Carnegie Mellon
Software Engineering Institute

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CMMI ®

CMMI® Acquisition Module

CMMI Technology Conference
Tutorial – 15 November, 2004

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® Capability Maturity Model, Capability Maturity Modeling, CMM, and CMMI are registered in the U.S. Patent and Trademark Office by Carnegie Mellon University.

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Agenda

The State of Acquisition Practices

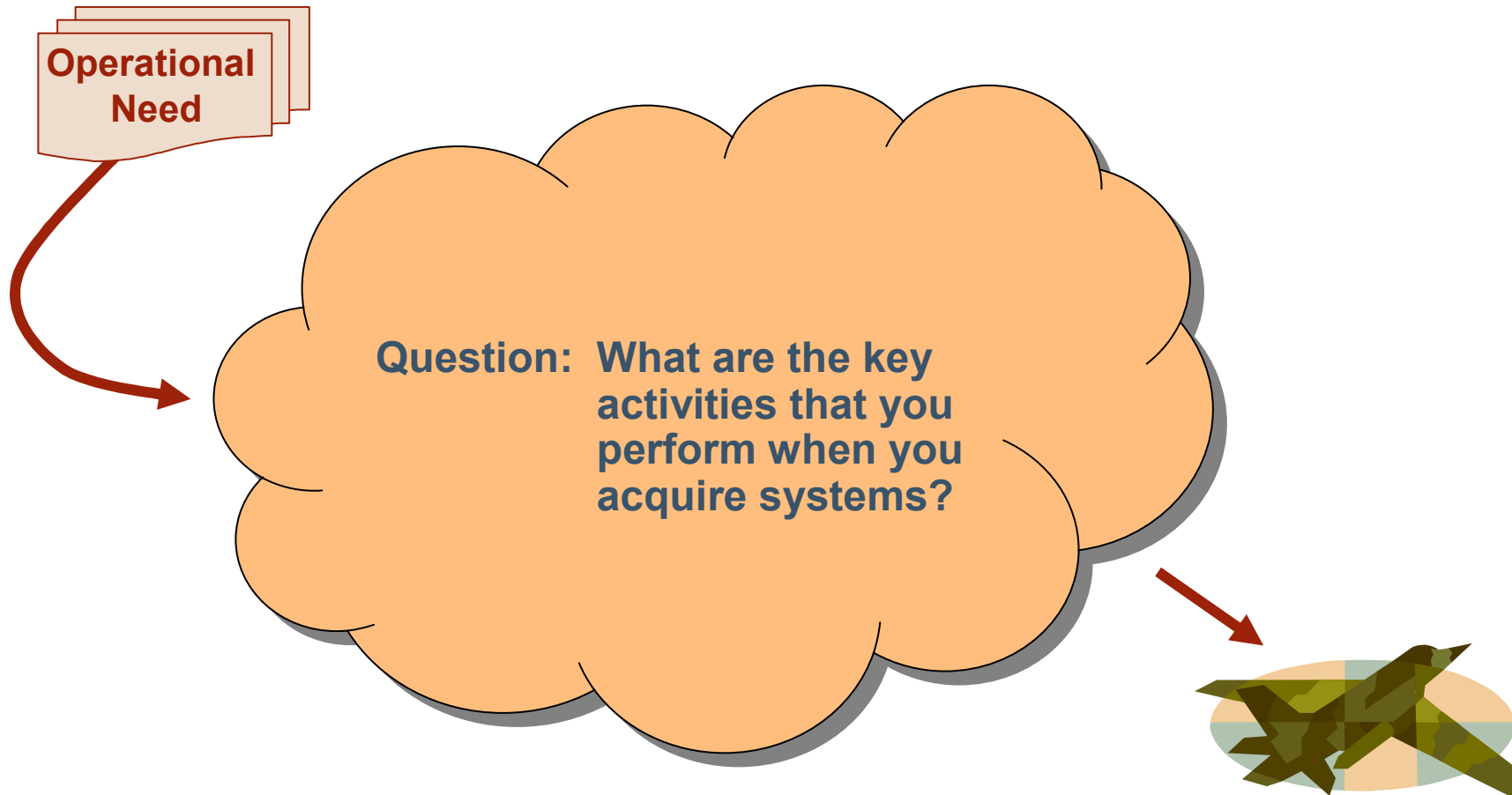Capability Maturity Model Integration

CMMI Acquisition Module

Improving Acquisition Processes

CMMI-AM Pilot Status

Conclusion

What is "Acquisition"

Operational Need

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

The State of Acquisition Practice -1

Virtually all (Air Force) software-intensive systems suffer from difficulties achieving cost, schedule, and performance objectives.
 [GAO 92]

"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 (5/6/02 Aviation Week)**
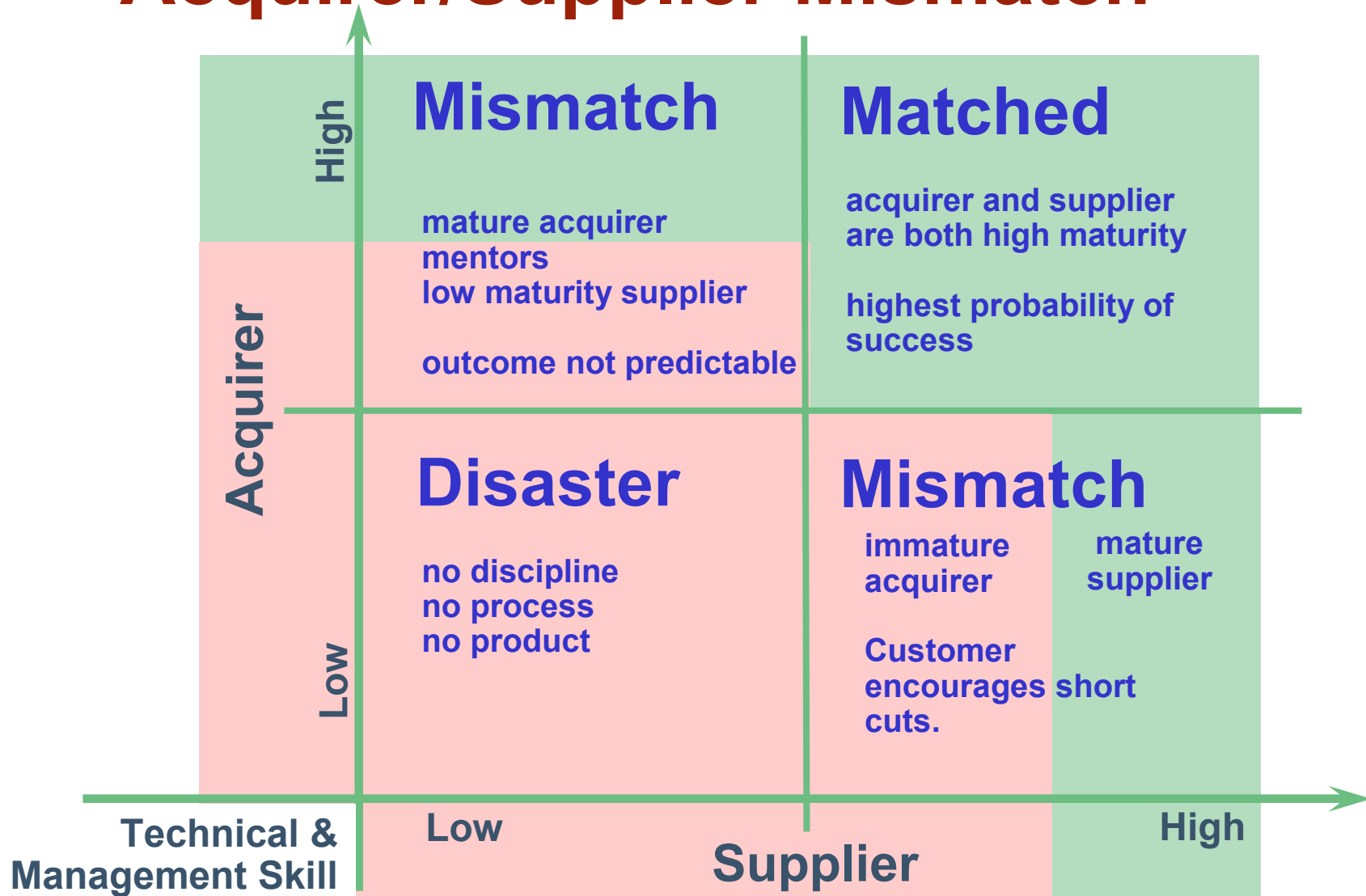
The State of Acquisition Practice -2

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.

Acquirer/Supplier Mismatch

Acquirer

High

Low

Mismatch

mature acquirer mentors low maturity supplier

outcome not predictable

Matched

acquirer and supplier are both high maturity

highest probability of success

Disaster

no discipline no process no product

Mismatch

immature acquirer

mature supplier

Customer encourages short cuts.

Technical & Management Skill

Low

High

Supplier

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 process and practices of the Supplier

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

We could improve the processes and practices of the Acquirer by:

- increasing the visibility of the acquirers contribution to program success

- defining, implementing, measuring and evolving effective acquisition processes and practices

Agenda

The State of Acquisition Practices

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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

Why is Process Important

Because process failure can be catastrophic

Process failure can result from:

- Improper implementation

- Lack of discipline

- Noncompliance

- Poor execution

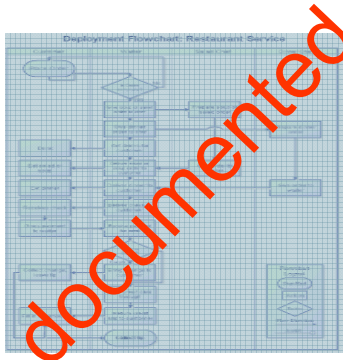Microsoft PowerPoint Slide Show

Petrobras oil platform

- Significant construction cost savings from bypassing rigid QA processes

- Sunk before commissioning

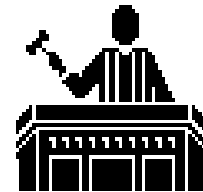# Characteristics of Effective Processes

documented

simple

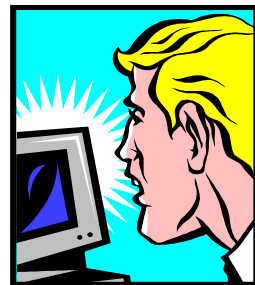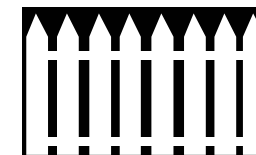trackable

enforced

trained

measurable

flexible

practiced

supported

STABLE

Well-defined gates

CMMI in a Nutshell

CMMI provides guidance for improving an organization's processes and ability to manage the development, acquisition, and maintenance of *products* or *product components*.

CMMI places proven approaches into a structure that

- helps your organization examine the effectiveness of your processes

- establishes priorities for improvement
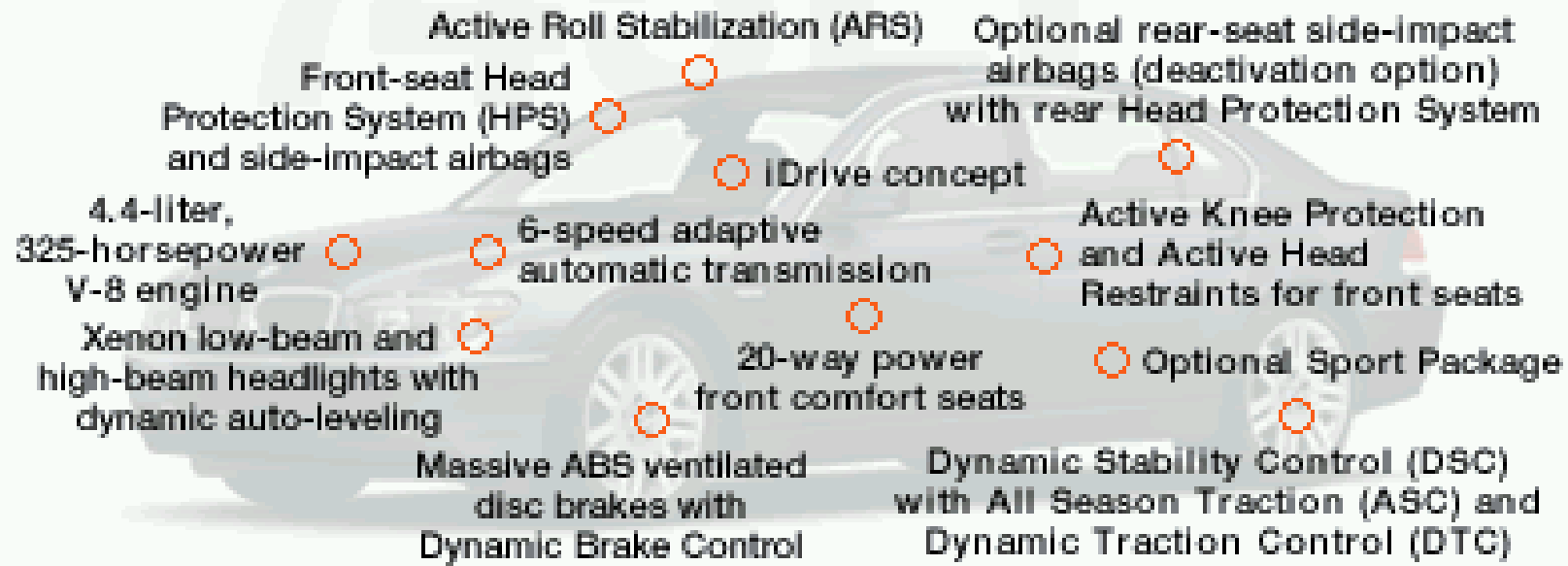
- helps you implement these improvements

Improving processes for better products
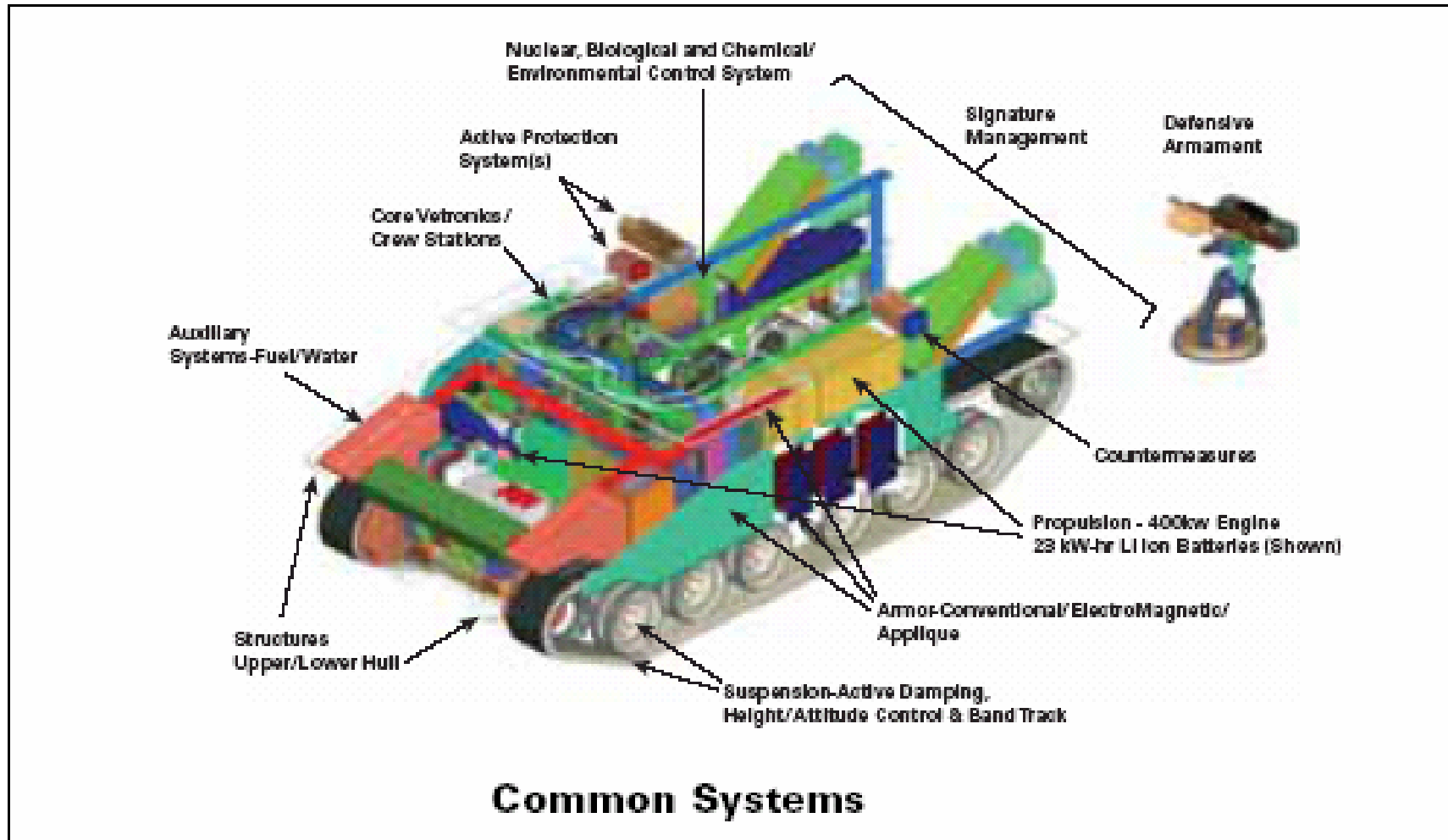
Complexity in Modern Systems

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

Active Roll Stabilization (ARS)

Front-seat Head Protection System (HPS) and side-impact airbags

Optional rear-seat side-impact airbags (deactivation option) with rear Head Protection System

iDrive concept

4.4-liter, 325-horsepower V-8 engine

6-speed adaptive automatic transmission

Active Knee Protection and Active Head Restraints for front seats

Xenon low-beam and high-beam headlights with dynamic auto-leveling

20-way power front comfort seats

Optional Sport Package

Massive ABS ventilated disc brakes with Dynamic Brake Control

Dynamic Stability Control (DSC) with All Season Traction (ASC) and Dynamic Traction Control (DTC)

