

# CAPABILITY MATURITY MODEL<sup>©</sup> INTEGRATION FOR DEVELOPMENT VERSION 1.2<sup>SM</sup>



## CMMI<sup>©</sup> LEVEL 2 THRU 5 POLICIES & PROCEDURES

Maturity Levels	Process Areas	Specific Goals	Specific Practices	Sub Practices	Work Products
1	0	0	0	0	0
2	7	15	56	219	15
3	11	28	92	420	29
4	2	3	13	62	4
5	2	4	11	60	4
Total	22	50	172	761	52

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# CAPABILITY MATURITY MODEL INTEGRATION FOR DEVELOPMENT — VERSION 1.2

Number

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Approved by

Date

CMMI-DEV-V1.2

Level 2 - Managed

1.0 REQUIREMENTS MANAGEMENT (REQM)

## 1.1 PURPOSE

The purpose of Requirements Management (REQM) 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.

## 1.2 REVISION HISTORY

Author	Description	Initials

## 1.3 PERSONS AFFECTED

Project manager, systems engineering, and software engineering.

## 1.4 POLICY

The policy of this organization is to ensure that:

1.4.1 Project managers, systems engineering, and software engineering Manage Requirements for the system under development.

## 1.5 RESPONSIBILITIES

1.5.1 Project managers, systems engineering, and software engineering are responsible for Obtain an Understanding of Requirements, Obtain Commitment to Requirements, Manage Requirements Changes, Maintain Bidirectional Traceability of Requirements, and Identify Inconsistencies Between Project Work and Requirements for the system under development.

## 1.6 PROCEDURE

### 1.6.1 Manage Requirements

#### 1.6.1.1 Obtain an Understanding of Requirements

Project managers, systems engineering, and software engineering shall Establish criteria for distinguishing appropriate requirements providers; Establish objective criteria for the evaluation and acceptance of requirements; Analyze requirements to ensure that the established criteria are met; and Reach an understanding of the requirements with the requirements provider so that the project participants can commit to them.

#### 1.6.1.2 Obtain Commitment to Requirements

Project managers, systems engineering, and software engineering shall Assess the impact of requirements on existing commitments and Negotiate and record commitments.

#### 1.6.1.3 Manage Requirements Changes

Project managers, systems engineering, and software engineering shall Document all requirements and requirements changes that are given to or generated by the project; Maintain the requirements change history with the rationale for the changes; Evaluate the impact of requirement changes from the standpoint of relevant stakeholders; and Make the requirements and change data available to the project.

#### 1.6.1.4 Maintain Bidirectional Traceability of Requirements

Project managers, systems engineering, and software engineering shall Maintain requirements traceability to ensure that the source of lower level (derived) requirements is documented; Maintain requirements traceability from a requirement to its derived requirements and allocation to functions, interfaces, objects, people, processes, and work products; and Generate the requirements traceability matrix.

#### 1.6.1.5 Identify Inconsistencies Between Project Work and Requirements

Project managers, systems engineering, and software engineering shall Review the project's plans, activities, and work products for consistency with the requirements and the changes made to them; Identify the source of the inconsistency and the rationale; Identify changes that need to be made to the plans and work products resulting from changes to the requirements baseline; and Initiate corrective

actions.

## 1.7 OUTPUTS

- 1.7.1 **Requirements management system.** A manual or automated system of people, processes, and technology for management of all requirements received by or generated by the project, including both technical and non-technical requirements as well as those requirements levied on the project by the organization (to include storage, retrieval, usage, analysis, and reporting of requirements, evaluation criteria, commitments, status, traceability, and corrective actions).

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2.0 PROJECT PLANNING (PP)

## 2.1 PURPOSE

The purpose of Project Planning (PP) is to establish and maintain plans that define project activities.

## 2.2 REVISION HISTORY

Author	Description	Initials

## 2.3 PERSONS AFFECTED

Project manager, systems engineering, and software engineering.

## 2.4 POLICY

The policy of this organization is to ensure that:

2.4.1 Project managers, systems engineering, and software engineering Establish Estimates, Develop a Project Plan, and Obtain Commitment to the Plan for the system under development.

## 2.5 RESPONSIBILITIES

2.5.1 Project managers, systems engineering, and software engineering are responsible for Estimate the Scope of the Project, Establish Estimates of Work Product and Task Attributes, Define Project Lifecycle, and Determine Estimates of Effort and Cost for the system under development.

2.5.2 Project managers, systems engineering, and software engineering are responsible for 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, and Establish the Project Plan for the system under development.

2.5.3 Project managers, systems engineering, and software engineering are responsible for Review Plans That Affect the Project, Reconcile Work and Resource Levels, and Obtain Plan Commitment for the system under development.

## 2.6 PROCEDURE

### 2.6.1 Establish Estimates

#### 2.6.1.1 Estimate the Scope of the Project

Project managers, systems engineering, and software engineering shall Develop a WBS based on the product architecture; Identify the work packages in sufficient detail to specify estimates of project tasks, responsibilities, and schedule; Identify product or product components that will be externally acquired; and Identify work products that will be reused.

#### 2.6.1.2 Establish Estimates of Work Product and Task Attributes

Project managers, systems engineering, and software engineering shall Determine the technical approach for the project; Use appropriate methods to determine the attributes of the work products and tasks that will be used to estimate the resource requirements; and Estimate the attributes of the work products and tasks.

#### 2.6.1.3 Define Project Lifecycle

#### 2.6.1.4 Determine Estimates of Effort and Cost

Project managers, systems engineering, and software engineering shall Collect the models or historical data that will be used to transform the attributes of the work products and tasks into estimates of the labor hours and cost; Include supporting infrastructure needs when estimating effort and cost; and Estimate effort and cost using models and/or historical data.

### 2.6.2 Develop a Project Plan

#### 2.6.2.1 Establish the Budget and Schedule

Project managers, systems engineering, and software engineering shall Identify major milestones; Identify schedule assumptions; Identify constraints; Identify task dependencies; Define the budget and

schedule; and Establish corrective action criteria.

#### **2.6.2.2 Identify Project Risks**

Project managers, systems engineering, and software engineering shall Identify risks; Document the risks; Review and obtain agreement with relevant stakeholders on the completeness and correctness of the documented risks; and Revise the risks as appropriate.

#### **2.6.2.3 Plan for Data Management**

Project managers, systems engineering, and software engineering shall Establish requirements and procedures to ensure privacy and security of the data; Establish a mechanism to archive data and to access archived data; and Determine the project data to be identified, collected, and distributed.

#### **2.6.2.4 Plan for Project Resources**

Project managers, systems engineering, and software engineering shall Determine process requirements; Determine staffing requirements; and Determine facilities, equipment, and component requirements.

#### **2.6.2.5 Plan for Needed Knowledge and Skills**

Project managers, systems engineering, and software engineering shall Identify the knowledge and skills needed to perform the project; Assess the knowledge and skills available; Select mechanisms for providing needed knowledge and skills; and Incorporate selected mechanisms into the project plan.

#### **2.6.2.6 Plan Stakeholder Involvement**

#### **2.6.2.7 Establish the Project Plan**

2.6.3 Obtain Commitment to the Plan

#### **2.6.3.1 Review Plans That Affect the Project**

#### **2.6.3.2 Reconcile Work and Resource Levels**

#### **2.6.3.3 Obtain Plan Commitment**

Project managers, systems engineering, and software engineering shall Identify needed support and negotiate commitments with relevant stakeholders; Document all organizational commitments, both full and provisional, ensuring appropriate level of signatories; Review internal commitments with senior management as appropriate; Review external commitments with senior management as appropriate; and Identify commitments on interfaces between elements in the project, and with other projects and organizational units so that they can be monitored.

## **2.7 OUTPUTS**

- 2.7.1 **Estimates.** A quantitative assessment of the likely amount or outcome of project costs, resources, effort, and durations and is usually preceded by a modifier (i.e., preliminary, conceptual, feasibility, order-of-magnitude, definitive) and some indication of accuracy (e.g.,  $\pm x$  percent).
- 2.7.2 **Project plan.** A formal, approved document that defines how the project is executed, monitored and controlled. It may be summary or detailed and may be composed of one or more subsidiary management plans and other planning documents.
- 2.7.3 **Project plan commitment.** Formal approval, agreement, or authority-to-proceed with the project plan by stakeholders, customers, sponsors, senior managers, functional managers, contract administrator, or other proxy.

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3.0 PROJECT MONITORING AND CONTROL (PMC)

## 3.1 PURPOSE

The purpose of Project Monitoring and Control (PMC) is to provide an understanding of the project's progress so that appropriate corrective actions can be taken when the project's performance deviates significantly from the plan.

## 3.2 REVISION HISTORY

Author	Description	Initials

## 3.3 PERSONS AFFECTED

Project manager, systems engineering, and software engineering.

## 3.4 POLICY

The policy of this organization is to ensure that:

3.4.1 Project managers, systems engineering, and software engineering Monitor Project Against Plan and Manage Corrective Action to Closure for the system under development.

## 3.5 RESPONSIBILITIES

3.5.1 Project managers, systems engineering, and software engineering are responsible for Monitor Project Planning Parameters, Monitor Commitments, Monitor Project Risks, Monitor Data Management, Monitor Stakeholder Involvement, Conduct Progress Reviews, and Conduct Milestone Reviews for the system under development.

3.5.2 Project managers, systems engineering, and software engineering are responsible for Analyze Issues, Take Corrective Action, and Manage Corrective Action for the system under development.

## 3.6 PROCEDURE

### 3.6.1 Monitor Project Against Plan

#### 3.6.1.1 Monitor Project Planning Parameters

Project managers, systems engineering, and software engineering shall Monitor progress against the schedule; Monitor the project's cost and expended effort; Monitor the attributes of the work products and tasks; Monitor resources provided and used; Monitor the knowledge and skills of project personnel; and Document the significant deviations in the project planning parameters.

#### 3.6.1.2 Monitor Commitments

Project managers, systems engineering, and software engineering shall Regularly review commitments (both external and internal); Identify commitments that have not been satisfied or that are at significant risk of not being satisfied; and Document the results of the commitment reviews.

#### 3.6.1.3 Monitor Project Risks

Project managers, systems engineering, and software engineering shall Periodically review the documentation of the risks in the context of the project's current status and circumstances; Revise the documentation of the risks, as additional information becomes available, to incorporate changes; and Communicate risk status to relevant stakeholders.

#### 3.6.1.4 Monitor Data Management

Project managers, systems engineering, and software engineering shall Periodically review data management activities against their description in the project plan; Identify and document significant issues and their impacts; and Document the results of data management activity reviews.

#### 3.6.1.5 Monitor Stakeholder Involvement

Project managers, systems engineering, and software engineering shall Periodically review the status of stakeholder involvement; Identify and document significant issues and their impacts; and Document the results of the stakeholder involvement status reviews.

#### 3.6.1.6 Conduct Progress Reviews

Project managers, systems engineering, and software engineering shall Regularly communicate status on assigned activities and work products to relevant stakeholders; Review the results of collecting and analyzing measures for controlling the project; Identify and document significant issues and deviations from the plan; Document change requests and problems identified in any of the work products and processes; Document the results of the reviews; and Track change requests and problem reports to closure.

#### **3.6.1.7 Conduct Milestone Reviews**

Project managers, systems engineering, and software engineering shall Conduct reviews at meaningful points in the project's schedule, such as the completion of selected stages, with relevant stakeholders; Review the commitments, plan, status, and risks of the project; Identify and document significant issues and their impacts; Document the results of the review, action items, and decisions; and Track action items to closure.

### 3.6.2 Manage Corrective Action to Closure

#### **3.6.2.1 Analyze Issues**

Project managers, systems engineering, and software engineering shall Gather issues for analysis and Analyze issues to determine need for corrective action.

#### **3.6.2.2 Take Corrective Action**

Project managers, systems engineering, and software engineering shall Determine and document the appropriate actions needed to address the identified issues; Review and get agreement with relevant stakeholders on the actions to be taken; and Negotiate changes to internal and external commitments.

#### **3.6.2.3 Manage Corrective Action**

Project managers, systems engineering, and software engineering shall Monitor corrective actions for completion; Analyze results of corrective actions to determine the effectiveness of the corrective actions; and Determine and document appropriate actions to correct deviations from planned results for corrective actions.

### 3.7 OUTPUTS

3.7.1 **Project monitoring results.** Records, reports, documents, or archives of monitoring project planning parameters, commitments, risks, data management, stakeholder involvement, progress reviews, and milestone reviews (to include measurement and data collection, earned value analysis, forecasting, replanning, and rebaselining the project plan).

3.7.2 **Project monitoring corrective actions.** Documented direction for executing the project work to bring expected future performance of the project work in line with the project management plan.

