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REVISION HISTORY			
REV	Description of Change	Author	Effective Date
0	Initial Release based on 7/98 DNV Audit and 6/98 Internal Audit (see DCR 98-027).	M. Hines	9/23/98
1	Clarifications based on 11/98 DNV Audit (DCR 98-059)	R. Serrano	12/18/98

REFERENCE DOCUMENTS	
Document Number	Document Title
53.ARC.0004.1	Project Management for the Design, Development, and Maintenance of Software
53.ARC.0004.2	Design and Development of Systems and Hardware
53.ARC.0009.4	Program and Project Management
53.ARC.0016	Quality Records

Documents referenced in this procedure are applicable to the extent specified herein.

1. Purpose

This procedure defines Configuration Management (CM) and describes its constituent functions, processes, and procedures. It defines the role of CM, its interfaces, and its functions. This procedure also provides a basis for tailoring CM for different program/projects with different life cycles and program/project specific requirements.

2. Scope

This procedure defines the CM requirements that apply to all hardware, software, or systems delivered to ARC customers **and to project-related documents (e.g., project plans, specifications, drawings, etc.), as defined by the project.** This procedure is for use by the following participants:

1. The Responsible Manager or Configuration Management Officers (CMOs) who are responsible for implementing CM for deliverable products and services.
2. Developers and custodians whom the Responsible Manager appoints to carry out the day to day CM activities.

General requirements for program and project management are defined within 53.ARC.0009.4. Requirements for system and hardware design and development are defined within 53.ARC.0004.2. Requirements for project management for the



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design, development, and maintenance of software are defined within 53.ARC.0004.1. These documents must be used in conjunction with this document to ensure that an appropriate CM system is established for products delivered to ARC customers.

3. Definitions and Acronyms

- | | | |
|-----|-------------------------------|--|
| 3.1 | Baseline | Configuration of hardware, software, or systems at a discrete point in time in its life cycle |
| 3.2 | CCB | Change Control Board |
| 3.3 | CMO | Configuration Management Officer |
| 3.4 | Configuration | Functional and/or physical characteristics of hardware, software, or systems as set forth in technical documentation and realized in a product |
| 3.5 | Configuration Authentication | Process of verifying that a deliverable hardware, software, or system baseline contains all of the items which are required for that delivery and that these items have themselves been verified; that is, they satisfy their requirements |
| 3.6 | Configuration Control | Process of evaluating, coordinating, and deciding on the disposition of proposed changes to the configuration items and for implementing approved changes to baselined systems, hardware, and software and associated documentation |
| 3.7 | Configuration Identification | Process of defining each baseline to be established during the hardware, software, or system life cycle. It describes the configuration items and their documentation that make up each baseline. |
| 3.8 | Configuration Item | Term used for each of the locally related components that make up some discrete element of the product |
| 3.9 | Configuration Management (CM) | Process whose objective is the identification of the configuration of the product at discrete points in time and the systematic control of changes to the identified configuration for the purpose of maintaining product integrity and traceability throughout the product life cycle. CM consists of four basic processes: configuration identification, configuration control, configuration status accounting, and configuration authentication. |



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|------|---------------------------------|---|
| 3.10 | Configuration Status Accounting | Process used to trace changes to the hardware, software, or system |
| 3.11 | Responsible Manager | Person having the responsibility and authority to accomplish/implement a specific activity or process (includes organizational line managers, project managers, etc.) |
| 3.12 | Shall | Use of this word means the action described is mandatory |
| 3.13 | Will | Use of this word shows intent |

4. Flowchart

There is no flowchart required for this document.

5. Responsibilities

5.1 Responsible Manager shall:

- write CMP or ensure that CMP is written,
- ensure that CM processes are established and utilized, and
- appoint CMO.

5.2 Configuration Management Officer (CMO) shall:

- operate the CM process,
- maintain configuration control over the evolving products,
- write or help write the Configuration Management Plan (CMP),
- set up the program/project change control process,
- process change requests (CRs),
- act as secretary for the program/project Change Control Board (CCB), and
- produce and distribute periodic status accounting reports.

5.3 Change Control Board (CCB) shall:

- review and disposition proposed changes to baselined requirements, documentation, and deliverable products, and
- assign final change classification.