Weapon System Complexity

Common Systems

FCS Manned Ground Vehicle concept
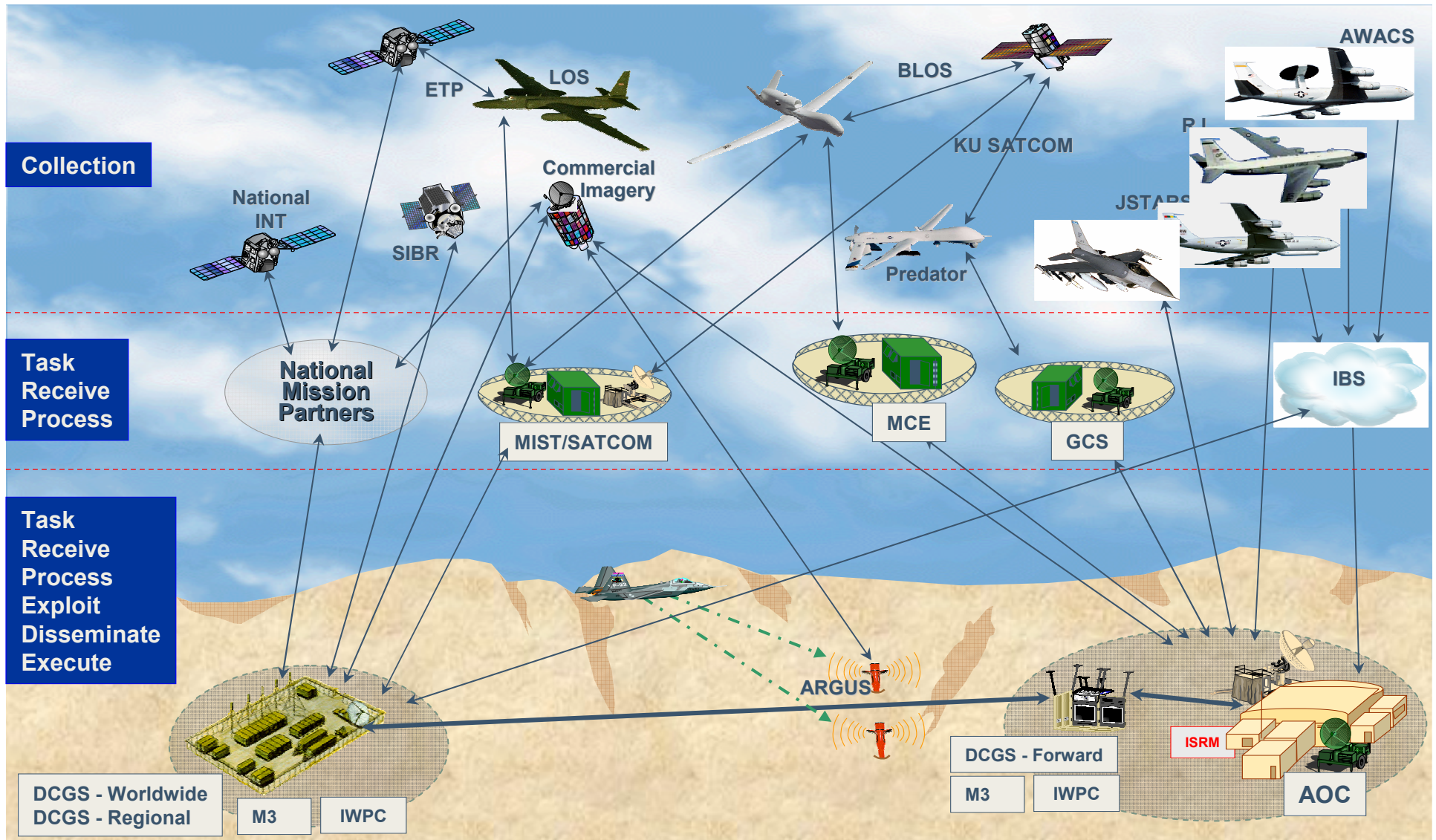
Increasing System Complexity

JSF
- UAVs
- NCW
- Inter-System Operability

F/A-18E/F 17101K

F/A-18C/D SMUG/ RUG 14268K

F/A-18 Night Attack 3054k

F/A-18C/D XN-8 6629K

A-6E 64K

A-4 (ARBS) 16K

EA-6B ICAP2 BLK 86 779K

AV-8B Radar 3748K

F-14 80K

F/A-18C/D 2130K

F-14D 416K

E-A6B ICAP1 48K

F-14B 364K

F-14B 2866K

EA-6B ICAP2 BLK 82 395K

AV-8B Night Attack 1780K

EA-6B ICAP2 BLK 89 2203K

A-7E 16K

F/A-18A/B 943K

AH-1 764K

AH-1 NTS 1000K

AV-8B 764K

A-E SWIP 364K

KSLOC axis: 0, 3000, 6000, 9000, 12000, 15000, 18000

Aircraft IOC, Year axis: 66, 70, 74, 78, 82, 86, 90, 94, 98, 02, 06, 10

Functionality Provided by Software in DoD Systems is Increasing

% of functionality SW provides

- 100%
- 90%
- 80%
- 70%
- 60%
- 50%
- 40%
- 30%
- 20%
- 10%
- 0%

F-4 — 1960
A-7 — 1964
F-111 — 1970
F-15 — 1975
F-16 — 1982
B-2 — 1990
F-22 — 2000

Ref: Defense Systems Management College
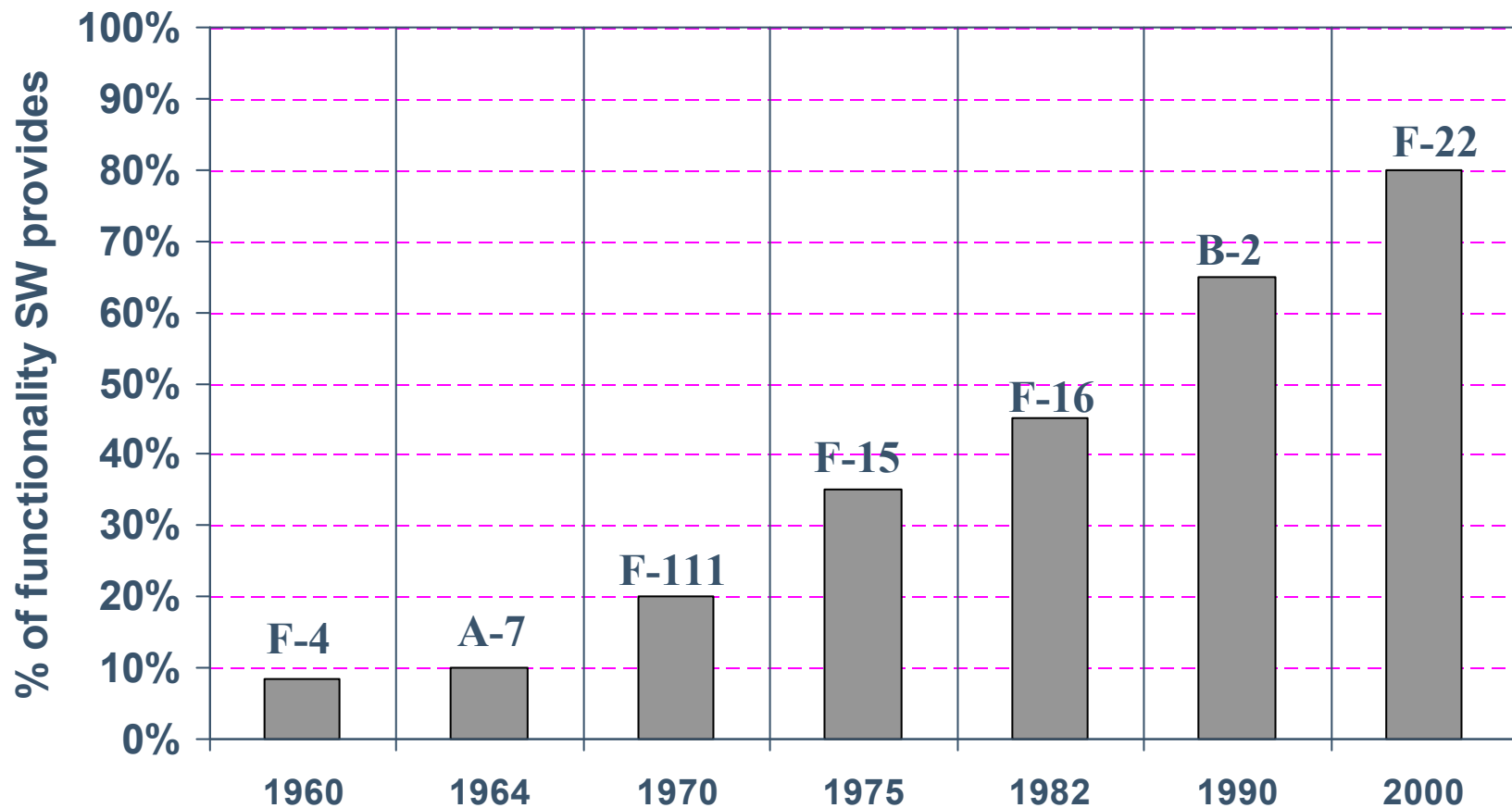
Focus of CMMI
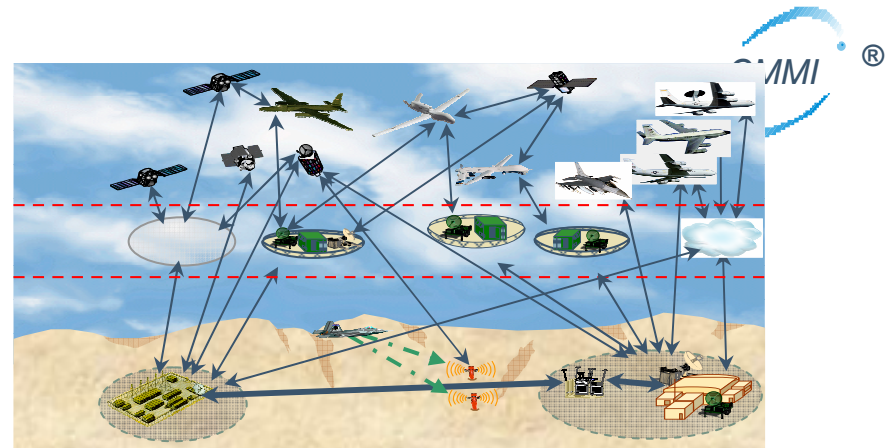
CMMI is applied here
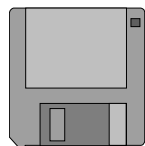
SW-CMM is applied here

CMMI - Continuous SE/SW/IPPD/SS

CMMI

Process Management

- Organizational Process Focus
- Organizational Process Definition
- Organizational Training
- Organizational Process Performance
- Organizational Innovation and Deployment

Project Management

- Project Planning
- Project Monitoring and Control
- Supplier Agreement Mgmt.
- **Integrated Project Mgmt.**
- Risk Management
- **Integrated Teaming**
- *Integrated Supplier Mgmt*
- Quantitative Project Mgmt.

Engineering

- Requirements Management
- Requirements Development
- Technical Solution
- Product Integration
- Verification
- Validation

Support

- Configuration Mgmt.
- Process and Product Quality Assurance
- Measurement & Analysis
- Decision Analysis and Resolution
- **Organizational Environment for Integration**
- Causal Analysis and Resolution

CMMI Steering Group

Mike Nicol, USAF (Government Co-chair)

Bob Rassa, Raytheon (Industry Co-chair)

Bob Skalamera, OUSD(AT&L)

Hal Wilson, Northrop Grumman

Brenda Zettervall, USN

Bob Lentz, General Dynamics

Tony D'Agosto, USA

Joan Weszka, Lockheed Martin

Linda Ibrahim, FAA

Clyde Chittister, SEI

John Kelly, NASA

Bill Peterson, SEI

Agenda

State of Acquisition Practices

Capability Maturity Model Integration

CMMI Acquisition Module

Improving Acquisition Processes

CMMI-AM Pilot Status

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Where Does Process Fit in Acquisition?

@ 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

@ Contractor
- Management of internal contractor activities
- Oversight of subcontractor processes

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

Suppliers

PMO

Project

Contractor

PM

CMMI ®

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

Direct Responsibility

PM

PMO AND PROCESS

Program Oversight 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

Project
Contract
Communication
Program Risk

Contractor

PM
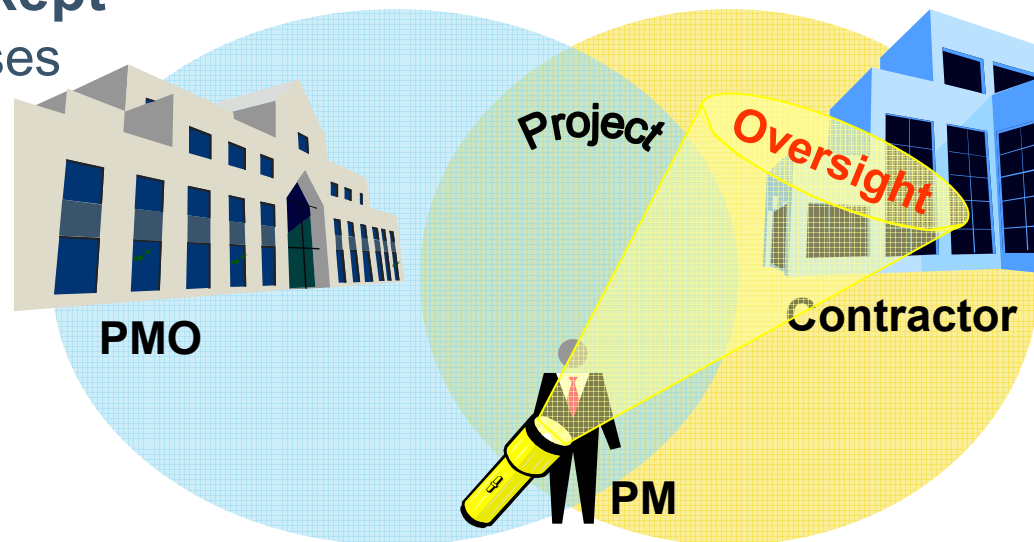
PMO AND PROCESS

Contractor Oversight Role 1

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

- Obtain process definitions and commitments
- Plan process integration

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

Project

Oversight

PMO

Contractor

PM

PMO AND PROCESS
Contractor Oversight Role 2

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

Suppliers

Indirect Oversight

Project

PMO

Contractor

PM
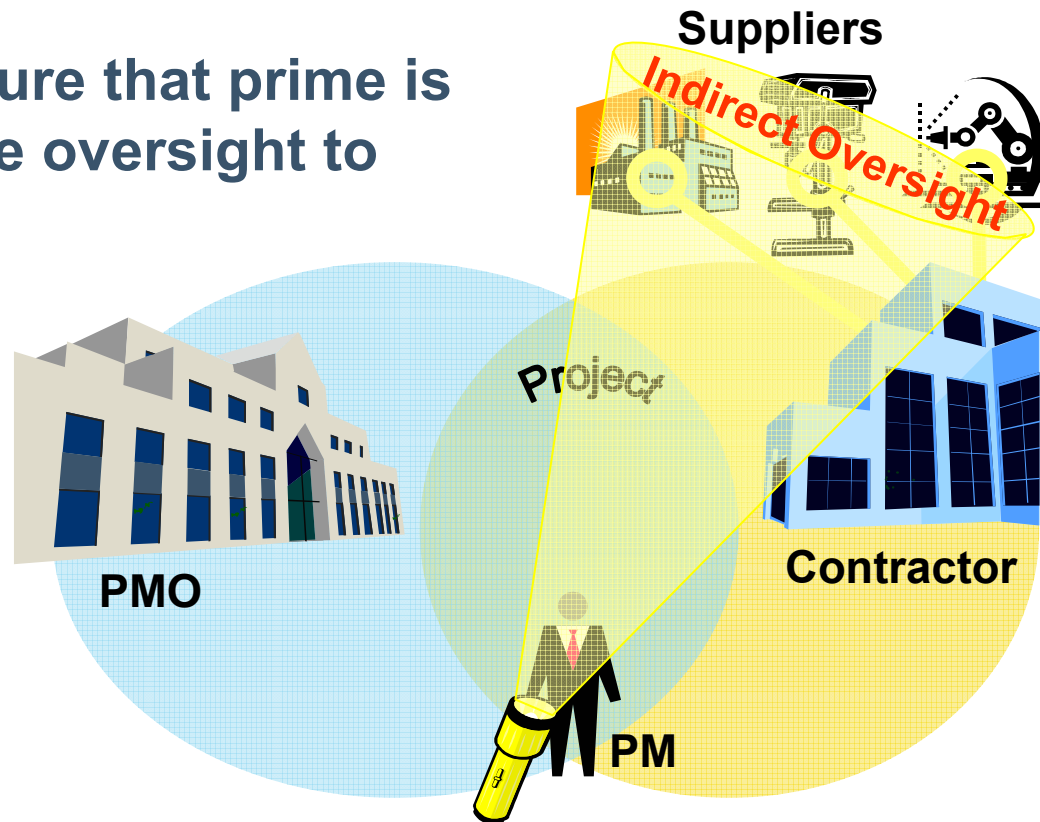
CMMI Acquisition Module

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 Acquisition Module (CMMI-AM)

CMMI Acquisition Module

Project Management

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

Engineering

- Requirements Management
- Requirements Development
- Verification
- Validation

Support

- Configuration Management
- Process and Product Quality Assurance
- Measurement and Analysis
- Decision Analysis and Resolution
- **Transition to Operations and Support**
- Organizational Environment for Integration

Key - New for CMMI-AM

Agenda

State of Acquisition Practices

Capability Maturity Model Integration

CMMI Acquisition Module
- Project Management Process Areas
- Engineering Process Areas
- Support Process Areas
- Integrated Process and Project Management Concepts
- Generic Practices