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4.0 SUPPLIER AGREEMENT MANAGEMENT (SAM)

## 4.1 PURPOSE

The purpose of Supplier Agreement Management (SAM) is to manage the acquisition of products from suppliers.

## 4.2 REVISION HISTORY

Author	Description	Initials

## 4.3 PERSONS AFFECTED

Project manager, systems engineering, and software engineering.

## 4.4 POLICY

The policy of this organization is to ensure that:

4.4.1 Project managers, systems engineering, and software engineering Establish Supplier Agreements and Satisfy Supplier Agreements for the system under development.

## 4.5 RESPONSIBILITIES

4.5.1 Project managers, systems engineering, and software engineering are responsible for Determine Acquisition Type, Select Suppliers, and Establish Supplier Agreements for the system under development.

4.5.2 Project managers, systems engineering, and software engineering are responsible for Execute the Supplier Agreement, Monitor Selected Supplier Processes, Evaluate Selected Supplier Work Products, Accept the Acquired Product, and Transition Products for the system under development.

## 4.6 PROCEDURE

### 4.6.1 Establish Supplier Agreements

#### 4.6.1.1 Determine Acquisition Type

#### 4.6.1.2 Select Suppliers

Project managers, systems engineering, and software engineering shall Establish and document criteria for evaluating potential suppliers; Identify potential suppliers and distribute solicitation material and requirements to them; Evaluate proposals according to evaluation criteria; Evaluate risks associated with each proposed supplier; Evaluate proposed suppliers' ability to perform the work; and Select the supplier.

#### 4.6.1.3 Establish Supplier Agreements

Project managers, systems engineering, and software engineering shall Revise the requirements (e.g., product requirements and service level requirements) to be fulfilled by the supplier to reflect negotiations with the supplier when necessary; Document what the project will provide to the supplier; Document the supplier agreement; Periodically review the supplier agreement to ensure it accurately reflects the project's relationship with the supplier and current risks and market conditions; Ensure that all parties to the agreement understand and agree to all requirements before implementing the agreement or any changes; Revise the supplier agreement as necessary to reflect changes to the supplier's processes or work products; and Revise the project's plans and commitments, including changes to the project's processes or work products, as necessary to reflect the supplier agreement.

### 4.6.2 Satisfy Supplier Agreements

#### 4.6.2.1 Execute the Supplier Agreement

Project managers, systems engineering, and software engineering shall Monitor supplier progress and performance (schedule, effort, cost, and technical performance) as defined in the supplier agreement; Conduct reviews with the supplier as specified in the supplier agreement; Conduct technical reviews with the supplier as defined in the supplier agreement; Conduct management reviews with the supplier as defined in the supplier agreement; Use the results of reviews to improve the supplier's performance and to establish and nurture long-term relationships with preferred suppliers; and Monitor risks



involving the supplier and take corrective action as necessary.

#### 4.6.2.2 Monitor Selected Supplier Processes

Project managers, systems engineering, and software engineering shall Identify the supplier processes that are critical to the success of the project; Monitor the selected supplier's processes for compliance with requirements of the agreement; and Analyze the results of monitoring the selected processes to detect issues as early as possible that may affect the supplier's ability to satisfy the requirements of the agreement.

#### 4.6.2.3 Evaluate Selected Supplier Work Products

Project managers, systems engineering, and software engineering shall Identify those work products that are critical to the success of the project and that should be evaluated to help detect issues early; Evaluate the selected work products; and Determine and document actions needed to address deficiencies identified in the evaluations.

#### 4.6.2.4 Accept the Acquired Product

Project managers, systems engineering, and software engineering shall Define the acceptance procedures; Review and obtain agreement with relevant stakeholders on the acceptance procedures before the acceptance review or test; Verify that the acquired products satisfy their requirements; Confirm that the non-technical commitments associated with the acquired work product are satisfied; Document the results of the acceptance review or test; Establish and obtain supplier agreement on an action plan for any acquired work products that do not pass their acceptance review or test; and Identify, document, and track action items to closure.

#### 4.6.2.5 Transition Products

Project managers, systems engineering, and software engineering shall Ensure that there are appropriate facilities to receive, store, use, and maintain the acquired products; Ensure that appropriate training is provided for those involved in receiving, storing, using, and maintaining the acquired products; and Ensure that storing, distributing, and using the acquired products are performed according to the terms and conditions specified in the supplier agreement or license.

### 4.7 OUTPUTS

- 4.7.1 **Supplier agreements.** Mutually binding agreements that legally obligate the supplier or seller to provide the specified product, service, or result, and obligate the customer, buyer, or project to pay for it, which may consist of contracts, subcontracts, licenses, service level agreements, memorandums of agreement, or similar legally-binding documents.
- 4.7.2 **Supplier agreement results.** Records, reports, documents, or archives of executing the supplier agreement, monitoring selected supplier processes, evaluating selected supplier work products, accepting the acquired product, and transitioning supplier products (to include supplier project, process, and product measurement, acceptance testing, and transition).

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5.0 MEASUREMENT AND ANALYSIS (MA)

## 5.1 PURPOSE

The purpose of Measurement and Analysis (MA) is to develop and sustain a measurement capability that is used to support management information needs.

## 5.2 REVISION HISTORY

Author	Description	Initials

## 5.3 PERSONS AFFECTED

Project manager, systems engineering, and software engineering.

## 5.4 POLICY

The policy of this organization is to ensure that:

5.4.1 Project managers, systems engineering, and software engineering Align Measurement and Analysis Activities and Provide Measurement Results for the system under development.

## 5.5 RESPONSIBILITIES

5.5.1 Project managers, systems engineering, and software engineering are responsible for Establish Measurement Objectives, Specify Measures, Specify Data Collection and Storage Procedures, and Specify Analysis Procedures for the system under development.

5.5.2 Project managers, systems engineering, and software engineering are responsible for Collect Measurement Data, Analyze Measurement Data, Store Data and Results, and Communicate Results for the system under development.

## 5.6 PROCEDURE

### 5.6.1 Align Measurement and Analysis Activities

#### 5.6.1.1 Establish Measurement Objectives

Project managers, systems engineering, and software engineering shall Document information needs and objectives; Prioritize information needs and objectives; Document, review, and update measurement objectives; Provide feedback for refining and clarifying information needs and objectives as necessary; and Maintain traceability of the measurement objectives to the identified information needs and objectives.

#### 5.6.1.2 Specify Measures

Project managers, systems engineering, and software engineering shall Identify candidate measures based on documented measurement objectives; Identify existing measures that already address the measurement objectives; Specify operational definitions for the measures; and Prioritize, review, and update measures.

#### 5.6.1.3 Specify Data Collection and Storage Procedures

Project managers, systems engineering, and software engineering shall Identify existing sources of data that are generated from current work products, processes, or transactions; Identify measures for which data are needed, but are not currently available; Specify how to collect and store the data for each required measure; Create data collection mechanisms and process guidance; Support automatic collection of the data where appropriate and feasible; Prioritize, review, and update data collection and storage procedures; and Update measures and measurement objectives as necessary.

#### 5.6.1.4 Specify Analysis Procedures

Project managers, systems engineering, and software engineering shall Specify and prioritize the analyses that will be conducted and the reports that will be prepared; Select appropriate data analysis methods and tools; Specify administrative procedures for analyzing the data and communicating the results; Review and update the proposed content and format of the specified analyses and reports; Update measures and measurement objectives as necessary; and Specify criteria for evaluating the utility

of the analysis results and for evaluating the conduct of the measurement and analysis activities.

#### 5.6.2 Provide Measurement Results

##### 5.6.2.1 Collect Measurement Data

Project managers, systems engineering, and software engineering shall Obtain the data for base measures; Generate the data for derived measures; and Perform data integrity checks as close to the source of the data as possible.

##### 5.6.2.2 Analyze Measurement Data

Project managers, systems engineering, and software engineering shall Conduct initial analyses, interpret the results, and draw preliminary conclusions; Conduct additional measurement and analysis as necessary, and prepare results for presentation; Review the initial results with relevant stakeholders; and Refine criteria for future analyses.

##### 5.6.2.3 Store Data and Results

Project managers, systems engineering, and software engineering shall Review the data to ensure their completeness, integrity, accuracy, and currency; Store the data according to the data storage procedures; Make the stored contents available for use only by appropriate groups and personnel; and Prevent the stored information from being used inappropriately.

##### 5.6.2.4 Communicate Results

Project managers, systems engineering, and software engineering shall Keep relevant stakeholders apprised of measurement results on a timely basis and Assist relevant stakeholders in understanding the results.

#### 5.7 OUTPUTS

5.7.1 **Measurement and analysis plan.** A document that specifies the objectives of measurement and analysis such that they are aligned with identified information needs and objectives; specifies the measures, analysis techniques, and mechanisms for data collection, data storage, reporting, and feedback; and specifies how to collect, store, analyze, and report the data.

5.7.2 **Measurement and analysis results.** Records, reports, documents, or archives of collecting measurement data, analyzing measurement data, storing data and results, and communicating results (to include raw measurement data, synthesized or aggregated data, results of data validation for long-term storage and future usage, and trend reports).

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6.0 PROCESS AND PRODUCT QUALITY ASSURANCE (PPQA)

## 6.1 PURPOSE

The purpose of Process and Product Quality Assurance (PPQA) is to provide staff and management with objective insight into processes and associated work products.

## 6.2 REVISION HISTORY

Author	Description	Initials

## 6.3 PERSONS AFFECTED

Project manager, systems engineering, and software engineering.

## 6.4 POLICY

The policy of this organization is to ensure that:

6.4.1 Project managers, systems engineering, and software engineering Objectively Evaluate Processes and Work Products and Provide Objective Insight for the system under development.

## 6.5 RESPONSIBILITIES

6.5.1 Project managers, systems engineering, and software engineering are responsible for Objectively Evaluate Processes and Objectively Evaluate Work Products and Services for the system under development.

6.5.2 Project managers, systems engineering, and software engineering are responsible for Communicate and Ensure Resolution of Noncompliance Issues and Establish Records for the system under development.

## 6.6 PROCEDURE

### 6.6.1 Objectively Evaluate Processes and Work Products

#### 6.6.1.1 Objectively Evaluate Processes

Project managers, systems engineering, and software engineering shall Promote an environment (created as part of project management) that encourages employee participation in identifying and reporting quality issues; Establish and maintain clearly stated criteria for the evaluations; Use the stated criteria to evaluate performed processes for adherence to process descriptions, standards, and procedures; Identify each noncompliance found during the evaluation; and Identify lessons learned that could improve processes for future products and services.

#### 6.6.1.2 Objectively Evaluate Work Products and Services

Project managers, systems engineering, and software engineering shall Select work products to be evaluated, based on documented sampling criteria if sampling is used; Establish and maintain clearly stated criteria for the evaluation of work products; Use the stated criteria during the evaluations of work products; Evaluate work products before they are delivered to the customer; Evaluate work products at selected milestones in their development; Perform in-progress or incremental evaluations of work products and services against process descriptions, standards, and procedures; Identify each case of noncompliance found during the evaluations; and Identify lessons learned that could improve processes for future products and services.

### 6.6.2 Provide Objective Insight

#### 6.6.2.1 Communicate and Ensure Resolution of Noncompliance Issues

Project managers, systems engineering, and software engineering shall Resolve each noncompliance with the appropriate members of the staff where possible; Document noncompliance issues when they cannot be resolved within the project; Escalate noncompliance issues that cannot be resolved within the project to the appropriate level of management designated to receive and act on noncompliance issues; Analyze the noncompliance issues to see if there are any quality trends that can be identified and addressed; Ensure that relevant stakeholders are aware of the results of evaluations and the quality trends in a timely manner; Periodically review open noncompliance issues and trends with the manager

designated to receive and act on noncompliance issues; and Track noncompliance issues to resolution.

#### **6.6.2.2 Establish Records**

Project managers, systems engineering, and software engineering shall Record process and product quality assurance activities in sufficient detail such that status and results are known and Revise the status and history of the quality assurance activities as necessary.

### **6.7 OUTPUTS**

- 6.7.1 **Process and product assurance plan.** A component or a subsidiary plan of the project plan that describes how the project team will implement the performing organization's quality policy to objectively evaluate processes, objectively evaluate work products and services, communicate and ensure resolution of noncompliance issues, and establish records.
- 6.7.2 **Process and product assurance results.** Records, reports, documents, or archives of objectively evaluating processes, work products, and services; communicating and ensuring resolution of noncompliance issues; and establishing records (to include evaluation reports, noncompliance reports, corrective actions, quality trends, and evaluation logs).

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7.0 CONFIGURATION MANAGEMENT (CM)

## 7.1 PURPOSE

The purpose of Configuration Management (CM) is to establish and maintain the integrity of work products using configuration identification, configuration control, configuration status accounting, and configuration audits.

