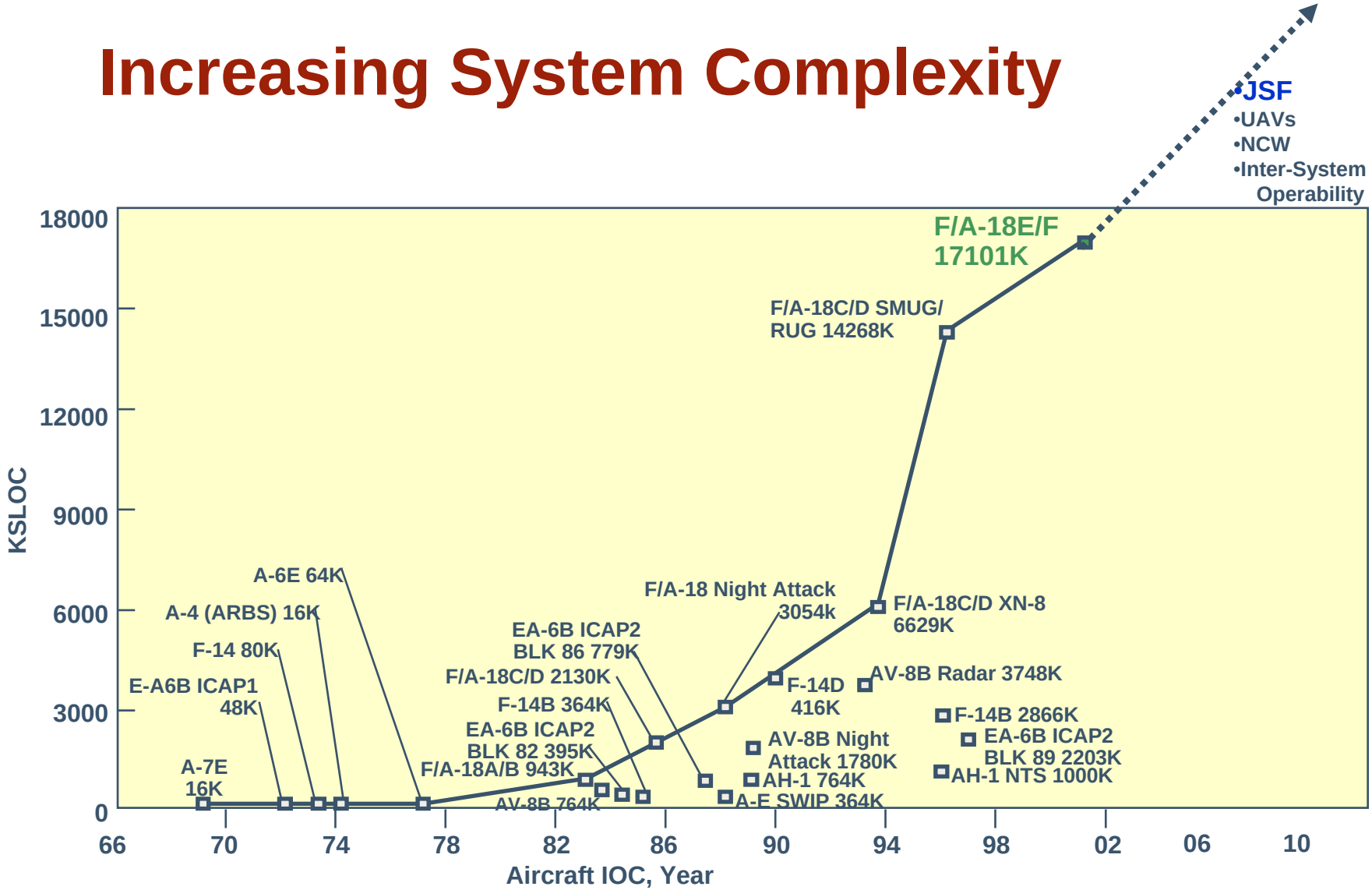


FCS Manned Ground Vehicle concept

System of Systems Complexity



Increasing System Complexity



Module 1 Agenda

The State of Acquisition Practices

Capability Maturity Model Integration

What Can Be Done?

Based on the premise that

The quality of the product is governed largely by the process used to create the product

We could improve the Supplier's process and practices

- But the developers have a head start (CMMI-based improvement programs are widespread)

We could improve the Acquirer's processes and practices by:

- increasing the visibility of the acquirers contribution to program success
- defining, implementing, measuring and evolving effective acquisition processes and practices

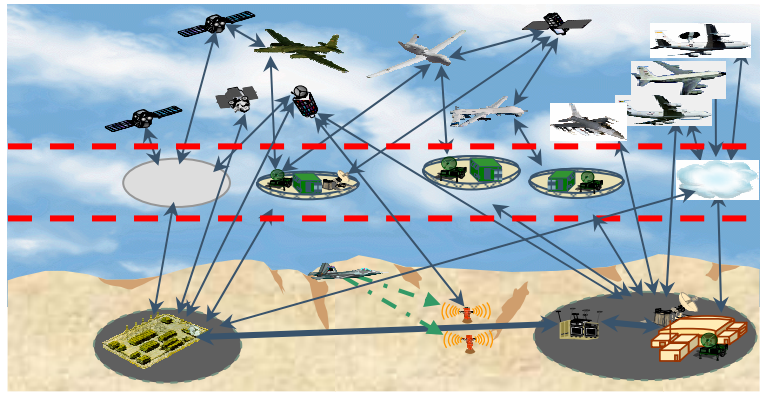
How Do You Want to Work?

- Random motion – lots of energy, not much progress
- No teamwork - each person goes his own way
- Frequent conflict
- You never know where you'll end up

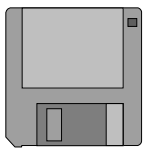
- Directed motion – every step brings you closer to the goal
- Coordinated efforts
- Cooperation
- Predictable results

Process can make the difference

Focus of CMMI

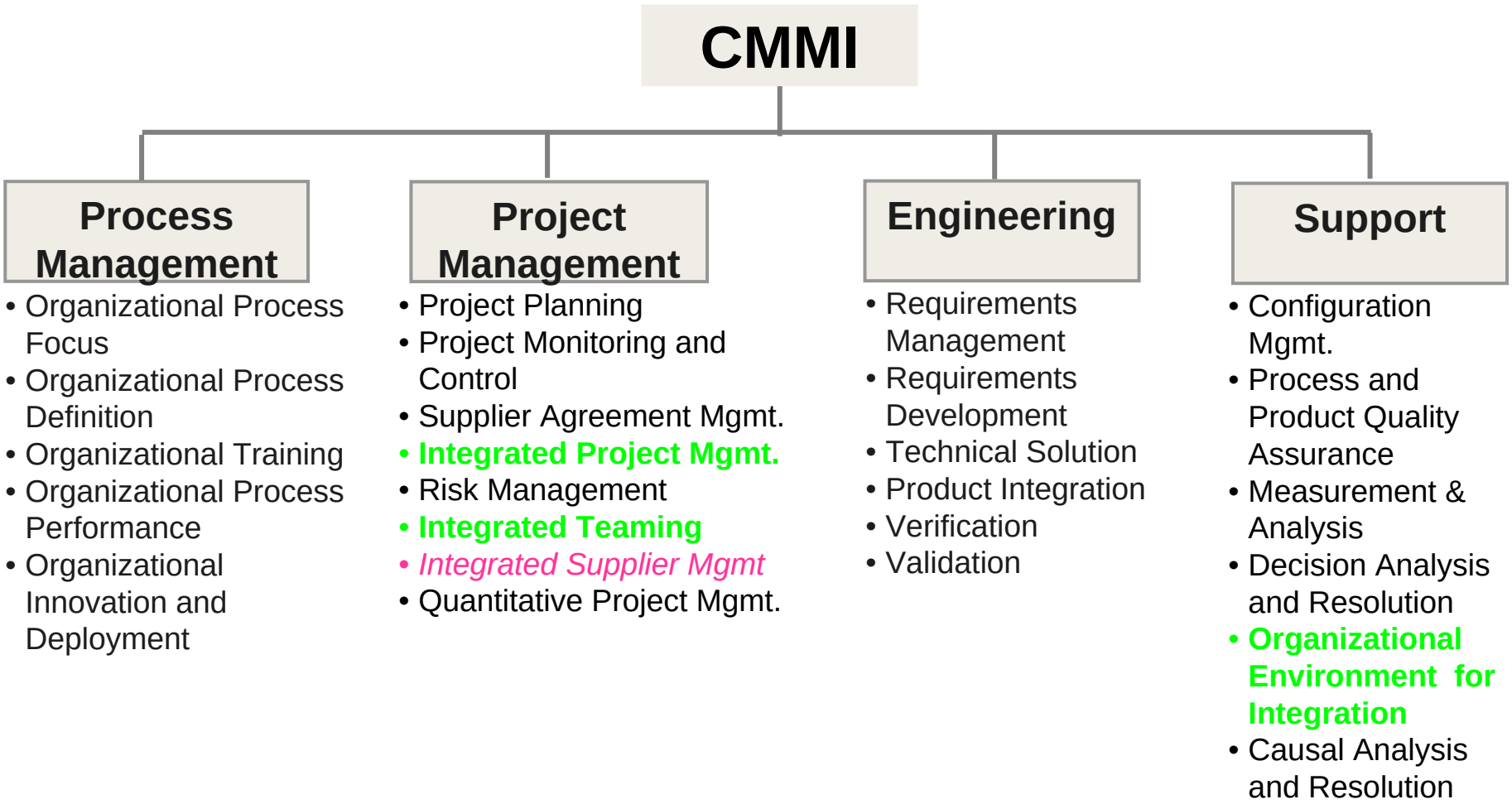


CMMI is applied here

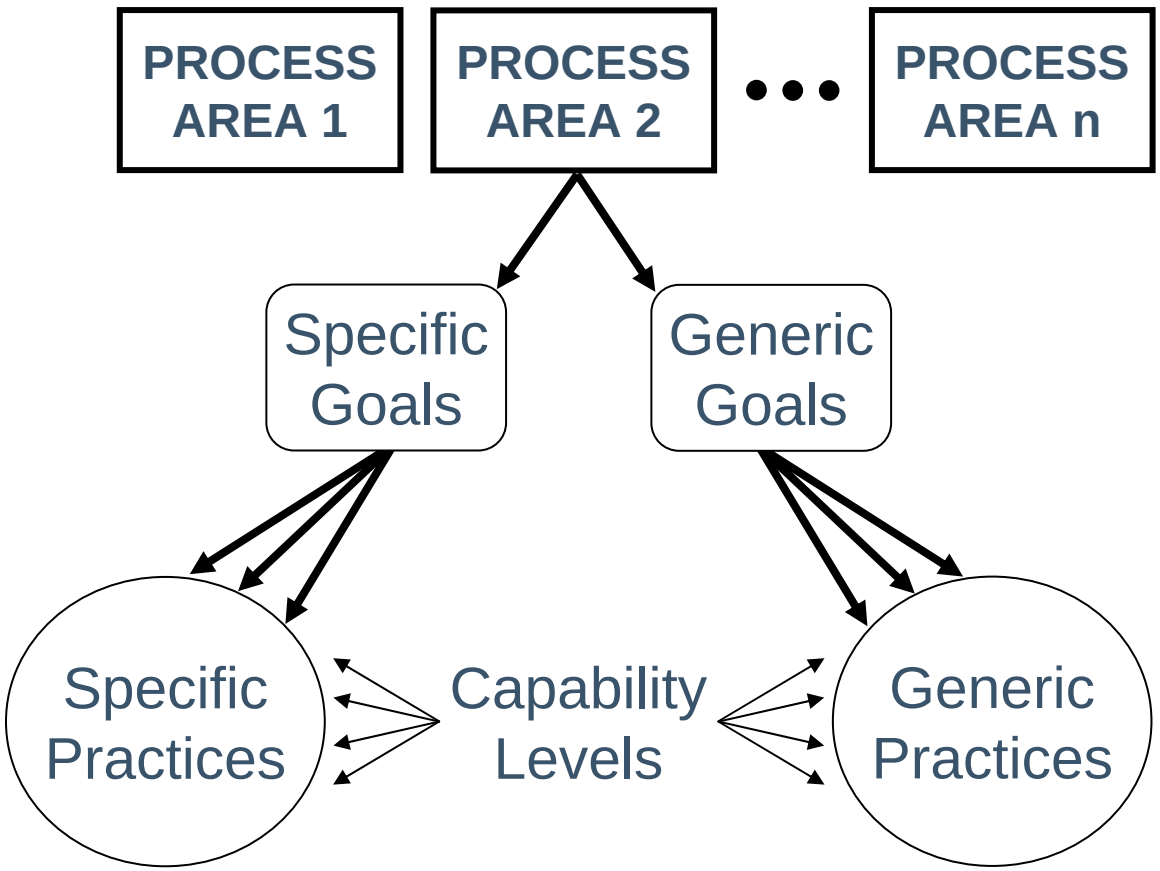


SW-CMM is applied here

CMMI - Continuous SE/SW/IPPD/*SS*



Structure of CMMI 1



For CMMI-SW/SE

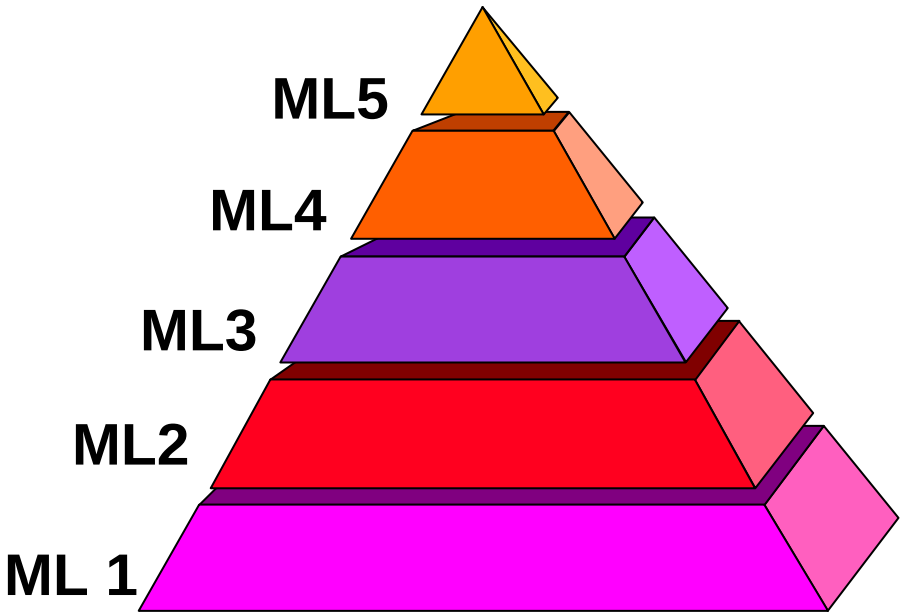
22 Process Areas

157 Goals

539 Practices

Perspectives on Maturity

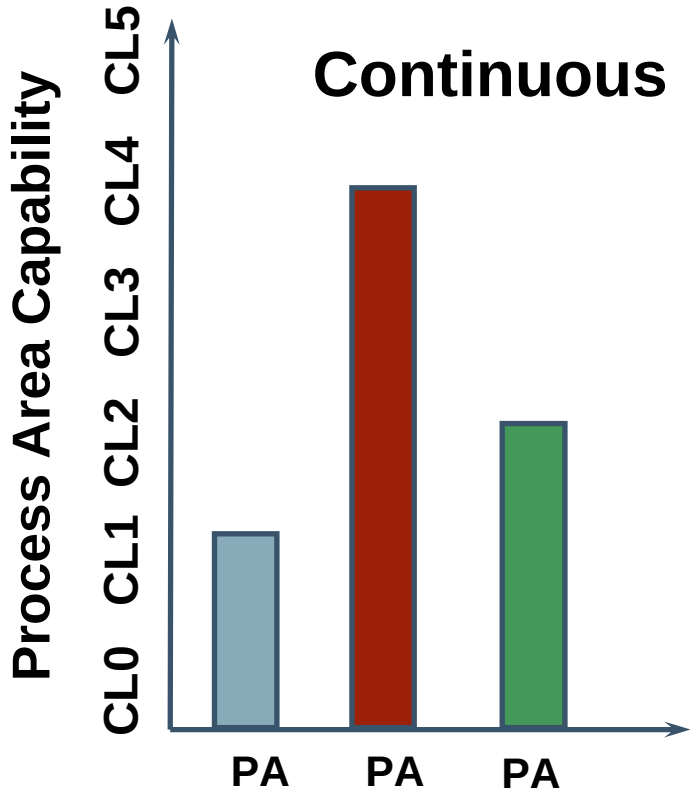
Staged



Organization-Focused

. . . for an established set of process areas across an organization

Continuous



Process-Focused

. . . for a single process area or a set of process areas

CONTRACTOR AND PROCESS

What Levels Tell Us

Levels are good indicators of *potential organizational performance*

They describe how the next project *could perform* based on a sampling of existing projects

Capability Levels and Maturity Levels reside at the organizational level (corporation, major division) and are not an indication of how any individual project *is performing*

Note: Sometimes a project is large enough to be considered an organizational unit (e.g. JSF, C-17)

Summary

Acquisition is a challenging multi-disciplinary effort occurring in a difficult environment, and demands for greater capabilities and increasing complexity are adding to this challenge.