Improving Acquisition Processes

CMMI-AM Pilot Status

Conclusion

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

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 <u>ALL</u> programs at:
  - Program Initiation for Ships
  - Milestone B
  - Milestone C
  - Full-Rate Production Deployment Review

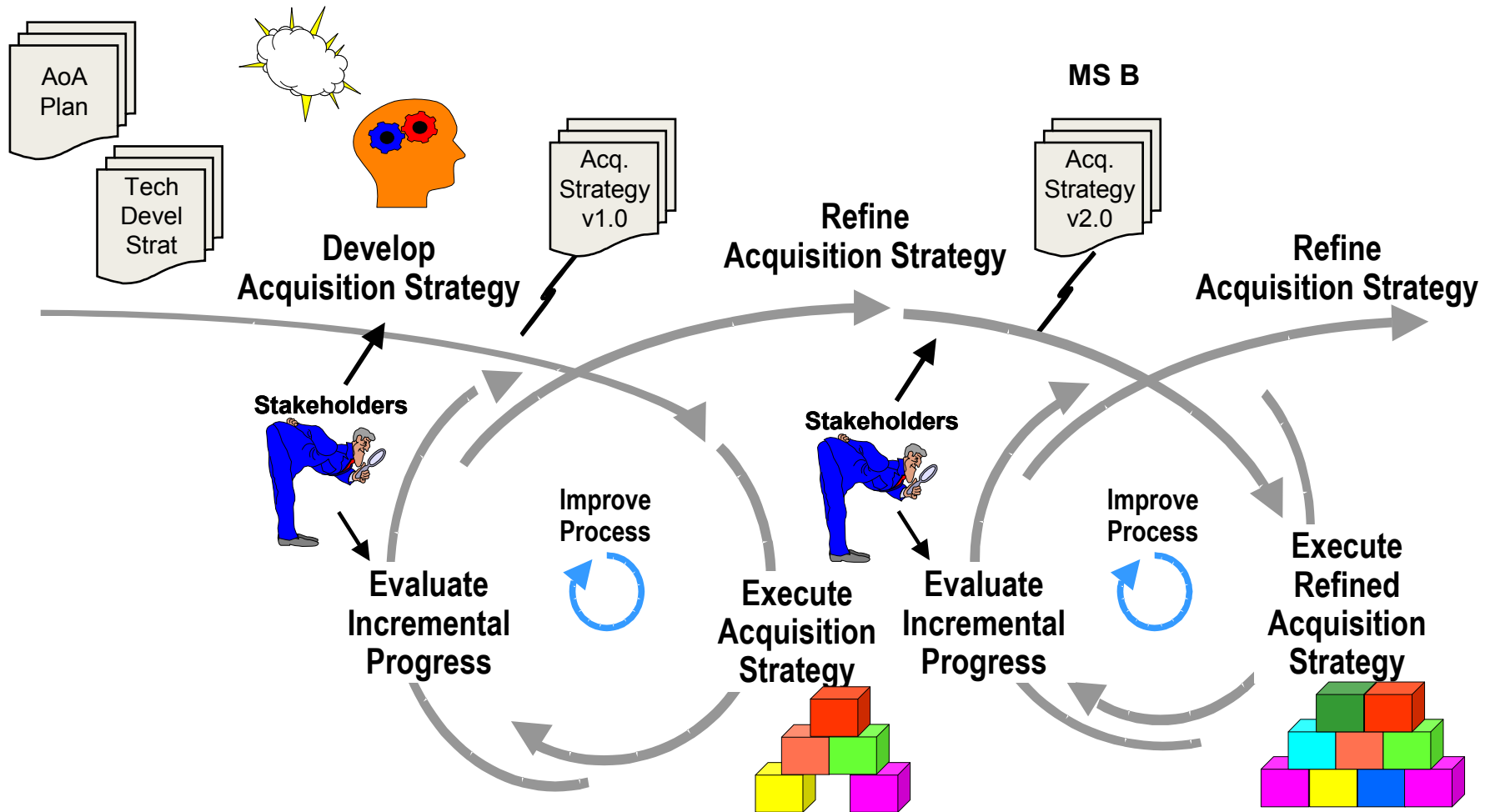Acquisition Plan is typically for one phase

    Required by the Federal Acquisition Regulation (FAR)

    Focuses on specifics of the acquisition

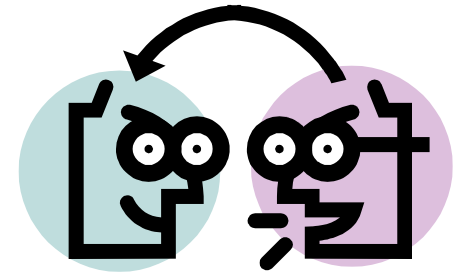   Concerned with contract type, incentives, etc.

Acquisition Planning Cycle

AoA Plan

Tech Devel Strat

Acq. Strategy v1.0

MS B

Acq. Strategy v2.0

Develop Acquisition Strategy

Refine Acquisition Strategy

Refine Acquisition Strategy

Stakeholders

Stakeholders

Improve Process

Improve Process

Evaluate Incremental Progress

Execute Acquisition Strategy

Evaluate Incremental Progress

Execute Refined Acquisition Strategy

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
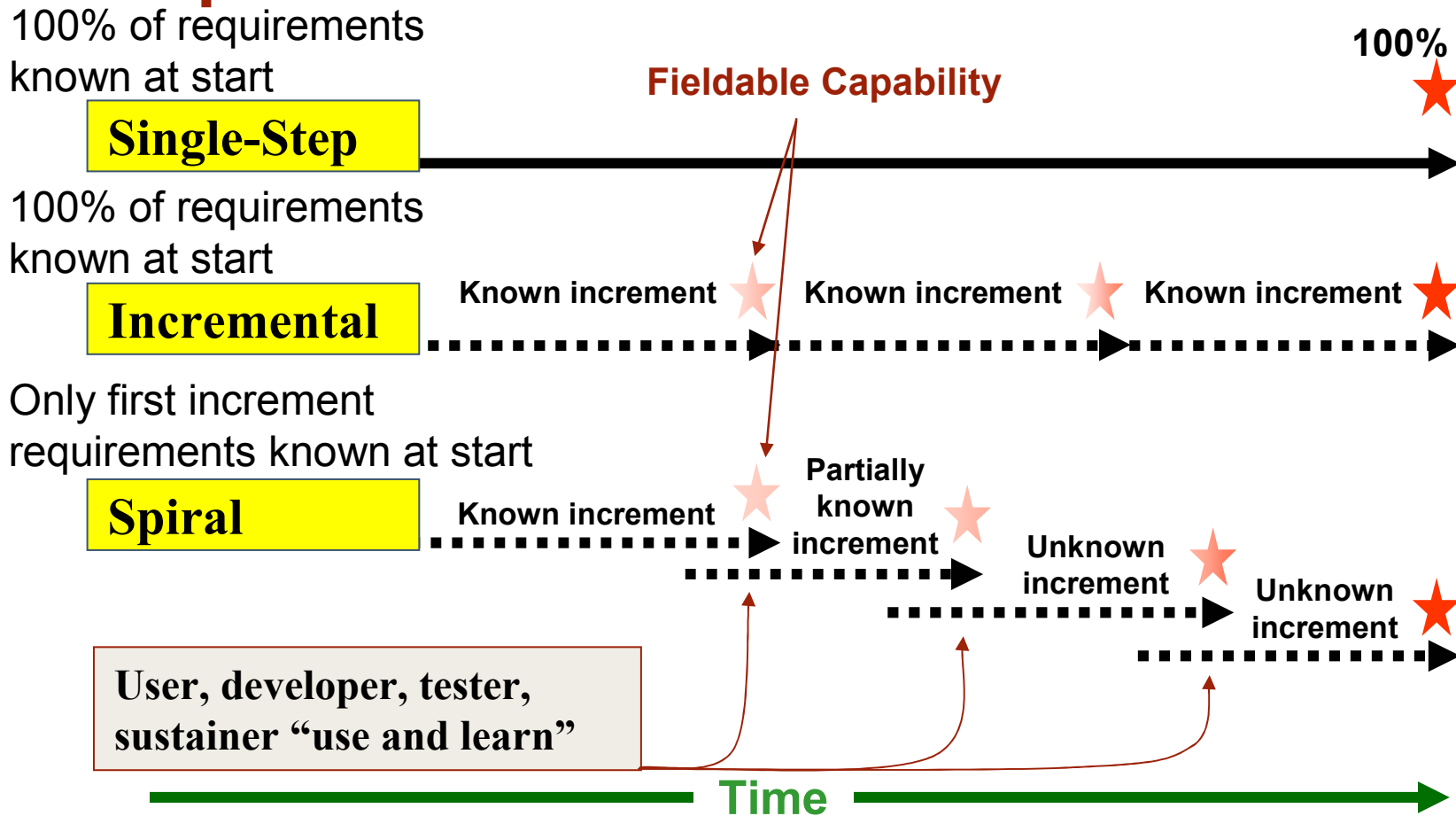
Design Considerations

Business Strategy

Program Management

Support Strategy

From Interim Defense Acquisition Guidebook, 30 Oct 2002

Single-Step and Evolutionary Acquisition

100% of requirements known at start

Fieldable Capability

100%

Single-Step

100% of requirements known at start

Incremental

Known increment   Known increment   Known increment

Only first increment requirements known at start

Spiral

Known increment   **Partially known increment**   **Unknown increment**   **Unknown increment**

User, developer, tester, sustainer "use and learn"

Time

Based on AF Program Manager Workshop presented by Mr Little

Acquisition Method

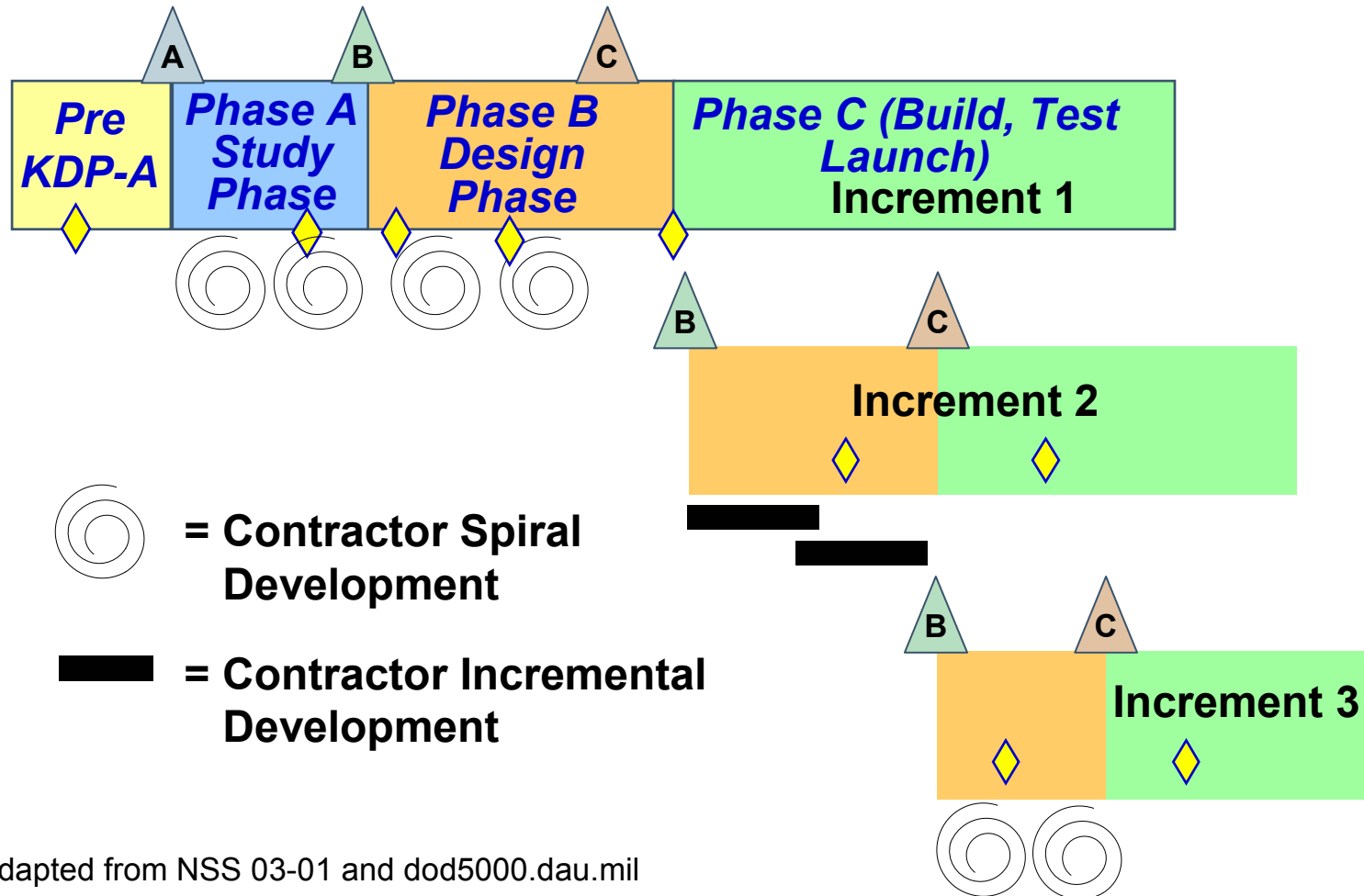| Method	Req'ts	Technology	Schedule	Comments	Example
Single Step	All known at start	All Mature at start	No need for early deployment	Software requirements must also be stable	New utility truck
Evolutionary - Incremental	All known at start	Technology for first increment mature	May be a need for early deployment	Could have incremental software and single-step hardware	Missile with improved range over 2-3 increments
Evolutionary - Spiral	Req'ts for first spiral known at start	Technology for first spiral mature	May be a need for early deployment	Spirals may also be for risk reduction – not deployment	A communi-cation system with new interfaces yet to be defined

Evolutionary Approach

= Contractor Spiral Development

= Contractor Incremental Development
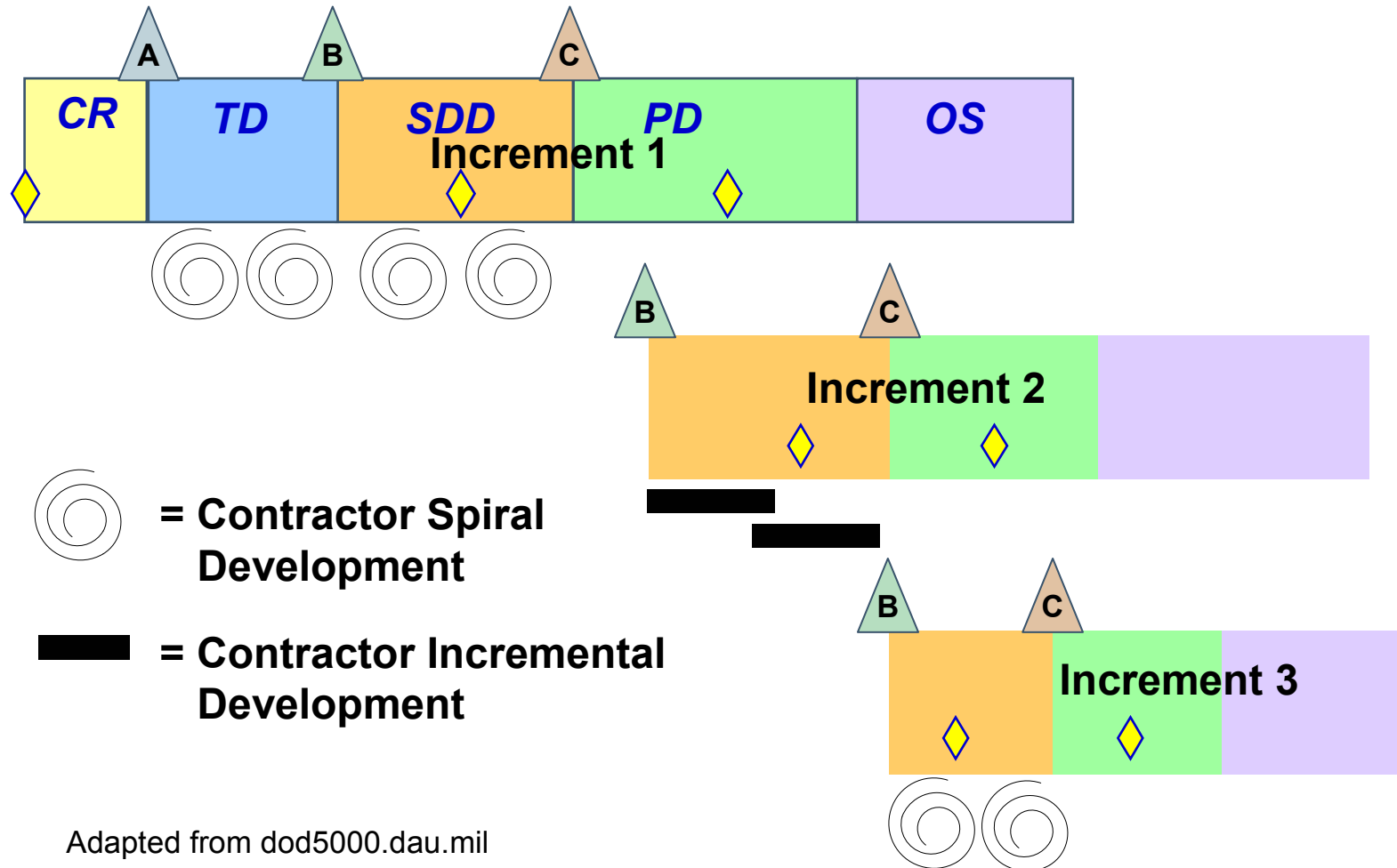
Adapted from dod5000.dau.mil

Evolutionary Approach (Space)