## 7.2 REVISION HISTORY

Author	Description	Initials

## 7.3 PERSONS AFFECTED

Project manager, systems engineering, and software engineering.

## 7.4 POLICY

The policy of this organization is to ensure that:

7.4.1 Project managers, systems engineering, and software engineering Establish Baselines, Track and Control Changes, and Establish Integrity for the system under development.

## 7.5 RESPONSIBILITIES

7.5.1 Project managers, systems engineering, and software engineering are responsible for Identify Configuration Items, Establish a Configuration Management System, and Create or Release Baselines for the system under development.

7.5.2 Project managers, systems engineering, and software engineering are responsible for Track Change Requests and Control Configuration Items for the system under development.

7.5.3 Project managers, systems engineering, and software engineering are responsible for Establish Configuration Management Records, and Perform Configuration Audits for the system under development.

## 7.6 PROCEDURE

### 7.6.1 Establish Baselines

#### 7.6.1.1 Identify Configuration Items

Project managers, systems engineering, and software engineering shall Select the configuration items and the work products that compose them based on documented criteria; Assign unique identifiers to configuration items; Specify the important characteristics of each configuration item; Specify when each configuration item is placed under configuration management; and Identify the owner responsible for each configuration item.

#### 7.6.1.2 Establish a Configuration Management System

Project managers, systems engineering, and software engineering shall Establish a mechanism to manage multiple control levels of configuration management; Store and retrieve configuration items in a configuration management system; Share and transfer configuration items between control levels within the configuration management system; Store and recover archived versions of configuration items; Store, update, and retrieve configuration management records; Create configuration management reports from the configuration management system; Preserve the contents of the configuration management system; and Revise the configuration management structure as necessary.

#### 7.6.1.3 Create or Release Baselines

Project managers, systems engineering, and software engineering shall Obtain authorization from the configuration control board (CCB) before creating or releasing baselines of configuration items; Create or release baselines only from configuration items in the configuration management system; Document the set of configuration items that are contained in a baseline; and Make the current set of baselines readily available.

### 7.6.2 Track and Control Changes

#### 7.6.2.1 Track Change Requests

Project managers, systems engineering, and software engineering shall Initiate and record change requests in the change request database; Analyze the impact of changes and fixes proposed in the change requests; Review change requests that will be addressed in the next baseline with the relevant stakeholders and get their agreement; and Track the status of change requests to closure.

#### **7.6.2.2 Control Configuration Items**

Project managers, systems engineering, and software engineering shall Control changes to configuration items throughout the life of the product; Obtain appropriate authorization before changed configuration items are entered into the configuration management system; Check in and check out configuration items from the configuration management system for incorporation of changes in a manner that maintains the correctness and integrity of the configuration items; Perform reviews to ensure that changes have not caused unintended effects on the baselines (e.g., ensure that the changes have not compromised the safety and/or security of the system); and Record changes to configuration items and the reasons for the changes as appropriate.

### **7.6.3 Establish Integrity**

#### **7.6.3.1 Establish Configuration Management Records**

Project managers, systems engineering, and software engineering shall Record configuration management actions in sufficient detail so the content and status of each configuration item is known and previous versions can be recovered; Ensure that relevant stakeholders have access to and knowledge of the configuration status of the configuration items; Specify the latest version of the baselines; Identify the version of configuration items that constitute a particular baseline; Describe the differences between successive baselines; and Revise the status and history (i.e., changes and other actions) of each configuration item as necessary.

#### **7.6.3.2 Perform Configuration Audits**

Project managers, systems engineering, and software engineering shall Assess the integrity of the baselines; Confirm that the configuration management records correctly identify the configuration items; Review the structure and integrity of the items in the configuration management system; Confirm the completeness and correctness of the items in the configuration management system; Confirm compliance with applicable configuration management standards and procedures; and Track action items from the audit to closure.

## **7.7 OUTPUTS**

- 7.7.1 **Configuration baseline.** The configuration information formally designated at a specific time during a product's or product component's life. Configuration baselines, plus approved changes from those baselines, constitute the current configuration information.
- 7.7.2 **Configuration control results.** Records, reports, documents, or archives of evaluating, coordinating, approving or disapproving, and implementing changes to configuration items after formal establishment of their configuration identification.
- 7.7.3 **Configuration management results.** Records, reports, documents, or archives of identifying configuration items, establishing a configuration management system, creating or releasing baselines, tracking change requests, controlling configuration items, establishing configuration management records, and performing configuration audits (to include identified configuration items, change requests, baselines, revisions, archives, changes, status, audits, and actions).

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8.0 REQUIREMENTS DEVELOPMENT (RD)

## 8.1 PURPOSE

The purpose of Requirements Development (RD) is to produce and analyze customer, product, and product component requirements.

## 8.2 REVISION HISTORY

Author	Description	Initials

## 8.3 PERSONS AFFECTED

Project manager, systems engineering, and software engineering.

## 8.4 POLICY

The policy of this organization is to ensure that:

8.4.1 Project managers, systems engineering, and software engineering Develop Customer Requirements, Develop Product Requirements, and Analyze and Validate Requirements for the system under development.

## 8.5 RESPONSIBILITIES

8.5.1 Project managers, systems engineering, and software engineering are responsible for Elicit Needs and Develop the Customer Requirements for the system under development.

8.5.2 Project managers, systems engineering, and software engineering are responsible for Establish Product and Product Component Requirements, Allocate Product Component Requirements, and Identify Interface Requirements for the system under development.

8.5.3 Project managers, systems engineering, and software engineering are responsible for Establish Operational Concepts and Scenarios, Establish a Definition of Required Functionality, Analyze Requirements, Analyze Requirements to Achieve Balance, and Validate Requirements for the system under development.

## 8.6 PROCEDURE

### 8.6.1 Develop Customer Requirements

#### 8.6.1.1 Elicit Needs

Project managers, systems engineering, and software engineering shall Engage relevant stakeholders using methods for eliciting needs, expectations, constraints, and external interfaces.

#### 8.6.1.2 Develop the Customer Requirements

Project managers, systems engineering, and software engineering shall Translate the stakeholder needs, expectations, constraints, and interfaces into documented customer requirements and Define constraints for verification and validation.

### 8.6.2 Develop Product Requirements

#### 8.6.2.1 Establish Product and Product Component Requirements

Project managers, systems engineering, and software engineering shall Develop requirements in technical terms necessary for product and product component design; Derive requirements that result from design decisions; and Establish and maintain relationships between requirements for consideration during change management and requirements allocation.

#### 8.6.2.2 Allocate Product Component Requirements

Project managers, systems engineering, and software engineering shall Allocate requirements to functions; Allocate requirements to product components; Allocate design constraints to product components; and Document relationships among allocated requirements.

#### 8.6.2.3 Identify Interface Requirements

Project managers, systems engineering, and software engineering shall Identify interfaces both external to the product and internal to the product (i.e., between functional partitions or objects) and Develop the



requirements for the identified interfaces.

### 8.6.3 Analyze and Validate Requirements

#### 8.6.3.1 Establish Operational Concepts and Scenarios

Project managers, systems engineering, and software engineering shall Develop operational concepts and scenarios that include functionality, performance, maintenance, support, and disposal as appropriate; Define the environment in which the product or product component will operate, including boundaries and constraints; Review operational concepts and scenarios to refine and discover requirements; and Develop a detailed operational concept, as products and product components are selected, that defines the interaction of the product, the end user, and the environment, and that satisfies the operational, maintenance, support, and disposal needs.

#### 8.6.3.2 Establish a Definition of Required Functionality

Project managers, systems engineering, and software engineering shall Analyze and quantify functionality required by end users; Analyze requirements to identify logical or functional partitions (e.g., subfunctions); Partition requirements into groups, based on established criteria (e.g., similar functionality, performance, or coupling), to facilitate and focus the requirements analysis; Consider the sequencing of time-critical functions both initially and subsequently during product component development; Allocate customer requirements to functional partitions, objects, people, or support elements to support the synthesis of solutions; and Allocate functional and performance requirements to functions and subfunctions.

#### 8.6.3.3 Analyze Requirements

Project managers, systems engineering, and software engineering shall Analyze stakeholder needs, expectations, constraints, and external interfaces to remove conflicts and to organize into related subjects; Analyze requirements to determine whether they satisfy the objectives of higher level requirements; Analyze requirements to ensure that they are complete, feasible, realizable, and verifiable; Identify key requirements that have a strong influence on cost, schedule, functionality, risk, or performance; Identify technical performance measures that will be tracked during the development effort; and Analyze operational concepts and scenarios to refine the customer needs, constraints, and interfaces and to discover new requirements.

#### 8.6.3.4 Analyze Requirements to Achieve Balance

Project managers, systems engineering, and software engineering shall Use proven models, simulations, and prototyping to analyze the balance of stakeholder needs and constraints; Perform a risk assessment on the requirements and functional architecture; and Examine product lifecycle concepts for impacts of requirements on risks.

#### 8.6.3.5 Validate Requirements

Project managers, systems engineering, and software engineering shall Analyze the requirements to determine the risk that the resulting product will not perform appropriately in its intended-use environment; Explore the adequacy and completeness of requirements by developing product representations (e.g., prototypes, simulations, models, scenarios, and storyboards) and by obtaining feedback about them from relevant stakeholders; and Assess the design as it matures in the context of the requirements validation environment to identify validation issues and expose unstated needs and customer requirements.

## 8.7 OUTPUTS

- 8.7.1 **Customer requirements.** The result of eliciting, consolidating, and resolving conflicts among the needs, expectations, constraints, and interfaces of the product's relevant stakeholders in a way that is acceptable to the customer.
- 8.7.2 **Product requirements.** A refinement of the customer requirements into the developers' language, making implicit requirements into explicit derived requirements (e.g., derived requirements and product component requirements).
- 8.7.3 **Requirements analysis.** The determination of product-specific performance and functional characteristics based on analyses of customer needs, expectations, and constraints; operational concept; projected utilization environments for people, products, and processes; and measures of effectiveness.

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9.0 TECHNICAL SOLUTION (TS)

## 9.1 PURPOSE

The purpose of Technical Solution (TS) is to design, develop, and implement solutions to requirements. Solutions, designs, and implementations encompass products, product components, and product-related lifecycle processes either singly or in combination as appropriate.

## 9.2 REVISION HISTORY

Author	Description	Initials

## 9.3 PERSONS AFFECTED

Project manager, systems engineering, and software engineering.

## 9.4 POLICY

The policy of this organization is to ensure that:

9.4.1 Project managers, systems engineering, and software engineering Select Product Component Solutions, Develop the Design, and Implement the Product Design for the system under development.

## 9.5 RESPONSIBILITIES

9.5.1 Project managers, systems engineering, and software engineering are responsible for Develop Alternative Solutions and Selection Criteria and Select Product Component Solutions for the system under development.

9.5.2 Project managers, systems engineering, and software engineering are responsible for Design the Product or Product Component, Establish a Technical Data Package, Design Interfaces Using Criteria, and Perform Make, Buy, or Reuse Analyses for the system under development.

9.5.3 Project managers, systems engineering, and software engineering are responsible for Implement the Design and Develop Product Support Documentation for the system under development.

## 9.6 PROCEDURE

### 9.6.1 Select Product Component Solutions

#### 9.6.1.1 Develop Alternative Solutions and Selection Criteria

Project managers, systems engineering, and software engineering shall Identify screening criteria to select a set of alternative solutions for consideration; Identify technologies currently in use and new product technologies for competitive advantage; Identify candidate COTS products that satisfy the requirements; Generate alternative solutions; Obtain a complete requirements allocation for each alternative; and Develop the criteria for selecting the best alternative solution.

#### 9.6.1.2 Select Product Component Solutions

Project managers, systems engineering, and software engineering shall Evaluate each alternative solution/set of solutions against the selection criteria established in the context of the operating concepts and scenarios; Based on the evaluation of alternatives, assess the adequacy of the selection criteria and update these criteria as necessary; Identify and resolve issues with the alternative solutions and requirements; Select the best set of alternative solutions that satisfy the established selection criteria; Establish the requirements associated with the selected set of alternatives as the set of allocated requirements to those product components; Identify the product component solutions that will be reused or acquired; and Establish and maintain the documentation of the solutions, evaluations, and rationale.

### 9.6.2 Develop the Design

#### 9.6.2.1 Design the Product or Product Component

Project managers, systems engineering, and software engineering shall Establish and maintain criteria against which the design can be evaluated; Identify, develop, or acquire the design methods appropriate for the product; Ensure that the design adheres to applicable design standards and criteria; Ensure that the design adheres to allocated requirements; and Document the design.