Capable performance by **BOTH** the acquirer and the supplier are essential to program success

A focus on **PROCESS** at the acquirer and at the supplier can help.

CMMI is a **proven** and **widely accepted** process improvement model

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Using CMMI-AM to Improve Acquisition Practices- Contents

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Introduction to the CMMI® Acquisition Module (CMMI-AM)

Module 2:
CMMI-AM and Project Management

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Module 2 Agenda

Introduction to the CMMI Acquisition Module

Project Management Process Areas

- Project Planning
- Project Monitoring and Control
- Solicitation and Contract Monitoring
- Integrated Project Management
- Risk Management

Summary

Where Does Process Fit in Acquisition?

… at the Project Management Office (PMO)

- Management of internal PMO activities
- Management of processes applied to project
- Oversight of contractors' processes
- Integration of contractors' and PMO processes

… at the Contractor

- Management of internal contractor activities
- Oversight of subcontractor processes

… for integration of PMO, contractor, and subcontractor processes

PMO AND PROCESS

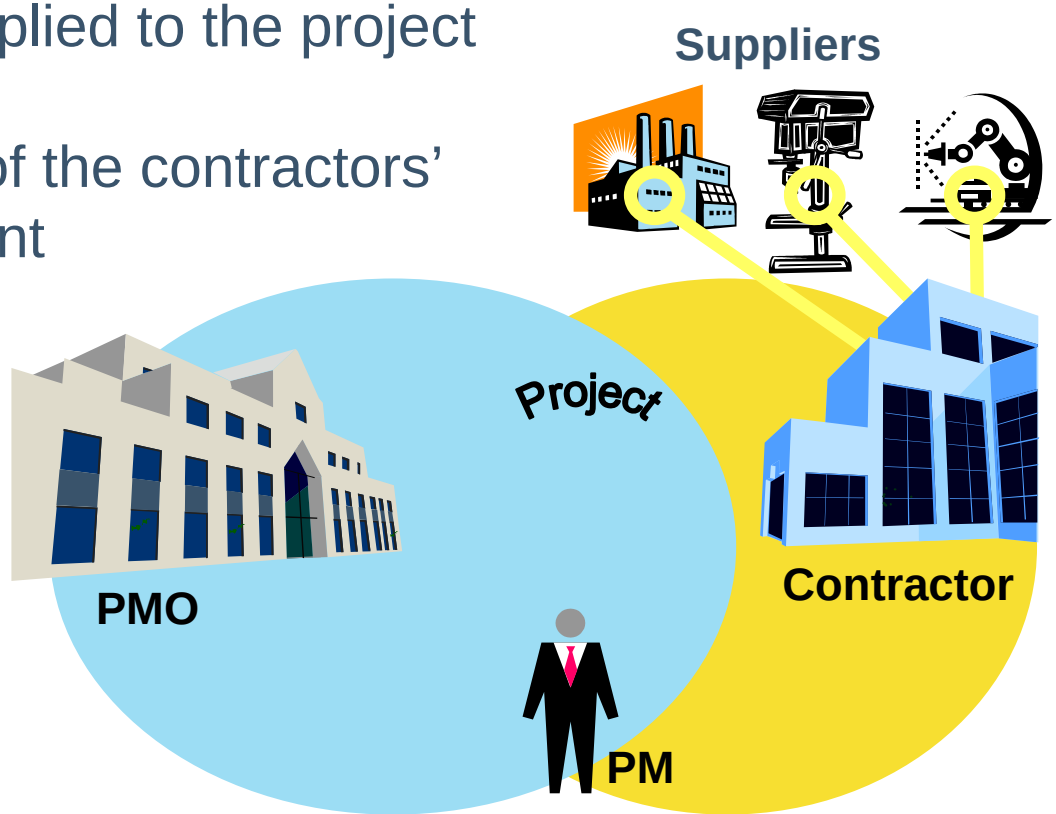
Process and the Roles of the PM

Manage process within the PMO

Manage process applied to the project

Exercise oversight of the contractors' process management

Ensure integration of contractor and PMO processes



PMO AND PROCESS

The PMO Management Role

The PM is responsible for managing internal PMO processes. The PM must take a hands-on approach to

- Identify, define, and document process needs
- Communicate and train the PMO staff
- Support, track, measure, and review the PMO processes

PMO AND PROCESS

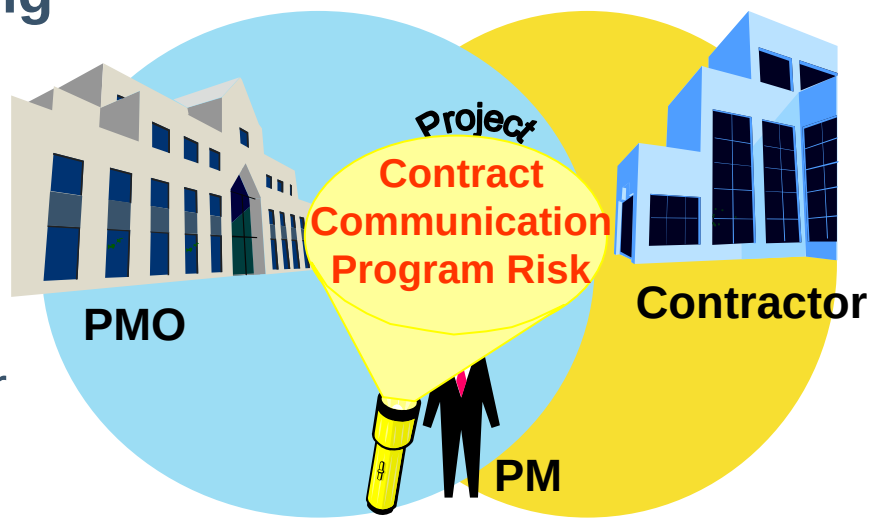
Program Management Role

Define the interface between the PMO and the contractor using the RFP and negotiations

- Project process requirements
- Project metrics
- Project communication needs
- Project risk management needs

Manage the interface during contract execution

- Real-time monitoring of deliverables
- Keep communication channels clear & open
- Develop trust with contractor

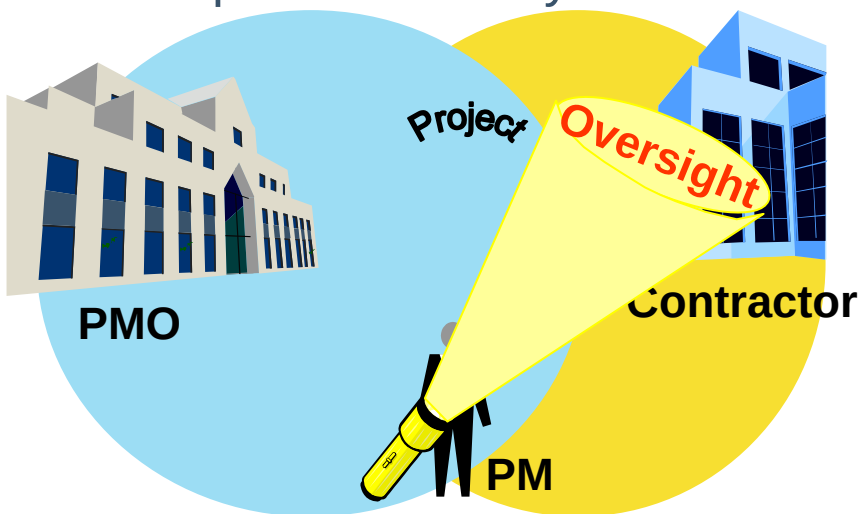


PMO AND PROCESS

Contractor Oversight Role 1

Process maturity of the contractor should be a consideration in source selection

- Obtain process definitions and commitments
  - Just requiring a CMMI Maturity Level is **NOT** enough.
  - You need to ensure that high-maturity processes are applied to YOUR project
  - Require your bidders to define the processes they will use in their proposals
  - Evaluate the proposed processes as a part of source selection
  - Reference the processes in the contract
- Plan process integration

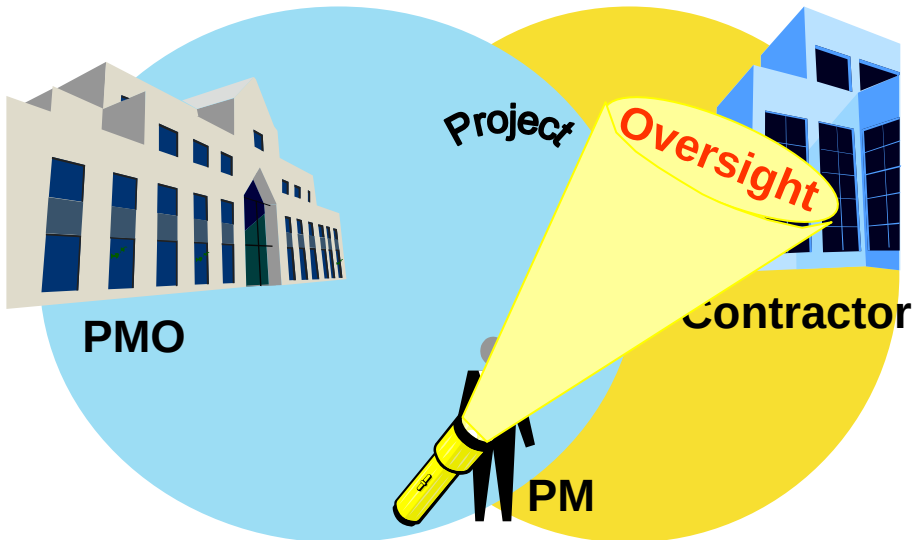


PMO AND PROCESS

Contractor Oversight Role 2

After contract award, ensure that contracted process commitments are kept

- Committed processes are used by the project team
- Process artifacts are evident
- Process integration is effective and monitored
- Consider periodic independent appraisals of key process areas



PMO AND PROCESS

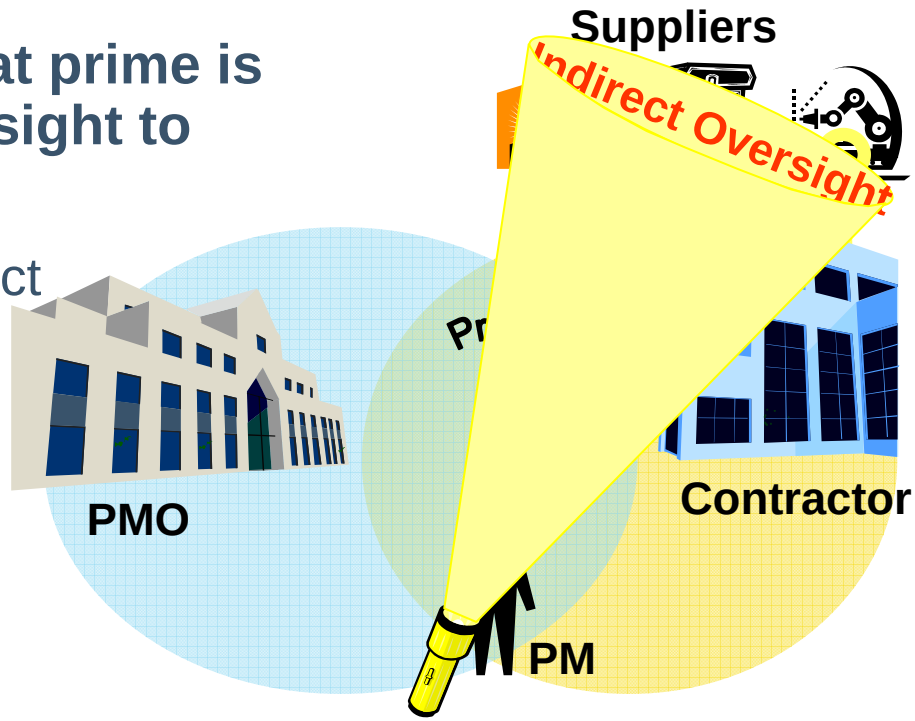
Subcontractor Oversight Role

For many systems, the bulk of the work is done by subcontractors

Primary responsibility for oversight of subcontractors lies with the prime contractor

PMO role is to ensure that prime is providing adequate oversight to subcontractors

- Ensure flowdown of project process requirements
- Ensure integration of prime and subcontractor processes

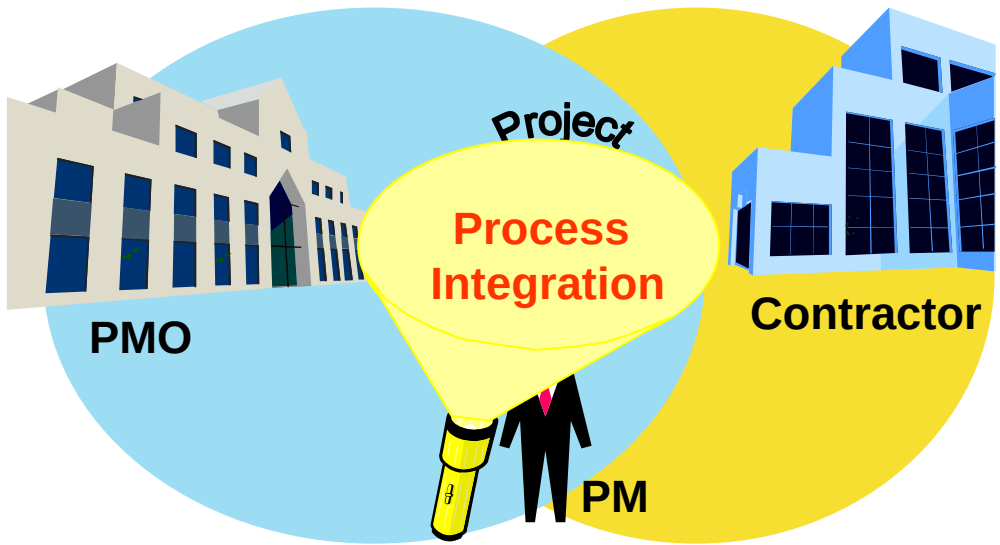


PMO AND PROCESS

Process Integration Role

It is the PMO's responsibility to ensure PMO and Contractor processes are compatible

- Include any process "must haves" in the RFP
  - Consider specific compatibility with tools for risk, requirements, schedule, etc.
- Ensure good communications with contractor(s) regarding process incompatibilities
- Integration focus needed throughout project



CMMI Acquisition Module (CMMI-AM)

Focuses on effective acquisition activities and practices that are implemented by first-level acquisition projects (e.g., System Project Office/Program Manager)

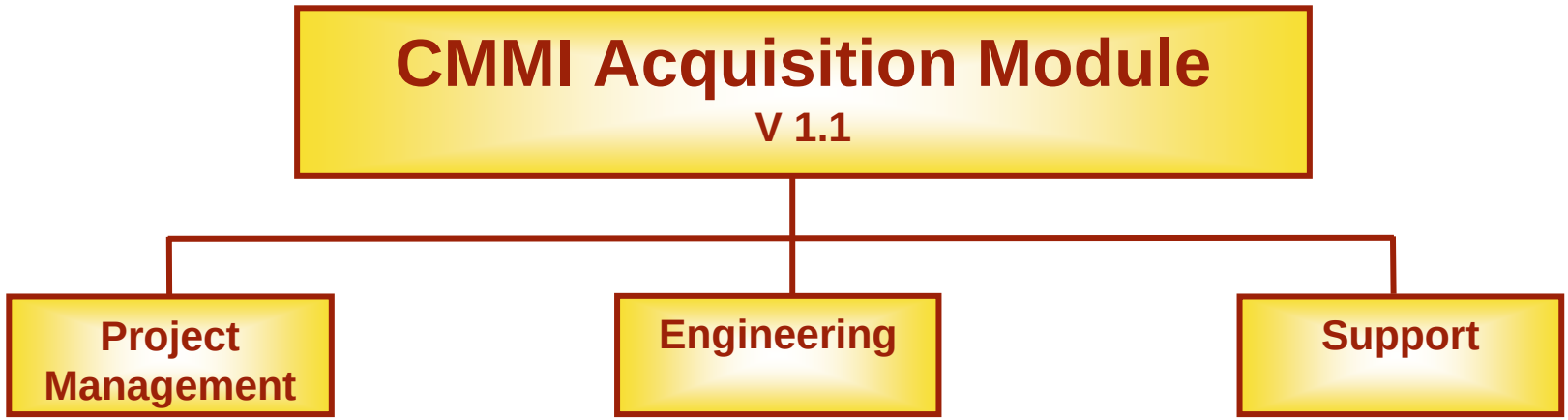
Acquisition practices drawn and summarized from existing sources of best practices:

- Software Acquisition Capability Maturity Model (SA-CMM)
- Capability Maturity Model Integration (CMMI)
- FAA Integrated Capability Maturity Model (iCMM)
- Section 804

Intended to be used in conjunction with the CMMI as an acquisition “lens” for interpreting the CMMI in acquisition environments

CMMI-AM – a tool for the acquirer

CMMI-AM Structure



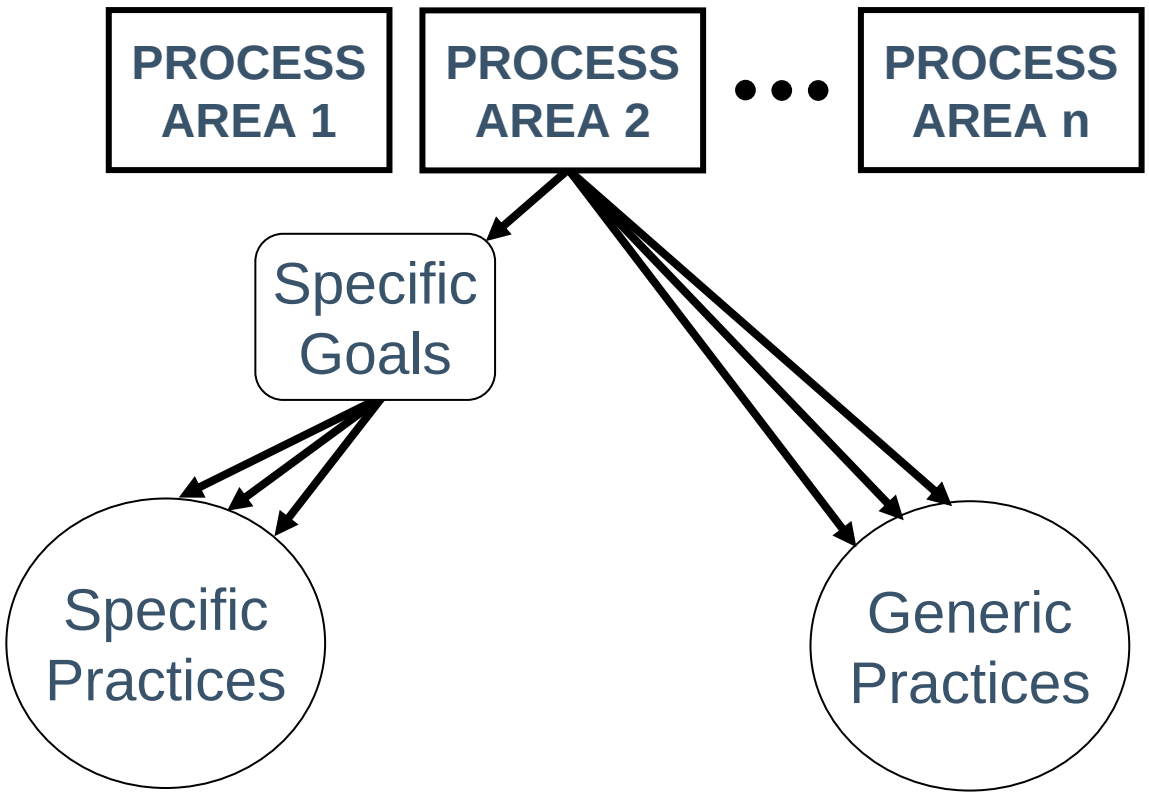
- Project Planning
- Project Monitor and Control
- Integrated Project Management
- Risk Management
- **Solicitation and Contract Monitoring**

- Requirements Management
- Requirements Development
- Verification
- Validation

- Measurement and Analysis
- Decision Analysis and Resolution
- **Transition to Operations and Support**

Key
New for CMMI-AM

Structure of CMMI-AM 1



For CMMI-SW/SE

12 Process Areas

28 Goals

246 Practices

… plus 47 self-assessment questions

Module 2 Agenda

Introduction to the CMMI Acquisition Module

Project Management Process Areas

- Project Planning
- Project Monitoring and Control
- Solicitation and Contract Monitoring
- Integrated Project Management
- Risk Management

Summary

Project Management PAs

Project management process areas cover the project management activities related to planning, monitoring, and controlling the project.

Project Planning	**PP**
Project Monitoring and Control	**PMC**
Solicitation and Contract Monitoring	**SCM**
Integrated Project Management	**IPM**
Risk Management	**RSKM**

Project Planning

The purpose of project planning is to establish and maintain plans that define project activities. For acquisition:

- Project planning starts by setting the acquisition strategy and is followed by planning the acquisition process in ever increasing levels of detail
- As the acquisition proceeds toward selection of a supplier, the supplier's planning process should be reviewed for sufficiency
- The resulting plans should also be reviewed for consistency with the system acquisition plans
- The acquirer's and developer's project planning processes are continuous and the plans evolve to meet the project's needs.

Purpose of Acquisition Planning

Guide program execution

- From initiation through re-procurement and during post-production support
- Systems, subsystems, components, spares, and services

Minimize the time and cost of satisfying identified, validated needs in a manner consistent with common sense and sound business practices

Planning evolves through an iterative process and becomes increasingly more definitive in describing the relationship of the essential elements of a program

Paraphrased from DoD 5000 Interim Guidebook

Poor Project Planning …

Symptoms

- Poor estimates lead to cost and schedule overruns.
- An inability to discover deviations from undocumented plans.
- Resources are not available/applied when needed.
- An inability to meet commitments.
- Project failure.

Why should we care?

- Customers don't trust acquirers or suppliers who waste their resources (i.e., loss of future business).
- No lessons learned for future projects means making the same mistakes on multiple projects.
- Unhappy customers, employees, and stakeholders means a short life for the business.

"If you fail to plan, then you plan to fail."

Acquisition Strategy vs. Acquisition Plan

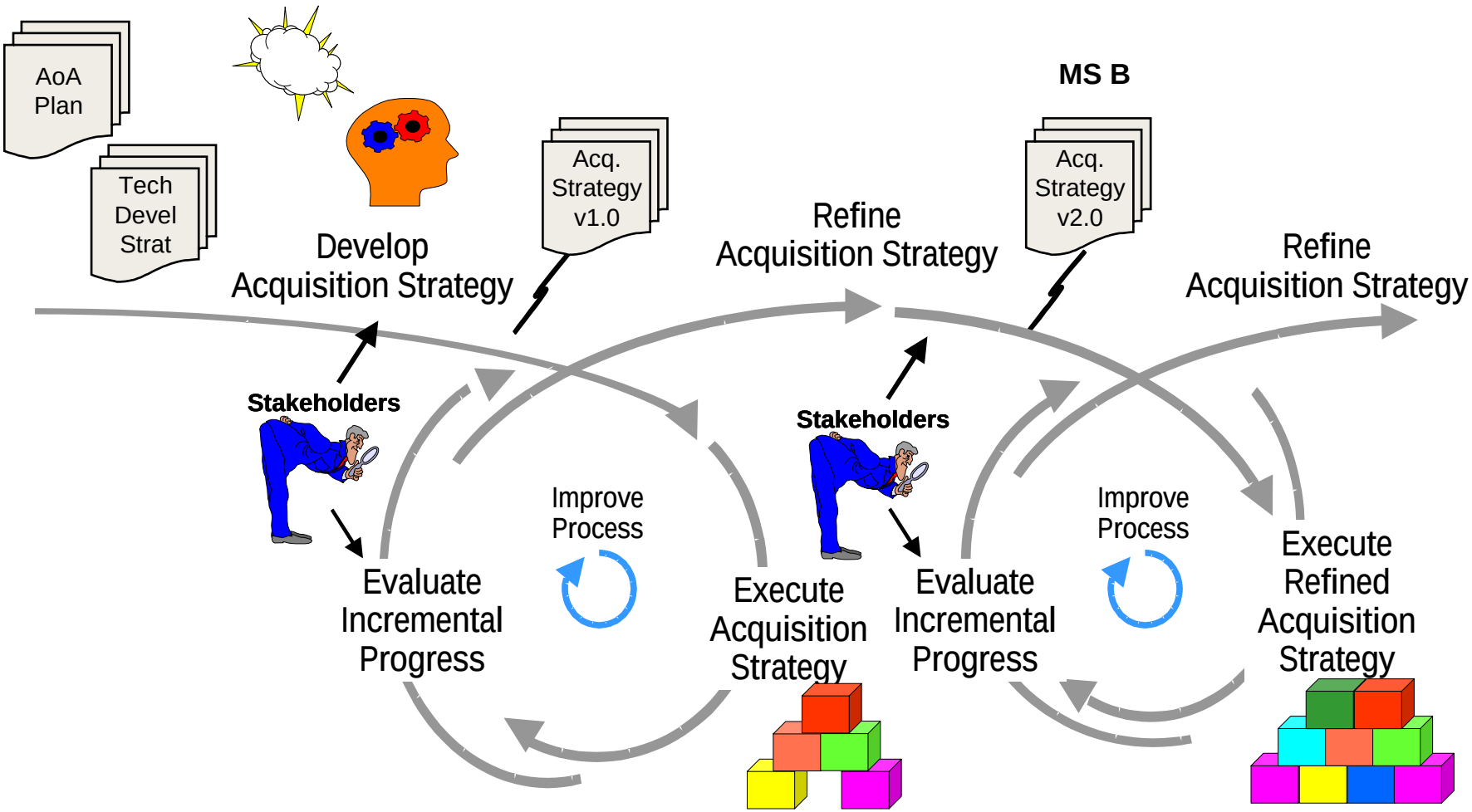
Acquisition Strategy is high-level

- "Top-level road map for program execution from program initiation through post-production support."
- ITERATIVE – should be updated
- Level of detail changes as you go through the phases
- As per DoDI 5000.2 required for ALL programs at:
  - Program Initiation for Ships
  - Milestone B
  - Milestone C
  - Full-Rate Production Deployment Review

Acquisition Plan is typically for one phase

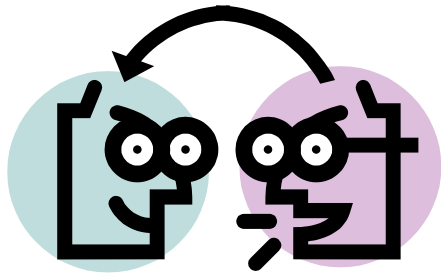
Required by the Federal Acquisition Regulation (FAR)
Focuses on specifics of the acquisition
Concerned with contract type, incentives, etc.

Acquisition Planning Cycle



Acquisition Planning Objectives

Communicate!



- Identify risks
  - Strategies for risk mitigation
  - Balance risks with cost, schedule and performance
- Define expectations for all stakeholders
  - Role and responsibilities of all parties
- Determine how to make your program executable within budget and schedule constraints
  - Expected program changes throughout lifecycle