= Contractor Spiral Development

= Contractor Incremental Development
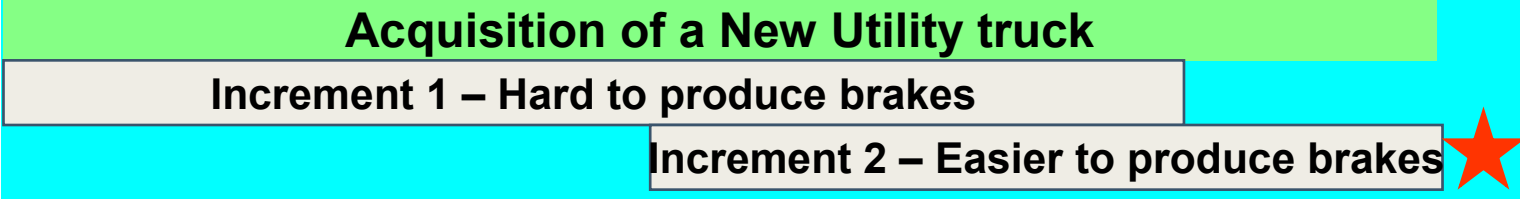
Adapted from NSS 03-01 and dod5000.dau.mil

Acquisition & Development Methods

Single Step Acquisition, Contractor Incremental Development

Acquisition of a New Utility truck

Increment 1 – Hard to produce brakes

Increment 2 – Easier to produce brakes ⭐

Evolutionary Acquisition (Spiral), Contractor Mixed Development
– Comms System

Inc 1 – HW Upgrades

Single Step Development ⭐

Inc 2–SW radios for existing interfaces

Increment 1- Interface 1

Increment 2- Interface 2 ⭐

Inc 3 – Develop new interfaces

Spiral 1 – Prototype 1

Spiral 2 – Prototype 2 ⭐

Spiral 3 – Prototype 3 ⭐

⭐ = fielded system
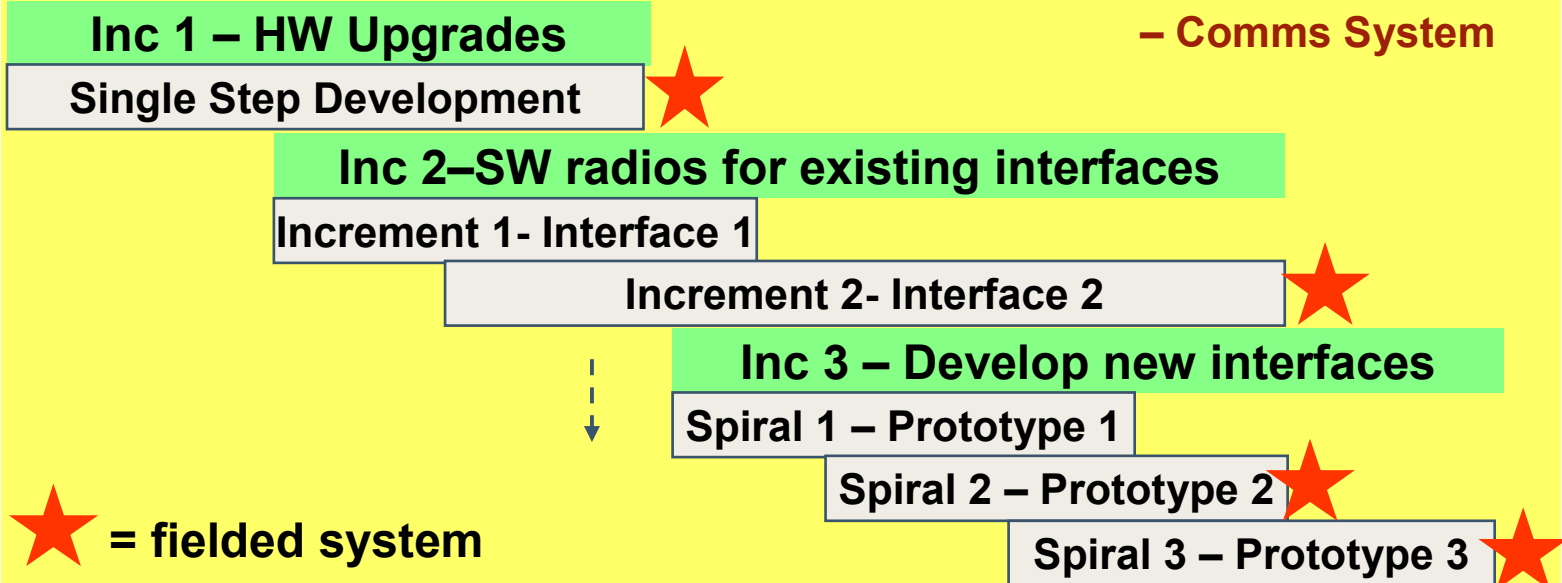
Program Drivers

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 Strategy Development

CONFLICT

Due to the **incomplete requirements**, you would prefer an *evolutionary acquisition*. You prefer *multiple solicitation phases*, with *competition*.

Due to the **tight schedule**, you want to *limit the total number of solicitation phases*. You also would prefer a *single step acquisition.*

Due to the **level of technology maturity**, especially of the ability to track fired munitions, you will *encourage competition,* and prefer *evolutionary acquisition*.

Because you know you have **limited funding**, you want to *limit the number of parallel contracts* over the life of the program. You would prefer *well-defined development phases* instead of a spiral development, and *limited testing*.

Because you are **deploying to multiple sites**, you would at least start out with *contractor logistic support (CLS).* You would prefer *single step acquisition* .

How Do I Get To a Top-Level Strategy?

Look at your top 2-3 drivers

Try to develop 2-3 strategies you think might work well for the risks posed by those drivers – you must consider the software risks!
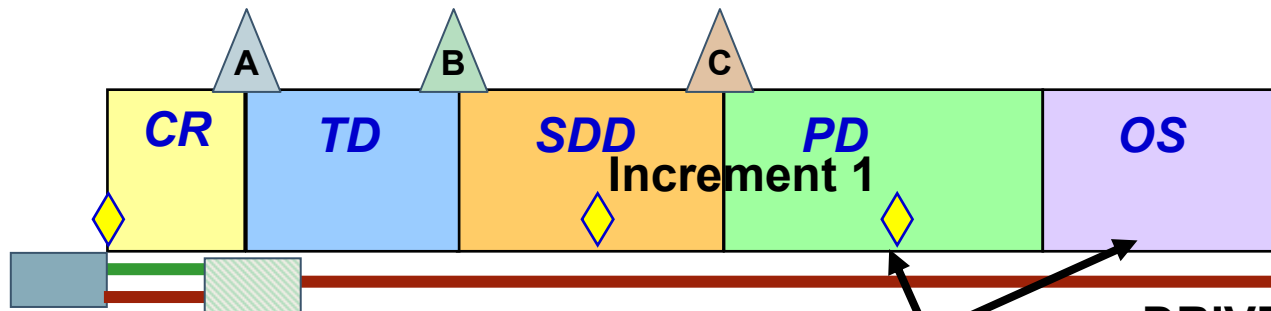
Consider:

> Number and timing of solicitations
> Number of contracts for each phase
> Sourcing – development or COTS
> Integration with other programs
> Any tailoring of phases
> Deployment and support strategies

Example Acquisition Strategy (Simplified)

Driver 1 - Incomplete Requirements
Driver 2 - Schedule

COMPETITION:

Full and Open

Downselect

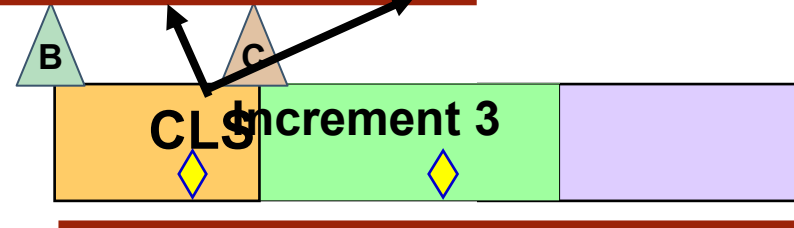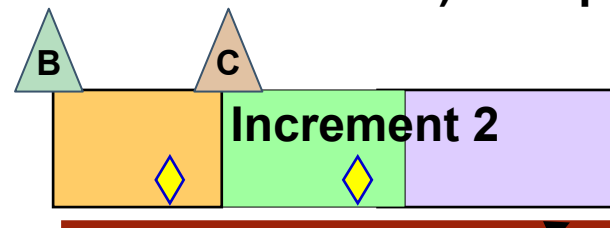**CR** | **TD** | **SDD** | **PD** | **OS**

Increment 1

CLS

DRIVER 1 – Incomplete Req't
1) Use Evolutionary Acquisition
2) Full and Open Competition
3) Multiple contracts for CR

DRIVER 2 - Schedule
1) Limit solicitation phases – downselect after CR
2) Use two Increments only
3) Use CLS

Increment 2

Increment 3

CLS

Example Acquisition Strategy (Simplified)

Driver 1 - Incomplete Requirements
Driver 2 - Schedule

COMPETITION:

Full and Open

Downselect

CR | TD | SDD | PD | OS

A | B | C

Increment 1

CLS

DRIVER 1 – Incomplete Req't
1) Use Evolutionary Acquisition
2) Full and Open Competition
3) Multiple contracts for CR

DRIVER 2 - Schedule
1) Limit solicitation phases – downselect after CR
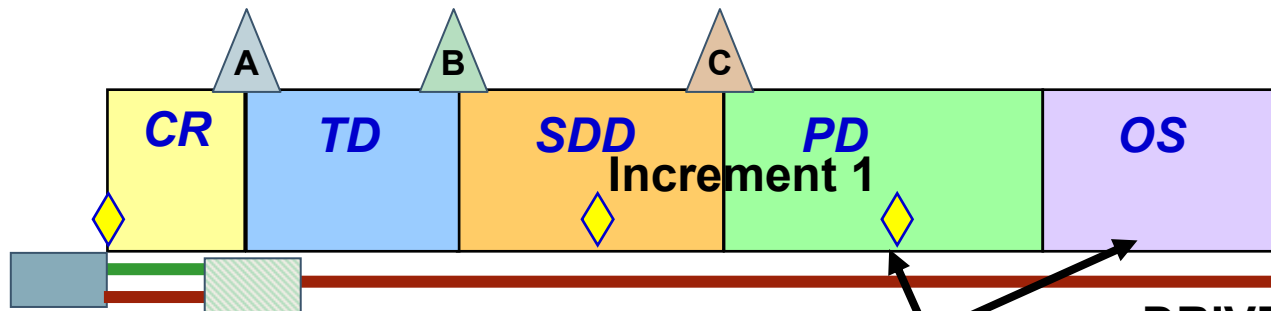2) Use two Increments only
3) Use CLS

B | C

Increment 2

CLS

You are here….
Middle of Concept Refinement

Both contractors have uncovered more requirements
challenges than expected – software requirements are
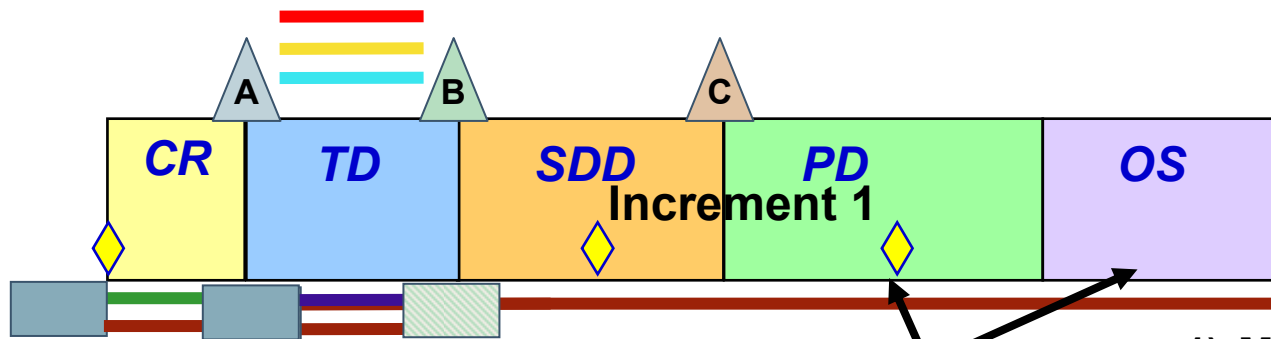unstable

- May not meet PMO exit criteria for requirements stability
  at end of Concept Refinement phase
- Lab efforts on technology to support tracking fired
  ammunition are not progressing as fast as hoped;
  communications software is challenging
- Schedule requirement is still tight
- Funding is still minimally acceptable

What might you do to refine your acquisition strategy?

Modified Acquisition Strategy

COMPETITION:

Full and Open

Downselect

CR | TD | SDD | PD | OS

Increment 1

CLS

1) Change to a full and open competition at the start of TD
2) Let 2 contracts for TD to continue requirements definition with a downselect at SDD
3) Let 2-5 Small Business Innovative Research and Development contracts for technology development
4) Continue with 2 increments and CLS

1) May need to deal with schedule increase
2) Will reduce funds for SDD and PD
3) Should increase requirements stability
4) Should increase technology maturity

1) May need to deal with schedule increase
2) Will reduce funds for SDD and PD
3) Should increase requirements stability
4) Should increase technology maturity

Increment 2

CLS

Modified Acquisition Strategy

COMPETITION:

Full and Open

Downselect

| CR | TD | SDD | PD | OS |

Increment 1

CLS

1) **Change to a full and open competition at the start of TD**
2) **Let 2 contracts for TD to continue requirements definition with a downselect at SDD**
3) **Let 2-3 Small Business Innovative Research and Development contracts for technology development**
4) **Continue with 2 increments and CLS**

1) **May need to deal with schedule increase**
2) **Will reduce funds for SDD and PD**
3) **Should increase requirements stability**
4) **Should increase technology maturity**

Increment 2

CLS

You are here….
Middle of Technology Definition

Technology development phase is going well

- Requirements are becoming more stable
- SBIR contracts are developing good ideas, but technology may not be ready for second increment
- Clear that the software architecture will be of critical importance
- Schedule requirement is still tight
- Funding is still minimally acceptable

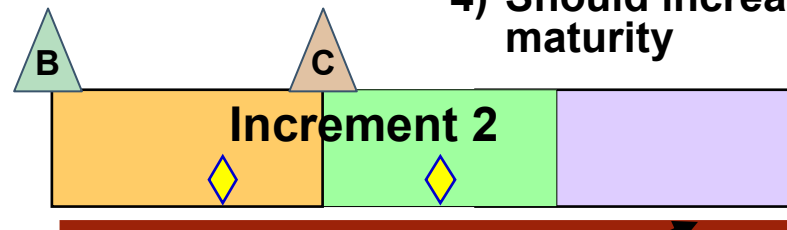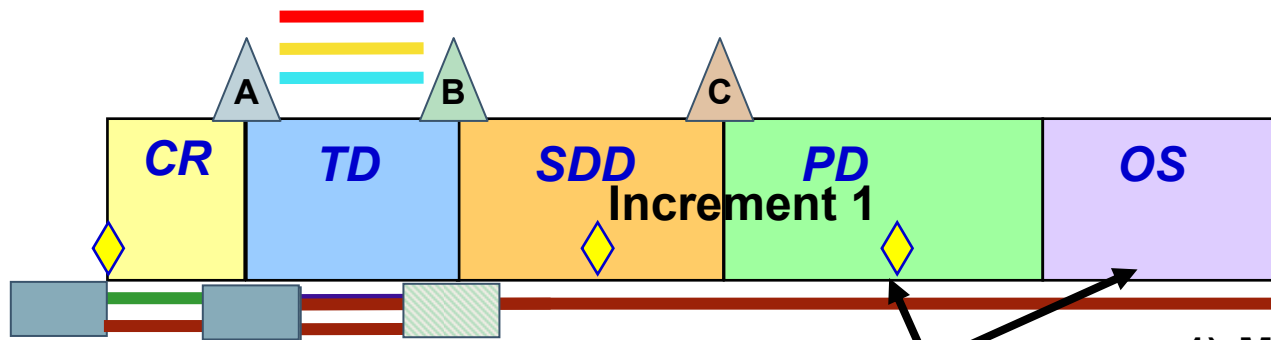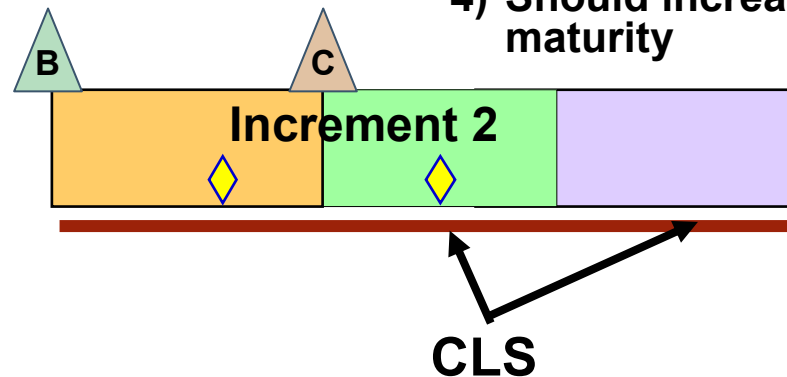What might you do to refine your acquisition strategy?