5.4 Configuration Librarian or CMO shall:

- control and store all products (i.e., drawings, specifications, software, and associated documentation), both electronic and hard copy,
- accept documents, code, data files, and other components of baselines and filing them in secure storage,



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- issue working copies to developers for authorized changes, and
- keep records and historical copies (either hard or electronic copy) of all versions of the components of baselines.

5.5 **Engineering Staff** shall:

- implement and verify approved CRs.

6. Procedure

6.1 Configuration Management Plan (CMP)

6.1.1 Configuration Plan Development

Configuration management (CM) activities for deliverable products shall be documented in a CMP or Project Plan. The Responsible Manager will determine whether or not a separate CMP is required. The CMP can be written by either the Responsible Manager or by a Configuration Management Officer (CMO). The CMP will address the requirements of the Configuration Identification, Configuration Control, Configuration Status Accounting, and Configuration Authentication sections below, as appropriate. Any boards (e.g., Change Control Board) shall have their roles, responsibilities, and membership defined within the CMP or referenced procedures which provides this information. The first version of the CMP should be written at the beginning of the project. The CMP details the personnel responsible for each role, defines the configuration items, and references the guides, procedures, work instructions, etc. to be followed.

6.1.2 CMP Approval and Distribution

The Responsible Manager and/or customer shall approve the CMP. The approved plan establishes the CM baseline requirements for the deliverable product. The Responsible Manager shall baseline the project, make available the authorized CMP or Project Plan, which includes CM requirements, to all members of the development effort, and issue detailed plans and tasks to individuals as appropriate. Once approved, the CMP establishes the CM requirements for the deliverable hardware, software, or system.

6.2 Configuration Identification

6.2.1 Configuration Item Selection

Hardware, software, or a system shall be grouped into configuration items. Each configuration item will be treated as an independent entity as far as the CM system is concerned. As a general rule, a configuration item is established for a separable piece of the hardware, software, or system that can be designed, implemented, and tested independently.



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Division of the product into configuration items may be specified in the customer agreement or may be accomplished by the developers during requirements definition and analysis. The configuration item selection will be complete by the end of the preliminary design phase.

6.2.2 Identification and Traceability

Where appropriate, each product component shall be uniquely identified. This identifier shall be used in tracking and reporting the component's status. Suitable means of identification shall be used from receipt through all stages of production, delivery, and installation. When required by customer agreement, the designation system shall result in identification of system elements, e.g., specifications, drawings, code, parts, components, and documentation, and shall include traceability of individual product or batches. The unique identification of product or batches requiring traceability shall be documented as a Quality Record. The specific record for a program/project shall be defined in that Program/Project/CM Plan.

6.2.3 Product Description

Hardware, software, or system components will be described in specifications and drawings (e.g., requirement specification, design specification, and product specification). The descriptions of the components will become more detailed as the design and development proceeds through the life cycle.

6.3 Configuration Control

6.3.1 Change Initiation

Each project or organization shall establish a method for processing change requests. Project change control will commence for products or their descriptions (drawings, specifications, etc.) after their initial approval. A change request (CR) may be submitted by a user, a customer, a reviewer, or by any other member of the program/project staff. A CR form which documents a proposed change and its disposition shall be established. Each project or organization should appoint a Configuration Management Officer (CMO) to receive the change form, assign it a tracking number and classification, and route it for processing.

The CMO will receive the CRs and review them for clarity and completeness. If the CMO determines that the CR is not complete, the CMO will return the CR to the originator. Once the CR is complete, the CMO assigns the CR a unique identifier for tracking purposes and records information about the CR in the CR tracking database or files.

6.3.2 Change Classification

Changes to hardware, software, or system and its documentation shall be classified according to the impact of the change and the



approval authority needed. The following is an example of a classification scheme:

- Class 1 is assigned to changes that would affect the system level requirements, external interfaces, system cost, and/or delivery schedule. The customer and appropriate Responsible Manager will approve these changes.
- Class 2 is assigned to changes that affect the interfaces between configuration items and the allocation of functions to configuration items, or which affect component level of cost and schedule. The Responsible Manager may approve this class of change.
- Class 3 changes are those that affect configuration item internal design and functionality. Project personnel may approve this class of change.

The individual who proposes the change may suggest a change classification. The CMO reviews suggested class and assigns a working classification. After assessment of the impact of the CR, the Change Control Board (CCB) will assign the final class.

