

Applying CMMI, Software Architecture Principles, and Process Improvement in a DoD Acquisition

SEPG Conference
March 2007

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Presentation Overview

Brief background of the Common Link Integration Processing (CLIP) program

Discuss techniques used in acquisition to support CLIP's goals and objectives

Lessons learned from the acquisition

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CLIP Program Background

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CLIP Background

- Cooperative Navy and Air Force program to develop common tactical data link (TDL) message processing software for air, ship, and shore platforms
- Provides non-invasive TDL functionality for TDL-disadvantaged platforms
- Facilitates communications between TDLs and IP-based communications to enable Network Centric Warfare
- Developed in 4 increments with increasing message processing and host platform interfaces
- Open, layer architecture design is Software Communication Architecture (SCA) compliant and can be hosted on multiple computing environments

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CLIP Goals and Objectives

- Enhanced interoperability
- Lower cost and faster time to fielding
- Insulate Host from terminal/radio and TDL standards changes
- Provide a common link-independent host interface
- Architecture supports key architectural qualities
- Based on a software product line development approach

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Acquisition Strategies Used for CLIP

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Strategy Used in Acquisition

Pre-Contract

- Acquisition Planning Workshop
- DoD 5000 Acquisition Documents for Milestone B
- Development of an acquisition timeline
- CDRL development/definition

Contract monitoring

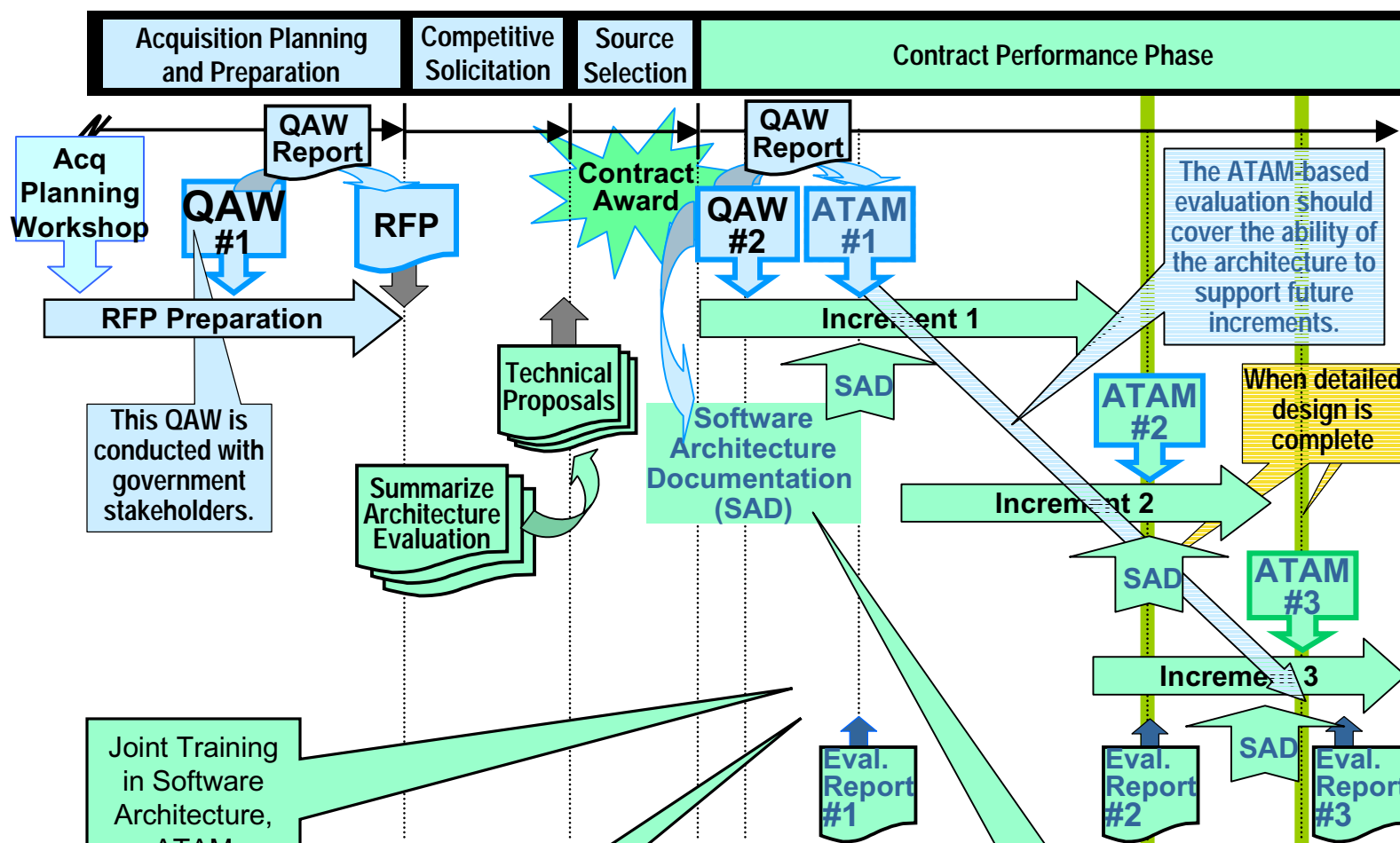
- Evaluation/Appraisal techniques
- Risk management
- CDRL review