### 9.6.2.2 Establish a Technical Data Package

Project managers, systems engineering, and software engineering shall Determine the number of levels of design and the appropriate level of documentation for each design level; Base detailed design descriptions on the allocated product component requirements, architecture, and higher level designs; Document the design in the technical data package; Document the rationale for key (i.e., significant effect on cost, schedule, or technical performance) decisions made or defined; and Revise the technical data package as necessary.

### 9.6.2.3 Design Interfaces Using Criteria

Project managers, systems engineering, and software engineering shall Define interface criteria; Identify interfaces associated with other product components; Identify interfaces associated with external items; Identify interfaces between product components and the product related lifecycle processes; Apply the criteria to the interface design alternatives; and Document the selected interface designs and the rationale for the selection.

### 9.6.2.4 Perform Make, Buy, or Reuse Analyses

Project managers, systems engineering, and software engineering shall Develop criteria for the reuse of product component designs; Analyze designs to determine if product components should be developed, reused, or purchased; and Analyze implications for maintenance when considering purchased or non-developmental (e.g., COTS, government off the shelf, and reuse) items.

## 9.6.3 Implement the Product Design

### 9.6.3.1 Implement the Design

Project managers, systems engineering, and software engineering shall Use effective methods to implement the product components; Adhere to applicable standards and criteria; Conduct peer reviews of the selected product components; Perform unit testing of the product component as appropriate; and Revise the product component as necessary.

### 9.6.3.2 Develop Product Support Documentation

Project managers, systems engineering, and software engineering shall Review the requirements, design, product, and test results to ensure that issues affecting the installation, operation, and maintenance documentation are identified and resolved; Use effective methods to develop the installation, operation, and maintenance documentation; Adhere to the applicable documentation standards; Develop preliminary versions of the installation, operation, and maintenance documentation in early phases of the project lifecycle for review by the relevant stakeholders; Conduct peer reviews of the installation, operation, and maintenance documentation; and Revise the installation, operation, and maintenance documentation as necessary.

## 9.7 OUTPUTS

- 9.7.1 **Product component solutions.** Product component solutions selected by the analysis of the performance, operational effectiveness, operational suitability, and estimated costs of alternative systems to meet a mission capability. The analysis assesses the advantages and disadvantages of alternatives product component solutions being considered to satisfy capabilities, including the sensitivity of each alternative to possible changes in key assumptions or variables.
- 9.7.2 **Product design.** A specification or representation of a system that identifies the system components and their associated functionality, describes connectivity of components, describes the mapping of functionality onto hardware and software components, a mapping of the software architecture onto the hardware architecture, and human interaction with these components.
- 9.7.3 **Product component.** A work product that is a lower level component of the product. Product components are integrated to produce the product. There may be multiple levels of product components (e.g., work product, deliverable, or product).

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10.0 PRODUCT INTEGRATION (PI)

## 10.1 PURPOSE

The purpose of Product Integration (PI) is to assemble the product from the product components, ensure that the product, as integrated, functions properly, and deliver the product.

## 10.2 REVISION HISTORY

Author	Description	Initials

## 10.3 PERSONS AFFECTED

Project manager, systems engineering, and software engineering.

## 10.4 POLICY

The policy of this organization is to ensure that:

10.4.1 Project managers, systems engineering, and software engineering Prepare for Product Integration, Ensure Interface Compatibility, and Assemble Product Components and Deliver the Product for the system under development.

## 10.5 RESPONSIBILITIES

10.5.1 Project managers, systems engineering, and software engineering are responsible for Determine Integration Sequence, Establish the Product Integration Environment, and Establish Product Integration Procedures and Criteria for the system under development.

10.5.2 Project managers, systems engineering, and software engineering are responsible for Review Interface Descriptions for Completeness, and Manage Interfaces for the system under development.

10.5.3 Project managers, systems engineering, and software engineering are responsible for Confirm Readiness of Product Components for Integration, Assemble Product Components, Evaluate Assembled Product Components, and Package and Deliver the Product or Product Component for the system under development.

## 10.6 PROCEDURE

### 10.6.1 Prepare for Product Integration

#### 10.6.1.1 Determine Integration Sequence

Project managers, systems engineering, and software engineering shall Identify the product components to be integrated; Identify the verifications to be performed during the integration of the product components; Identify alternative product component integration sequences; Select the best integration sequence; Periodically review the product integration sequence and revise as needed; and Record the rationale for decisions made and deferred.

#### 10.6.1.2 Establish the Product Integration Environment

Project managers, systems engineering, and software engineering shall Identify the requirements for the product integration environment; Identify verification criteria and procedures for the product integration environment; Decide whether to make or buy the needed product integration environment; Develop an integration environment if a suitable environment cannot be acquired; Maintain the product integration environment throughout the project; and Dispose of those portions of the environment that are no longer useful.

#### 10.6.1.3 Establish Product Integration Procedures and Criteria

Project managers, systems engineering, and software engineering shall Establish and maintain product integration procedures for the product components; Establish and maintain criteria for product component integration and evaluation; and Establish and maintain criteria for validation and delivery of the integrated product.

### 10.6.2 Ensure Interface Compatibility

#### 10.6.2.1 Review Interface Descriptions for Completeness

Project managers, systems engineering, and software engineering shall Review interface data for completeness and ensure complete coverage of all interfaces; Ensure that product components and interfaces are marked to ensure easy and correct connection to the joining product component; and Periodically review the adequacy of interface descriptions.

#### 10.6.2.2 Manage Interfaces

Project managers, systems engineering, and software engineering shall Ensure the compatibility of the interfaces throughout the life of the product; Resolve conflict, noncompliance, and change issues; and Maintain a repository for interface data accessible to project participants.

### 10.6.3 Assemble Product Components and Deliver the Product

#### 10.6.3.1 Confirm Readiness of Product Components for Integration

Project managers, systems engineering, and software engineering shall Track the status of all product components as soon as they become available for integration; Ensure that product components are delivered to the product integration environment in accordance with the product integration sequence and available procedures; Confirm the receipt of each properly identified product component; Ensure that each received product component meets its description; Check the configuration status against the expected configuration; and Perform a pre-check (e.g., by a visual inspection and using basic measures) of all the physical interfaces before connecting product components together.

#### 10.6.3.2 Assemble Product Components

Project managers, systems engineering, and software engineering shall Ensure the readiness of the product integration environment; Ensure that the assembly sequence is properly performed; and Revise the product integration sequence and available procedures as appropriate.

#### 10.6.3.3 Evaluate Assembled Product Components

Project managers, systems engineering, and software engineering shall Conduct the evaluation of assembled product components following the product integration sequence and available procedures and Record the evaluation results.

#### 10.6.3.4 Package and Deliver the Product or Product Component

Project managers, systems engineering, and software engineering shall Review the requirements, design, product, verification results, and documentation to ensure that issues affecting the packaging and delivery of the product are identified and resolved; Use effective methods to package and deliver the assembled product; Satisfy the applicable requirements and standards for packaging and delivering the product; Prepare the operational site for installation of the product; Deliver the product and related documentation and confirm receipt; and Install the product at the operational site and confirm correct operation.

## 10.7 OUTPUTS

- 10.7.1 **Product integration plan.** The product integration plan provides the high-level planning information for integrating the components into the product. It identifies stakeholders, milestones, and any other applicable information.
- 10.7.2 **Interface control document.** A document that describes the relationship between two components of a system in terms of data items and messages passed, protocols observed, timing, and sequencing of events (e.g., describes the interaction between a user and the system, a software component and a hardware device or two software components, etc.).
- 10.7.3 **Assembled product components.** Product components that are assembled into larger, more complex product components. These assembled product components are checked for correct interoperation and this process continues until product integration is complete and the individual product components have been successfully integrated into a product.

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Level 3 - Defined

11.0 VERIFICATION (VER)

## 11.1 PURPOSE

The purpose of Verification (VER) is to ensure that selected work products meet their specified requirements.

## 11.2 REVISION HISTORY

Author	Description	Initials

## 11.3 PERSONS AFFECTED

Project manager, systems engineering, and software engineering.

## 11.4 POLICY

The policy of this organization is to ensure that:

11.4.1 Project managers, systems engineering, and software engineering Prepare for Verification, Perform Peer Reviews, and Verify Selected Work Products for the system under development.

## 11.5 RESPONSIBILITIES

11.5.1 Project managers, systems engineering, and software engineering are responsible for Select Work Products for Verification, Establish the Verification Environment, and Establish Verification Procedures and Criteria for the system under development.

11.5.2 Project managers, systems engineering, and software engineering are responsible for Prepare for Peer Reviews, Conduct Peer Reviews, and Analyze Peer Review Data for the system under development.

11.5.3 Project managers, systems engineering, and software engineering are responsible for Perform Verification and Analyze Verification Results for the system under development.

## 11.6 PROCEDURE

### 11.6.1 Prepare for Verification

#### 11.6.1.1 Select Work Products for Verification

Project managers, systems engineering, and software engineering shall Identify work products for verification; Identify the requirements to be satisfied by each selected work product; Identify the verification methods that are available for use; Define the verification methods to be used for each selected work product; and Submit for integration with the project plan the identification of work products to be verified, the requirements to be satisfied, and the methods to be used.

#### 11.6.1.2 Establish the Verification Environment

Project managers, systems engineering, and software engineering shall Identify verification environment requirements; Identify verification resources that are available for reuse and modification; Identify verification equipment and tools; and Acquire verification support equipment and an environment, such as test equipment and software.

#### 11.6.1.3 Establish Verification Procedures and Criteria

Project managers, systems engineering, and software engineering shall Generate the set of comprehensive, integrated verification procedures for work products and any commercial off-the-shelf products, as necessary; Develop and refine the verification criteria when necessary; Identify the expected results, any tolerances allowed in observation, and other criteria for satisfying the requirements; and Identify any equipment and environmental components needed to support verification.

### 11.6.2 Perform Peer Reviews

#### 11.6.2.1 Prepare for Peer Reviews

Project managers, systems engineering, and software engineering shall Determine what type of peer review will be conducted; Define requirements for collecting data during the peer review; Establish and maintain entry and exit criteria for the peer review; Establish and maintain criteria for requiring another

peer review; Establish and maintain checklists to ensure that the work products are reviewed consistently; Develop a detailed peer review schedule, including the dates for peer review training and for when materials for peer reviews will be available; Ensure that the work product satisfies the peer review entry criteria prior to distribution; Distribute the work product to be reviewed and its related information to the participants early enough to enable participants to adequately prepare for the peer review; Assign roles for the peer review as appropriate; and Prepare for the peer review by reviewing the work product prior to conducting the peer review.

#### 11.6.2.2 Conduct Peer Reviews

Project managers, systems engineering, and software engineering shall Perform the assigned roles in the peer review; Identify and document defects and other issues in the work product; Record the results of the peer review, including the action items; Collect peer review data; Identify action items and communicate the issues to relevant stakeholders; Conduct an additional peer review if the defined criteria indicate the need; and Ensure that the exit criteria for the peer review are satisfied.

#### 11.6.2.3 Analyze Peer Review Data

Project managers, systems engineering, and software engineering shall Record data related to the preparation, conduct, and results of the peer reviews; Store the data for future reference and analysis; Protect the data to ensure that peer review data are not used inappropriately; and Analyze the peer review data.

### 11.6.3 Verify Selected Work Products

#### 11.6.3.1 Perform Verification

Project managers, systems engineering, and software engineering shall Perform verification of selected work products against their requirements; Record the results of verification activities; Identify action items resulting from verification of work products; and Document the “as-run” verification method and the deviations from the available methods and procedures discovered during its performance.

#### 11.6.3.2 Analyze Verification Results

Project managers, systems engineering, and software engineering shall Compare actual results to expected results; Based on the established verification criteria, identify products that have not met their requirements or identify problems with the methods, procedures, criteria, and verification environment; Analyze the verification data on defects; Record all results of the analysis in a report; Use verification results to compare actual measurements and performance to technical performance parameters; and Provide information on how defects can be resolved (including verification methods, criteria, and verification environment) and initiate corrective action.

## 11.7 OUTPUTS

- 11.7.1 **Verification plan.** A document used to confirm that work products properly reflect the requirements specified for them (e.g., verification ensures that “you built it right”). The verification plan ensures the product and intermediate work products are verified against all selected requirements, including customer, product, and product component requirements.
- 11.7.2 **Peer review plan.** A document that describes the review of work products performed by peers during development of the work products to identify defects for removal.
- 11.7.3 **Verification results.** Records, reports, documents, or archives of performing verification and analyzing verification results (to include verification results, verification reports, demonstrations, trouble reports, defects, problem reports, etc.).

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12.0 VALIDATION (VAL)

## 12.1 PURPOSE

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

## 12.2 REVISION HISTORY

Author	Description	Initials

## 12.3 PERSONS AFFECTED

Project manager, systems engineering, and software engineering.