6.3.3 Change Evaluation

Each change shall be analyzed for impact on safety, reliability, maintainability, system functionality, interfaces, cost, schedule, and customer requirements. The CMO routes the CR to the development or engineering staff for evaluation. The engineering analysis will produce documentation that describes the changes that will have to be made to implement the CR, the configuration items and documents that will have to be changed, and the resources needed to do the change. This documentation becomes part of the change package. After completion of the analysis, the change package is returned to the CMO.

6.3.4 Change Disposition

The Change Control Board (CCB) is a working group consisting of representatives from the various disciplines and organizations of the developing project. However, for small projects the CCB may consist of only a single person. The Responsible Manager or designee shall be the CCB chairperson.

CCB shall disposition changes to baselined items. Membership and responsibilities for the CCB will be defined. The CCB will approve, disapprove, returned for further analysis or information, or defer a CR.

Once a CR is disposition, it is sent to the CMO for action. Rejected items are returned to the originator along with the CCB's rationale for rejection. CRs needing further analysis are returned to the analysis group with the CCB's questions or requests attached. Deferred CRs are filed and sent back to the CCB at the proper time. Approved CRs

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are sent to the development organization.

The CMO is the secretary of the CCB; as such, the CMO prepares and distributes the meeting minutes and records the current status of the CR. This information will be added to the tracking database or recorded in files. CRs shall be retained as Quality Records.

6.3.5 Change Implementation

Approved CRs are used as a change authorization form. The development organization schedules the resources to make the change. Official copies of the baseline components to be changed are obtained from the configuration library. Associated documentation has to be revised to reflect the change. Once the change has been made and testing is completed, the revised component and documents are returned to the control of the configuration library.

6.3.6 Change Verification

The implemented changes shall be verified (this will usually occur at the configuration item level). This may require the rerun of tests specified in the test plan or the development of additional test documentation. For software changes, regression testing will usually have to be included in the test to assure that errors have not been introduced in existing functions by the change. Once verification is complete, the development organization submits evidence of it to the configuration library, which will then accept the changed items for inclusion in the CM controlled files that make up the new version of the baseline.

After the successful implementation and testing of the change described in the CR, the CMO will record the occurrence of this process into the CR tracking database or files.

6.3.7 Baseline Change Control

Changes to hardware, software, or systems are not complete until the changes have been implemented and tested and the changes to associated documentation have been made and all of the changes verified. Changes to hardware, software, or system should usually be grouped into releases. Each release shall contain product and documentation that has been tested and controlled as a total hardware, software, or system.

6.4 Configuration Status Accounting

Configuration status accounting establishes the record and status of the evolving product throughout its life cycle. It will provide traceability of changes to the baselined requirements, design, code and data, and associated documentation. It documents each version of the product and the changes that lead up to that version. It tracks the changes and contents of

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products, including their versions and releases. It defines the as-built configuration of the deliverable product.

Status accounting will begin when the first specification (i.e., requirement specification) is baselined and will continue throughout the hardware's, software's, or system's life cycle. Status accounting provides a list of the contents of each product's delivery and associated documentation.

Status accounting records will include the identification of the initial hardware, software, or system and its associated documents and their current status, status of evolving baselines, status of proposed and approved changes, and the implementation status of approved changes. Status accounting will provide periodic reports as defined in the CMP.

6.5 Configuration Authentication

Configuration authentication shall only be performed when required by the customer agreement. Authentication is accomplished by performing a Functional Configuration Audit and a Physical Configuration Audit.

6.5.1 Function Configuration Audit

The Functional Configuration Audit (FCA) authenticates that the actual performance of the configuration item complies with the requirements stated in the baselined documentation. The FCA will evaluate the test methods, procedures, reports, and other engineering design documentation (e.g., requirements traceability matrix). An audit report will be prepared documenting the results of the FCA.

6.5.2 Physical Configuration Audit

The Physical Configuration Audit (PCA) is the examination of the as-built version of the component against the baselined technical documentation defining the component. The PCA will assure that changes to be included in the version of the product to be delivered are really included and that all required items of hardware, software, system, data, procedures, and documentation are included. An audit report will be prepared documenting the results of the PCA.



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7. Metrics

There are no metrics required for this document.

8. Quality Records

The following Quality Records shall be generated and managed in accordance with 53.ARC.0016.

Required Record	Custodian
Change Request (CR)	CMO
Product/Batch Traceability Record	Responsible Manager

9. Form(s)

There are no forms required for this document.