Acquisition Strategy Elements

Acquisition Approach

Requirements

Risk Management

Design Considerations

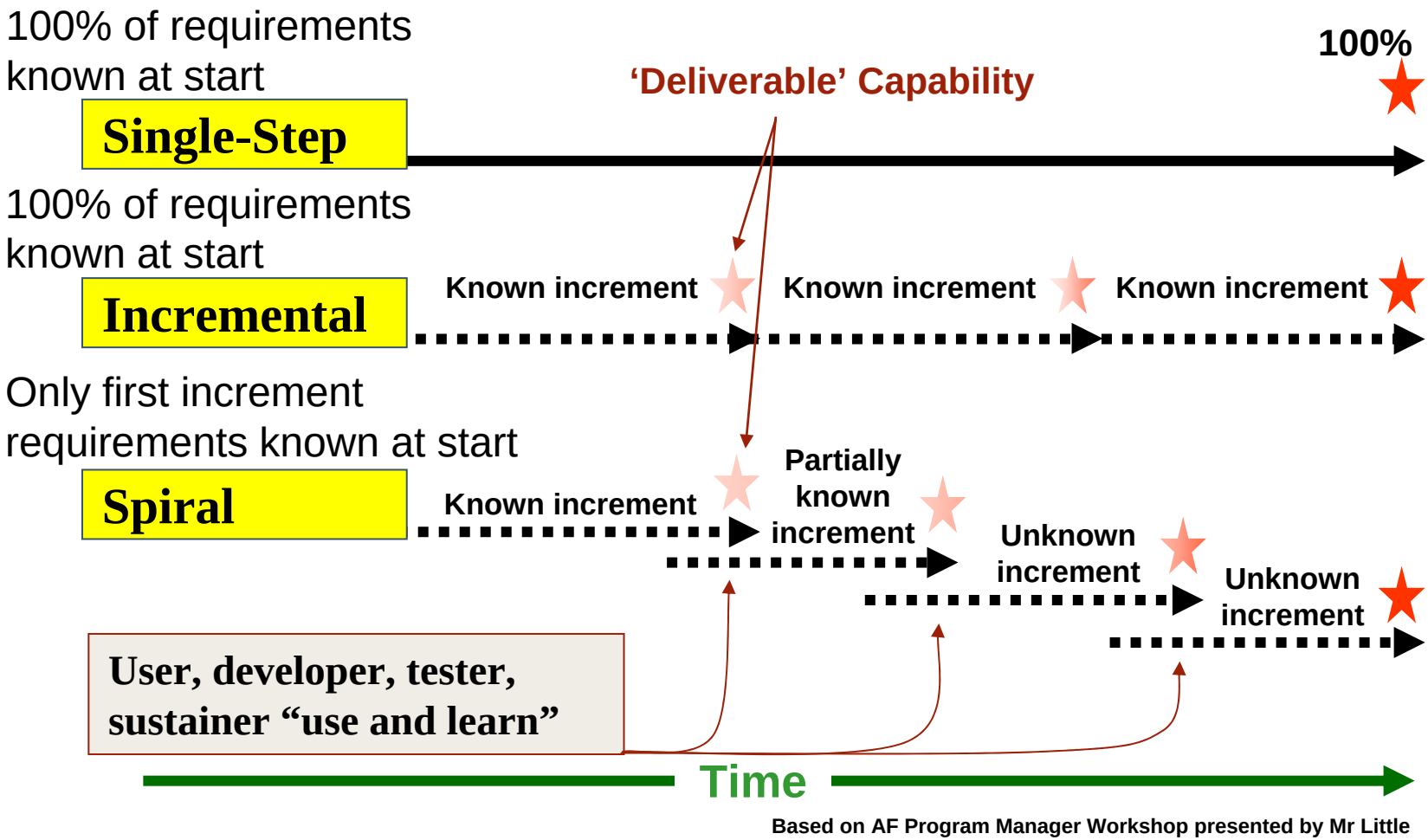
Business Strategy

Program Management

Support Strategy

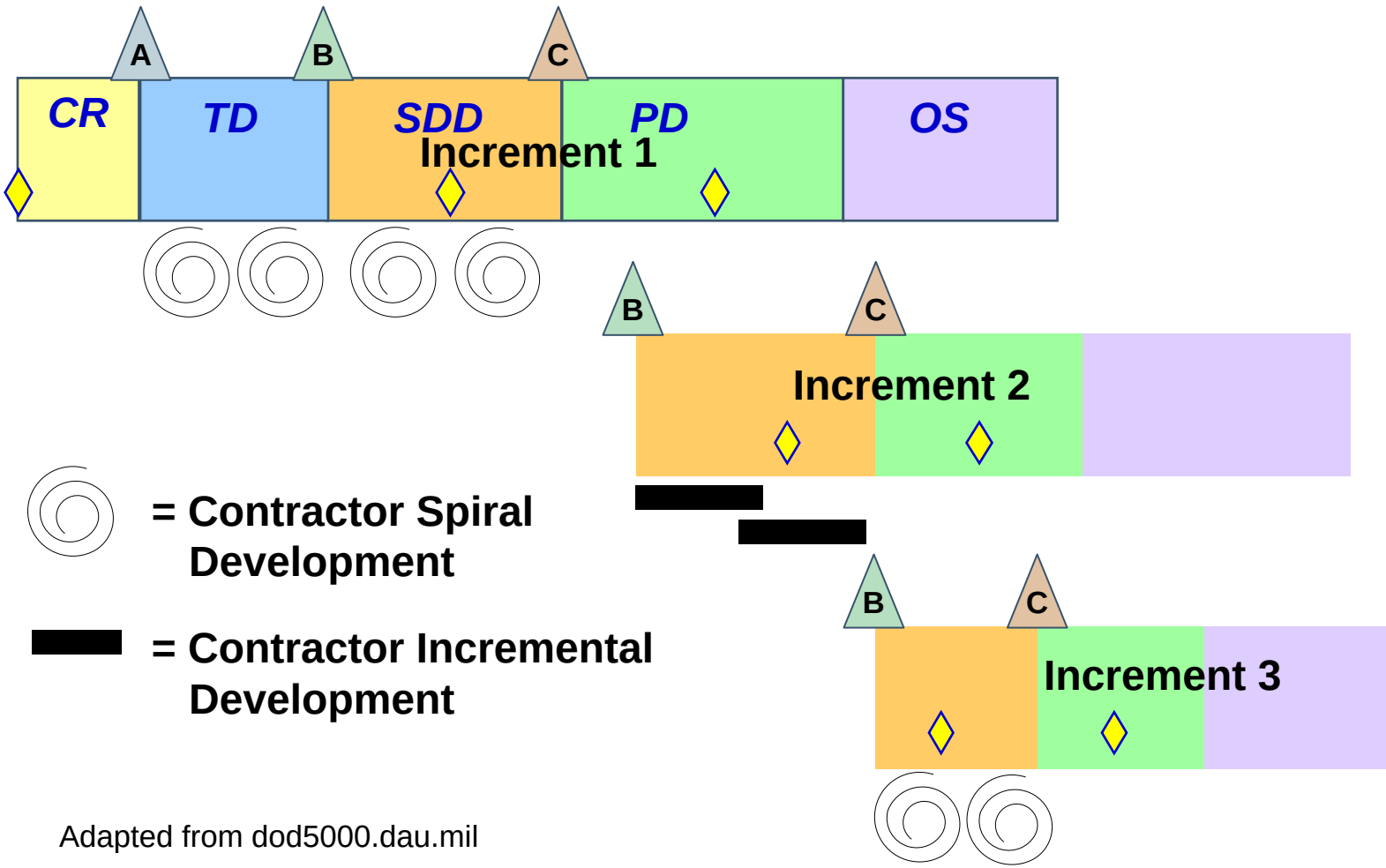
From Interim Defense Acquisition Guidebook, 30 Oct 2002

Single-Step and Evolutionary Acquisition



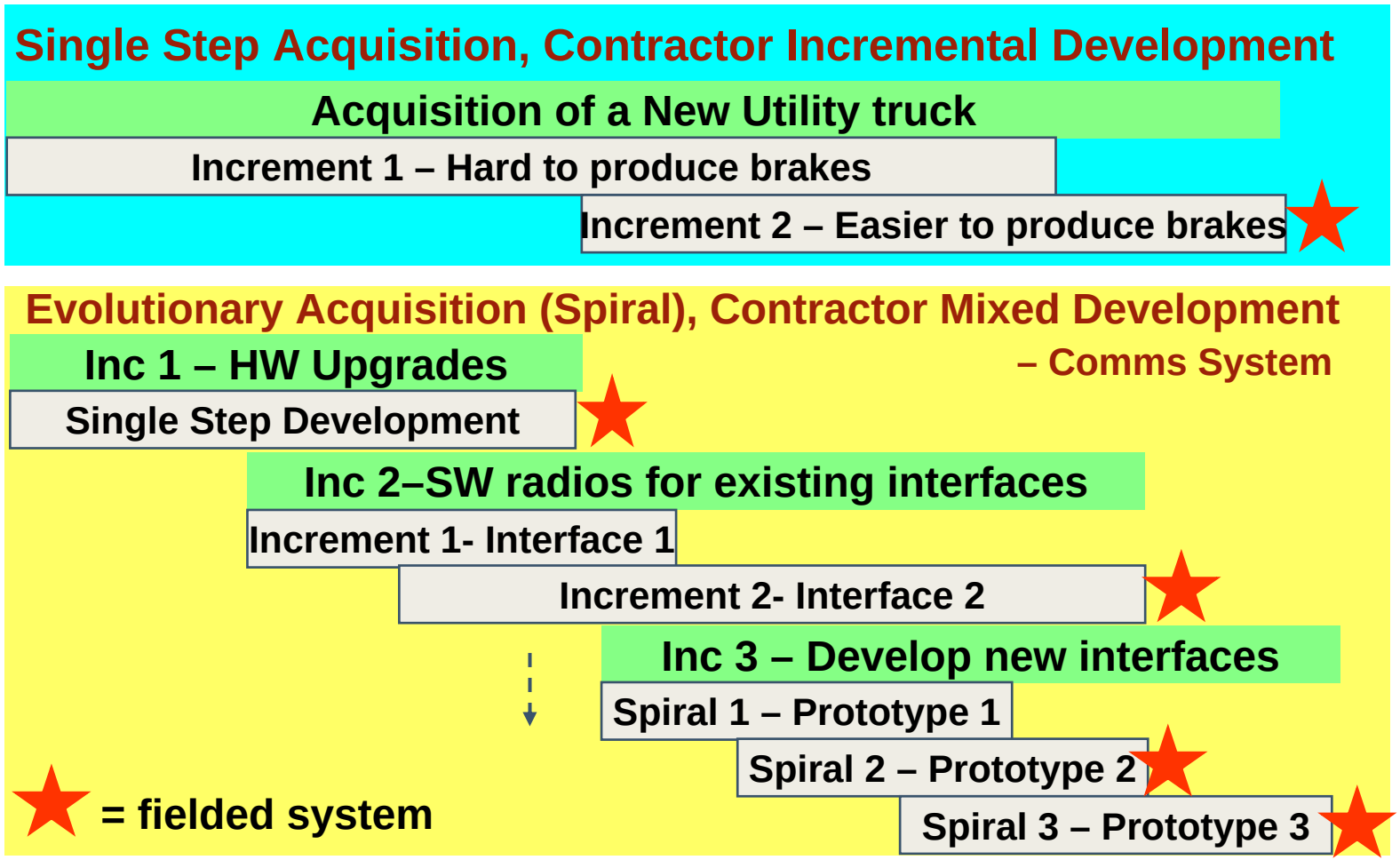
Based on AF Program Manager Workshop presented by Mr Little

Evolutionary Approach



Adapted from dod5000.dau.mil

Acquisition & Development Methods



Program Drivers

What software and system issues might DRIVE your acquisition strategy due to the risk they pose to successful execution?

- Schedule
- Funding
- Requirements Stability
- External Interfaces
- Deployment
- Interoperability (Programmatic and Developmental)
- Technology Maturity
- Staffing
- Test Requirements
- User Support
- Policy Mandates
- Security
- System Complexity Precedented / Unprecedented

Dealing with Drivers

Determine which present the highest risk exposure to your program

Determine how the drivers will influence your acquisition strategy elements

- Formulate strategies that you believe will deal with the risks posed by the top drivers

Analyze the strategies to determine gaps and remaining high risk areas

Acquisition Plan Contents

Acquisition background and objectives

- Statement of need
- Cost
- Risks
- Delivery or performance-period requirements
- Applicable conditions
- Capability or performance
- Trade-offs

Plan of action (sample)

- Sources
- Source-selection procedures
- Budgeting and funding
- Make or buy
- Test and evaluation
- Security considerations
- Competition
- Acquisition considerations
- Government-furnished property
- Inherently governmental functions
- Logistics considerations
- Contractor versus Government performance

Project Planning

CMMI-AM Goals and Practices 1

Specific Goal	Specific Practice
Establish Estimates	• Estimate the Scope of the Project • Establish Estimates of Work Product and Task Attributes • Define Project Life Cycle • Determine Estimates of Effort and Cost
Develop a Project Plan	• Establish the Budget and Schedule • Identify Project Risks • Plan for Data Management • Plan for Project Resources • Plan for Needed Knowledge and Skills • Plan Stakeholder Involvement • Establish the Project Plan
Obtain Commitment to the Plan	• Review Plans that Affect the Project • Reconcile Work and Resource Levels • Obtain Plan Commitment

Project Planning

Goal 1: Establish Estimates [1]

Estimates of project planning parameters are established and maintained

Establish a top-level WBS[1] to estimate the scope of the project

- Defines tasks for the ENTIRE project, including efforts of:
  - The supplier
  - The acquirer
  - Other stakeholders (e.g., test community, users)
- Based upon product architecture

Establish estimates of work product and task attributes

- Provides a basis for cost and effort estimation
- Software examples – KSLOC, function points, # of objects, # of interfaces, data volume, etc.

[1] See MIL-HDBK-881A (http://dcarc.pae.osd.mil/881handbook/881A.pdf)

Project Planning

Goal 1: Establish Estimates 2

Define the project life-cycle phases upon which to scope the planning effort

- Acquisition method
  - Single-Step - Evolutionary-incremental Evolutionary-spiral
- Life Cycle phases
  - Development - Manufacturing - Verification - Training
  - Deployment - Operation - Support - Disposal

Estimate the project effort and cost for the work products and tasks based on estimation rationale

- Define estimation rationale
- Estimate cost and effort for each work product and task
- Consider independent review of estimates

Project Planning

Goal 2: Develop a Project Plan 1

A project plan is established and maintained as the basis for managing the project

Establish and maintain the project's budget and schedule

- Identify assumptions, constraints, major milestones
- Identify task dependencies

Identify and analyze project risks

- Involve stakeholders in identification of risk
- Analyze impact, timeframe, and probability of occurrence

Plan for the management of project data

- Create master list of data to be managed (formal and informal)
  - Identify needs for version control and configuration mg't
- Define data content and formats
- Establish requirements for security and information assurance

Project Planning

Goal 2: Develop a Project Plan 2

Plan for necessary resources to perform the project

- Identify and plan for process requirements
- Identify and plan for staffing requirements
- Identify and plan for facilities and equipment requirements

Plan for knowledge and skills needed to perform the project

- Identify skills needed
- Assess available skills
- Develop a plan to fill the gaps

Project Planning

Goal 2: Develop a Project Plan 3

Plan the involvement of identified stakeholders

- Identify relevant stakeholders
- Plan their involvement
- Obtain commitments for involvement

Establish and maintain the overall project plan content

- Captures all relevant planning items to enable communication among the project team and stakeholders
- May be comprised of multiple plans such as
  - Integrated Master Plan
  - Integrate Master Schedule
  - Systems Engineering Management Plan
  - Software Development Plan
- Must be maintained throughout the acquisition

Module 2 Agenda

Introduction to the CMMI Acquisition Module

Project Management Process Areas

- Project Planning
- Project Monitoring and Control
- Solicitation and Contract Monitoring
- Integrated Project Management
- Risk Management

Summary

Project Monitoring and Control$_1$

The purpose of project monitoring and control is to provide understanding into the project's progress so that appropriate corrective actions can be taken when the project's performance deviates significantly from the plan.

Project Monitoring and Control$_2$

For Acquisition, monitoring and control functions are directed within the acquisition project early in the process as the acquisition planning is performed and the strategy is defined. As the acquisition process enfolds, monitoring and control are essential to ensuring that appropriate resources are being applied and that the internal acquisition activities are progressing according to plan.

Once a supplier is selected and an award is made, the role of monitoring and control becomes two fold, concerned with both continuing to monitor and control internally while also monitoring and controlling the progress of the supplier's execution under the supplier's project plan.

Poor Project Monitoring and Control…

Symptoms

- Lots of time is spent in meetings trying to discover project status rather than reporting on it.
- Data needed for management decisions is unavailable when needed.
- Actions that should have been taken early aren't identified until it's too late

Why should we care?

- If you don't know what's going on, corrective action can't be taken early when it's least expensive.
- Lack of management insight/oversight makes project results highly unpredictable, even later in the project.
- If your confidence in the status you give to your customer is low, they probably perceive it.

Project Monitoring and Control

CMMI-AM Goals and Practices

Specific Goal	Specific Practice
Monitor Project Against Plan	• Monitor Project Planning Parameters • Monitor Commitments • Monitor Project Risks • Monitor Data Management • Monitor Stakeholder Involvement • Conduct Progress Reviews • Conduct Milestone Reviews
Manage Corrective Action to Closure	• Analyze Issues • Take Corrective Action • Manage Corrective Action

Module 2 Agenda

Introduction to the CMMI Acquisition Module

Project Management Process Areas

- Project Planning
- Project Monitoring and Control
- Solicitation and Contract Monitoring
- Integrated Project Management
- Risk Management

Summary

Solicitation and Contract Monitoring

The purpose of Solicitation and Contract Monitoring is to prepare a solicitation package that identifies the needs of a particular acquisition, to select a supplier who is best capable of satisfying those needs, and to establish the process for monitoring the supplier for the duration of the contract.

For Acquisition, the solicitation must comply with the applicable federal, departmental, and service acquisition regulations and policies. The solicitation should address issues appropriate to the product domain or acquisition environment (e.g., supplier process evaluations, operational safety suitability and effectiveness, certifications, architecture evaluations, and interoperability). The representatives responsible for these activities within the project or stakeholder organizations should be consulted for proper inclusion of those activities into the solicitation and contract monitoring process.

Poor Solicitation and Contract Monitoring…

Symptoms

- The solicitation package does not include the agreement/contractual requirements and proposal evaluation criteria.
- The technical and management elements of proposals are not properly evaluated to ensure that the requirements of the agreement/contract will be satisfied.
- The selection official will not select suppliers who are qualified to satisfy the agreement/contract's requirements for the project's products..

Why Do We Care?

- The project team will have insufficient insight into the supplier's activities to ensure the effort is managed, controlled and complies with contract requirements.
- The project team and supplier team will be unable to maintain ongoing communication and commitments.

Solicitation and Contract Monitoring

CMMI-AM Goals and Practices

Specific Goal	Specific Practice
Prepare for the Solicitation	• Designate a Selection Official • Establish a Solicitation Package and Evaluation Criteria • Establish Cost and Schedule Estimates • Validate the Solicitation Package
Select Suppliers	• Evaluate Proposals • Use Evaluation Results to Select Suppliers
Award Contracts	• Establish an Understanding of the Contract and Proposed Approach • Establish Communications Processes and Procedures
Coordinate Work with Suppliers	• Monitor Selected Supplier Processes • Evaluate Selected Supplier Work Products • Revise the Supplier Agreement or Relationship

Solicitation and Contract Monitoring

Goal 1: Prepare for the Solicitation 1

The project is prepared to conduct the solicitation

Designate a selection official responsible for making the selection decision

Establish and maintain a solicitation package that includes the needs of the acquisition and corresponding proposal evaluation criteria

- Define the required proposal content
  - Process descriptions and commitments
  - Proposed development approach (e.g., processes, tasks, activities)
  - Metrics to be provided to the PMO (including process metrics)
  - Appropriate plans (e.g., Integrated Mg't plan, Software Development Plan, risk Management Plan)

Solicitation and Contract Monitoring

Goal 1: Prepare for the Solicitation 2

Establish and maintain independently reviewed cost and schedule estimates for the products to be acquired

- Reviewers should not be connected with the acquisition team or the supplier

Validate the solicitation package with end users and potential offerors to ensure the approach and cost and schedule estimates are realistic and can reasonably lead to a usable product.