## 12.4 POLICY

The policy of this organization is to ensure that:

12.4.1 Project managers, systems engineering, and software engineering Prepare for Validation and Validate Product or Product Components for the system under development.

## 12.5 RESPONSIBILITIES

12.5.1 Project managers, systems engineering, and software engineering are responsible for Select Products for Validation, Establish the Validation Environment, and Establish Validation Procedures and Criteria for the system under development.

12.5.2 Project managers, systems engineering, and software engineering are responsible for Perform Validation and Analyze Validation Results for the system under development.

## 12.6 PROCEDURE

### 12.6.1 Prepare for Validation

#### 12.6.1.1 Select Products for Validation

Project managers, systems engineering, and software engineering shall Identify the key principles, features, and phases for product or product component validation throughout the life of the project; Determine which categories of user needs (operational, maintenance, training, or support) are to be validated; Select the product and product components to be validated; Select the evaluation methods for product or product component validation; and Review the validation selection, constraints, and methods with relevant stakeholders.

#### 12.6.1.2 Establish the Validation Environment

Project managers, systems engineering, and software engineering shall Identify validation environment requirements; Identify customer-supplied products; Identify reuse items; Identify test equipment and tools; Identify validation resources that are available for reuse and modification; and Plan the availability of resources in detail.

#### 12.6.1.3 Establish Validation Procedures and Criteria

Project managers, systems engineering, and software engineering shall Review the product requirements to ensure that issues affecting validation of the product or product component are identified and resolved; Document the environment, operational scenario, procedures, inputs, outputs, and criteria for the validation of the selected product or product component; and Assess the design as it matures in the context of the validation environment to identify validation issues.

### 12.6.2 Validate Product or Product Components

#### 12.6.2.1 Perform Validation

#### 12.6.2.2 Analyze Validation Results

Project managers, systems engineering, and software engineering shall Compare actual results to expected results; Based on the established validation criteria, identify products and product components



that do not perform suitably in their intended operating environments, or identify problems with the methods, criteria, and/or environment; Analyze the validation data for defects; Record the results of the analysis and identify issues; and Use validation results to compare actual measurements and performance to intended use or operational need.

#### 12.7 OUTPUTS

- 12.7.1 **Validation plan.** A document used to confirm that the product as provided will fulfill its intended use (e.g., validation ensures that “you built the right thing”). The validation plan identifies activities that can be applied to all aspects of the product in any of its intended environments, such as operation, training, manufacturing, maintenance, and support services.
- 12.7.2 **Validation results.** Records, reports, documents, or archives of performing validation and analyzing validation results (to include validation results, validation reports, demonstrations, trouble reports, defects, problem reports, etc.).

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13.0 ORGANIZATIONAL PROCESS FOCUS (OPF)

## 13.1 PURPOSE

The purpose of Organizational Process Focus (OPF) is to plan, implement, and deploy organizational process improvements based on a thorough understanding of the current strengths and weaknesses of the organization's processes and process assets.

## 13.2 REVISION HISTORY

Author	Description	Initials

## 13.3 PERSONS AFFECTED

Project manager, systems engineering, and software engineering.

## 13.4 POLICY

The policy of this organization is to ensure that:

13.4.1 Project managers, systems engineering, and software engineering Determine Process Improvement Opportunities, Plan and Implement Process Improvements, and Deploy Organizational Process Assets and Incorporate Lessons Learned for the system under development.

## 13.5 RESPONSIBILITIES

13.5.1 Project managers, systems engineering, and software engineering are responsible for Establish Organizational Process Needs, Appraise the Organization's Processes, and Identify the Organization's Process Improvements for the system under development.

13.5.2 Project managers, systems engineering, and software engineering are responsible for Establish Process Action Plans and Implement Process Action Plans for the system under development.

13.5.3 Project managers, systems engineering, and software engineering are responsible for Deploy Organizational Process Assets, Deploy Standard Processes, Monitor Implementation, and Incorporate Process-Related Experiences into the Organizational Process Assets for the system under development.

## 13.6 PROCEDURE

### 13.6.1 Determine Process Improvement Opportunities

#### 13.6.1.1 Establish Organizational Process Needs

Project managers, systems engineering, and software engineering shall Identify the policies, standards, and business objectives that are applicable to the organization's processes; Examine relevant process standards and models for best practices; Determine the organization's process-performance objectives; Define the essential characteristics of the organization's processes; Document the organization's process needs and objectives; and Revise the organization's process needs and objectives as needed.

#### 13.6.1.2 Appraise the Organization's Processes

Project managers, systems engineering, and software engineering shall Obtain sponsorship of the process appraisal from senior management; Define the scope of the process appraisal; Determine the method and criteria for process appraisal; Plan, schedule, and prepare for the process appraisal; Conduct the process appraisal; and Document and deliver the appraisal's activities and findings.

#### 13.6.1.3 Identify the Organization's Process Improvements

Project managers, systems engineering, and software engineering shall Determine candidate process improvements; Prioritize the candidate process improvements; Identify and document the process improvements that will be implemented; and Revise the list of planned process improvements to keep it current.

### 13.6.2 Plan and Implement Process Improvements

#### 13.6.2.1 Establish Process Action Plans

Project managers, systems engineering, and software engineering shall Identify strategies, approaches, and actions to address the identified process improvements; Establish process action teams to implement the actions; Document process action plans; Review and negotiate process action plans with relevant stakeholders; and Review process action plans as necessary.

#### **13.6.2.2 Implement Process Action Plans**

Project managers, systems engineering, and software engineering shall Make process action plans readily available to relevant stakeholders; Negotiate and document commitments among the process action teams and revise their process action plans as necessary; Track progress and commitments against process action plans; Conduct joint reviews with the process action teams and relevant stakeholders to monitor the progress and results of the process actions; Plan pilots needed to test selected process improvements; Review the activities and work products of process action teams; Identify, document, and track to closure issues in implementing process action plans; and Ensure that the results of implementing process action plans satisfy the organization's process improvement objectives.

### **13.6.3 Deploy Organizational Process Assets and Incorporate Lessons Learned**

#### **13.6.3.1 Deploy Organizational Process Assets**

Project managers, systems engineering, and software engineering shall Deploy organizational process assets across the organization; Document the changes to the organizational process assets; Deploy the changes that were made to the organizational process assets across the organization; and Provide guidance and consultation on the use of the organizational process assets.

#### **13.6.3.2 Deploy Standard Processes**

Project managers, systems engineering, and software engineering shall Identify projects within the organization that are starting up; Identify active projects that would benefit from implementing the organization's current set of standard processes; Establish plans to implement the organization's current set of standard processes on the identified projects; Assist projects in tailoring the organization's set of standard processes to meet project needs; Maintain records of tailoring and implementing processes on the identified projects; Ensure that the defined processes resulting from process tailoring are incorporated into the plans for process-compliance audits; and As the organization's set of standard processes are updated, identify which projects should implement the changes.

#### **13.6.3.3 Monitor Implementation**

Project managers, systems engineering, and software engineering shall Monitor projects for their use of the organization's process assets and changes to them; Review selected process artifacts created during the life of each project; Review the results of process-compliance evaluations to determine how well the organization's set of standard processes has been deployed; and Identify, document, and track to closure issues related to implementing the organization's set of standard processes.

#### **13.6.3.4 Incorporate Process-Related Experiences into the Organizational Process Assets**

Project managers, systems engineering, and software engineering shall Conduct periodic reviews of the effectiveness and suitability of the organization's set of standard processes and related organizational process assets relative to the organization's business objectives; Obtain feedback about the use of the organizational process assets; Derive lessons learned from defining, piloting, implementing, and deploying the organizational process assets; Make available lessons learned to the people in the organization as appropriate; Analyze the organization's common set of measures; Appraise the processes, methods, and tools in use in the organization and develop recommendations for improving the organizational process assets; Make the best of the organization's processes, methods, and tools available to the people in the organization as appropriate; Manage process improvement proposals; and Establish and maintain records of the organization's process improvement activities.

## **13.7 OUTPUTS**

- 13.7.1 **Appraisal findings.** The results of an appraisal that identify the most important issues, problems, or opportunities for process improvement within the appraisal scope. Appraisal findings are inferences drawn from corroborated objective evidence.
- 13.7.2 **Process improvement plan.** A plan for achieving organizational process improvement objectives based on a thorough understanding of the current strengths and weaknesses of the organization's processes and process assets.
- 13.7.3 **Process improvement results.** Records, reports, documents, or archives of deploying organizational process assets, deploying standard processes, monitoring implementation, and incorporating process-related experiences into the organizational process assets (to include training, changes, status, lessons learned, measurements, etc.).

# CAPABILITY MATURITY MODEL INTEGRATION FOR DEVELOPMENT — VERSION 1.2

Number

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Level 3 - Defined

14.0 ORGANIZATIONAL PROCESS DEFINITION (OPD)

## 14.1 PURPOSE

The purpose of Organizational Process Definition (OPD) is to establish and maintain a usable set of organizational process assets and work environment standards.

## 14.2 REVISION HISTORY

Author	Description	Initials

## 14.3 PERSONS AFFECTED

Project manager, systems engineering, and software engineering.

## 14.4 POLICY

The policy of this organization is to ensure that:

14.4.1 Project managers, systems engineering, and software engineering Establish Organizational Process Assets and Enable IPPD Management for the system under development.

## 14.5 RESPONSIBILITIES

14.5.1 Project managers, systems engineering, and software engineering are responsible for Establish Standard Processes, Establish Lifecycle Model Descriptions, Establish Tailoring Criteria and Guidelines, Establish the Organization's Measurement Repository, Establish the Organization's Process Asset Library, and Establish Work Environment Standards for the system under development.

14.5.2 Project managers, systems engineering, and software engineering are responsible for Establish Empowerment Mechanisms, Establish Rules and Guidelines for Integrated Teams, and Balance Team and Home Organization Responsibilities for the system under development.

## 14.6 PROCEDURE

14.6.1 Establish Organizational Process Assets

### 14.6.1.1 Establish Standard Processes

Project managers, systems engineering, and software engineering shall Decompose each standard process into constituent process elements to the detail needed to understand and describe the process; Specify the critical attributes of each process element; Specify the relationships of the process elements; Ensure that the organization's set of standard processes adheres to applicable policies, standards, and models; Ensure that the organization's set of standard processes satisfies the process needs and objectives of the organization; Ensure that there is appropriate integration among the processes that are included in the organization's set of standard processes; Document the organization's set of standard processes; Conduct peer reviews on the organization's set of standard processes; and Revise the organization's set of standard processes as necessary.

### 14.6.1.2 Establish Lifecycle Model Descriptions

Project managers, systems engineering, and software engineering shall Select lifecycle models based on the needs of projects and the organization; Document the descriptions of the lifecycle models; Conduct peer reviews on the lifecycle models; and Revise the descriptions of the lifecycle models as necessary.

### 14.6.1.3 Establish Tailoring Criteria and Guidelines

Project managers, systems engineering, and software engineering shall Specify the selection criteria and procedures for tailoring the organization's set of standard processes; Specify the standards for documenting the defined processes; Specify the procedures for submitting and obtaining approval of waivers from the requirements of the organization's set of standard processes; Document the tailoring guidelines for the organization's set of standard processes; Conduct peer reviews on the tailoring guidelines; and Revise the tailoring guidelines as necessary.

### 14.6.1.4 Establish the Organization's Measurement Repository

Project managers, systems engineering, and software engineering shall Determine the organization's needs for storing, retrieving, and analyzing measurements; Define a common set of process and product measures for the organization's set of standard processes; Design and implement the measurement repository; Specify the procedures for storing, updating, and retrieving measures; Conduct peer reviews on the definitions of the common set of measures and the procedures for storing and retrieving measures; Enter the specified measures into the repository; Make the contents of the measurement repository available for use by the organization and projects as appropriate; and Revise the measurement repository, common set of measures, and procedures as the organization's needs change.

#### **14.6.1.5 Establish the Organization's Process Asset Library**

Project managers, systems engineering, and software engineering shall Design and implement the organization's process asset library, including the library structure and support environment; Specify the criteria for including items in the library; Specify the procedures for storing and retrieving items; Enter the selected items into the library and catalog them for easy reference and retrieval; Make the items available for use by the projects; Periodically review the use of each item and use the results to maintain the library contents; and Revise the organization's process asset library as necessary.

#### **14.6.1.6 Establish Work Environment Standards**

Project managers, systems engineering, and software engineering shall Evaluate commercially-available work environment standards appropriate for the organization and Adopt existing work environment standards and develop new ones to fill gaps based on the organization's process needs and objectives.