Modified Acquisition Strategy

COMPETITION:

Full and Open

Downselect

CR | TD | SDD | PD | OS

Increment 1

CLS

Increment 2

Increment 2

CLS

Increment 3

CLS
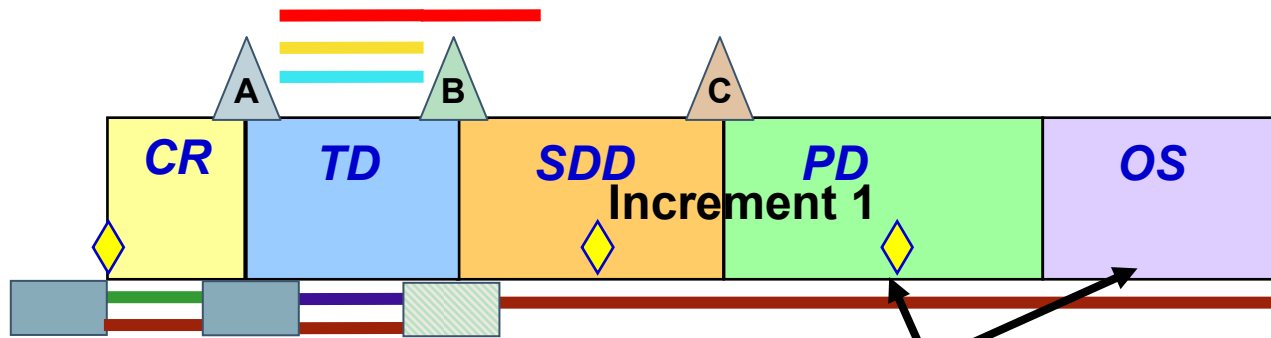
1) Continue with downselect at SDD
2) Continue with 1 SBIR contract
3) Include Architecture Eval early in SDD
4) Add third increment to allow immature technology to mature before insertion later

Modified Acquisition Strategy
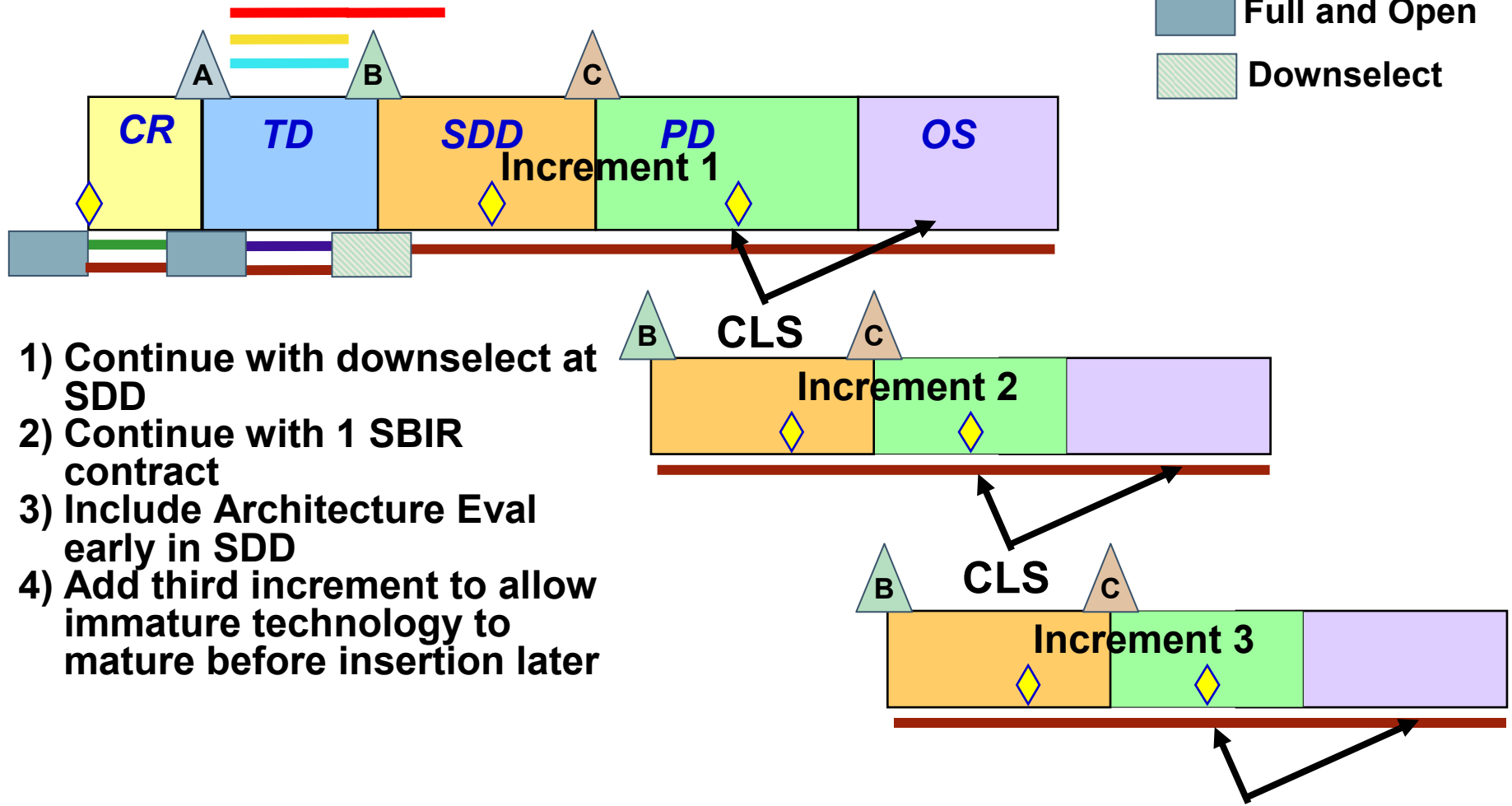
COMPETITION:

Full and Open

Downselect

A   B   C

CR   TD   SDD   PD   OS

Increment 1

CLS

B   C

Increment 2

CLS

B   C

Increment 3

CLS

1) Continue with downselect at SDD
2) Continue with 1 SBIR contract
3) Include Architecture Eval early in SDD
4) Add third increment to allow immature technology to mature before insertion later

Acquisition Strategy – Final Thoughts

You should develop more than one strategy early on – compare them keeping in mind progam risks

You should evaluate your strategies against your drivers and important acquisition elements

Should be a TEAM effort – need experts in systems, software, contracts, etc.

This is HARD WORK – especially in software intensive systems!

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

Understanding Project Management PAs

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

Project Management Process Areas

Project Planning   PP
Project Monitoring and Control   PMC
Solicitation and Contract Monitoring   SCM
Integrated Project Management for IPPD   *IPM/IPPD*
Risk Management   RSKM
Integrated Teaming   *IT*

covered in Integrated Process and Project Management Concepts section

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 projects needs.

Mapping of 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

Mapping of Goals and Practices ₂

Specific Goal	Specific Practice
Obtain Commitment to the Plan	• Review Plans that Affect the Project • Reconcile Work and Resource Levels • Obtain Plan Commitment

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.

Mapping of 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**

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 provide leadership throughout the life of the acquisition to ensure those needs are met.

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

Mapping of Goals and Practices [1]

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**

Mapping of Goals and Practices 2

Specific Goal	Specific Practice
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**

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 cycle to mitigate adverse impacts on achieving objectives.

For Acquisition, risk identification and estimation of probability and impact, particularly the risk 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, as well as 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.

What Makes Software-Intensive System Acquisition "Riskier"?

Computer software and hardware technology is evolving faster than any other

Few program managers — the key decision-makers — have in-depth understanding of software technology

Software project management, particularly task duration and effort estimation, is still immature

Reuse has potential benefits but also potentially complicates the development process

Software misconceptions: "you can fix any design shortfalls in software" and "software is free"

RSKM Principles

Defining principles
- Forward-looking view
- Shared product vision
- Global Perspective

Sustaining Principles
- Integrated Management
- Teamwork
- Continuous Process

FORWARD-LOOKING VIEW

Continuous Process

Open Communication

Integrated Management

SHARED PRODUCT VISION

Teamwork

GLOBAL PERSPECTIVE
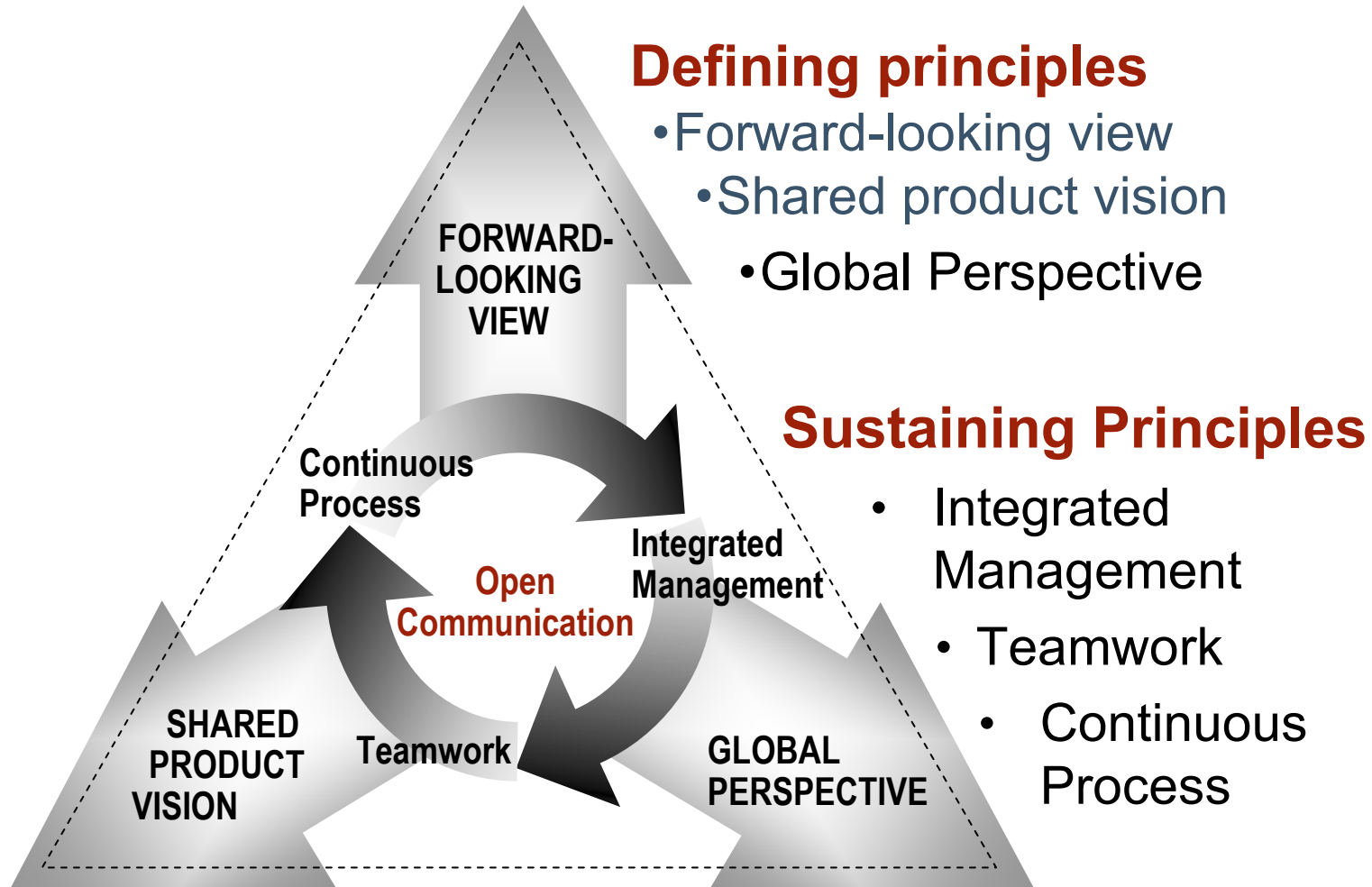
RSKM Paradigm

Identify – Look for risks BEFORE they become problems

Analyze – Extract decision-making information

Plan – Translate into decisions and mitigating actions

Track – Monitor risk indicators and mitigation plans

Control – Correct deviations from mitigation plans

Control

Track

Identify

Communicate

Plan

Analyze

1
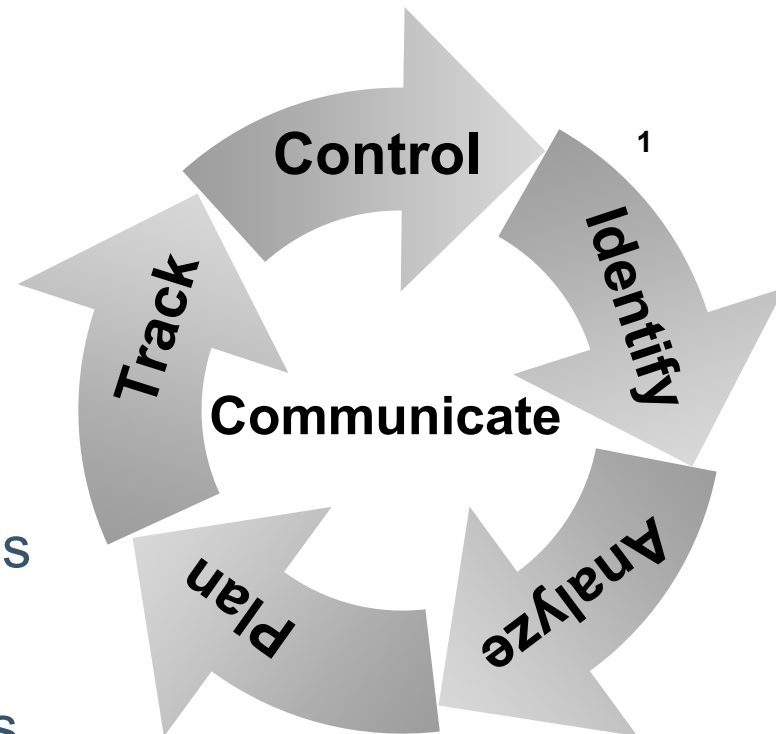
Communicate!
Widely disseminate data and feedback

1 Van Scoy, *Software Development Risk: Opportunity, Not Problem.* SEI, 1992

The SEI "Risk Statement"

A "standard" format for risk statements provides:
- Clarity
- Consistency
- A basis for future risk processing

| Source | → | Condition | → | Consequence |

Context
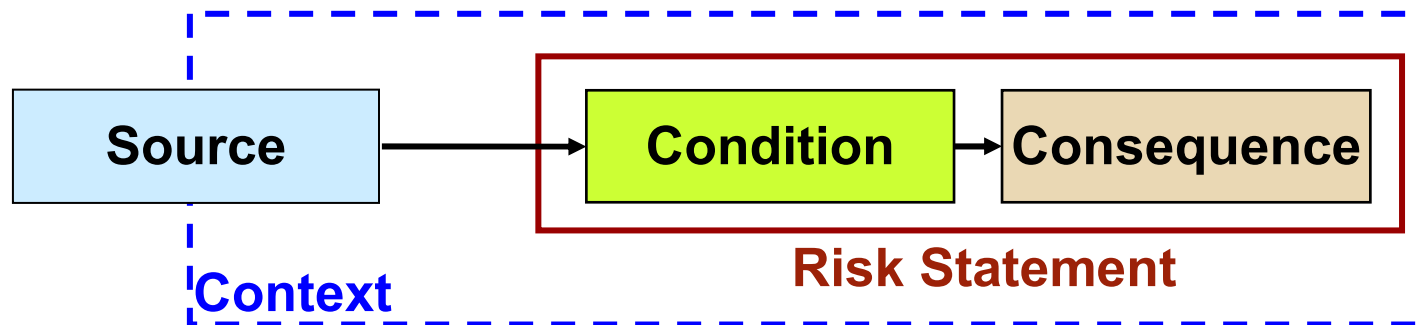
Risk Statement

A good risk statement is:
- **Fact-based**
- **Actionable**
- **Brief**

Sample Risk Statements

Good example:

This module must be coded in Java, but we <mark>*don't have enough Java programmers; the*</mark> *module may not be completed on time.*

Condition

Consequence

Bad example:

Unclear requirements may increase costs

- Not a fact-based condition
- Not specific
- Not actionable

Mapping of 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

Agenda

State of Acquisition Practices

Capability Maturity Model Integration

CMMI Acquisition Module
- Project Management Process Areas
- Engineering Process Areas
- Support Process Areas
- Integrated Process and Project Management Concepts
- Generic Practices

Improving Acquisition Processes

CMMI-AM Pilot Status

Conclusion

Understanding Engineering PAs

The Engineering process areas establish a consistent set of requirements that are derived from stakeholder needs and operational capability statements so that work products developed internally by the acquirer and work products and delivered systems from the suppliers are proven to successfully satisfy end user needs and provide operational capabilities.

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 system 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

Engineering Process Areas

Requirements Management   REQM

Requirements Development   RD

Verification   VER

Validation   VAL

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.

Requirements Management$_2$

For Acquisition, requirements management includes the direct management of acquirer controlled requirements and 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 should define "approved" requirements providers and an approved path by which requirements are provided to the supplier.

Commitment to the requirements by the project participants includes having coordinated and approved documents that define requirements.

Each change to a controlled requirement should be assessed for impact to the project's performance, cost, and schedule baselines and to project risk. The existing cost, schedule and performance baselines should be changed, as required, to accommodate the requirements change.

What are the Consequences of not Managing Requirements Effectively?

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

Tunnel vision
- Sometimes a workaround or revised business process is the simplest solution rather than a new system or system capability

Requirements creep

Incompatible release scope given resources and time

Recent ITA Key Findings

A majority of Independent Technical Assessments (ITAs) done by the SEI have key findings regarding requirements

Some findings:
- Lack of focus in maintaining system attributes
- Core requirements are deferred instead of addressed
- Inadequate attention to interface definition and control
- Requirements baselines not established
- Requirements are at a high level and open to interpretation
- No agreement on requirements among stakeholders
- Requirements maturation process is ineffective
- No detailed software requirements
- Minimal documentation of requirements

Mapping of Goals and Practices

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**

Obtain an Understanding of Reqts.