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Coordinated Use of SEI Methods and Training in CLIP Acquisition



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SCAMPI B appraisal (annual)

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Software Product Line Approach

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Key DoD 5000 Acquisition Documents

- Acquisition Strategy/Plan (AS/AP)
- Test and Evaluation Master Plan (TEMP)
- Source Selection Plan (SSP)
- System Engineering Plan (SEP)
- Request for Proposal (RFP)



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System Engineering Plan

Initially tried to model CMMI v1.1

Next tried mapping EIA-632 to the program's CDRLs—too complicated/confusing and resource intensive

Guided by OSD for System Engineering Plan

Revised System Engineering Plan focused on 4 process areas

- Risk management
- Measurement and analysis
- Architecture evaluation (technical solution)
- Interface control (product integration)

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Request for Proposal - 1

Section B

- Identified program milestones and associated exit criteria with ties to award fee

Statement of Work (SOW)

- IEEE/EIA 12207 Software Life Cycle Processes
- Capability Maturity Model Integration (CMMI)
- Quality Attribute Workshop (QAW)
- Architecture Tradeoff Analysis Method (ATAM)

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Request for Proposal - 2

Sections L and M

- Technical solution, Program Management Plan (PMP), Process Improvement Plan (PIP), Integrated Master Schedule (IMS), Risk Management Plan (RMP)

Contract Data Requirements List (CDRLs)

- MilStd 498, IEEE 828, 1028, 1016, 12207, EIA-632, ISO/IEC-15288



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IEEE/EIA 12207 Software Life Cycle Processes

Process implementation

System Requirements Analysis

System Architectural Design

Software Requirements Analysis

Software Architecture Design

Software Detailed Design

Software Coding and Testing

Software Integration

Software Qualification Testing

System Integration

System Qualification Testing

Software Installation

Software Acceptance Support

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CMMI Requirements - 1

- CMMI- SE/SW/IPPD/SS v1.1 (staged representation)
- Prime contractor shall have or obtain and maintain a minimum of SEI CMMI maturity Level 3 (Note: not current SEI guidance)
- Contractor team (subcontracted and interdivisional work) shall have a minimum combined maturity level of CMMI Level 2 rating
- If Contractor and team not at required levels at contract award, it shall be achieved within 12 months

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CMMI Requirements - 2

On-site Government appraisal of Contractor's processes no later than 9 months after contract award

- Compare proposal to actual CLIP program processes/practices
- Baseline capabilities for future