### **14.6.2 Enable IPPD Management**

#### **14.6.2.1 Establish Empowerment Mechanisms**

Project managers, systems engineering, and software engineering shall Determine rules and guidelines for the degree of empowerment provided to people and integrated teams; Determine rules and guidelines for the use of different decision types in making various kinds of team decisions; Define the process for using the decision-making rules and guidelines; Define a process for issue resolution when an issue cannot be decided at the level at which it arose; and Maintain the empowerment mechanisms and the rules and guidelines for decision making.

#### **14.6.2.2 Establish Rules and Guidelines for Integrated Teams**

Project managers, systems engineering, and software engineering shall Establish rules and guidelines for structuring and forming integrated teams; Define the expectations, rules, and guidelines that will guide how the integrated teams work collectively; and Maintain the rules and guidelines for structuring and forming integrated teams.

#### **14.6.2.3 Balance Team and Home Organization Responsibilities**

Project managers, systems engineering, and software engineering shall Establish guidelines for home organization responsibilities that promote integrated team behavior; Establish guidelines for team management responsibilities to ensure integrated team members report appropriately to their home organizations; Establish a performance review process that considers input from both home organization and integrated team leaders; and Maintain the guidelines for balancing team and home organization responsibilities.

## **14.7 OUTPUTS**

- 14.7.1 **Organizational process assets.** Artifacts that relate to describing, implementing, and improving processes (e.g., policies, measurements, process descriptions, and process implementation support tools). The term process assets is used to indicate that these artifacts are developed or acquired to meet the business objectives of the organization, and they represent investments by the organization that are expected to provide current and future business value (e.g., process asset library).
- 14.7.2 **Integrated teaming process.** The policies, processes, and procedures that are part of the organization's set of standard processes and the project's defined process for establishing groups of people with complementary skills and expertise who are committed to delivering specified work products in timely collaboration (by establishing empowerment mechanisms, establishing rules and guidelines for integrated teams, and balancing team and home organization responsibilities).

# CAPABILITY MATURITY MODEL INTEGRATION FOR DEVELOPMENT — VERSION 1.2

Number

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Level 3 - Defined

15.0 ORGANIZATIONAL TRAINING (OT)

## 15.1 PURPOSE

The purpose of Organizational Training (OT) is to develop the skills and knowledge of people so they can perform their roles effectively and efficiently.

## 15.2 REVISION HISTORY

Author	Description	Initials

## 15.3 PERSONS AFFECTED

Project manager, systems engineering, and software engineering.

## 15.4 POLICY

The policy of this organization is to ensure that:

15.4.1 Project managers, systems engineering, and software engineering Establish an Organizational Training Capability and Provide Necessary Training for the system under development.

## 15.5 RESPONSIBILITIES

15.5.1 Project managers, systems engineering, and software engineering are responsible for Establish the Strategic Training Needs, Determine Which Training Needs Are the Responsibility of the Organization, Establish an Organizational Training Tactical Plan, and Establish Training Capability for the system under development.

15.5.2 Project managers, systems engineering, and software engineering are responsible for Deliver Training, Establish Training Records, and Assess Training Effectiveness for the system under development.

## 15.6 PROCEDURE

15.6.1 Establish an Organizational Training Capability

### 15.6.1.1 Establish the Strategic Training Needs

Project managers, systems engineering, and software engineering shall Analyze the organization's strategic business objectives and process improvement plan to identify potential future training needs; Document the strategic training needs of the organization; Determine the roles and skills needed to perform the organization's set of standard processes; Document the training needed to perform the roles in the organization's set of standard processes; Document the training needed to maintain the safe, secure and continued operation of the business; and Revise the organization's strategic needs and required training as necessary.

### 15.6.1.2 Determine Which Training Needs Are the Responsibility of the Organization

Project managers, systems engineering, and software engineering shall Analyze the training needs identified by the various projects and support groups; Negotiate with the various projects and support groups on how their specific training needs will be satisfied; and Document the commitments for providing training support to the projects and support groups.

### 15.6.1.3 Establish an Organizational Training Tactical Plan

Project managers, systems engineering, and software engineering shall Establish plan content; Establish commitments to the plan; and Revise plan and commitments as necessary.

### 15.6.1.4 Establish Training Capability

Project managers, systems engineering, and software engineering shall Select the appropriate approaches to satisfy specific organizational training needs; Determine whether to develop training materials internally or acquire them externally; Develop or obtain training materials; Develop or obtain qualified instructors; Describe the training in the organization's training curriculum; and Revise the training materials and supporting artifacts as necessary.

15.6.2 Provide Necessary Training

**15.6.2.1 Deliver Training**

Project managers, systems engineering, and software engineering shall Select the people who will receive the training necessary to perform their roles effectively; Schedule the training, including any resources, as necessary (e.g., facilities and instructors); Conduct the training; and Track the delivery of training against the plan.

**15.6.2.2 Establish Training Records**

Project managers, systems engineering, and software engineering shall Keep records of all students who successfully complete each training course or other approved training activity as well as those who are unsuccessful; Keep records of all staff who have been waived from specific training; Keep records of all students who successfully complete their designated required training; and Make training records available to the appropriate people for consideration in assignments.

**15.6.2.3 Assess Training Effectiveness**

Project managers, systems engineering, and software engineering shall Assess in-progress or completed projects to determine whether staff knowledge is adequate for performing project tasks; Provide a mechanism for assessing the effectiveness of each training course with respect to established organizational, project, or individual learning (or performance) objectives; and Obtain student evaluations of how well training activities met their needs.

**15.7 OUTPUTS**

- 15.7.1 **Training plan.** A formal, documented plan to deliver the training that is the responsibility of the organization and is necessary for individuals to perform their roles effectively. The training plan addresses the near-term execution of training and is adjusted periodically in response to changes (e.g., in needs or resources) and to evaluations of effectiveness.
- 15.7.2 **Training results.** Records, reports, documents, or archives of delivering training, establishing training records, and assessing training effectiveness (to include training records, courses taken, updates, surveys, evaluations, exams, etc.).

# CAPABILITY MATURITY MODEL INTEGRATION FOR DEVELOPMENT — VERSION 1.2

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Level 3 - Defined

16.0 INTEGRATED PROJECT MANAGEMENT (IPM)

## 16.1 PURPOSE

The purpose of Integrated Project Management (IPM) is to establish and manage the project and the involvement of the relevant stakeholders according to an integrated and defined process tailored from the organization's standard processes.

## 16.2 REVISION HISTORY

Author	Description	Initials

## 16.3 PERSONS AFFECTED

Project manager, systems engineering, and software engineering.

## 16.4 POLICY

The policy of this organization is to ensure that:

16.4.1 Project managers, systems engineering, and software engineering Use the Project's Defined Process, Coordinate and Collaborate with Relevant Stakeholders, and Apply IPPD Principles for the system under development.

## 16.5 RESPONSIBILITIES

16.5.1 Project managers, systems engineering, and software engineering are responsible for Establish the Project's Defined Process, Use Organizational Process Assets for Planning Project Activities, Establish the Project's Work Environment, Integrate Plans, Manage the Project Using the Integrated Plans, and Contribute to the Organizational Process Assets for the system under development.

16.5.2 Project managers, systems engineering, and software engineering are responsible for Manage Stakeholder Involvement, Manage Dependencies, and Resolve Coordination Issues for the system under development.

16.5.3 Project managers, systems engineering, and software engineering are responsible for Establish the Project's Shared Vision, Establish the Integrated Team Structure, Allocate Requirements to Integrated Teams, Establish Integrated Teams, and Ensure Collaboration among Interfacing Teams for the system under development.

## 16.6 PROCEDURE

### 16.6.1 Use the Project's Defined Process

#### 16.6.1.1 Establish the Project's Defined Process

Project managers, systems engineering, and software engineering shall Select a lifecycle model from the organizational process assets; Select the standard processes from the organization's set of standard processes; Tailor the organization's set of standard processes according to the tailoring guidelines; Use other artifacts from the organization's process asset library; Document the project's defined process; Conduct peer reviews of the project's defined process; and Revise the project's defined process.

#### 16.6.1.2 Use Organizational Process Assets for Planning Project Activities

Project managers, systems engineering, and software engineering shall Use the tasks and work products of the project's defined process as a basis for estimating and planning the project's activities and Use the organization's measurement repository in estimating the project's planning parameters.

#### 16.6.1.3 Establish the Project's Work Environment

Project managers, systems engineering, and software engineering shall Plan, design, and install a work environment; Provide ongoing maintenance and operational support for the work environment; Maintain the qualification of the work environment; and Periodically review the work environment.

#### 16.6.1.4 Integrate Plans

Project managers, systems engineering, and software engineering shall Integrate other plans; Incorporate measures; Identify interface risks; Schedule tasks in sequence; Incorporate peer reviews; Incorporate training; Establish entry and exit criteria; Ensure compatibility with stakeholders; and Identify conflicts.

#### 16.6.1.5 Manage the Project Using the Integrated Plans



Project managers, systems engineering, and software engineering shall Implement the project's defined process; Monitor and control the project's activities and work products; Obtain and analyze the selected measures; and Review the project's performance with the current needs, objectives, and requirements.

#### **16.6.1.6 Contribute to the Organizational Process Assets**

Project managers, systems engineering, and software engineering shall Propose process improvements; Store process and product measures; Submit documentation for inclusion; Document lessons learned; and Provide processes associated with tailoring and implementing the organization's standard processes.

### **16.6.2 Coordinate and Collaborate with Relevant Stakeholders**

#### **16.6.2.1 Manage Stakeholder Involvement**

Project managers, systems engineering, and software engineering shall Coordinate with the relevant stakeholders; Ensure that work products are produced; and Develop recommendations and coordinate the actions to resolve problems with the product requirements, architecture, and design.

#### **16.6.2.2 Manage Dependencies**

Project managers, systems engineering, and software engineering shall Conduct reviews with stakeholders; Identify each critical dependency; Establish need dates and plan dates; Review and get agreement on the commitments; Document the critical dependencies; and Track critical dependencies.

#### **16.6.2.3 Resolve Coordination Issues**

Project managers, systems engineering, and software engineering shall Identify and document issues; Communicate issues; Resolve issues; Escalate issues not resolvable; Track the issues to closure; and Communicate with the relevant stakeholders on the status and resolution of the issues.

### **16.6.3 Apply IPPD Principles**

#### **16.6.3.1 Establish the Project's Shared Vision**

Project managers, systems engineering, and software engineering shall Articulate the project's shared vision; Reach consensus on the project's shared vision; Establish a strategy to communicate the project's shared vision; Create presentations for the various audiences; and Ensure activities and tasks are aligned.

#### **16.6.3.2 Establish the Integrated Team Structure**

Project managers, systems engineering, and software engineering shall Establish an integrated team structure and Periodically evaluate and modify the integrated team structure to best meet project needs.

#### **16.6.3.3 Allocate Requirements to Integrated Teams**

Project managers, systems engineering, and software engineering shall Allocate the tasks, responsibilities, and work products; Check that the distribution of requirements and interfaces covers all specified product requirements; and Designate the sponsor for each integrated team.

#### **16.6.3.4 Establish Integrated Teams**

Project managers, systems engineering, and software engineering shall Choose a leader for each integrated team; Allocate resources; Charter each team; Review the composition of an integrated team; Review the composition of a team; and Manage the overall performance of the teams.

#### **16.6.3.5 Ensure Collaboration among Interfacing Teams**

Project managers, systems engineering, and software engineering shall Establish and maintain the boundaries of work product ownership; Establish and maintain interfaces and processes; and Develop, communicate, and distribute among interfacing teams the commitment lists and work plans.

## **16.7 OUTPUTS**

- 16.7.1 **Project's defined process.** The integrated, defined, and managed process tailored from the organization's set of standard processes according to the organization's guidelines; has a maintained process description; and contributes work products, measures, and other process improvement information to the organizational process assets.
- 16.7.2 **Stakeholder involvement results.** Records, reports, documents, or archives of managing stakeholder involvement, managing dependencies, and resolving coordination issues (to include stakeholder meeting agendas, issues, recommendations, defects, action items, dependencies, commitments, status, etc.).
- 16.7.3 **Integrated teaming plan.** A formal, documented plan to create an IPPD environment that enables integrated teams to efficiently meet the project's requirements and produce a quality product (by establishing the project's shared vision, integrated team structure, allocating requirements, integrated teams, and collaboration among teams).

# CAPABILITY MATURITY MODEL INTEGRATION FOR DEVELOPMENT — VERSION 1.2

Number

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Level 3 - Defined

17.0 RISK MANAGEMENT (RSKM)

## 17.1 PURPOSE

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

## 17.2 REVISION HISTORY

Author	Description	Initials

## 17.3 PERSONS AFFECTED

Project manager, systems engineering, and software engineering.