- In a competitive environment, ensure equal access to all potential offerors. Provide a means for reviewers to offer clarifications of ambiguous capabilities.
- In a sole source or change order environment, ensure that relevant stakeholders recognize the consequences of proposed changes

Solicitation and Contract Monitoring

Goal 2: Select Supplier

Suppliers are selected based on the solicitation package

Evaluate proposals according to the documented evaluation criteria

- In addition to evaluating the technical approach, evaluate
  - Management practices
  - Process capabilities
  - Cost
  - Past Performance
  - Sufficiency of plans
  - Domain experience
  - Schedule

Use proposal evaluation results as a basis to support selection decisions

Solicitation and Contract Monitoring

Goal 3: Award Contracts 1

Contracts are issued based on the needs of the acquisition and the suppliers' proposed approaches

Establish and maintain a mutual understanding of the contract with selected suppliers and end users based on the acquisition needs and the suppliers' proposed approaches

- Ensure that contractual commitments are made for factors critical to project success (e.g., process execution, metrics collection and reporting)
- Maintain mutual understanding for the duration of the contract

Solicitation and Contract Monitoring

Goal 3: Award Contracts 2

Establish and maintain communication processes and procedures with suppliers that emphasize the needs, expectations, and measures of effectiveness to be used throughout the acquisition

- Define ground rules for
  - communication (e.g., data reported, frequency of reporting)
  - key decision-making (e.g., rationale, documentation, acquirer involvement)
  - conflict resolution
- Monitor process deployment and effectiveness
- Maintain open lines of communication

Solicitation and Contract Monitoring

Goal 4: Coordinate Work 1

Work is coordinated with suppliers to ensure the contract is executed properly

Monitor and evaluate selected processes used by the supplier based on the supplier's documented processes

- Adherence to plan
- Timeliness of deployment
- Effectiveness of process

Evaluate selected supplier work products based on documented evaluation criteria

- Define work products to be evaluated (may include interime products) and evaluation criteria
- Ensure capacity and capability for timely and accurate evaluation

Solicitation and Contract Monitoring

Goal 4: Coordinate Work 2

Revise the supplier agreement or relationship, as appropriate, to reflect changes in conditions

- Address shortfalls in both products and processes
- Offer relief when needs evolve to invalidate process requirements, documentation requirements, reporting requirements, etc.

Module 2 Agenda

Introduction to the CMMI Acquisition Module

Project Management Process Areas

- Project Planning
- Project Monitoring and Control
- Solicitation and Contract Monitoring
- Integrated Project Management
- Risk Management

Summary

Integrated Project Management

For Acquisition, integrated project management involves establishing project management processes consistent with and tailored from the organizations standard processes. This includes higher level acquisition guidance, regulations, instructions, as well as local practices established to be used across various projects in the local organization. Establishing an integrated project management process incorporating and involving all stakeholders (executive level acquisition offices, users, test organizations, developers, and associated government support organizations) is critical to the successful development of the project.

Formal interfaces among project stakeholders take the form of memorandums of understanding (MOUs), memorandums of agreements (MOAs), contractual commitments, associate contractor agreements and similar documents depending on the nature of the interfaces and involved stakeholders.

Poor Integrated Project Mg't …

Symptoms

- No defined processes for the project
- Project estimates make no reference to prior projects
- Plans do not reflect the way the project is executed
- Project staff does not know what is in the project plans
- Stakeholders are not identified and involved

Why do we care?

- Without processes, performance is ad hoc
- Without the history of prior projects, we may make the same mistakes
- If execution doesn't follow the plans, what does it follow?
- Uninvolved stakeholders can provide last-minute surprises
- Lessons learned are not captured

Integrated Project Management

CMMI-AM Goals and Practices

Specific Goal	Specific Practice
Use the Project's Defined Process	• Establish the Project's Defined Process • Use Organizational Process Assets for Planning Project Activities • Integrate Plans • Manage the Project Using the Integrated Plans • Contribute to the Organizational Process Assets
Coordinate and Collaborate with Relevant Stakeholders	• Manage Stakeholder Involvement • Manage Dependencies • Resolve Coordination Issues

Module 2 Agenda

Introduction to the CMMI Acquisition Module

Project Management Process Areas

- Project Planning
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- Solicitation and Contract Monitoring
- Integrated Project Management
- Risk Management

Summary

Risk Management

The purpose of risk management is to identify potential problems before they occur, so that risk-handling activities may be planned and invoked as needed across the life of the product or project to mitigate adverse impacts on achieving objectives.

For Acquisition, risk identification and estimation of probability of occurrence and impact, particularly for those risks involved in meeting performance requirements, schedules, and cost targets, largely determines the acquisition strategy. The acquirer has a dual role, first in assessing and managing overall project risks for the duration of the project, and second, in assessing and managing risks associated with the performance of the supplier. As the acquisition progresses to the selection of a supplier, the risk specific to the supplier's technical and management approach becomes important to the success of the acquisition.

Poor Risk Management …

Symptoms

- Risks are being ignored.
- Known risks to project staff are a surprise to management.
- Every time a new problem manifests, a new management technique is tried.

Why should we care?

- The project may escape some of the “bullets,” but not all of them.
- No lessons learned for future projects means making the same mistakes on multiple projects.
- Repeated project failures due to unforeseen (but predictable) risks costs you and your organization.

Risk Management

CMMI-AM Goals and Practices

Specific Goal	Specific Practice
Prepare for Risk Management	• Determine Risk Sources and Categories • Define Risk Parameters • Establish a Risk Management Strategy
Identify and Analyze Risks	• Identify Risks • Evaluate, Categorize, and Prioritize Risks
Mitigate Risks	• Develop Risk Mitigation Plans • Implement Risk Mitigation Plans

Acquisition Risk Management 1

What Can Acquisition Program Offices Do? — A Few Ideas

Start a risk management program on Day 1 of the program

Ensure that PMO staff have appropriate risk management training

Use multiple methods to identify risk sources:

- periodic risk reporting
- voluntary risk reporting
- taxonomy-based questionnaire (TBQ)
- brainstorming
- risk report forms
- TBQ interviews

Acquisition Risk Management 2

What Can Acquisition Program Offices Do? — A Few Ideas

- Add language to RFPs and contracts that specify how risks are to be reported to the PMO
- Encourage decentralization of risk identification and analysis following an organizationally defined process
- Establish and maintain a schedule of joint risk reviews with all contractors throughout the program, including joint prioritization of the most important risks to the program
- Find ways to reward contractors for early identification of issues and risks
- Define a process and criteria for escalating risks to the next higher level

Module 2 Agenda

Introduction to the CMMI Acquisition Module

Project Management Process Areas

- Project Planning
- Project Monitoring and Control
- Solicitation and Contract Monitoring
- Integrated Project Management
- Risk Management

Summary

Summary 1

PM roles include PMO management, project management, supplier oversight, indirect subcontractor oversight, and process integration

CMMI-AM is a tool intended to help the **acquirer** achieve success

Development of a suitable **acquisition strategy** is a key component of project planning

Principal goals of **Project Planning**

- Establish estimates
- Develop a project plan
- Obtain commitment to the plan

Principal goals of **Project Monitoring and Control**

- Monitor Project Against Plan
- Manage Corrective Action to Closure

Summary 2

Principal goals of **Solicitation and Contract Monitoring**

- Prepare for the Solicitation
- Select Suppliers
- Award Contracts
- Coordinate Work with Suppliers

Principal goals of **Integrated Project Management**

- Use the Project's Defined Process
- Coordinate and Collaborate with Relevant Stakeholders

Principal goals of **Risk Management**

- Prepare for Risk Management
- Identify and Analyze Risks
- Mitigate Risks

Using CMMI-AM to Improve Acquisition Practices- Contents

Carnegie Mellon
Software Engineering Institute

Pittsburgh, PA 15213-3890

Using CMMI-AM to Improve Acquisition Practices

Module 3:
CMMI-AM and Engineering

Sponsored by the U.S. Department of Defense

Module 3 Agenda

Engineering Process Areas

- Requirements Development
- Requirements Management
- Verification
- Validation

Summary

PMO Role in Systems Engineering 1

Inherent PMO Responsibility:

- Ensure technology readiness level is appropriate for program phase
- Develop initial system requirements in conjunction with stakeholders and ensure continued involvement
- Develop technical evaluation criteria and evaluate proposals during source selection
- Develop independent cost and schedule estimates for the technical effort
- Ensure external interfaces are properly identified and monitored
- Ensure PMO has adequate systems engineering staff

PMO Role in Systems Engineering 2

PMO responsibility in conjunction with your contractor:

- Ensure contractor development method is appropriate
- Ensure contractor's systems engineering processes are acceptable and being followed
- Ensure compatible processes between prime and sub contractors and between the contractor team and the PMO
- Review and approve systems engineering documentation
- Ensure systems engineering function is adequately integrated with other areas such as logistics and test
- Manage the top-level change control process
- Perform technical evaluations
- Systems Integration (if applicable)
- Ensure end system meets requirements

Module 3 Agenda

Engineering Process Areas

- Requirements Development
- Requirements Management
- Verification
- Validation

Summary

Requirements Development 1

The purpose of requirements development is to produce and analyze customer, product, and product-component requirements.

Requirements Development 2

The purpose of requirements development is to produce and analyze customer, product, and product-component requirements.

For Acquisition, requirements development has two contexts;

- The amalgamation and coordination of the operational requirements (customer requirements) into a requirements set that will define the scope and direction of the acquisition;
- The allocation and extension of the customer requirements and additional acquirer requirements (e.g., architecture, formal and informal reviews, reporting or data requirements) that become the basis of the processes utilized by the supplier's organization.

Requirements Development 3

There is a continuous iteration of requirements down through the multiple tiers of requirements documents associated with the components of the system.

- For example, requirements flow from the stakeholders to the system level to multiple subsystem levels and eventually to either hardware or software component levels.

The responsibility for developing requirements across the levels is generally split between the acquirer and the supplier.

- The acquirer is generally responsible for the higher level, starting with operational requirements and the supplier is responsible for successive levels below that.

Poor Requirements Development ...

Symptoms

- Unstated requirements or poorly stated requirements lead to confusion among staff and customers.
- Design, implementation, and test work products inconsistently interpret the requirements.
- It takes a long time to get agreement on product design.

Why should we care?

- Unusable products and unhappy customers
- Wasted time and resources building the “wrong” product
- Staff members get tired of rework because requirements have been re-interpreted yet again.
- Excessive spending to satisfy customer expectations

Requirements: Input or Output?

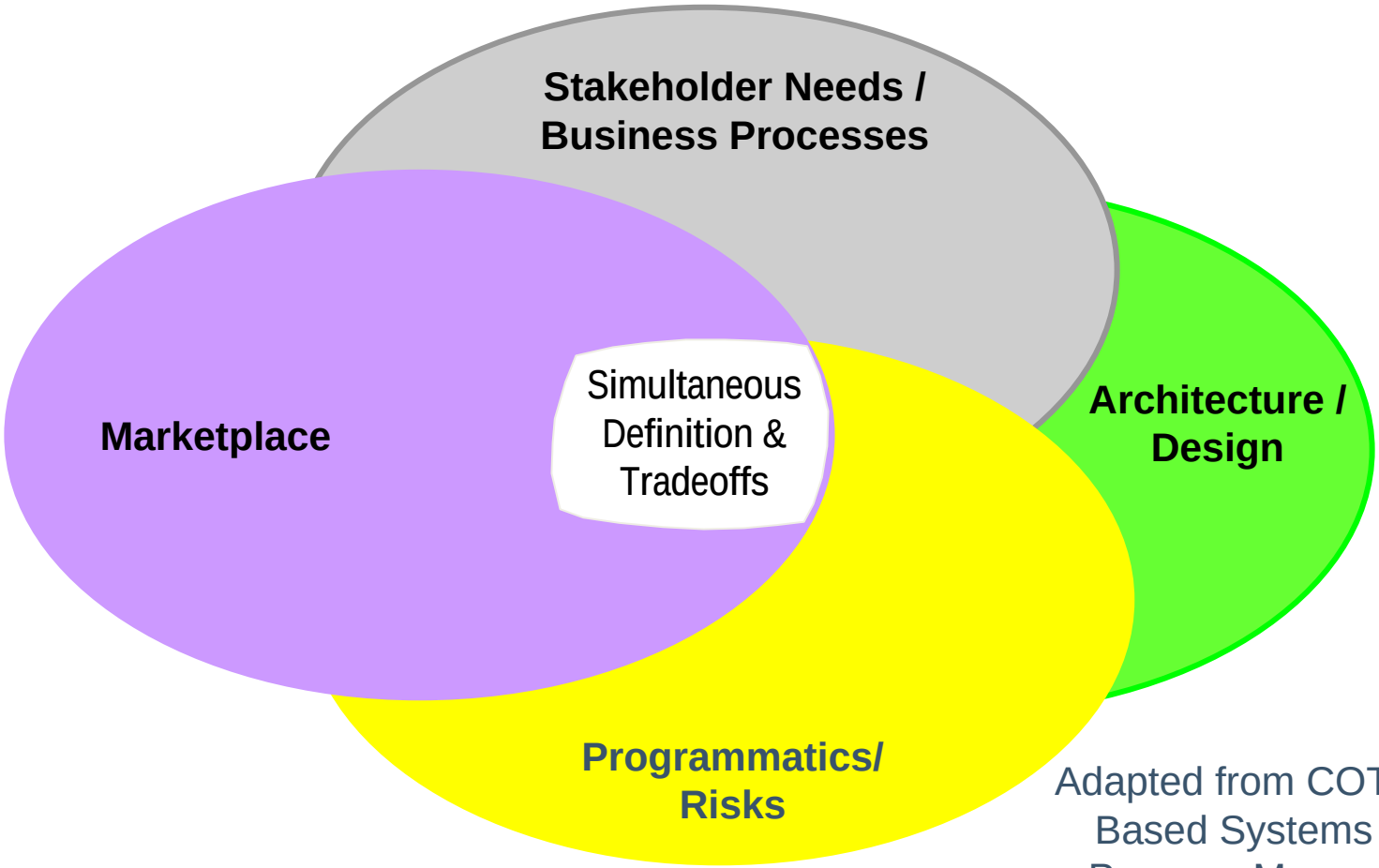
BOTH !

You **RECEIVE** requirements from your customer
- Operational needs

You **DELIVER** requirements to your supplier
- Through the solicitation, SOW, SOO, and/or contract

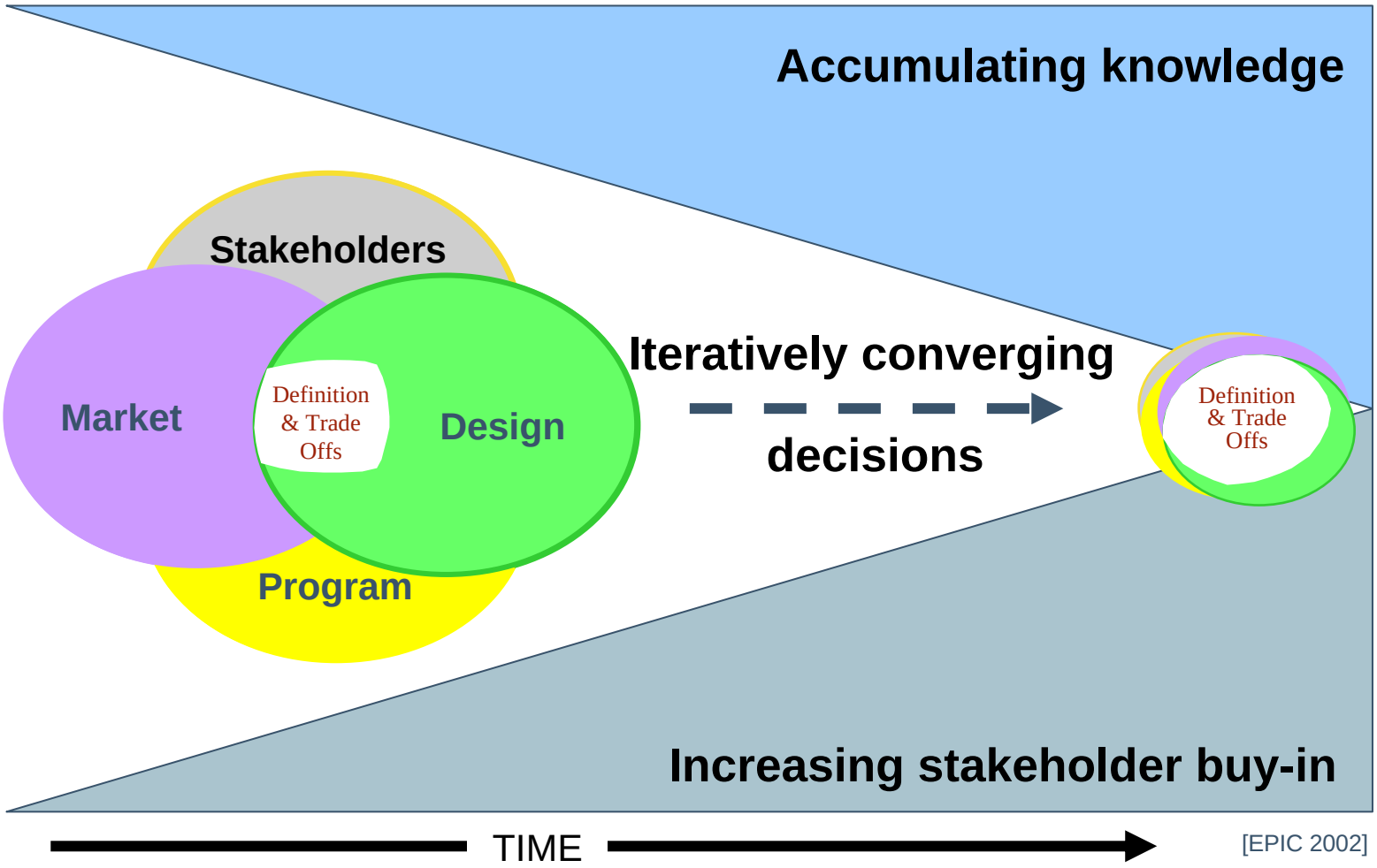
Your job is
- To ensure the quality of the inputs
- To convert the inputs to the high-quality outputs

Requirements Must be Balanced



Adapted from COTS-Based Systems for Program Managers

Requirements Must Evolve



[EPIC 2002]

Requirements Development

CMMI-AM Goals and Practices

Specific Goal	Specific Practice
Develop Customer Requirements	• Elicit Needs • Develop the Customer Requirements
Develop Product Requirements	• Establish Product and Product- Component Requirements • Allocate Product-Component Requirements • Identify Interface Requirements
Analyze and Validate Requirements	• Establish Operational Concepts and Scenarios • Establish a Definition of Required Functionality • Analyze Requirements • Analyze Requirements to Achieve Balance • Validate Requirements with Comprehensive Methods

Module 3 Agenda

Engineering Process Areas

- Requirements Development
- **Requirements Management**
- Verification
- Validation

Summary

Requirements Management 1

The purpose of requirements management is to manage the requirements of the project's products and product components and to identify inconsistencies between those requirements and the project's plans and work products.