PIP

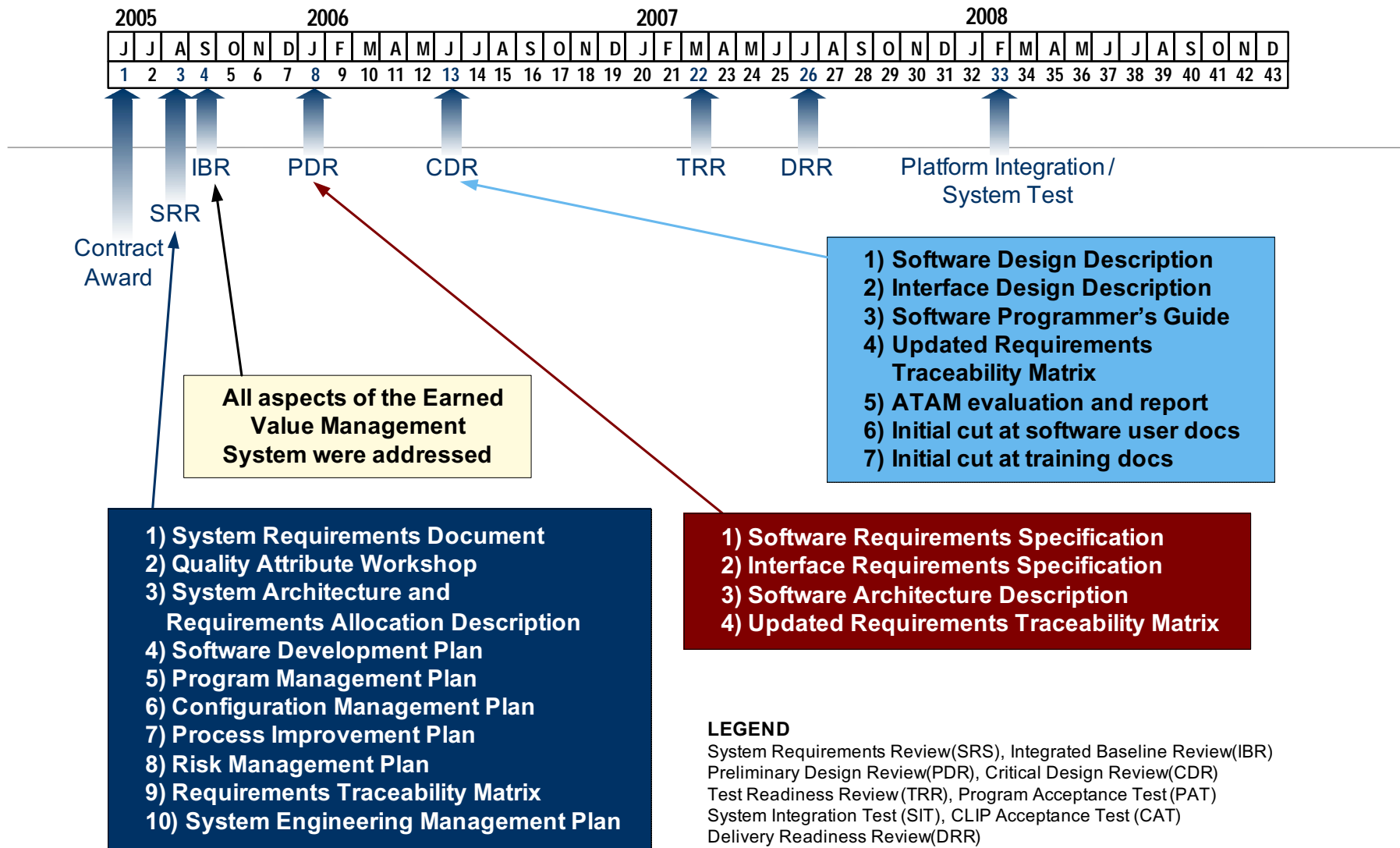
- For achieving and maintaining the required process discipline
- Commitment to process improvement
- Identifies current assessed CMMI levels of Contractor and team

Annual SCAMPI B appraisals

- Verify Contractor is following their processes
- Measure continuous process improvement

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CLIP Timeline

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Contract Monitoring Activities