## 17.4 POLICY

The policy of this organization is to ensure that:

17.4.1 Project managers, systems engineering, and software engineering Prepare for Risk Management, Identify and Analyze Risks, and Mitigate Risks for the system under development.

## 17.5 RESPONSIBILITIES

17.5.1 Project managers, systems engineering, and software engineering are responsible for Determine Risk Sources and Categories, Define Risk Parameters, and Establish a Risk Management Strategy for the system under development.

17.5.2 Project managers, systems engineering, and software engineering are responsible for Identify Risks and Evaluate, Categorize, and Prioritize Risks for the system under development.

17.5.3 Project managers, systems engineering, and software engineering are responsible for Develop Risk Mitigation Plans and Implement Risk Mitigation Plans for the system under development.

## 17.6 PROCEDURE

### 17.6.1 Prepare for Risk Management

#### 17.6.1.1 Determine Risk Sources and Categories

Project managers, systems engineering, and software engineering shall Determine risk sources and Determine risk categories.

#### 17.6.1.2 Define Risk Parameters

Project managers, systems engineering, and software engineering shall Define consistent criteria for evaluating and quantifying risk likelihood and severity levels; Define thresholds for each risk category; and Define bounds on the extent to which thresholds are applied against or within a category.

#### 17.6.1.3 Establish a Risk Management Strategy

### 17.6.2 Identify and Analyze Risks

#### 17.6.2.1 Identify Risks

Project managers, systems engineering, and software engineering shall Identify the risks associated with cost, schedule, and performance; Review environmental elements that may impact the project; Review all elements of the work breakdown structure as part of identifying risks to help ensure that all aspects of the work effort have been considered; Review all elements of the project plan as part of identifying risks to help ensure that all aspects of the project have been considered; Document the context, conditions, and potential consequences of the risk; and Identify the relevant stakeholders associated with each risk.

#### 17.6.2.2 Evaluate, Categorize, and Prioritize Risks

Project managers, systems engineering, and software engineering shall Evaluate the identified risks using the defined risk parameters; Categorize and group risks according to the defined risk categories; and Prioritize risks for mitigation.

### 17.6.3 Mitigate Risks

### 17.6.3.1 Develop Risk Mitigation Plans

Project managers, systems engineering, and software engineering shall Determine the levels and thresholds that define when a risk becomes unacceptable and triggers the execution of a risk mitigation plan or a contingency plan; Identify the person or group responsible for addressing each risk; Determine the cost-to-benefit ratio of implementing the risk mitigation plan for each risk; Develop an overall risk mitigation plan for the project to orchestrate the implementation of the individual risk mitigation and contingency plans; and Develop contingency plans for selected critical risks in the event their impacts are realized.

### 17.6.3.2 Implement Risk Mitigation Plans

Project managers, systems engineering, and software engineering shall Monitor risk status; Provide a method for tracking open risk-handling action items to closure; Invoke selected risk-handling options when monitored risks exceed the defined thresholds; Establish a schedule or period of performance for each risk handling activity that includes the start date and anticipated completion date; Provide continued commitment of resources for each plan to allow successful execution of the risk-handling activities; and Collect performance measures on the risk-handling activities.

## 17.7 OUTPUTS

- 17.7.1 **Risk management strategy.** An organized, technical approach to identify what might cause harm or loss (identify risks); to assess and quantify the identified risks; and to develop and, if needed, implement an appropriate approach to prevent or handle causes of risk that could result in significant harm or loss. Typically, risk management is performed for project, organization, or product developing organizational units.
- 17.7.2 **Risk list.** The document containing the results of the qualitative risk analysis, quantitative risk analysis, and risk response planning. The risk list details all identified risks, including description, category, cause, probability of occurring, impact(s) on objectives, proposed responses, owners, and current status.
- 17.7.3 **Risk mitigation results.** Records, reports, documents, or archives of identifying alternative courses of action, workarounds, and fallback positions with a recommended course of action for each critical risk by developing risk mitigation plans and implementing risk mitigation plans (to include handling options, risk mitigation plans, contingency plans, risk status, risk assessments, risk actions, etc.).

# CAPABILITY MATURITY MODEL INTEGRATION FOR DEVELOPMENT — VERSION 1.2

Number	
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Date	

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Level 3 - Defined

18.0 DECISION ANALYSIS AND RESOLUTION (DAR)

## 18.1 PURPOSE

The purpose of Decision Analysis and Resolution (DAR) is to analyze possible decisions using a formal evaluation process that evaluates identified alternatives against established criteria.

## 18.2 REVISION HISTORY

Author	Description	Initials

## 18.3 PERSONS AFFECTED

Project manager, systems engineering, and software engineering.

## 18.4 POLICY

The policy of this organization is to ensure that:

18.4.1 Project managers, systems engineering, and software engineering Evaluate Alternatives for the system under development.

## 18.5 RESPONSIBILITIES

18.5.1 Project managers, systems engineering, and software engineering are responsible for Establish Guidelines for Decision Analysis, Establish Evaluation Criteria, Identify Alternative Solutions, Select Evaluation Methods, Evaluate Alternatives, and Select Solutions for the system under development.

## 18.6 PROCEDURE

### 18.6.1 Evaluate Alternatives

#### 18.6.1.1 Establish Guidelines for Decision Analysis

Project managers, systems engineering, and software engineering shall Establish guidelines and Incorporate the use of the guidelines into the defined process where appropriate.

#### 18.6.1.2 Establish Evaluation Criteria

Project managers, systems engineering, and software engineering shall Define the criteria for evaluating alternative solutions; Define the range and scale for ranking the evaluation criteria; Rank the criteria; Assess the criteria and their relative importance; Evolve the evaluation criteria to improve their validity; and Document the rationale for the selection and rejection of evaluation criteria.

#### 18.6.1.3 Identify Alternative Solutions

Project managers, systems engineering, and software engineering shall Perform a literature search; Identify alternatives for consideration in addition to those that may be provided with the issue; and Document the proposed alternatives.

#### 18.6.1.4 Select Evaluation Methods

Project managers, systems engineering, and software engineering shall Select the methods based on the purpose for analyzing a decision and on the availability of the information used to support the method; Select evaluation methods based on their ability to focus on the issues at hand without being overly influenced by side issues; and Determine the measures needed to support the evaluation method.

#### 18.6.1.5 Evaluate Alternatives

Project managers, systems engineering, and software engineering shall Evaluate the proposed alternative solutions using the established evaluation criteria and selected methods; Evaluate the assumptions related to the evaluation criteria and the evidence that supports the assumptions; Evaluate whether uncertainty in the values for alternative solutions affects the evaluation and address as appropriate; Perform simulations, modeling, prototypes, and pilots as necessary to exercise the evaluation criteria, methods, and alternative solutions; Consider new alternative solutions, criteria, or methods if the proposed alternatives do not test well; repeat the evaluations until alternatives do test well; and Document the results of the evaluation.

**18.6.1.6 Select Solutions**

Project managers, systems engineering, and software engineering shall Assess the risks associated with implementing the recommended solution and Document the results and rationale for the recommended solution.

**18.7 OUTPUTS**

- 18.7.1 **Decision analysis and resolution plan.** A formal, documented plan that establishes guidelines to determine which issues should be subjected to a formal evaluation process and then applying formal evaluation processes to these issues. A formal evaluation process is a structured approach to evaluating alternative solutions against established criteria to determine a recommended solution to address an issue.
- 18.7.2 **Decision analysis and resolution results.** Records, reports, documents, or archives of identifying alternative solutions, selecting evaluation methods, evaluating alternatives, and selecting solutions (to include evaluation criteria, rankings, alternatives, methods, results, and solutions, etc.).

# CAPABILITY MATURITY MODEL INTEGRATION FOR DEVELOPMENT — VERSION 1.2

Number

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CMMI-DEV-V1.2 | Level 4 - Quantitatively Managed

19.0 ORGANIZATIONAL PROCESS PERFORMANCE (OPP)

## 19.1 PURPOSE

The purpose of Organizational Process Performance (OPP) is to establish and maintain a quantitative understanding of the performance of the organization's set of standard processes in support of quality and process-performance objectives, and to provide the process-performance data, baselines, and models to quantitatively manage the organization's projects.

## 19.2 REVISION HISTORY

Author	Description	Initials

## 19.3 PERSONS AFFECTED

Project manager, systems engineering, and software engineering.

## 19.4 POLICY

The policy of this organization is to ensure that:

19.4.1 Project managers, systems engineering, and software engineering Establish Performance Baselines and Models for the system under development.

## 19.5 RESPONSIBILITIES

19.5.1 Project managers, systems engineering, and software engineering are responsible for Select Processes, Establish Process-Performance Measures, Establish Quality and Process-Performance Objectives, Establish Process-Performance Baselines, and Establish Process-Performance Models for the system under development.

## 19.6 PROCEDURE

19.6.1 Establish Performance Baselines and Models

### 19.6.1.1 Select Processes

### 19.6.1.2 Establish Process-Performance Measures

Project managers, systems engineering, and software engineering shall Determine which of the organization's business objectives for quality and process performance need to be addressed by the measures; Select measures that provide appropriate insight into the organization's quality and process performance; Incorporate the selected measures into the organization's set of common measures; and Revise the set of measures as necessary.

### 19.6.1.3 Establish Quality and Process-Performance Objectives

Project managers, systems engineering, and software engineering shall Review the organization's business objectives related to quality and process performance; Define the organization's quantitative objectives for quality and process performance; Define the priorities of the organization's objectives for quality and process performance; Review, negotiate, and obtain commitment for the organization's quality and process-performance objectives and their priorities from the relevant stakeholders; and Revise the organization's quantitative objectives for quality and process performance as necessary.

### 19.6.1.4 Establish Process-Performance Baselines

Project managers, systems engineering, and software engineering shall Collect measurements from the organization's projects; Establish and maintain the organization's process-performance baselines from the collected measurements and analyses; Review and get agreement with relevant stakeholders about the organization's process-performance baselines; Make the organization's process-performance information available across the organization in the organization's measurement repository; Compare the organization's process-performance baselines to the associated objectives; and Revise the organization's process-performance baselines as necessary.

### 19.6.1.5 Establish Process-Performance Models

Project managers, systems engineering, and software engineering shall Establish the process-performance models based on the organization's set of standard processes and the organization's

process-performance baselines; Calibrate the process-performance models based on the organization's past results and current needs; Review the process-performance models and get agreement with relevant stakeholders; Support the projects' use of the process-performance models; and Revise the process-performance models as necessary.

#### 19.7 OUTPUTS

- 19.7.1 **Process performance baseline.** A documented characterization of the actual results achieved by following a process, which is used as a benchmark for comparing actual process performance against expected process performance. Process performance is a measure of actual results achieved by following a process, characterized by both process measures (e.g., effort, cycle time, and defect removal efficiency) and product measures (e.g., reliability, defect density, and response time).
- 19.7.2 **Process performance model.** A description of the relationships among attributes of a process and its work products that is developed from historical process-performance data and calibrated using collected process and product measures from the project and that is used to predict results to be achieved by following a process.

# CAPABILITY MATURITY MODEL INTEGRATION FOR DEVELOPMENT — VERSION 1.2

Number

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CMMI-DEV-V1.2 | Level 4 - Quantitatively Managed

20.0 QUANTITATIVE PROJECT MANAGEMENT (QPM)

## 20.1 PURPOSE

The purpose of Quantitative Project Management (QPM) is to quantitatively manage the project's defined process to achieve the project's established quality and process-performance objectives.

## 20.2 REVISION HISTORY

Author	Description	Initials

## 20.3 PERSONS AFFECTED

Project manager, systems engineering, and software engineering.

## 20.4 POLICY

The policy of this organization is to ensure that:

20.4.1 Project managers, systems engineering, and software engineering Quantitatively Manage the Project and Statistically Manage Subprocess Performance for the system under development.

## 20.5 RESPONSIBILITIES

20.5.1 Project managers, systems engineering, and software engineering are responsible for Establish the Project's Objectives, Compose the Defined Process, Select the Subprocesses that Will Be Statistically Managed, and Manage Project Performance for the system under development.

20.5.2 Project managers, systems engineering, and software engineering are responsible for Select Measures and Analytic Techniques, Apply Statistical Methods to Understand Variation, Monitor Performance of the Selected Subprocesses, and Record Statistical Management Data for the system under development.