For Acquisition, requirements management is applied to the requirements that are received from the requirements development process.

Requirements Management 2

During acquisition, requirements management includes

- the direct management of acquirer-controlled requirements
- oversight of supplier requirements management

Requirements are managed and maintained with discipline so that changes are not executed without recognizing the impact to the project.

Requirements management does not end with the selection of a supplier and an award.

- The acquisition project continues to manage high-level requirements, including changes
- the selected supplier manages the lower level requirements

Poor Requirements Management …

Symptoms

- High levels of re-work throughout the project.
- Requirements are accepted by staff from any unauthorized sources.
- “Galloping” requirements creep.
- Inability to prove that the product meets the approved requirements

Why should we care?

- Solutions that don’t match user needs or may have to be replaced or retired early
- Inability to hold contractor to commitments
- Excessive budget consumption [LEFF 2003]
  - Requirements errors are the most common error & most expensive to fix
  - Requirements error are likely to consume 25% - 40% of the total project budget when not caught early

Requirements Management

CMMI-AM Goals and Practices 1

Specific Goal	Specific Practice
Manage Requirements	• Obtain an Understanding of Requirements • Obtain Commitment to Requirements • Manage Requirement Changes • Maintain Bidirectional Traceability of Requirements • Identify Inconsistencies Between Project Work and Requirements

Module 3 Agenda

Engineering Process Areas

- Requirements Development
- Requirements Management
- Verification
- Validation

Summary

Verification versus Validation

Verification

- Are you building the *product right*?
- That is, are you meeting the specified requirements?

Validation

- Are you building the *right product*?
- That is, are you meeting the operational need?

Verification

The purpose of verification is to ensure that selected work products meet their specified requirements.

For Acquisition, verification involves ensuring that the evolving work products of the acquisition project meet specified requirements for those products. The acquisition project should ensure

- a proper verification environment exists
- work products are selected for evaluation based on documented criteria.

Peer reviews are intended to be used for work products developed by the acquisition project

The acquisition project is also responsible for ensuring that the supplier uses appropriate methods to verify its work products.

Poor Verification …

Symptoms

- There is disagreement among technical staff as to the "done-ness" of different components.
- Under test the product doesn't meet requirements or design expectations.
- Defects that could have been caught early escape into later life cycle phases.
- There is increased integration or test time.

Why should we care?

- Product reliability suffers if defects aren't detected or corrected prior to customer release.
- The product costs more to test if early verification activities are ignored.
- Customers don't want to pay for defective products, and you probably won't get their business next time

Module 3 Agenda

Engineering Process Areas

- Requirements Development
- Requirements Management
- Verification
- Validation

Summary

Validation 1

The purpose of Validation is to demonstrate that a product or product component fulfills its intended use when placed in its intended environment.

Validation activities can be applied to all aspects of the product in any of its intended environments

- e.g., operation, training, manufacturing, maintenance, and support services.

The methods employed to accomplish validation can be applied to **work products** as well as to the **product** and **product components**.

The work products (e.g., requirements, designs, prototypes) should be selected for validation based on which are the best predictors of how well the delivered end product and product components will satisfy user needs.

Validation 2

For acquisition, validation involves ensuring that the evolving acquisition work products (e.g., RFPs, SOWs, plans) meet the acquisition project's needs.

Validation activities are normally performed early and continuously throughout the acquisition life cycle.

The acquirer also uses validation processes to ensure that the product or service received from the supplier will fulfill its intended use.

The test community is a major stakeholder, participating in up-front planning through final-product acceptance.

- The supplier and/or the test community may perform many of the validation practices, with the acquisition project facilitating the correction of deficiencies or enhancements by the supplier or follow-on maintenance organization.

Poor Validation …

Symptoms

- Lots of user change requests are received before or soon after the product is released.
- There are arguments among the technical staff as to what the user really wants.
- The released product doesn't meet user expectations.

Why should we care?

- Customers don't want to pay for products that don't meet their needs.
- If an end user refuses to use the product as delivered, their confidence in you is eroded.
- You'll spend a lot of money trying to make it right, or you'll give up that customer's future business.

Validation

CMMI-AM Goals and Practices

Specific Goal	Specific Practice
Prepare for Validation	• Select Products for Validation • Establish the Validation Environment • Establish Validation Procedures and Criteria
Validate Product of Product Components	• Perform Validation • Analyze Validation Results

Module 3 Agenda

Engineering Process Areas

- Requirements Development
- Requirements Management
- Verification
- Validation

Summary

Summary 1

PMO plays a critical role in the systems engineering of a project

Principal goals of **Requirements Development**

- Develop Customer Requirements
- Develop Product Requirements
- Analyze and Validate Requirements

Principal goals of **Requirements Management**

- Manage Requirements

Summary 2

Principal goals of **Verification**

- Prepare for Verification
- Perform Peer Reviews
- Verify Selected Work Products

Principal goals of **Validation**

- Prepare for Validation
- Validate Product of Product Components

Using CMMI-AM to Improve Acquisition Practices- Contents

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Using CMMI-AM to Improve Acquisition Practices

Module 4:

CMMI-AM and Support and Generic Practices

Module 4 Agenda

Support Process Areas

- Decision Analysis and Resolution
- Measurement and Analysis
- Transition to Operations and Support

Summary

Generic Practices

Decision Analysis and Resolution

The purpose of decision analysis and resolution is to analyze possible decisions using a formal evaluation process that evaluates identified alternatives against established criteria.

For Acquisition, a repeatable criteria-based decision-making process is especially important, both while making the critical decisions that define and guide the acquisition process itself and later when critical decisions are made with the selected supplier. The establishment of a formal process for decision-making provides the acquisition project with documentation of the decision rationale. Such documentation allows the criteria for critical decisions to be revisited when changes that impact project requirements or other critical project parameters change.

Poor Decision Analysis and Resolution …

Symptoms

- It is unclear who is authorized to make what decisions.
- Decisions are made on primarily subjective bases.
- The same issue is “decided” over and over and over.
- Rationale for earlier decisions is unavailable when needed to understand the decision later in the project.
- Too few choices are considered for major decisions.

Why should we care?

- Wasted effort pursuing changing goals
- Lost opportunities
- Low morale
- Perception of indecisiveness (or incompetence) by customer and others

Decision Analysis and Resolution

CMMI-AM Goals and Practices

Specific Goal	Specific Practice
Evaluate Alternatives	• Establish Guidelines for Decision Analysis • Establish Evaluation Criteria • Identify Alternative Solutions • Select Evaluation Methods • Evaluate Alternatives • Select Solutions

Module 4 Agenda

Support Process Areas

- Decision Analysis and Resolution
- Measurement and Analysis
- Transition to Operations and Support

Summary

Generic Practices

Measurement and Analysis

The purpose of measurement and analysis is to develop and sustain a measurement capability that is used to support management information needs.

For Acquisition, the acquisition project has information needs for determining the status of its activities throughout the lifecycle of the acquisition, the supplier's activities per contractual requirements, and the status of the evolving products acquired. In acquisition projects where multiple products are acquired to deliver a capability to the end-user, or where there are teaming relationships with other acquisition projects to acquire joint capabilities, additional information needs may be identified to ensure programmatic, technical, and operational interoperability product objectives are identified, measured, and achieved.

Poor Measurement and Analysis …

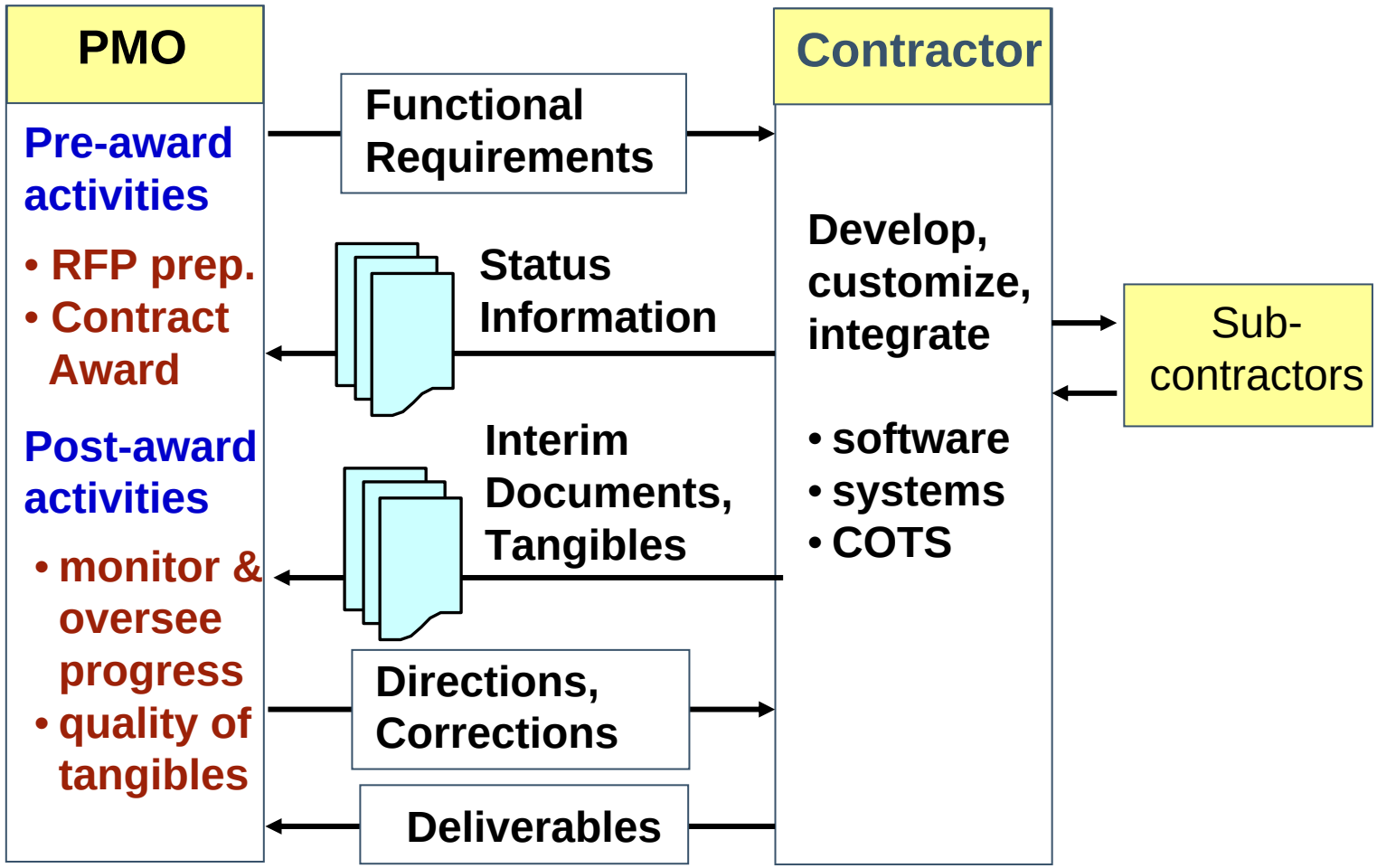
Symptoms

- Management lacks objective data for decision making
- Decisions are based upon intuition
- Status of project is not clearly known
- No historical data is available for reference

Why should we care?

- Bad data or No data ⇒ Bad decisions
- Issues remain undetected until they blossom into problems
- No data ⇒ No learning ⇒ Repeated mistakes

Roles and Information Exchange



PMO Major Responsibilities

Post Contract Award

Contractor

Develop the System

Deliverables

Documents
- **SRD**
- **SDP**
- **Meas Plan**
- **SDD**
- **Etc.**

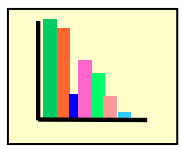
Status Rpts
- **Sched.**
- **Cost**
- **Testing**
- **Etc.**

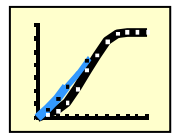
Final Product

PMO

PMO Responsibilities (Post Contract Award)

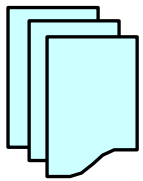
- **Evaluate Quality of deliverables**
- **Monitor and Oversight**
  - **Schedule & Progress**
  - **Resources & Costs**
  - **Developer's Processes**





Evaluate Quality of Deliverables

Documents to review
- SRD
- SDP
- Meas Plan
- SDD
- Etc.



Final Deliverables

PMO's Inspection or Review Process

PMO's Evaluation criteria

Measurable Results (Examples)

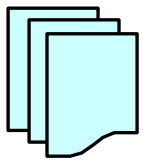
Products
- defects discovered
  - description, severity, class, type
- size of the work product

Process
- effort invested in the inspection process
- time spent during the inspection activities

Indicators

Monitor and Oversee

Status Information



- schedule progress
- budget status
- test results
- process results, e.g. inspections
- Process compliance
- etc.

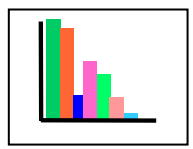
PMO's Analysis & Review Process

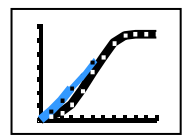
PMO's Evaluation Criteria

Measurable Results (Examples)

- contractor effort actual vs. plan
- contractor schedule actual vs. plan
- defects reported
  - description, severity, class, type
- size, complexity of the work product

Indicators





PMO vs. Contractor Focus

PMO

Key Management Issues

Contractor's Performance
- Schedule & Progress
- Resources & Cost
- Product Quality

PMO's Performance
- Schedule & Progress
- Resources & Cost
- Product Quality

PMO's Processes
- Documented
- Improvements

Contractor

Key Management Issues

Schedule & Progress

Resources & Cost

Product Size & Stability

Product Quality

Process Performance

Technology Effectiveness

Customer Satisfaction

Measurement and Analysis

CMMI-AM Goals and Practices

Specific Goal	Specific Practice
Align Measurement and Analysis Activities	• Establish Measurement Objectives • Specify Measures • Specify Data Collection and Storage Procedures • Specify Analysis Procedures
Provide Measurement Results	• Collect Measurement Data • Analyze Measurement Data • Store Data and Results • Communicate Results

Module 4 Agenda

Support Process Areas

- Decision Analysis and Resolution
- Measurement and Analysis
- Transition to Operations and Support

Summary

Generic Practices

Transition to Operations and Support 1

The purpose of transition to operations and support is to provide for the transition of the product to the end user and the eventual support organization and to accommodate lifecycle evolution of the product.