Quality Attribute Workshop

- Requirement development and refinement

Annual SCAMPI B appraisals

Architecture Tradeoff Analysis Method

- Technical solution

Joint training

Peer review participation

IPT communications/participation



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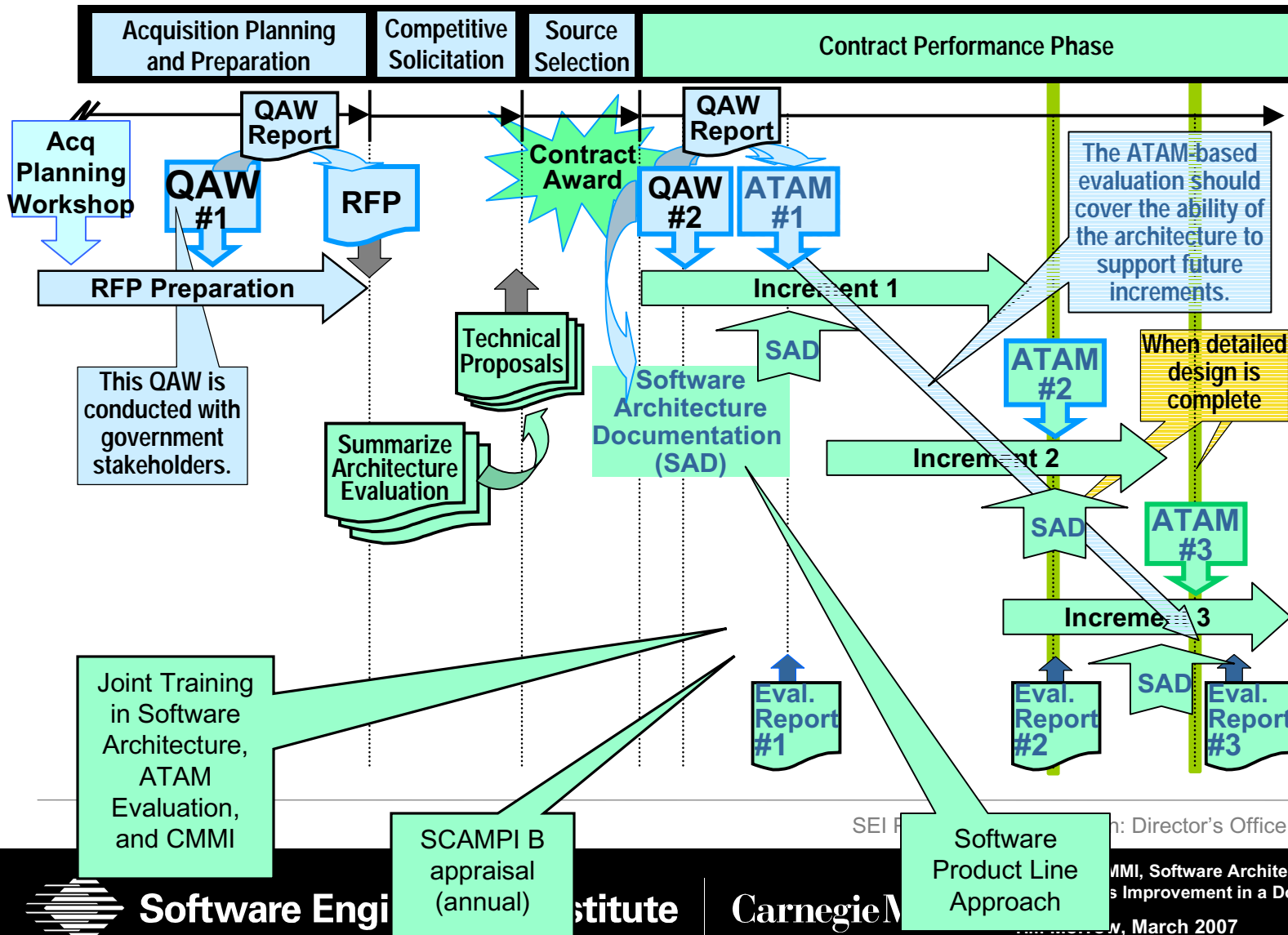
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Coordinated Use of SEI Methods and Training in CLIP Acquisition



Quality Attributes Workshop

Provides a common forum for discussing quality attribute requirements and architectural implications