- Establish criteria for distinguishing appropriate requirements
- Establish objective criteria for the acceptance of requirements
- Analyze requirements to ensure that the criteria are met
- Reach an understanding of the requirements with the stakeholders

Typical Work Products

- Lists of criteria for distinguishing appropriate requirement providers
- Criteria for evaluation and acceptance of requirements
- Results of analyses against criteria
- Agreed to set of requirements

Sample Key Issues

Missing stakeholders

Lack of acceptance criteria resulting in inadequate verification, rework or system rejection

Failure to have a common understanding of requirements

Insufficient analysis techniques

Obtain Commitment to Requirements

- Assess the impact of requirements on existing commitments
- Negotiate and record commitments

Typical Work Products

- Requirement impact assessments

- Documented commitments to requirements and requirement changes

Sample Key Issues

Inadequate assessments

Existing commitments are not well known or defined

Failure to negotiate with balance in mind

Failure to obtain written commitment

Manage Requirements Changes

- Capture all requirements and requirements changes
- Maintain the requirements change history with the rationale for the changes
- Evaluate the impact of the requirement changes from the standpoint of the stakeholders
- Make the requirements and change data available

Typical Work Products

- Requirement impact assessments

- Documented commitments to requirements and requirement changes

Sample Key Issues

Lagging documentation

Failure to plan for and manage the change process

Incomplete impact assessments

Lack of backup plans

Requirements Development

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

Requirements Development

For Acquisition, requirements development has two contexts; first, the amalgamation and coordination of the operational requirements (customer requirements) into a requirements set that will define the scope and direction of the acquisition; second, 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.

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.

Mapping of Goals and Practices [1]

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**

Mapping of Goals and Practices 2

Specific Goal	Specific Practice
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**

Develop Customer Requirements

- Collect stakeholder needs
- Elicit needs
- Develop customer requirements

Typical Work Products

- Customer requirements

- Customer constraints on the conduct of verification

- Customer constraints on the conduct of validation

Sample Key Issues

Overly simplistic elicitation

Failure to identify / validate "root" of the requirement

Lack of attention to stakeholder requirements

Failure to involve all stakeholders

Develop Product Requirements

- Establish product and product component requirements
- Allocate requirements
- Identify interface requirements

Typical Work Products

- Product and Product component requirements
- Derived requirements
- Requirement allocation sheets
- Design constraints
- Interface requirements
- Relationships among derived requirements

Sample Key Issues

Failure to address critical product qualities & performance

Insufficient specification & understanding of interface requirements

Forgetting to allocate all requirements, including derived requirements

Failure to derive requirements based upon selection of a technology

Requirements Must be Balanced
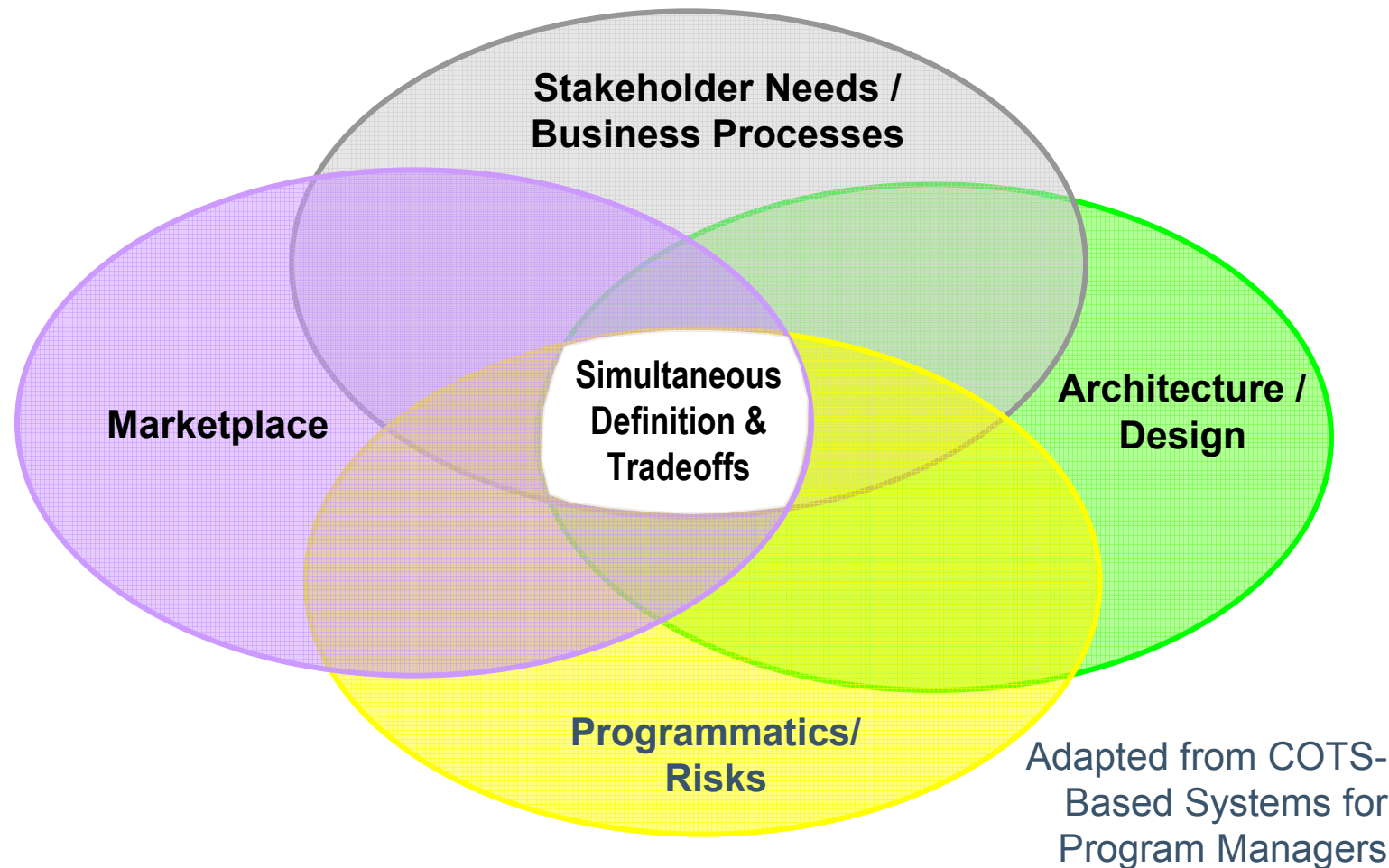
Stakeholder Needs / Business Processes

Marketplace

Architecture / Design

Simultaneous Definition & Tradeoffs

Programmatics/ Risks

Adapted from COTS-Based Systems for Program Managers

Analyze and Validate Requirements

- Establish operational concepts and scenarios
- Establish a definition of required functionality
- Analyze requirements to achieve balance
- Validate requirements

<u>Typical Work Products</u>	<u>Sample Key Issues</u>
• Operational concept	**Insufficiently detailed Operational Concept**
• Product installation, operational, maintenance and support concepts	**Not verifying requirements are complete, feasible, realizable and verifiable**
• Use cases and activity diagrams	
• Requirements defects reports	**Missing required balance in requirements**
• Technical performance measures	
• New requirements and proposed changes to resolve defects	**Failure to use multiple techniques to validate the product will perform in the user's environment**
• Assessment of risks related to requirements	

Requirements Must Evolve

Accumulating knowledge

Iteratively converging

decisions

Definition & Trade Offs

Definition & Trade Offs

Increasing stakeholder buy-in
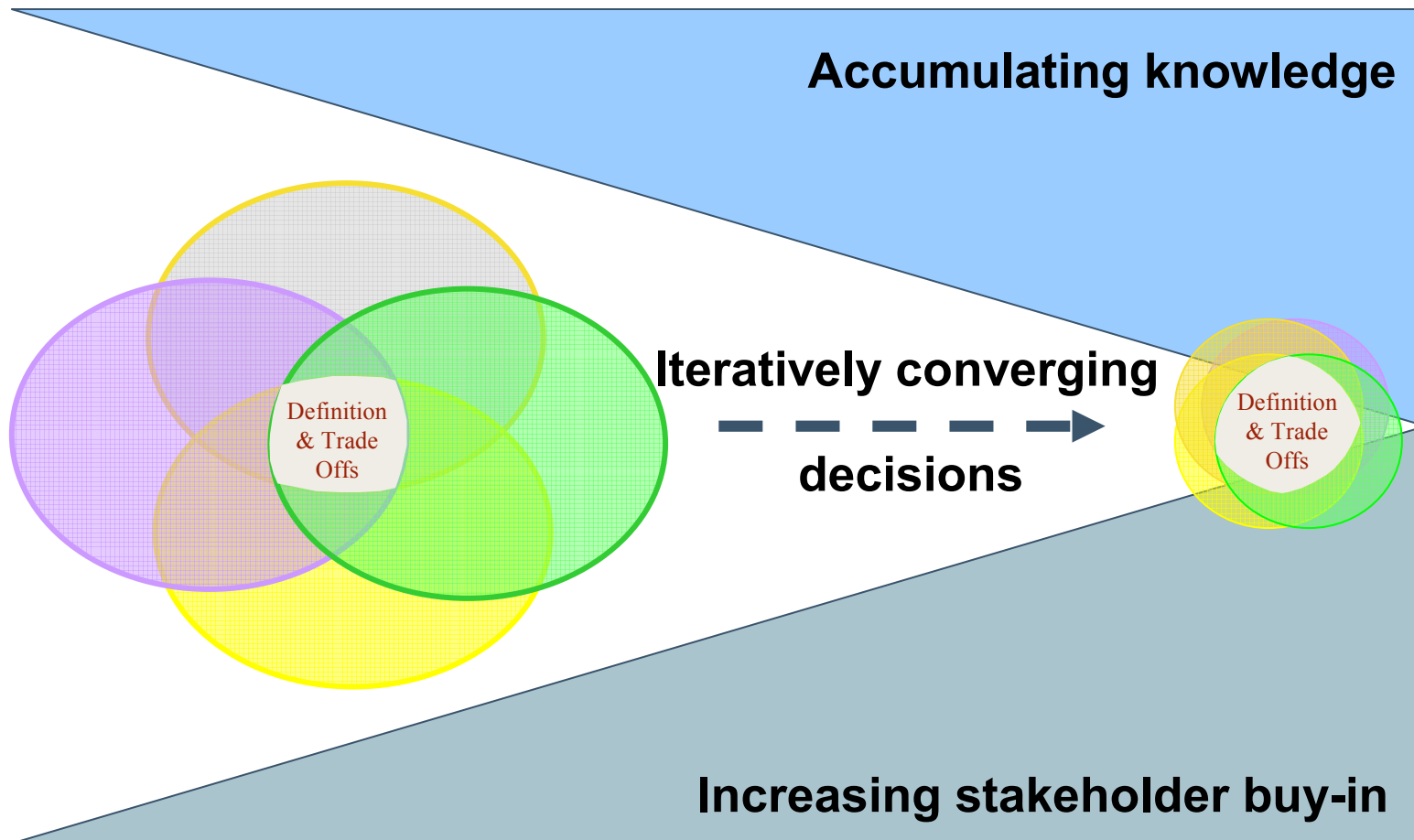
[EPIC 2002]

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 is normally performed early and continuously throughout the acquisition lifecycle. The acquirer ensures that selected work products of the acquisition process meet the project requirements (e.g., the solicitation package and other plans are built according to specified templates, meet all laws and regulations, and are inspected for defects). The acquirer also ensures the evolving acquired products satisfy contractual requirements.

Mapping of Goals and Practices [1]

Specific Goal	Specific Practice
Prepare for Verification	• **Select Work Products for Verification** • **Establish the Verification Environment** • **Establish Verification Procedures and Criteria**
Perform Peer Reviews	• **Prepare for Peer Reviews** • **Conduct Peer Reviews** • **Analyze Peer Review Data**

Mapping of Goals and Practices $_2$

Specific Goal	Specific Practice
Verify Selected Work Products	• **Perform Verification** • **Analyze Verification Results and Identify Corrective Action**

Validation

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

For Acquisition:

Validation is normally performed early and continuously throughout the acquisition lifecycle The acquirer uses validation processes to demonstrate that the work products of the acquisition process will fulfill the acquisition strategy and that the processes will effectively acquire the product or services. The acquirer also uses validation to ensure that the product or service received from the supplier will fulfill its intended use. In this context, the test community is a major stakeholder, including up front planning through final system validation .It is important that the acquirer define at the outset the degree to which validation is required both early in the definition of the project and later when the products are received. In addition, plans should identify adequate resources to execute validation activities.

Mapping of 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 or Product Components	• **Perform Validation** • **Analyze Validation Results**

Agenda

State of Acquisition Practices

Capability Maturity Model Integration

CMMI Acquisition Module
- Project Management Process Areas
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- Support Process Areas
- Integrated Process and Project Management Concepts
- Generic Practices

Improving Acquisition Processes

CMMI-AM Pilot Status

Conclusion

Understanding Support Processes

The organizational support environment includes the infrastructure (facilities, tools, equipment, and support to effectively use them) and tools that people need to perform their jobs effectively.

An integrated support environment helps people communicate clearly and efficiently about the products; processes; people needs; organization; business, technical, and political environments; and their interfaces. Integrated communication tool sets reduce wasted time spent converting information from one medium or platform to another.

Support Process Areas

Configuration Management   CM

Process and Product Quality Assurance   PPQA

Measurement and Analysis   MA

Decision Analysis and Resolution   DAR

Transition to Operations and Support   TOS

Organizational Environment for Integration   *OEI*

*covered in Integrated Process and Project Management Concepts
   section

Configuration Management

The purpose of configuration management is to establish and maintain the integrity of work products using configuration identification, configuration control, configuration status accounting, and configuration audits.

For Acquisition, work products, such as solicitation packages, that are created by the acquisition project are placed under configuration management internally. In addition, configuration management of acquired products (both final and interim products) created by the primary and subordinate suppliers require monitoring to ensure that project goals are met.

Mapping of Goals and Practices

Specific Goal	Specific Practice
Establish Baselines	• **Identify Configuration Items** • **Establish a Configuration Management System** • **Create or Release Baselines**
Track and Control Changes	• **Track Change Requests** • **Control Configuration Items**
Establish Integrity	• **Establish Configuration Management Records** • **Perform Configuration Audits**

Process and Product Quality Assurance

The purpose of process and product quality assurance is to provide staff and management with objective insight into processes and associated work products.

For Acquisition, the products and processes evaluated are those of the acquisition project. For example, the acquisition project may develop and maintain a solicitation package. The PPQA function would ensure that the solicitation package was developed per the standard or format agreed to by the project team and that it conforms to all applicable policies and laws. As a process evaluation, the PPQA function may evaluate the acquisition project's risk management process against their plan for risk management to ensure the project is effectively implementing their agreed to process.

Mapping of Goals and Practices

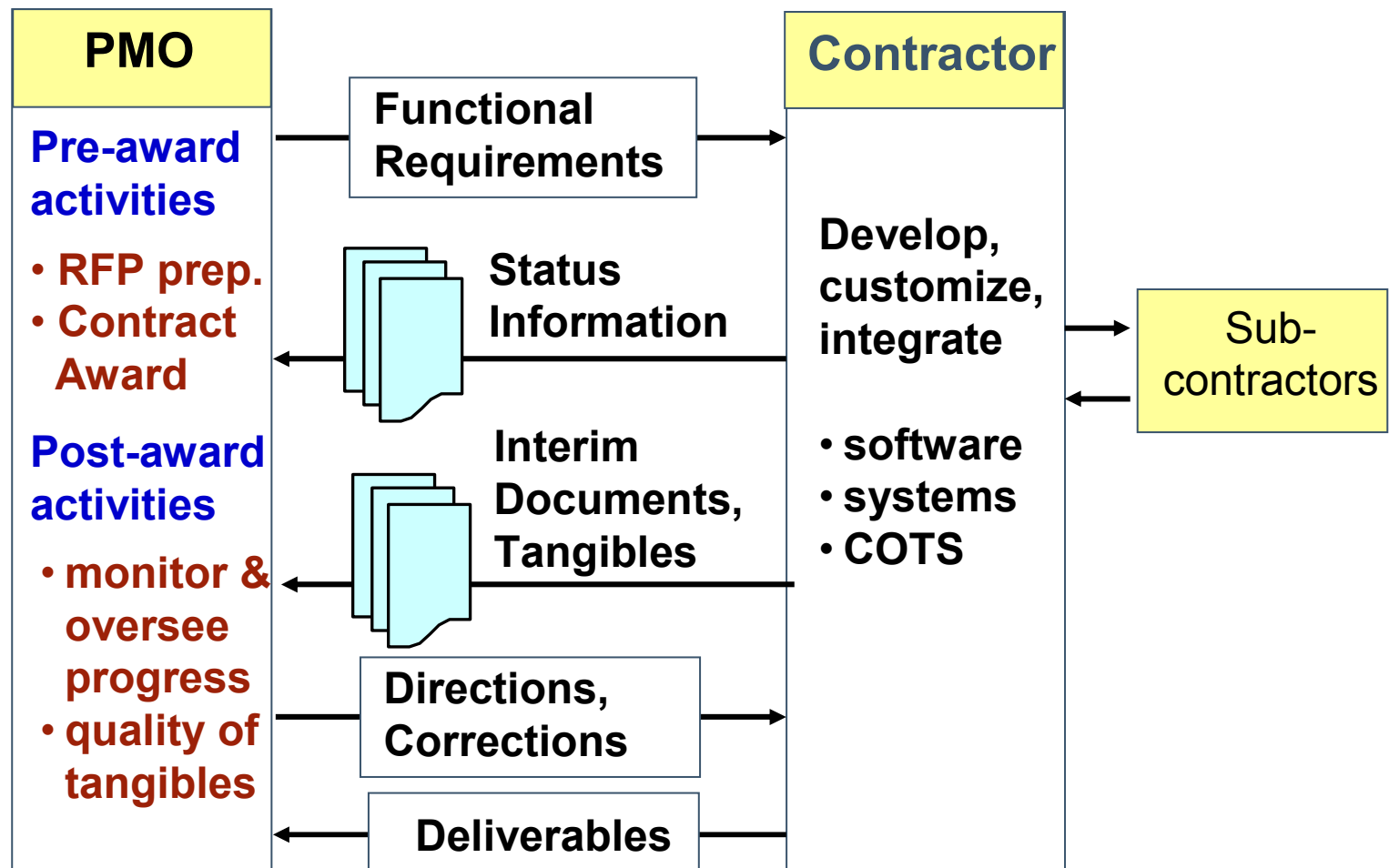| Specific Goal	Specific Practice
Objectively Evaluate Processes and Work Products	• **Objectively Evaluate Processes** • **Objectively Evaluate Work Products and Services**
Provide Objective Insight	• **Communicate and Ensure Resolution of Noncompliance Issues** • **Establish Records**

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, as well as 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 objectives are identified, measured, and achieved.