## 20.6 PROCEDURE

### 20.6.1 Quantitatively Manage the Project

#### 20.6.1.1 Establish the Project's Objectives

Project managers, systems engineering, and software engineering shall Review the organization's objectives for quality and process performance; Identify the quality and process performance needs and priorities of the customer, suppliers, end users, and other relevant stakeholders; Identify how process performance is to be measured; Define and document measurable quality and process performance objectives for the project; Derive interim objectives for each lifecycle phase, as appropriate, to monitor progress toward achieving the project's objectives; Resolve conflicts among the project's quality and process performance objectives (e.g., if one objective cannot be achieved without compromising another objective); Establish traceability to the project's quality and process performance objectives from their sources; Define and negotiate quality and process-performance objectives for suppliers; and Revise the project's quality and process-performance objectives as necessary.

#### 20.6.1.2 Compose the Defined Process

Project managers, systems engineering, and software engineering shall Establish the criteria to use in identifying which subprocesses are valid candidates for use; Determine whether the subprocesses that are to be statistically managed, and that were obtained from the organizational process assets, are suitable for statistical management; Analyze the interaction of subprocesses to understand the relationships among the subprocesses and the measured attributes of the subprocesses; and Identify the risk when no subprocess is available that is known to be capable of satisfying the quality and process-performance objectives (i.e., no capable subprocess is available or the capability of the subprocess is not known).

#### 20.6.1.3 Select the Subprocesses that Will Be Statistically Managed

Project managers, systems engineering, and software engineering shall Identify which of the quality and process-performance objectives of the project will be statistically managed; Identify the criteria to be used in selecting the subprocesses that are the main contributors to achieving the identified quality and



process-performance objectives and for which predictable performance is important; Select the subprocesses that will be statistically managed using the selection criteria; and Identify the product and process attributes of the selected subprocesses that will be measured and controlled.

#### **20.6.1.4 Manage Project Performance**

Project managers, systems engineering, and software engineering shall Periodically review the performance of each subprocess and the capability of each subprocess selected to be statistically managed to appraise progress toward achieving the project's quality and process-performance objectives; Periodically review the actual results achieved against established interim objectives for each phase of the project lifecycle to appraise progress toward achieving the project's quality and process performance objectives; Track suppliers' results for achieving their quality and process performance objectives; Use process-performance models calibrated with obtained measures of critical attributes to estimate progress toward achieving the project's quality and process-performance objectives; Identify and manage the risks associated with achieving the project's quality and process-performance objectives; and Determine and document actions needed to address the deficiencies in achieving the project's quality and process performance objectives.

### **20.6.2 Statistically Manage Subprocess Performance**

#### **20.6.2.1 Select Measures and Analytic Techniques**

Project managers, systems engineering, and software engineering shall Identify common measures from the organizational process assets that support statistical management; Identify additional measures that may be needed for this instance to cover critical product and process attributes of the selected subprocesses; Identify the measures that are appropriate for statistical management; Specify the operational definitions of the measures, their collection points in the subprocesses, and how the integrity of the measures will be determined; Analyze the relationship of the identified measures to the organization's and project's objectives, and derive objectives that state specific target measures or ranges to be met for each measured attribute of each selected subprocess; Instrument the organizational support environment to support collection, derivation, and analysis of statistical measures; Identify the appropriate statistical analysis techniques that are expected to be useful in statistically managing the selected subprocesses; and Revise the measures and statistical analysis techniques as necessary.

#### **20.6.2.2 Apply Statistical Methods to Understand Variation**

Project managers, systems engineering, and software engineering shall Establish trial natural bounds for subprocesses having suitable historical performance data; Collect data, as defined by the selected measures, on the subprocesses as they execute; Calculate the natural bounds of process performance for each measured attribute; Identify special causes of variation; Analyze the special cause of process variation to determine the reasons the anomaly occurred; Determine what corrective action should be taken when special causes of variation are identified; and Recalculate the natural bounds for each measured attribute of the selected subprocesses as necessary.

#### **20.6.2.3 Monitor Performance of the Selected Subprocesses**

Project managers, systems engineering, and software engineering shall Compare the quality and process-performance objectives to the natural bounds of the measured attribute; Monitor changes in quality and process-performance objectives and selected subprocess' process capability; Identify and document subprocess capability deficiencies; and Determine and document actions needed to address subprocess capability deficiencies.

#### **20.6.2.4 Record Statistical Management Data**

## **20.7 OUTPUTS**

- 20.7.1 **Quantitative management plan.** A formal, documented plan for managing the project's quality and process performance objectives, identifying subprocesses that compose the project's defined process based on historical stability and capability data found in process-performance baselines or models, selecting subprocesses to be statistically managed, monitoring the project to determine whether the project's objectives are being satisfied, and identifying corrective actions.
- 20.7.2 **Quantitative management results.** Records, reports, documents, or archives of selecting measures and analytic techniques, applying statistical methods to understand variation, monitoring performance of the selected subprocesses, and recording statistical management data (to include metrics, models, measures, measurements, performance, capability, etc.).

# CAPABILITY MATURITY MODEL INTEGRATION FOR DEVELOPMENT — VERSION 1.2

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CMMI-DEV-V1.2

Level 5 - Optimizing

21.0 ORGANIZATIONAL INNOVATION AND DEPLOYMENT (OID)

## 21.1 PURPOSE

The purpose of Organizational Innovation and Deployment (OID) is to select and deploy incremental and innovative improvements that measurably improve the organization's processes and technologies. The improvements support the organization's quality and process-performance objectives as derived from the organization's business objectives.

## 21.2 REVISION HISTORY

Author	Description	Initials

## 21.3 PERSONS AFFECTED

Project manager, systems engineering, and software engineering.

## 21.4 POLICY

The policy of this organization is to ensure that:

21.4.1 Project managers, systems engineering, and software engineering Select Improvements and Deploy Improvements for the system under development.

## 21.5 RESPONSIBILITIES

21.5.1 Project managers, systems engineering, and software engineering are responsible for Collect and Analyze Improvement Proposals, Identify and Analyze Innovations, Pilot Improvements, and Select Improvements for Deployment for the system under development.

21.5.2 Project managers, systems engineering, and software engineering are responsible for Plan the Deployment, Manage the Deployment, and Measure Improvement Effects for the system under development.

## 21.6 PROCEDURE

### 21.6.1 Select Improvements

#### 21.6.1.1 Collect and Analyze Improvement Proposals

Project managers, systems engineering, and software engineering shall Collect process- and technology-improvement proposals; Analyze the costs and benefits of process- and technology improvement proposals as appropriate; Identify the process- and technology-improvement proposals that are innovative; Identify potential barriers and risks to deploying each process- and technology-improvement proposal; Estimate the cost, effort, and schedule required for deploying each process- and technology-improvement proposal; Select the process- and technology-improvement proposals to be piloted before broad-scale deployment; Document the results of the evaluation of each process- and technology-improvement proposal; and Monitor the status of each process- and technology-improvement proposal.

#### 21.6.1.2 Identify and Analyze Innovations

Project managers, systems engineering, and software engineering shall Analyze the organization's set of standard processes to determine areas where innovative improvements would be most helpful; Investigate innovative improvements that may improve the organization's set of standard processes; Analyze potential innovative improvements to understand their effects on process elements and predict their influence on the process; Analyze the costs and benefits of potential innovative improvements; Create process- and technology-improvement proposals for those innovative improvements that would result in improving the organization's processes or technologies; Select the innovative improvements to be piloted before broad-scale deployment; and Document the results of the evaluations of innovative improvements.

#### 21.6.1.3 Pilot Improvements

Project managers, systems engineering, and software engineering shall Plan the pilots; Review and get relevant stakeholder agreement on the plans for the pilots; Consult with and assist the people performing the pilots; Perform each pilot in an environment that is characteristic of the environment present in a broad-scale deployment; Track the pilots against their plans; and Review and document the results of

pilots.

#### **21.6.1.4 Select Improvements for Deployment**

Project managers, systems engineering, and software engineering shall Prioritize the candidate process and technology improvements for deployment; Select the process and technology improvements to be deployed; Determine how each process and technology improvement will be deployed; and Document the results of the selection process.

### **21.6.2 Deploy Improvements**

#### **21.6.2.1 Plan the Deployment**

Project managers, systems engineering, and software engineering shall Determine how each process and technology improvement must be adjusted for organization-wide deployment; Determine the changes necessary to deploy each process and technology improvement; Identify strategies to address potential barriers to deploying each process and technology improvement; Establish measures and objectives for determining the value of each process and technology improvement with respect to the organization's quality and process-performance objectives; Document the plan for deploying each process and technology improvement; Review and get agreement with relevant stakeholders on the plan for deploying each process and technology improvement; and Revise the plan for deploying each process and technology improvement as necessary.

#### **21.6.2.2 Manage the Deployment**

Project managers, systems engineering, and software engineering shall Monitor the deployment of the process and technology improvements using the deployment plan; Coordinate the deployment of process and technology improvements across the organization; Quickly deploy process and technology improvements in a controlled and disciplined manner, as appropriate; Incorporate the process and technology improvements into organizational process assets, as appropriate; Coordinate the deployment of the process and technology improvements into the projects' defined processes as appropriate; Provide consulting, as appropriate, to support deployment of the process and technology improvements; Provide updated training materials to reflect the improvements to the organizational process assets; Confirm that the deployment of all process and technology improvements is completed; Determine whether the ability of the defined process to meet quality and process-performance objectives is adversely affected by the process and technology improvement, and take corrective action as necessary; and Document and review the results of process- and technology improvement deployment.

#### **21.6.2.3 Measure Improvement Effects**

Project managers, systems engineering, and software engineering shall Measure the actual cost, effort, and schedule for deploying each process and technology improvement; Measure the value of each process and technology improvement; Measure the progress toward achieving the organization's quality and process-performance objectives; Analyze the progress toward achieving the organization's quality and process-performance objectives and take corrective action as needed; and Store the measures in the organization's measurement repository.

### **21.7 OUTPUTS**

- 21.7.1 **Process and technology improvement proposals.** Formal, documented plans that describe incremental and innovative improvements to processes and to process or product technologies improve product quality (e.g., functionality, performance), increase productivity, decrease cycle time, improve customer and end-user satisfaction, reduce development or production time to change functionality or add new features, or adapt to new technologies.
- 21.7.2 **Process and technology improvement results.** Records, reports, documents, or archives of planning process and technology deployments, managing process and technology deployments, and measuring improvement effects (to include deployment plans, training materials, documented results, revised measures, documented measurements, etc.).

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Level 5 - Optimizing

22.0 CAUSAL ANALYSIS AND RESOLUTION (CAR)

## 22.1 PURPOSE

The purpose of Causal Analysis and Resolution (CAR) is to identify causes of defects and other problems and take action to prevent them from occurring in the future.

## 22.2 REVISION HISTORY

Author	Description	Initials

## 22.3 PERSONS AFFECTED

Project manager, systems engineering, and software engineering.

## 22.4 POLICY

The policy of this organization is to ensure that:

22.4.1 Project managers, systems engineering, and software engineering Determine Causes of Defects and Address Causes of Defects for the system under development.

## 22.5 RESPONSIBILITIES

22.5.1 Project managers, systems engineering, and software engineering are responsible for Select Defect Data for Analysis and Analyze Causes for the system under development.

22.5.2 Project managers, systems engineering, and software engineering are responsible for Implement the Action Proposals, Evaluate the Effect of Changes, and Record Data for the system under development.

## 22.6 PROCEDURE

### 22.6.1 Determine Causes of Defects

#### 22.6.1.1 Select Defect Data for Analysis

Project managers, systems engineering, and software engineering shall Gather relevant defect or problem data and Determine which defects and other problems will be analyzed further.

#### 22.6.1.2 Analyze Causes

Project managers, systems engineering, and software engineering shall Conduct causal analysis with the people who are responsible for performing the task; Analyze selected defects and other problems to determine their root causes; Group the selected defects and other problems based on their root causes; and Propose and document actions that need to be taken to prevent the future occurrence of similar defects or other problems.

### 22.6.2 Address Causes of Defects

#### 22.6.2.1 Implement the Action Proposals

Project managers, systems engineering, and software engineering shall Analyze the action proposals and determine their priorities; Select the action proposals that will be implemented; Create action items for implementing the action proposals; Identify and remove similar defects that may exist in other processes and work products; and Identify and document improvement proposals for the organization's set of standard processes.

#### 22.6.2.2 Evaluate the Effect of Changes

Project managers, systems engineering, and software engineering shall Measure the change in the performance of the project's defined process as appropriate and Measure the capability of the project's defined process as appropriate.

#### 22.6.2.3 Record Data

## 22.7 OUTPUTS

22.7.1 **Action proposals.** A formal, documented plan that usually documents the originator of the action proposal, description of the problem, description of the defect cause, defect cause category, phase when the problem was

introduced, phase when the defect was identified, description of the action proposal, and action proposal category.

22.7.2 **Action proposal results.** Records, reports, documents, or archives of implementing action proposals, evaluating the effect or changes and recording data (to include records of performance measures and performance changes, etc.).