Configuration Management
Compliance Validation

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13. ABSTRACT ***(Maximum 200 Words)***

The increasing technological sophistication of the Department of Defense (DoD) leads to a dependency on technology that, in turn, represents potentially crippling vulnerabilities. DoD is dependent upon advanced weapon systems and Command, Control, Communications, Computers, and Intelligence (C4I) systems throughout all mission areas from tactical to strategic. Preventing or minimizing the disruption, denial, degradation, destruction, or disclosure, of information and information systems is the objective of information assurance (IA). The process of ensuring information assurance is increasingly focused on being proactive and solving problems before they become problems. Prevention may be as simple as properly configuring a new computer's operating system (OS). Prevention may also include reconfiguring that OS to respond to a new vulnerability and ensuring that solution is properly implemented across all potentially affected systems. Expeditious execution and compliance of verification are essential to minimize the window of vulnerability. The Defense Information Systems Agency (DISA) Information Assurance Vulnerability Alert (IAVA) process is an example of this control measure for ensuring all security patches have been applied to DoD systems in a timely manner. Commanders and leaders at every level should have a working knowledge of CM. Those charged with executing organizational Configuration Management (CM) must understand and execute the process, policies, and disciplines. This Critical Review and Technology Assessment (CR/TA) will provide both that overarching understanding of CM as well as a comprehensive examination of CM to aid the practitioners to meet the challenges of their responsibilities.

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Configuration Management (CM) Compliance Validation

Critical Review & Technology Assessment (CR/TA) Report

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Mr. Perrault has extensive and diversified configuration management (CM) experience in the Department of Defense (DoD), international C4I, and healthcare information and management systems. Mr. Perrault has provided technical CM support of existing and evolving Health Affairs Executive Information/Decision Support (EI/DS) Systems. In addition to the areas of CM, he provided support to the Y2K effort, software development, software problem resolution, and software rapid applications development (RAD) of Electronic Data Warehousing (EDW) capability.

Mr. Perrault is a member of the Armed Forces Communications and Electronics Association, the International Test and Evaluation Association, and the U.S. Naval Institute.

Mr. Perrault's thesis, "Consolidation of Naval ADP and Telecommunications Management Functions: An Analysis of WWMCCS Support," was published in 1975.

Ms. Hylton-Bilbrey has 14 years of professional experience in computer systems electronic engineering, network management, information assurance, and system configuration management. Ms. Hylton-Bilbrey provides Information Systems Security and Information Operations support to the Information Assurance Technical Analysis Center (IATAC), the Navy Marine Corps Intranet (NMCI) Red teaming effort, the Communications Electronics Command (CECOM) Commander in Chief (CINC) Interoperability Program Office (CIPO) PKI Roadmap initiative, and the Space and Naval Warfare Systems (SPAWAR) Systems Service Center Charleston security tasking.

Recently, Ms. Hylton-Bilbrey served as the Information Systems Security Manager (ISSM) and the Information Assurance Officer at Commander in Chief U.S. Atlantic Fleet (CINCLANTFLT). Previously, she was also the ISSM and Information Assurance Officer for Commander, U.S. Marine Corps Forces, Atlantic (MARFORLANT) where she developed, implemented, and managed an Information Assurance program across the enterprise.

Ms. Hylton-Bilbrey is a member of the Association of Old Crows, Armed Forces Communications and Electronics Association (AFCEA), Information Systems Security Association (ISSA), Information Systems Audit and Control Association (ISACA), and also a member of the Association for Configuration and Data Management, as well as the Blue Ridge CMII User Group. She holds numerous technical certifications and the ISSM certification by the Defense Intelligence Agency (DIA).

Mr. Wall has 20+ years of experience in hardware installation, repair, system configuration, system integration, system administration, network design, information system security, configuration management, and system documentation. He has been involved with developing and implementing new automation capabilities within the work environment.

During his career, Mr. Wall has led planning and implementation of new technology (voice, video, and data) for the Department of Defense, U.S. Marine Corps, U.S. Navy, U.S. Army, U.S. Airforce, and Joint Services Commands. His efforts have been showcased in historical events such as his technical direction of the first secure presidential VTC to troops at sea before they landed on foreign soil.

He has a M.B.A from Troy State University, a B.A. in management from the University of Maryland, and an Information System Security Management (ISSM) certification by DoD, as well as multiple technical certifications.