Roles and Information Exchange

PMO

Pre-award activities

- RFP prep.
- Contract Award

Post-award activities

- monitor & oversee progress
- quality of tangibles

Functional Requirements →

← Status Information

← Interim Documents, Tangibles

Directions, Corrections →

← Deliverables

Contractor

Develop, customize, integrate

- software
- systems
- COTS

→ Sub-contractors ←

PMO Major Responsibilities
Post Contract Award

Deliverables

PMO

Contractor

**Develop
the
System**

⟷

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

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

**Final
Product**

⟷

**PMO Responsibilities
(Post Contract Award)**
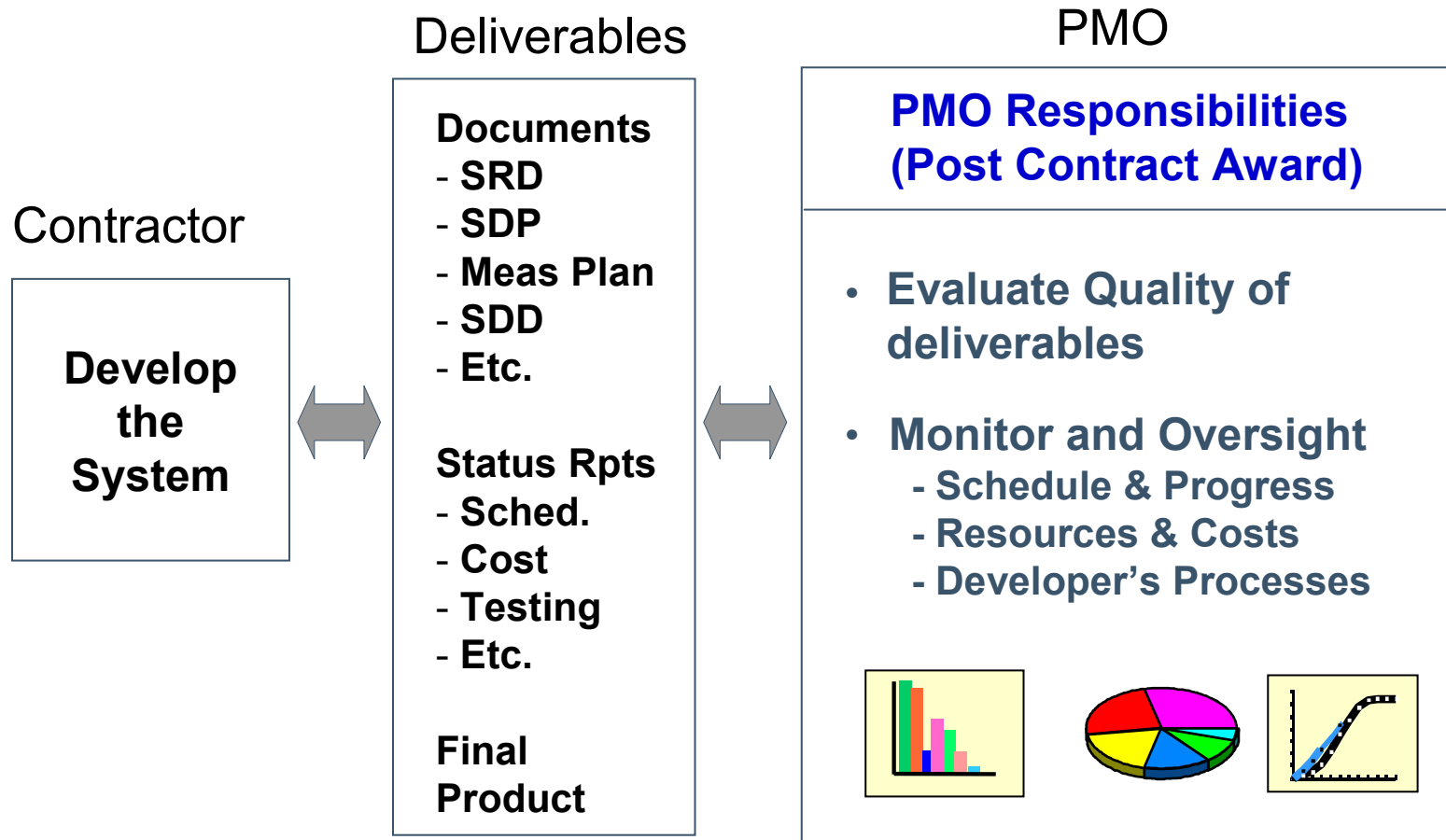
- **Evaluate Quality of deliverables**

- **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

Mapping of 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**

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 or technology insertion decisions that impact essential requirements are considered.

Mapping of 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**

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. Eventual disposal of the product should be considered.

Transition to Operations and Support$_2$

For Acquisition, planning for transition includes establishing strategies for support (i.e., source of repair) through organic support infrastructures, contractor logistics support (CLS), or other sources. The roles and responsibilities of the acquirer, supporter, and user should be defined in the life-cycle support of the system. Responsibility for capability enhancements during the support phase should be defined, considering the magnitude and complexity of the envisioned change. Additionally, the acquisition project will need to work with the operational units to plan for transition of the products into operational use This includes identifying and providing for initial spares, operational training capabilities, etc.

Mapping of 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**

Agenda

State of Acquisition Practices

Capability Maturity Model Integration

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CMMI-AM Pilot Status

Conclusion

Definition

An integrated team is a group of people with complementary skills and expertise who are committed to delivering specified work products in timely collaboration.

Integrated team members provide skills and advocacy appropriate to all phases of the work products' life and are collectively responsible for delivering the work products as specified.

An integrated team should include empowered representatives from organizations, disciplines, and functions that have a stake in the success of the work products.

IPPD-Specific Content

In the CMMI Acquisition Module there are

- two IPPD-specific process areas
- two specific goals in Integrated Project Management

IPPD Fundamental Concepts

IPPD process areas and goals add the following concepts:

- effective use of cross-functional or multidisciplinary teams

- leadership commitment

- appropriate allocation and delegation of decision making

- organizational structure that rewards team performance

Critical Concepts

The following concepts are intended to permeate the practices of the CMMI:

- design of downstream processes during the acquisition

- focus on the customer's needs during the acquisition

- timely and appropriate collaboration of all relevant stakeholders

- continuous and proactive identification and management of risk

- focus on measurement and improvement of processes to acquire the capability or product

IPPD - Overview

OEI
Organizational Focus

IPM
Project Focus

IT
Team Focus
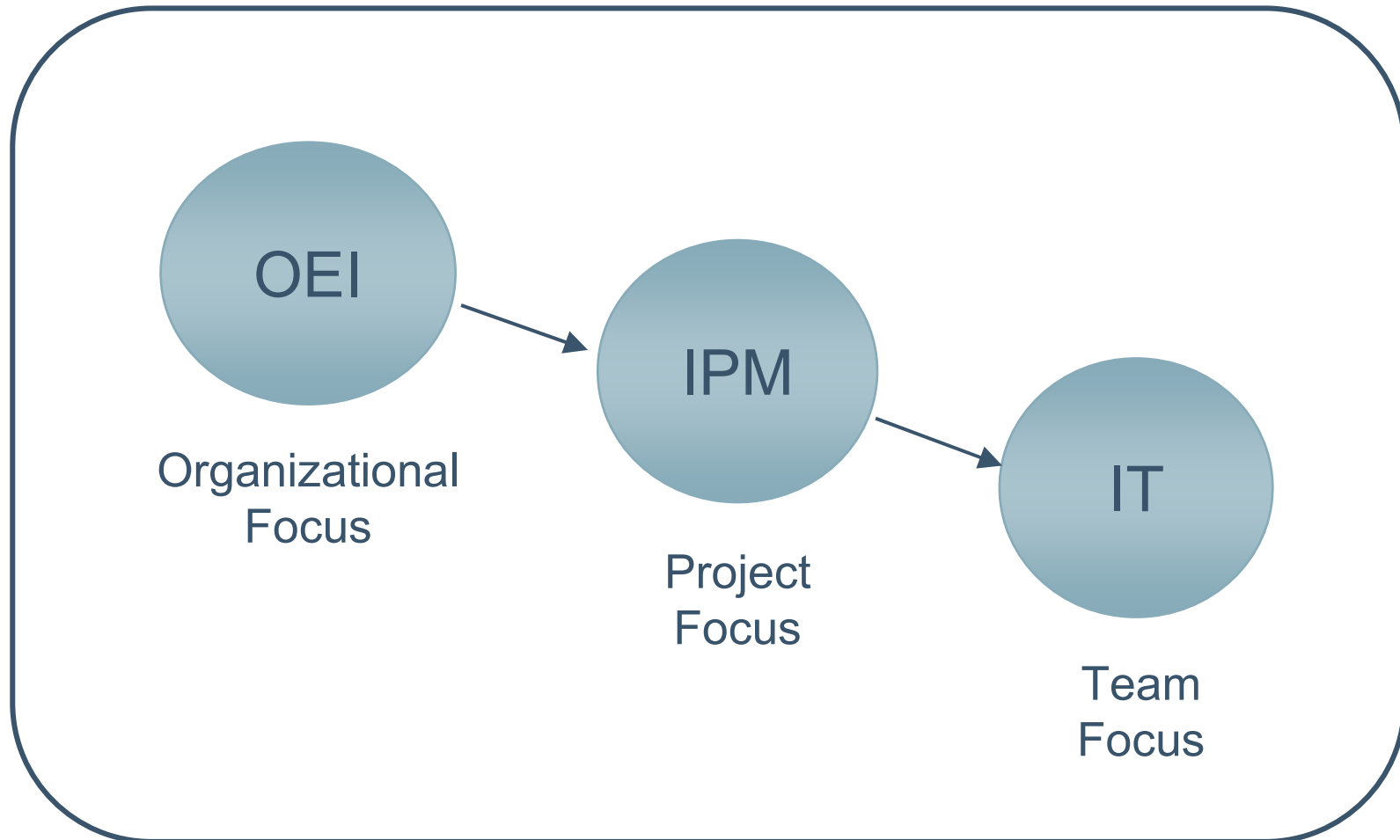
Organizational Environment for Integration

The purpose of organizational environment for integration is to provide an Integrated Product and Process Development (IPPD) infrastructure and manage people for integration.

For Acquisition, organization environment for integration is an important element in establishing an environment where integrated teams are used. Practices in this process area provide the infrastructure to establish fully functional teams from among all stakeholders (acquisition project, supplier, and other supporting organizations).

Mapping of Goals and Practices

Goal	Practice
Provide IPPD Infrastructure	• **Establish the Organization's Shared Vision** • **Establish an Integrated Work Environment** • **Identify IPPD-Unique Skill Requirements**
Manage People for Integration	• **Establish Leadership Mechanisms** • **Establish Incentives for Integration** • **Establish Mechanisms to Balance Team and Home Organization Responsibilities**

Integrated Project Management [1]

The purpose of integrated project management is to establish and manage the project and the involvement of the relevant stakeholders according to an integrated and defined process that is tailored from the organization's set of standard processes.

It also covers the establishment of a shared vision for the project and a team structure for integrated teams that will carry out the objectives of the project.

Integrated Project Management ₂

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.

Mapping of Goals and Practices ₁

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**

Mapping of Goals and Practices ₂

Specific Goals	Practice
Use the Project's Shared Vision for IPPD	• **Define Project's Shared-Vision Context** • **Establish the Project's Shared Vision**
Organize Integrated Teams for IPPD	• **Determine Integrated Team Structure for the Project** • **Develop Preliminary Distribution of Requirements to Integrated Teams** • **Establish Integrated Teams**

Integrated Teaming [1]

The purpose of Integrated Teaming is to form and sustain an integrated team for the development of work products.

Integrated Teaming ₂

For Acquisition, Integrated Teaming should consider the overall scope of and requirement for participation of stakeholders from users, acquisition executives, acquisition organizations, developers (primes, associate subcontractors, suppliers, and vendors), test organizations, and other support organizations in the establishment of the integrated team structure for the project.

The establishment of the processes to be used by the team is a significant issue that should be addressed. For example, does the team adopt a common process for team operation or rely on each team member to use his or her own organization's processes? An example of this would be the decision regarding the software development processes to be used by each developer (a common process across the team's developers or unique but compatible process for each developer?). At the very least, the various team member processes should be compatible at the interface points of the team member processes.

Mapping of Goals and Practices

Goal	Practice
Establish Team Composition	• **Identify Team Tasks** • **Identify Needed Knowledge and Skills** • **Assign Appropriate Team Members**
Govern Team Operation	• **Establish a Shared Vision** • **Establish a Team Charter** • **Define Roles and Responsibilities** • **Establish Operating Procedures** • **Collaborate Among Interfacing Teams**

IPPD - Summary
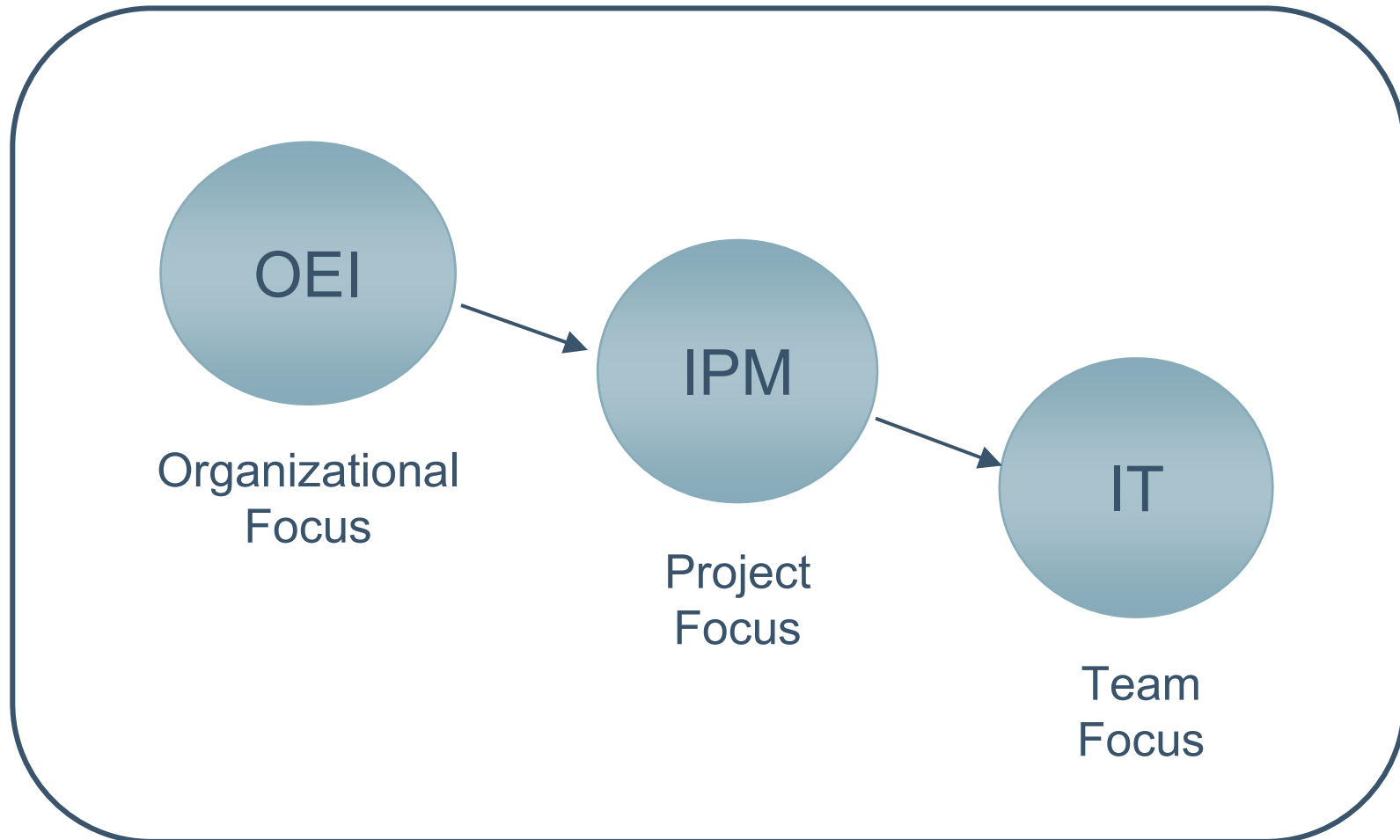
OEI
Organizational Focus

IPM
Project Focus

IT
Team Focus

Agenda

State of Acquisition Practices

Capability Maturity Model Integration

CMMI Acquisition Module
- Project Management Process Areas
- Engineering Process Areas
- Support Process Areas
- Integrated Process and Project Management Concepts
- Generic Practices

Improving Acquisition Processes

CMMI-AM Pilot Status

Conclusion

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.

Generic Practices in the CMMI Acquisition Module

Generic Goals	Generic Practices
Institutionalize 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
Institutionalize a Defined Process	Establish a Defined Process Collect Improvement Information

Managed - Generic Goal

Institutionalize a Managed Process

The process is institutionalized as a *managed* process.

Managed – Generic Practices [1]

The generic practices are the same for all process areas.

Establish an Organizational Policy

Establish and maintain an organizational policy for planning and performing the <x> process.

Plan the Process

Establish and maintain the plan for performing the <x> process.

<x> represents the name of a process area (e.g., Requirements Management)

Managed – Generic Practices ₂

Provide Resources

Provide adequate resources for performing the <x> process, developing the work products, and providing the services of the process.

Assign Responsibility

Assign responsibility and authority for performing the process, developing the work products, and providing the services of the <x> process.

Train People

Train the people performing or supporting the <x> process as needed.

Managed – Generic Practices ₃

Manage Configurations

Place designated work products of the <x> process under appropriate levels of configuration management.