Gain stakeholder buy-in

Two QAWs were held

- Pre-RFP QAW – used to develop/refine requirements and develop technical evaluation questions and criteria for RFP
- Post-contract award QAW – used to gain a shared vision for the CLIP architecture and support requirement refinement

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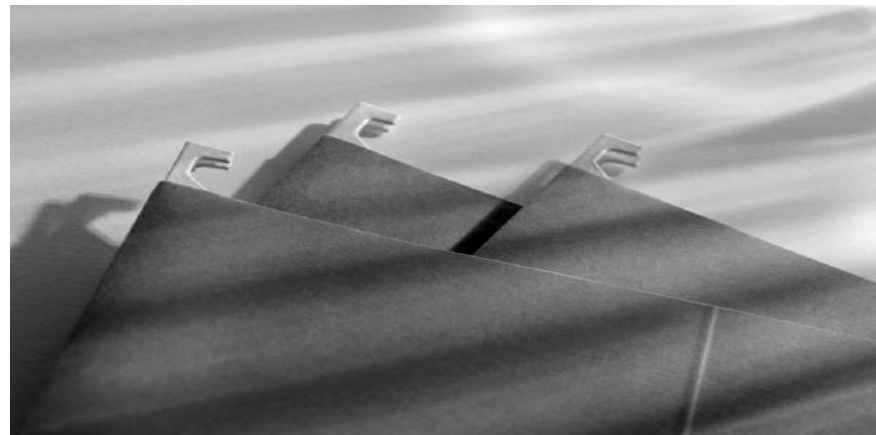
SCAMPI

Annual SCAMPI B appraisals of the contractor will be performed to determine their conformance to their processes

Introduction to CMMI training course was taken by CLIP Program Office and Contractor personnel

Six CLIP Program Office participated on SCAMPI B appraisal team

SCAMPI evaluation team also include a SSTC SEPO representative and one of the contractor's sub-contractor



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Category	CMMI Process Areas
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 Management Integrated Project Management for IPPD Risk Management Integrated Teaming Integrated Supplier Management Quantitative Project Management
Engineering	Requirements Management Requirements Development Technical Solution Product Integration Verification Validation <div data-bbox="1417 862 1707 980" style="border: 1px solid black; padding: 5px; display: inline-block; margin-left: 20px;"> Legend PAs covered. </div>
Support	Configuration Management Process and Product Quality Assurance Measurement and Analysis Decision Analysis and Resolution Organizational Environment for Integration Causal Analysis and Resolution

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Architecture Tradeoff Analysis Method

Increase communication among stakeholders

Clarify quality attribute requirements

Identify software risks early in the development cycle

Provide documented basis for architectural decisions



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Risk Management

The Risk Management Plan was the first CDRL submitted and signed off on because of its importance to the program

Joint risk management process

Monthly Risk Review Boards

Open communication (**risk** is not a 4-letter word)

Value to the program by providing visibility to other program offices and senior management

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CDRL Implementation Concerns

Delivery aspects of CDRLs

- Frequency
- Date of First Submission
- Date of Subsequent Submission are filled in

Ability of the program office to support the reviews

How are communications between CDRL developers and the associated program office IPT representatives?

The review process was revised between PDR and CDR milestones to improve the process to make sure the content of the documents satisfied the expectations of both sides

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Lessons Learned

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RFP and Proposal Review Lessons

Cost realization of proposals

Source selection plan

Number of CDRLs and which are important

Having a concept of a technical solution

Software estimation and productivity factors

Proposal presentations

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Contract Monitoring Lessons

Identify a few important metrics

Direct team focus to concentrate on metrics

Software estimation and productivity factors



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Summary

Pro-active planning at the RFP stage lays the foundation for the contract monitoring phase

Cost proposals are very difficult to develop and even more difficult provide cost realism to, so the program office needs to convey as clear and complete picture of the acquisition, as possible, in the RFP

Identify the three or four most important items for the government program office to try to accomplish during the acquisition and focus on those items

Communication between the program office and the contractor's team needs to be continuously after contract award, like risk management, so that expectations can be set appropriately within the program, as well as for those external to the program.

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