For acquisition, Transition to Operations and Support involves

- the processes used to plan for and manage the transition of new or evolved products into operational use
- their transition to the eventual maintenance or support organization.
- any special conditions that may apply during the eventual decommissioning or disposal of the products.

Transition to Operations and Support 2

The acquisition project is responsible for ensuring

- the acquired products meet specified requirements (see Verification)
- can be used in the intended environment (see the Validation)
- can be transitioned into operational use to achieve the users' desired mission capabilities and can be maintained and sustained over their intended life cycles.

Transition to Operations and Support 3

The acquisition project is responsible for

- ensuring reasonable planning for transition into operations is conducted
- clear transition criteria exist and are agreed to by relevant stakeholders
- planning is completed for product maintenance and support of products after they become operational.

These plans include reasonable accommodation for known and potential evolution of the products and their eventual removal from operational use.

Poor Transition to Operations and Support …

Symptoms

- Operational and support functions are not involved during development
- Support concerns not addressed during development
- Training only addressed late in the development process

Why should we care?

- Product poorly received by Ops and Support
- Deployment delayed due to late Ops training or support training
- Excessive support costs

Transition to Operations and Support

CMMI-AM Goals and Practices

Specific Goal	Specific Practice
Prepare for Transition	• Establish a Transition Strategy • Establish Product Transition Plans • Establish Operations and Support Training Requirements • Establish Lifecycle Resource Requirements • Identify Support Responsibility • Establish Enhancement Criteria • Establish Transition Criteria
Transition Products	• Evaluate Product Readiness • Evaluate Personnel Readiness • Analyze Results and Take Action

Transition to Operations and Support

Goal 1: Prepare for Transition 1

Preparation for transition to operations and support is conducted

Establish and maintain a strategy for transition to operations and support

- Source of support (organic, contractor, etc.)
- Level of support (line, intermediate, depot, etc.)

Establish and maintain plans for transitioning acquired products into operational use and support

- Documented, available to, and approved by relevant stakeholders

Establish and maintain training requirements for operational and support personnel

- Training objectives
- Skills maintenance
- Trainee skills assessment

Transition to Operations and Support

Goal 1: Prepare for Transition 2

Establish and maintain initial and life-cycle resource requirements for performing operations and support

- Initial spares
- Facilities
- Future spares and service
- Disposal

Identify and assign organizational responsibility for support

- Identify and involve **EARLY** and **THROUGHOUT** product development

Establish and maintain criteria for assigning responsibility for enhancements

- Magnitude and complexity of enhancement
- Required domain knowledge and experience
- Required acquisition knowledge

Establish and maintain transition criteria for the acquired products

- Assure criteria satisfaction through verification and validation

Transition to Operations and Support

Goal 2: Transition Products

Transition decisions and actions are executed in accordance with transition criteria

Evaluate the readiness of the acquired products to undergo transition to operations and support

- e.g. Readiness of product, documentation, training, maintenance equipment, etc.
- Evaluated throughout acquisition life cycle

Evaluate the readiness of the operational and support personnel to assume responsibility for the acquired products

- Skills, training, staffing, support equipment availability, etc.

Analyze the results of all transition activities and identify appropriate action

- Strengths and weaknesses
- Actions to bolster weaknesses

Module 4 Agenda

Support Process Areas

- Decision Analysis and Resolution
- Measurement and Analysis
- Transition to Operations and Support

Summary

Generic Practices

Summary

PMO plays a critical role in the systems engineering of a project

Principal goals of **Decision Analysis and Resolution**

- Evaluate Alternatives

Principal goals of **Measurement and Analysis**

- Align Measurement and Analysis Activities
- Provide Measurement Results

Principal goals of **Transition to Operations and Support**

- Prepare for Transition
- Transition Products

Module 4 Agenda

Support Process Areas

- Decision Analysis and Resolution
- Measurement and Analysis
- Transition to Operations and Support

Summary

Generic Practices

Generic Practices

Generic practices are activities that ensure that the processes associated with the process area will be effective, repeatable, and lasting.

Generic practices are applied to **EVERY** process area.

Definitions

Managed Process

A performed process that

- Is planned and executed in accordance with policy
- Employs skilled people having adequate resources to produce controlled outputs
- Involves relevant stakeholders
- Is monitored, controlled, and reviewed
- Is evaluated for adherence to its process description

Defined Process

A Managed Process that

- Is tailored from the organization's set of standard processes according to the organization's tailoring guidelines
- Has a maintained process description
- Contributes work products, measures, and other process-improvement information to the organizational process assets

CMMI-AM Generic Practices

Practices focused on institutionalizing a Managed Process

- Establish an Organizational Policy
- Plan the Process
- Provide Resources
- Assign Responsibility
- Train People
- Manage Configurations
- Identify and Involve Relevant Stakeholders
- Monitor and Control the Process
- Objectively Evaluate Adherence
- Review Status with Higher Level Management

Practices focused on institutionalizing a Defined Process

- Establish a Defined Process
- Collect Improvement Information

Using CMMI-AM to Improve Acquisition Practices- Contents

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Using CMMI-AM to Improve Acquisition Practices

Module 5:
Using CMMI-AM

Module 5 Agenda

Using CMMI-AM

Summary

CMMI-AM Self-Assessment

To guide the PM in assessing the acquisition program, the CMMI-AM includes a series of executive questions focused on:

- Acquisition Strategy
- Acquisition Planning
- Cost Schedule and Performance Baselines
- User Requirements
- Product Engineering
- Acquisition Processes
- Risk Identification and Management

Questions are linked to the CMMI-AM Process Areas

CMMI-AM Executive Questions

Acquisition Strategy

Method of Acquisition Strategy determination?

Risk Mitigation through Acquisition Strategy?

Stakeholder involvement in Acquisition Strategy?

CMMI-AM Executive Questions

Acquisition Planning

Relationship to Acquisition Strategy?

Program Scope determination?

Determination of Development Effort size?

Determination of resource needs?

Determination of critical path?

Coordination of plans with relevant stakeholders?

Staffing with appropriate skills and experience?

Ensuring adequate supplier resources?

Ensuring adequate supplier experience and capability?

CMMI-AM Executive Questions

Cost, Schedule, and Performance Baselines

Means of validating and integrating baselines?

Provisions for independent reviews?

Inclusion of all life cycle costs?

Plans to track cost, schedule, and performance?

Baseline change management?

Evaluation of change impact?

CMMI-AM Executive Questions

User Requirements

Plans to manage user involvement?

Means of ensuring understanding of user needs?

PMO role in requirements generation?

Adaptation strategy for evolving operations environment?

CMMI-AM Executive Questions

Product Engineering

Process to define, verify, and validate requirements and architectures?

Development status monitoring?

Means of incorporating non-developmental items (NDI)?

Satisfaction of NDI goals?

NDI interface definition and acceptance?

Effort to test and integrate NDI?

Supplier demonstration of performance and stability of development environment and tools?

CMMI-AM Executive Questions

Acquisition Process

Existence, quality, and usage of acquisition processes?

Monitoring, control, and improvement of acquisition processes?

Project adherence to acquisition processes?

CMMI-AM Executive Questions

Risk Identification and Management

Means of identifying program risk?

Risks related to acquisition strategy and plans?

Risks associated with cost and schedule?

Means of ensuring understand of cost risk?

Risks related to supplier execution?

Risks outside of your control?

Analysis (likelihood and impact) of program risks?

Mitigation effort monitoring?

Risk management tools?

Participants in risk assessment?

Reserves for risk mitigation and problem impact

Assessment of supplier mechanisms for rapid process stand-up

CMMI-AM Self Assessment Tool -1

The survey instrument is intended to be used to get a sense of the degree to which the *Capability Maturity Module Integration - Acquisition Module (CMMI-AM) Goals* are implemented within a particular program or project's work culture.

Acquisition practices within the module are drawn and summarized from existing sources of best practices:

- Software Acquisition Capability Maturity Model (SA-CMM)
- Capability Maturity Model Integration (CMMI)
- FAA Integrated Capability Maturity Model (iCMM)
- Section 804

This instrument will allow members of the program to give anonymous feedback on how well they think things are going, and then this information can be conveniently aggregated and presented to program members for discussion and problem-solving.

CMMI-AM Self Assessment Tool -2

Example Questions

1. Estimates are based on wild guesses or dictated from above.

   Estimates of project planning parameters (i.e, scope, task attributes, lifecycle, cost, effort, etc.) are established and maintained.

   1 2 3 4 5 6 7 8 9 10

2. Plans are rarely written down nor do they reflect current project activities.

   A project plan is established and maintained as the basis for managing the project.

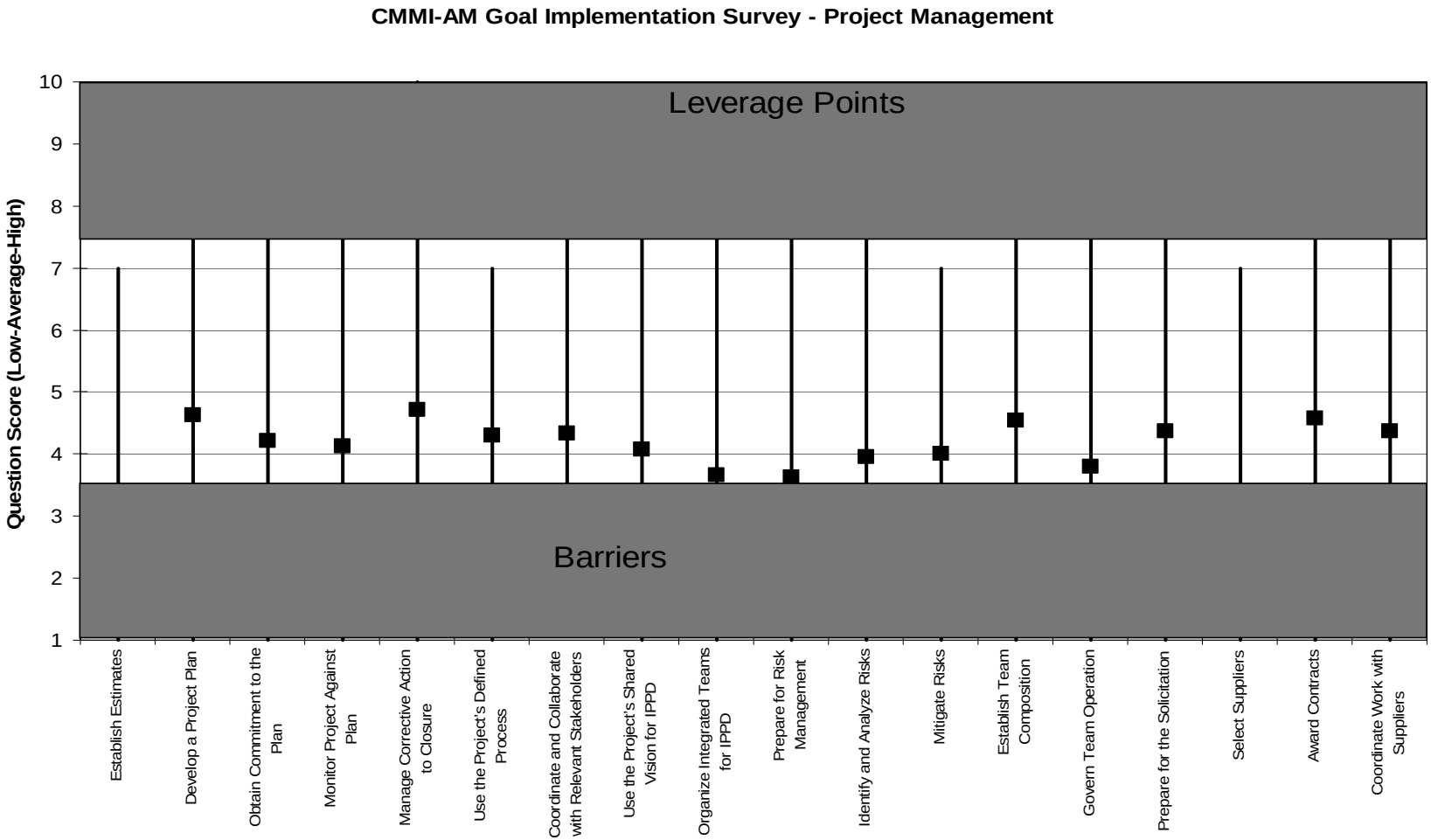
   1 2 3 4 5 6 7 8 9 10

3. We rarely seek commitments from those affected by the project plan.

   Commitments to the project plan are established and maintained.

   1 2 3 4 5 6 7 8 9 10

CMMI-AM Self Assessment Tool -3
Sample Output



CMMI-AM Self Assessment Tool -4 Interpretation

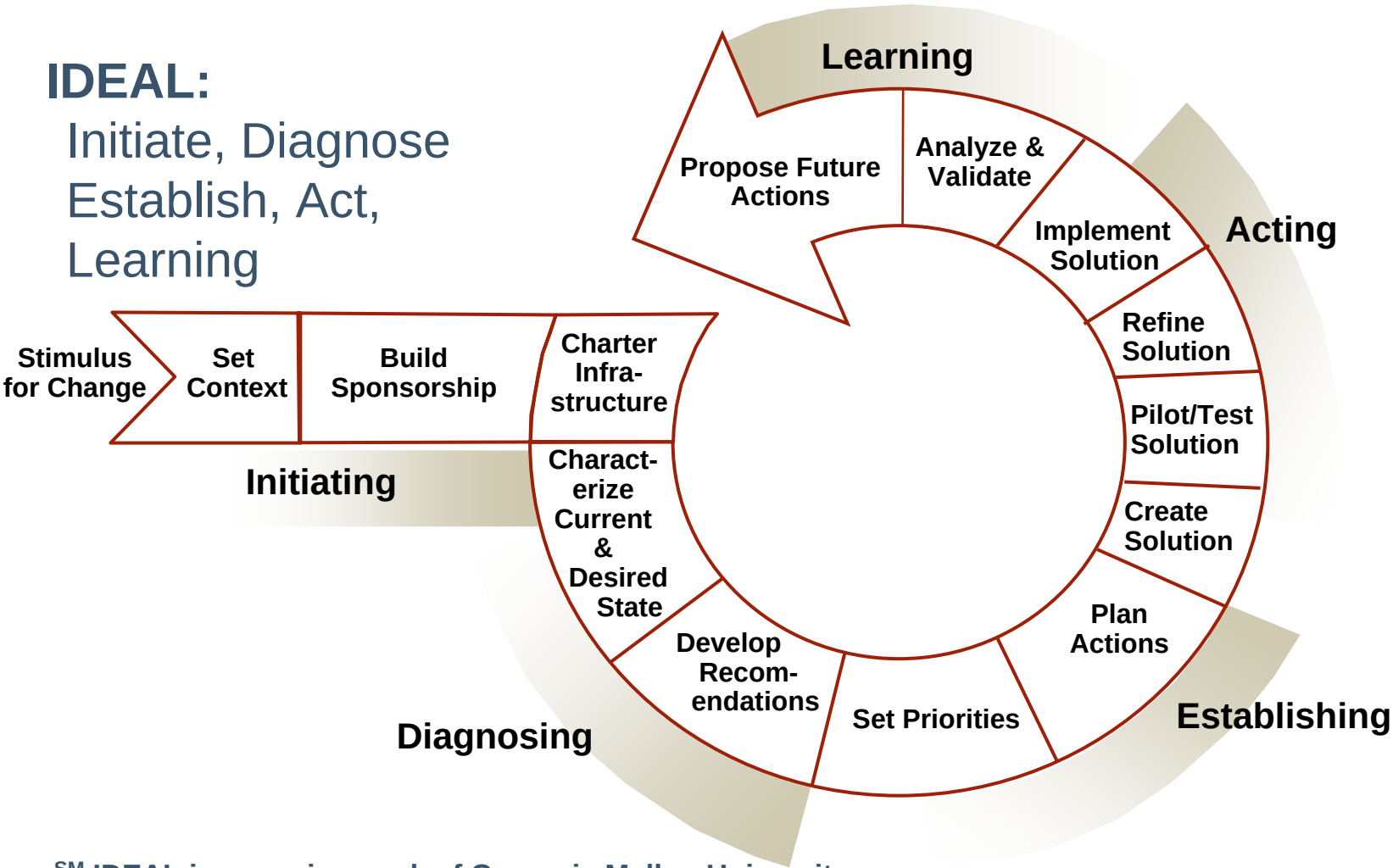
The CMMI-AM Goal Implementation Score indicates your perception of overall level of your program's current acquisition management effort based on implementation of the CMMI-AM.