Identify and Involve Relevant Stakeholders

Identify and involve the relevant stakeholders of the <x> process as planned.

Monitor and Control the Process

Monitor and control the <x> process against the plan for performing the process and take appropriate corrective action.

Managed – Generic Practices ₄

Objectively Evaluate Adherence

Objectively evaluate adherence of the <x> process against its process description, standards, and procedures, and address noncompliance.

Review Status with Higher Level Management

Review the activities, status, and results of the <x> process with higher level management and resolve issues.

Defined - Generic Goal

Institutionalize a Defined Process

The process is institutionalized as a *defined* process.

Defined – Generic Practices

The generic practices are the same for all process areas.

Establish a Defined Process

Establish and maintain the description of a defined <x> process.

Collect Improvement Information

Collect work products, measures, measurement results, and improvement information derived from planning and performing the <x> process to support the future use and improvement of the organization's processes and process assets.

Agenda

State of Acquisition Practices

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- Project Management Process Areas
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Conclusion

Early Process Improvement

The theories of process management are a synthesis of the concepts of Deming, Crosby, Juran, and others.

Over the past 30 years, these theories have been used to address problems common to many organizations.

Solutions have been discovered, but a gap existed between the state of the practice and the state of the art.

Many of these concepts have been used to build process-improvement models.

What Is a Process Model?

A model is a structured collection of elements that describes characteristics of effective processes.

Processes included are those proven by experience to be effective.

How Is a Model Used?

A model is used

- to help set process improvement objectives and priorities

- to help ensure stable, capable, and mature processes

- as a guide for improvement of project and organizational processes

- with an appraisal methodology to diagnose the state of improvement efforts

Why Is a Model Important?

A model provides
- a place to start
- the benefit of a community's prior experiences
- a common language and a shared vision
- a framework for prioritizing actions
- a way to define what "improvement" means for your organization

"All models are wrong; some are useful."
-George Box

The Bottom Line [1]

Process improvement should be done to help the business—not for its own sake.

"In God we trust,
all others bring data."
- W. Edwards Deming

The Bottom Line ₂

Improvement means different things to different organizations.

- **What are your business goals?**

- **How do you measure progress?**

Improvement is a long-term, strategic effort.

- **What is the expected impact on the bottom line?**

- **How will impact be measured?**
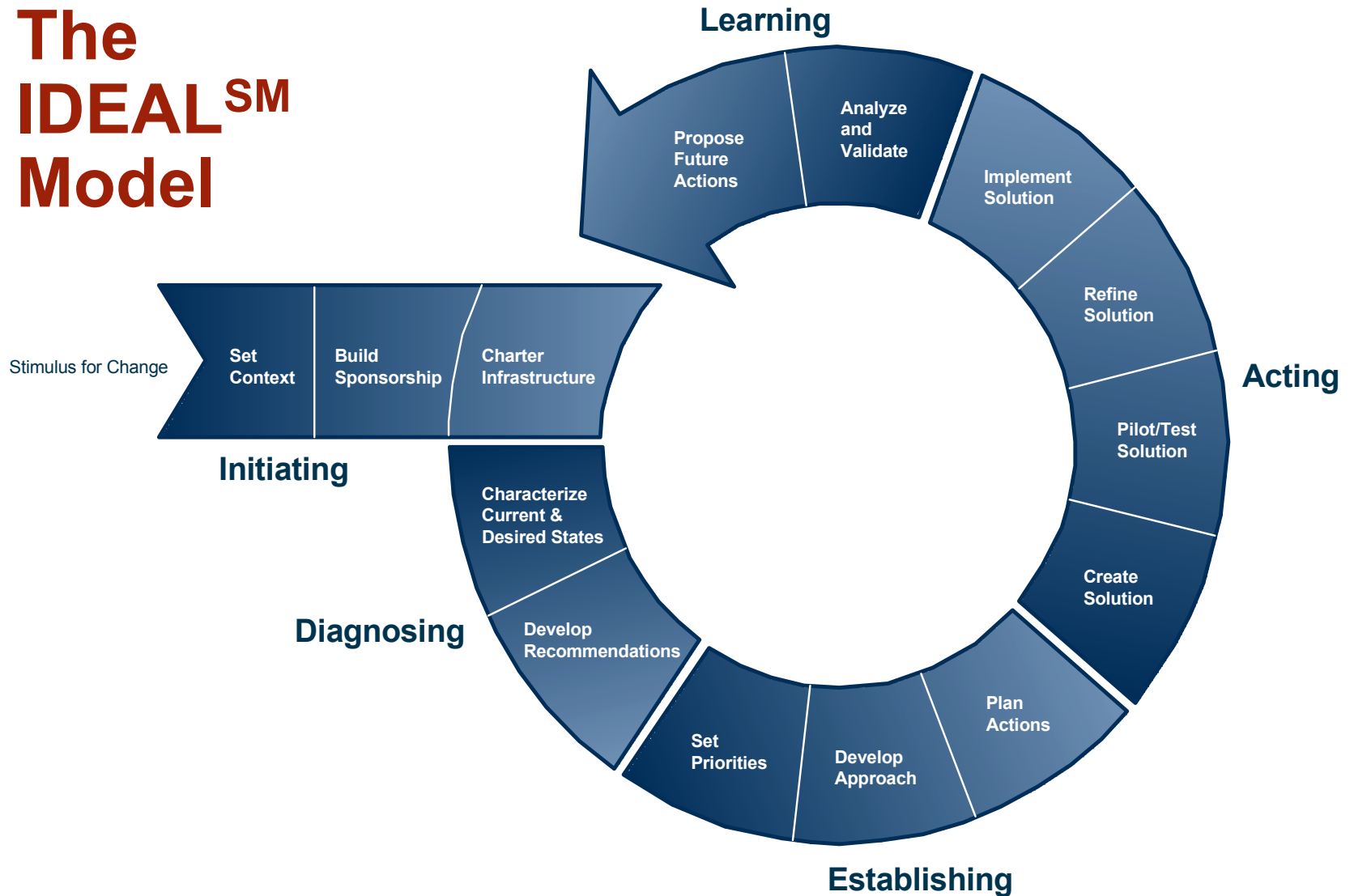
Simple Improvement Processes

**Determine where you are.
Determine where you want to be.
Make a plan.
Execute the plan.
Learn lessons and do it again.**

Another improvement process is <u>P</u>lan <u>D</u>o <u>C</u>heck <u>A</u>ct.

IDEAL^{SM}

The IDEAL℠ Model

Learning
- Propose Future Actions
- Analyze and Validate

Acting
- Implement Solution
- Refine Solution
- Pilot/Test Solution
- Create Solution

Establishing
- Plan Actions
- Develop Approach
- Set Priorities

Diagnosing
- Characterize Current & Desired States
- Develop Recommendations

Initiating
- Set Context
- Build Sponsorship
- Charter Infrastructure

Stimulus for Change

℠ IDEAL is a service mark of Carnegie Mellon University.

Using the CMMI Acquisition Module with the IDEAL Model [1]

Initiating phase

Can assist an organization in understanding how to build sponsorship and in developing the infrastructure for improvement.

Diagnosing phase

Provides a yardstick for appraising processes based on the Module.

Using the CMMI Acquisition Module with the IDEAL Model ₂

Establishing phase

Process areas focus the process improvement teams.

Acting phase

Provide guidance for defining or improving processes.

Learning phase

Lessons learned are documented and are the basis for revision of an organizational approach.

Agenda

The State of Acquisition

Capability Maturity Model Integration

CMMI Acquisition Module

Improving Acquisition Processes

CMMI-AM Pilot Status

Conclusion

CMMI Acquisition Module:
Near Term Implementation

PHASE I – fact-finding (SA-CMM historical adoption issues)
- Meet with SA-CMM practitioners to characterize how it is being applied, and capture lessons learned

PHASE II – Plan pilot strategy using Section 804 framework
- Socialize CMMI Acquisition Module with Acquisition Executives
- Offer CMMI Acquisition Module as a "tool" to achieve 804 compliance
- Select candidate programs from each Service/Agency as "Pilots"

PHASE III – conduct Pilot assessments
- Workshop (awareness training) for PM Staff
- Gap Analysis to identify opportunities for process improvement and program risk reduction

PHASE IV – Make necessary modifications
- Analyze Pilot results and Fact Finding lessons learned
- Re-assess Gap Analysis from Pilots after 3 months to measure effectiveness and return on investment

PHASE V – full release of CMMI Acquisition Module

Phase III Progress

Pilot program assessments complete.

Draft report prepared by OUSD; reviewed by assessment team members who had participated on more than one assessment (10 people).

Report, including recommendations, under review by OUSD management and authors of CMMI–AM.

Report, including recommendations, to Steering Committee prior to November meeting.

Pilot Program Characteristics

Program	Attribute				
	Life Cycle Phase	*ACAT y*	*Size*	*Applications*	*System of Systems*
1	Insight/Oversight	I AM	150 people	ERP	No
2	Spiral Development; Spiral 2 (RDT&E)	I AM	$4B approx 250 People	Missile Defense System	Yes
3	Sustainment	I C	$1.6B approx. 250 people*	Globemaster III	No
4	Spiral 1	I D	$5B 150 people	Weapons/ Battle Management	Yes
5	Pre Milestone III but Deployment with waivers	I D	>$100M >100 people	Battle Management	No
6	Replan	III A	12 people	IT	No
7	Source Selection- Spiral 1 ; Insight/Oversight- Spiral 2	IV D/AAP	7 people	IT	No
8	Sustainment	AAP	$0.6B 6 people	GOTS/IT	No

*Does not include $2B for aircraft purchase

General Results-Positive

No show stoppers to prevent immediate use when accompanied with training.

Applicable to all life cycle phases, applications, and program size within pilot study with appropriate interpretation.

More robust process areas: Project Planning, Project Monitoring and Control, Risk Management, Requirements Management, and Requirements Development.

For more details, see OSD presentation Wednesday, 1015am, Wind River room

Agenda

The State of Acquisition

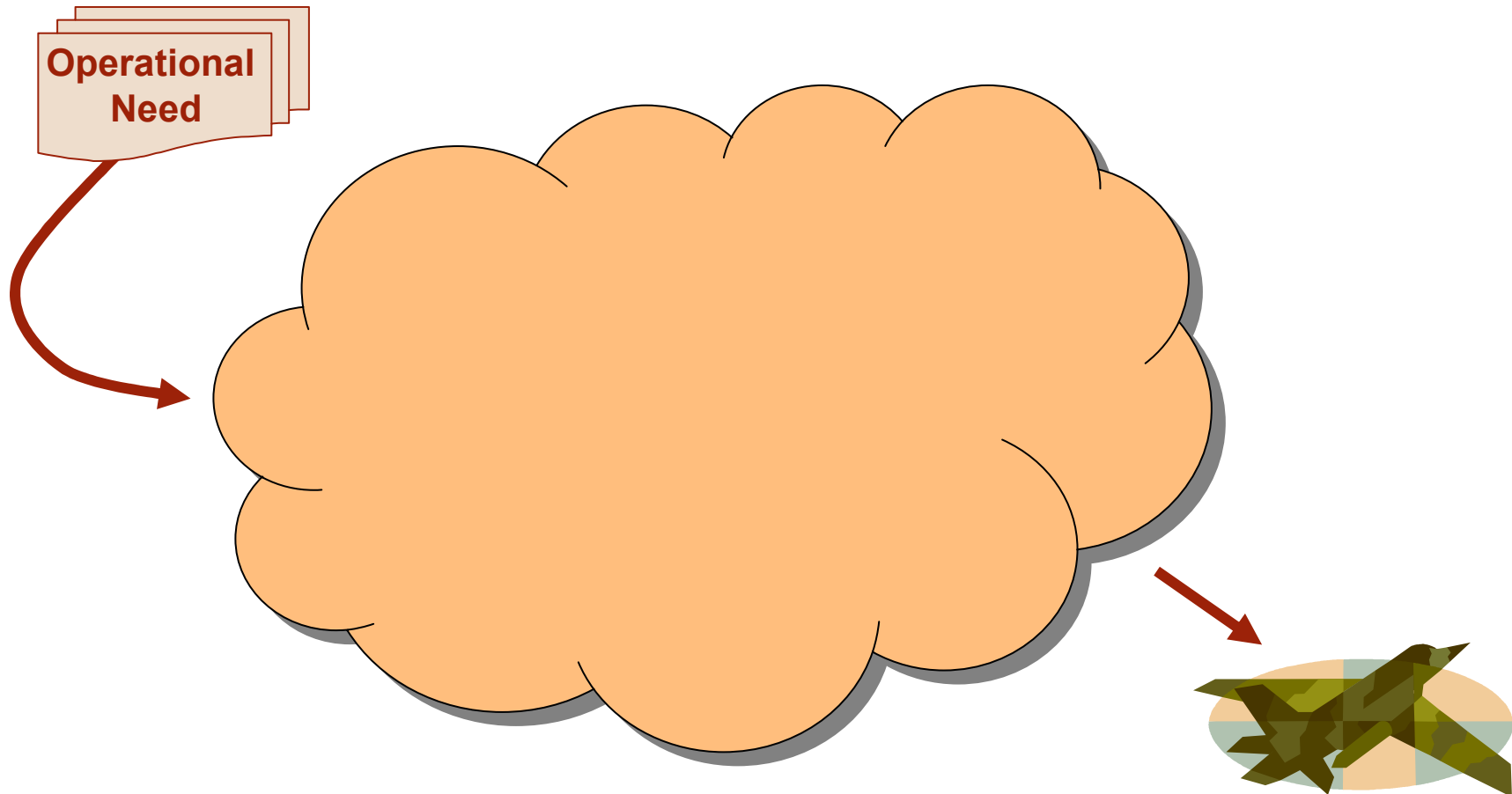Capability Maturity Model Integration

CMMI Acquisition Module

Improving Acquisition Processes
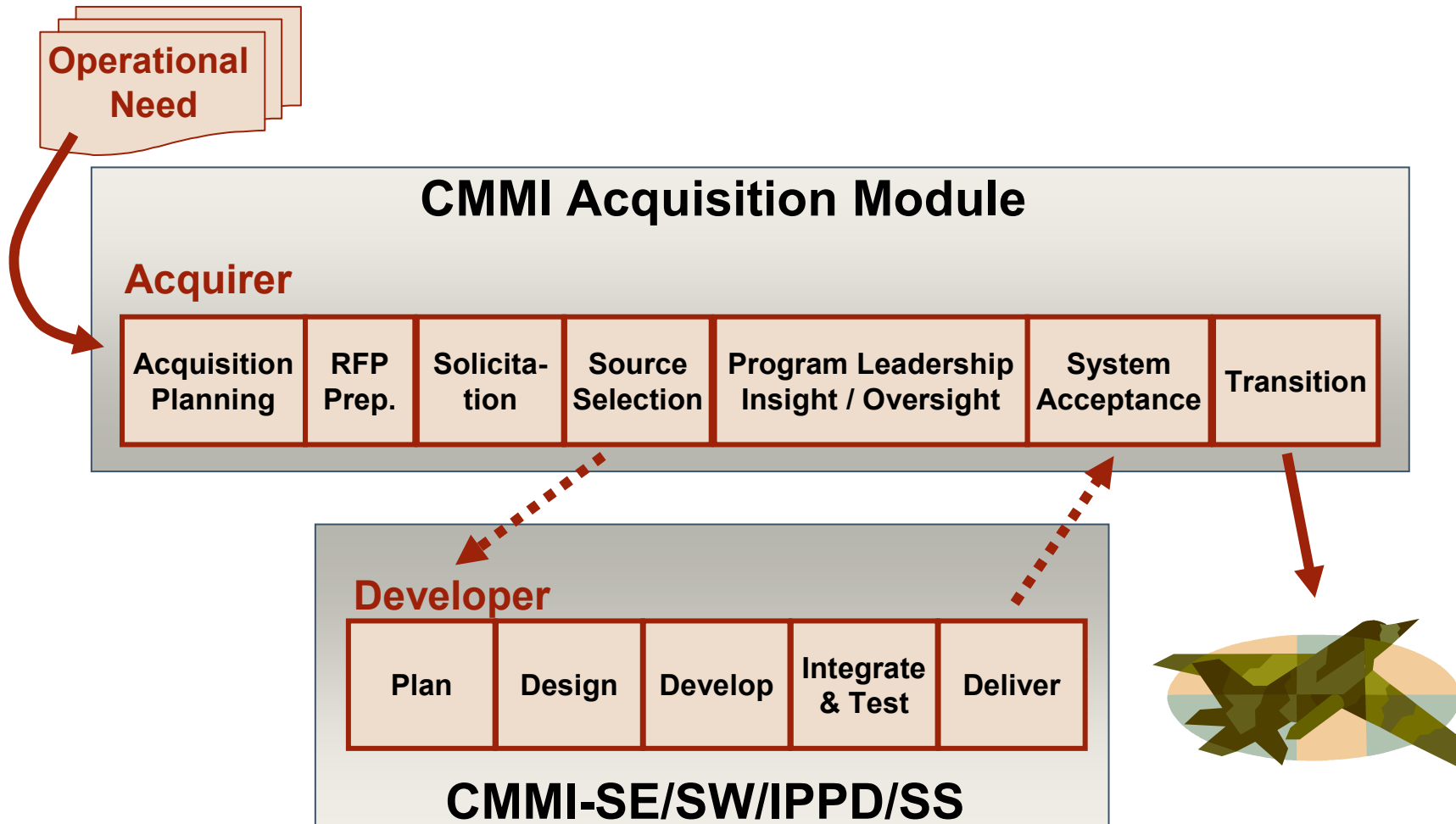
CMMI-AM Pilot Status

Conclusion

"Ad Hoc" Acquisition Practices

Operational Need

Explicit Acquisition Practices

Operational Need

CMMI Acquisition Module

Acquirer

Acquisition Planning	RFP Prep.	Solicita-tion	Source Selection	Program Leadership Insight / Oversight	System Acceptance	Transition

Developer

Plan	Design	Develop	Integrate & Test	Deliver

CMMI-SE/SW/IPPD/SS

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