High scores are an indication that you feel these goals are being achieved within your program and may even be institutionalized.

Scores in other ranges mean that you must build strategies to improve the project's ability to effectively manage the project.

Using IDEAL to adopt CMMI-AM 1

IDEAL:
Initiate, Diagnose
Establish, Act,
Learning



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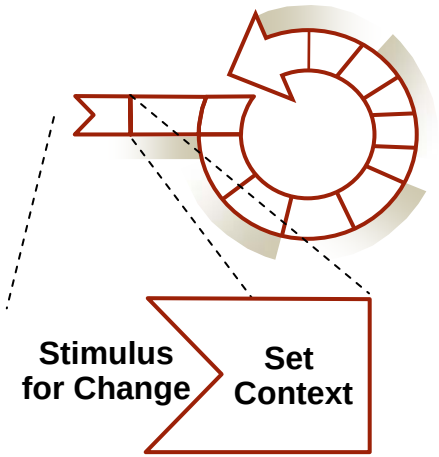
Using IDEAL to adopt CMMI-AM 2



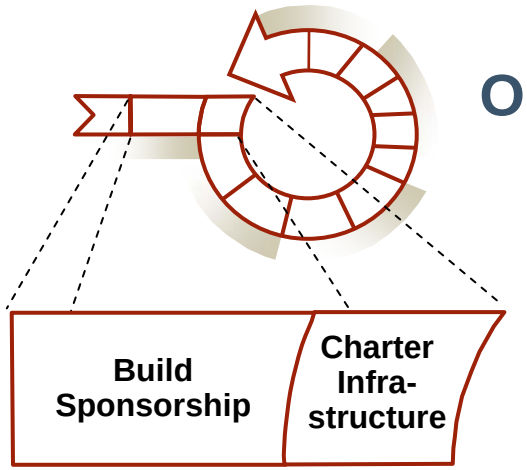
Something prompts a need to improve acquisition practices

- Reaction to unanticipated events or circumstances
- Edict from above
- Recognition that process improvement is the route to program success

Setting context – make sure there is consensus on

- The organization's core mission
- Business goals and strategies
- A coherent vision for the future
- A strategy to achieve that vision
- Models to be used

Using IDEAL to adopt CMMI-AM 3



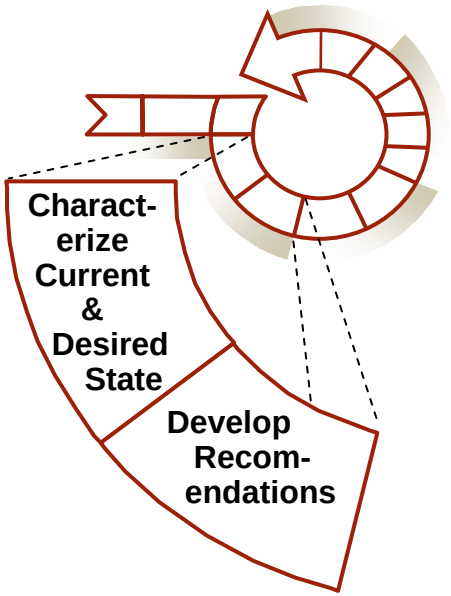
Obtain senior level (PEO?) sponsorship to

- Provide personal commitment to project
- Provide needed resources
- Change their behavior, if necessary
- Provide appropriate rewards

May need to establish

- An oversight group
- A change management group
- One or more Technical working groups

Using IDEAL to adopt CMMI-AM 4



Understand your current-state

- Start with the CMMI-AM questionnaire
- Consider an external assessment of your PMO
- Learn more about process improvement

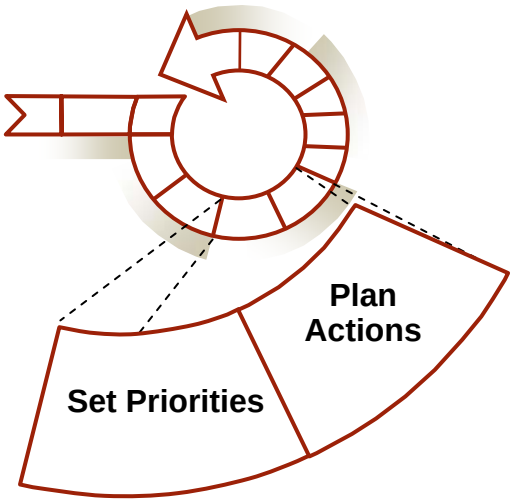
Define your end-state

- Establish goals for process improvement
- Establish a time table

Develop recommendations

- Gap analysis
- Define improvement projects
- Develop estimates for cost, schedule, and resources

Using IDEAL to adopt CMMI-AM 5



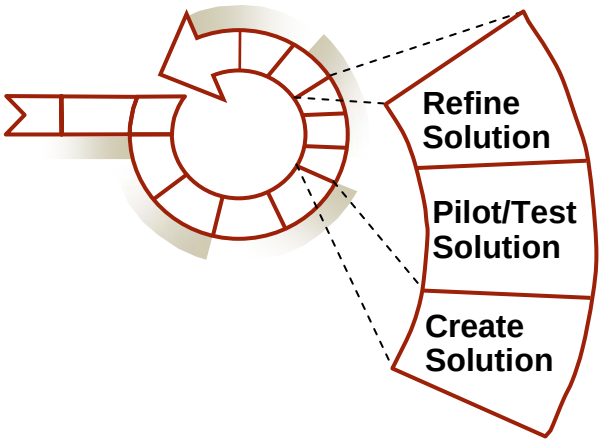
Set priorities

- Based on urgency of need
- Based on ROI
- A quick return bolsters support for process improvement

Plan Actions

- Define deliverables, activities resources
- Identify decision points
- Identify risks and mitigations
- Define schedule and milestone
- Plan for monitoring and tracking

Using IDEAL to adopt CMMI-AM 6



Create solution

- Identify performance objectives
- Finalize plans for test/pilot groupt
- Construct the solution

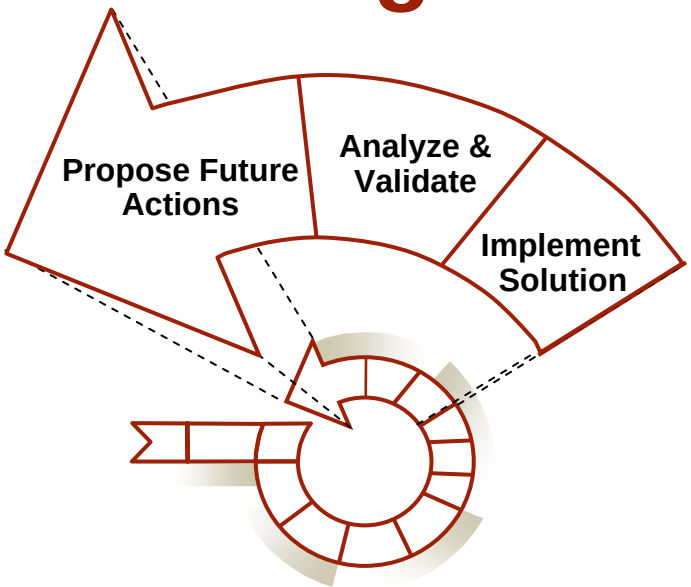
Test the solution

- Train the pilot group
- Execute pilot
- Provide feedback

Refine the solution

- Almost never works right the first time (keep you pilots small)
- Learn and repeat

Using IDEAL to adopt CMMI-AM 7



Implement solution

- Monitor during implementation, and adjust as needed

Analyze and validate

- What went right? What went wrong?
- Were objectives met?

Propose future actions

- Process improvement is never complete
- Past success enables more ambitious future projects

Module 5 Agenda

Using CMMI-AM

Summary

Summary

Process models provide a structured approach to process improvement

Process improvement demands patience, persistence, and management support

Assess your program using the questions of the CMMI-AM

Use IDEAL to implement CMMI-AM and process improvement within your PMO

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Using CMMI-AM to Improve Acquisition Practices

Module 6:
Conclusion

Using CMMI-AM to Improve Acquisition Practices- Contents

Module 1 – Background
Tutorial information and background

Module 2 – CMMI-AM and Project Management
Project Management process areas, goals, and practices

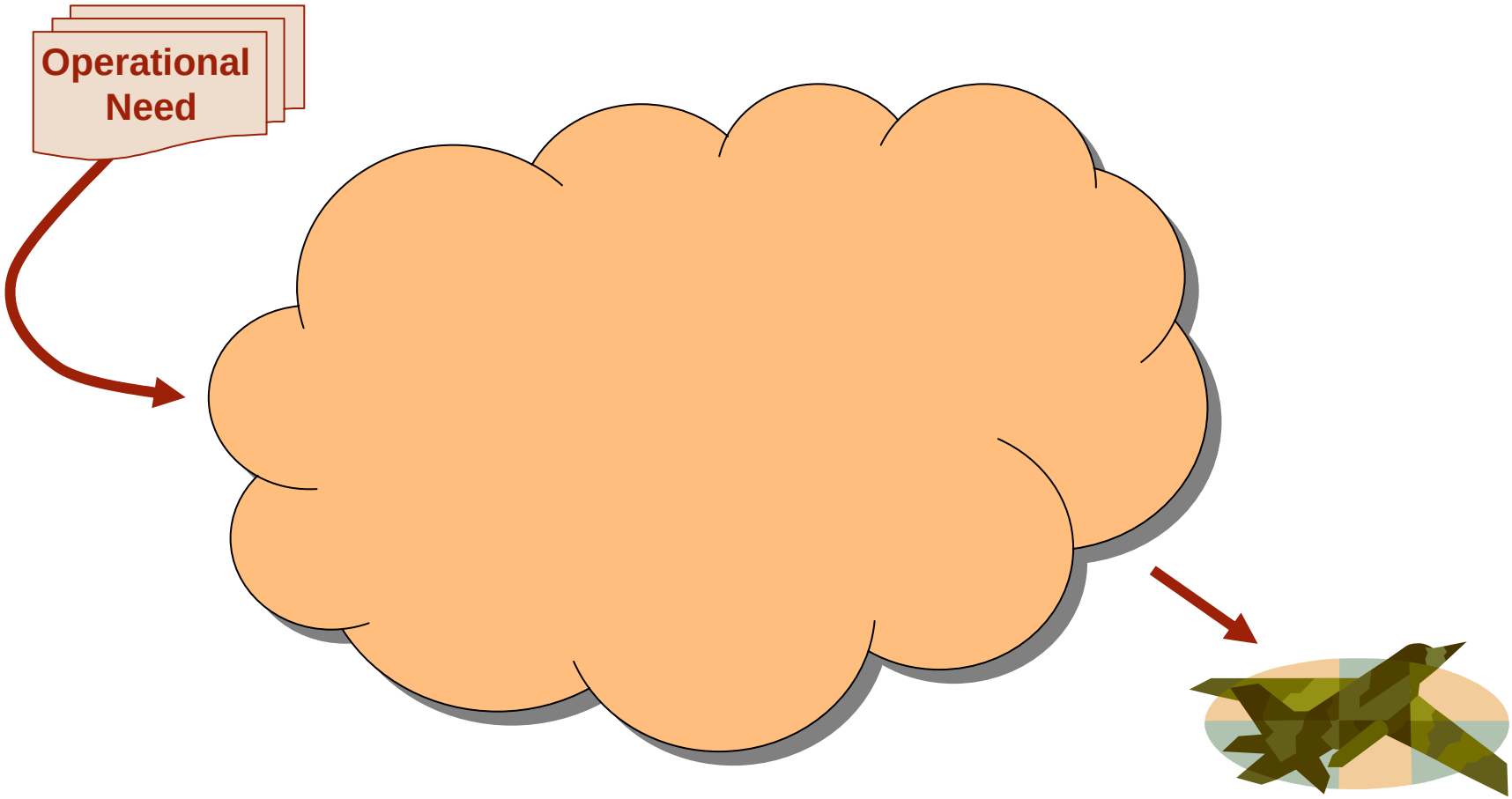
Module 3 – CMMI-AM and Engineering
Engineering process areas, goals, and practices

Module 4 – CMMI-AM and Support and Generic Practices
Support process areas, goals, and practices; and Generic Practices

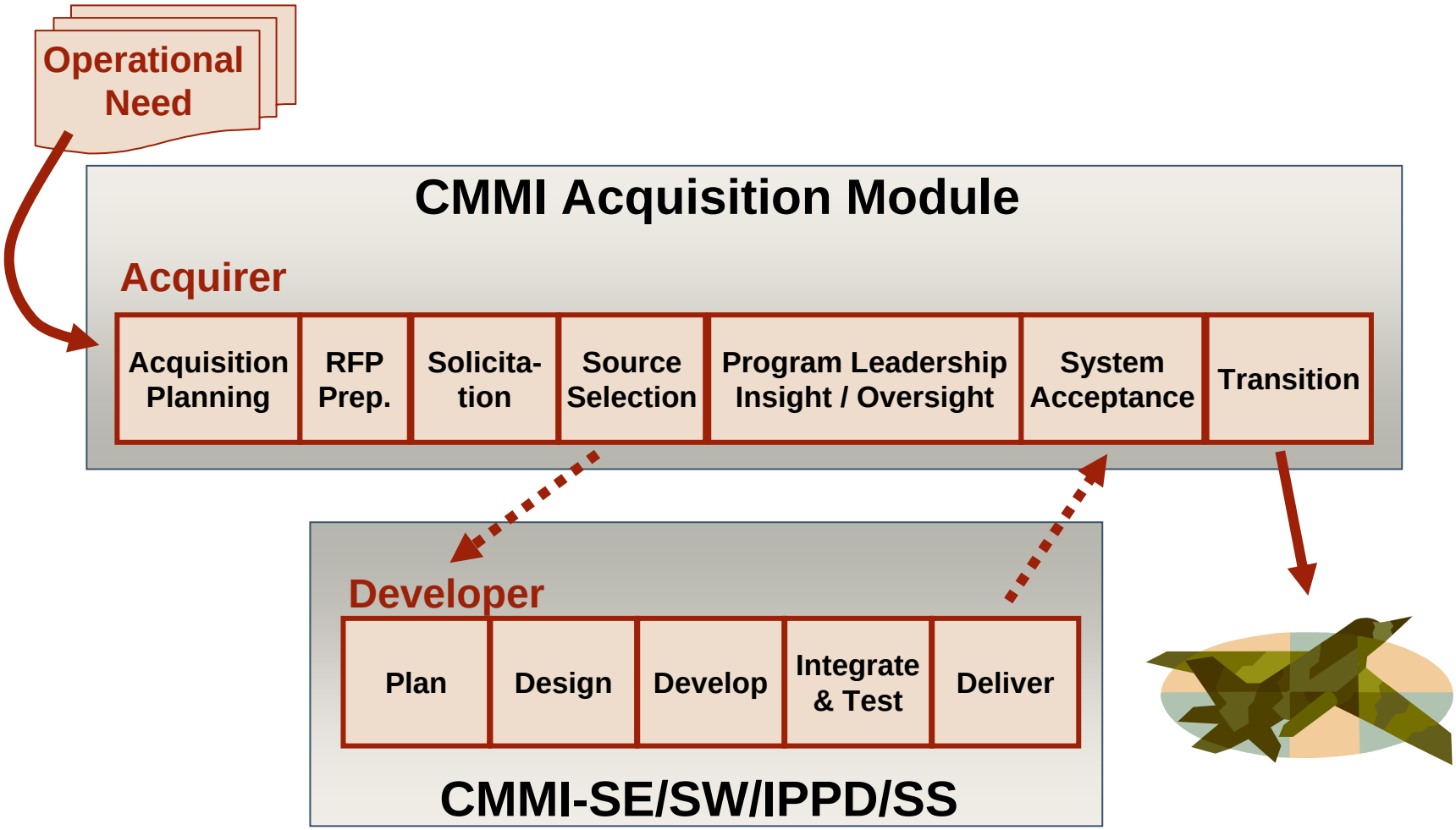
Module 5 – Using CMMI-AM

Module 6 – Summary and Conclusion

"Ad Hoc" Acquisition Practices



Explicit Acquisition Practices



Questions

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