He is a member of the National Black Masters of Business Administration Association (NBMBAA), Armed Forces Communications and Electronics Association (AFCEA), and also a member of the Association for Configuration and Data Management, as well as the Blue Ridge CMII User Group. He has authored white papers on system integration through web portals, baseline documentation, and System management diagrams.

Mr. Belke has significant Configuration Management-related expertise on major software and system projects gained from his years as a nuclear engineer, a design engineer for the Seawolf (SSN–21) class submarine's AN/BSY–2 combat system and as a software engineer for the Navy's Advanced Industrial Management System (AIMS) shipyard software project. His current focus centers on information technology and information operations.

Mr. Belke is the author of recent articles including—

- *Technology Driven Upgrades Give Subs Combat Advantage* (National Defense, October 1995)
- *Controlling C3I System Life Cycle Costs* (Sub. Qtrly Review, July 1996)
- *Coping With Open System/COTS Supportability* (Sub. Qtrly Review, October 1996)
- *Incident at Kangnung: North Korea's Ill-fated Submarine Incursion* (Sub. Qtrly Review, April 1997)
- *The Spirit of Human Bombs* (Sub. Qtrly Review, April '98; East Asian Review, Summer, 1998)
- *Measuring Training Effectiveness in the Simulation Domain: Matching Training Metrics to Simulation Capability and Performance Requirements* (technical symposium article, 2000)

Mr. Read received his B.B.A., concentrating in Computer Information Systems, from James Madison University in May 2000.

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About IATAC

The Information Assurance Technology Analysis Center (IATAC) provides the Department of Defense (DoD) with emerging scientific and technical information in support of Defensive Information Operations. IATAC's mission is to provide a DoD central point of access for information on Information Assurance (IA) emerging technologies. These technologies include system vulnerabilities, research and development, models, and analysis to support the effective defense against Information Warfare attacks. IATAC focuses on all defensive activities related to the use of information, information-based processes and information systems. One of thirteen DoD-sponsored Information Analysis Centers (IACs), IATAC is managed by the Defense Technical Information Center (DTIC), Defense Information Systems Agency (DISA).

IATAC basic services provide the infrastructure to support Defensive Information Operations. Basic services include the collection, analysis, and dissemination of IA scientific and technical information; support for user inquiries; database operations; current awareness activities (e.g., IAnewsletter); and the development of critical review and technology assessment and state-of-the-art reports.

Critical Review and Technology Assessments (CR/TA) are reports that evaluate and synthesize the latest information resulting from research and development activities, or they may be comparative assessments of technologies and/or methodologies based on specific technical characteristics. Topic areas for CR/TA reports are solicited from the IA Community to ensure applicability to emerging warfighter requirements.

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Chapter 1 Introduction

The increasing technological sophistication of the Department of Defense (DoD) leads to a dependency on technology that, in turn, represents potentially crippling vulnerabilities. DoD is dependent upon advanced weapon systems and Command, Control, Communications, Computers, and Intelligence (C4I) systems throughout all mission areas from tactical to strategic. Preventing or minimizing the disruption, denial, degradation, destruction, or disclosure, of information and information systems is the objective of information assurance (IA). The process of ensuring information assurance is increasingly focused on being proactive and solving problems before they become problems. Prevention may be as simple as properly configuring a new computer's operating system (OS). Prevention may also include reconfiguring that OS to respond to a new vulnerability and ensuring that solution is properly implemented across all potentially affected systems. Expeditious execution and compliance of verification are essential to minimize the window of vulnerability. The Defense Information Systems Agency (DISA) Information Assurance Vulnerability Alert (IAVA) process is an example of this control measure for ensuring all security patches have been applied to DoD systems in a timely manner. DISA's IAVA process is an example of configuration management (CM) at work.

Commanders and leaders at every level should have a working knowledge of CM. Those charged with executing organizational CM must understand and execute the process, policies, and disciplines. This Critical Review and Technology Assessment (CR/TA) will provide both that overarching understanding of CM as well as a comprehensive examination of CM to aid the practitioners to meet the challenges of their responsibilities. Figure 1 provides an overview of the Department

of Defense (DoD) Configuration Management (CM) Process Flow. Specifically based on MIL–HDBK–61A (SE) Configuration Management, Figure 1 defines the CM process inputs, constraints, mechanisms facilitators, and output results.

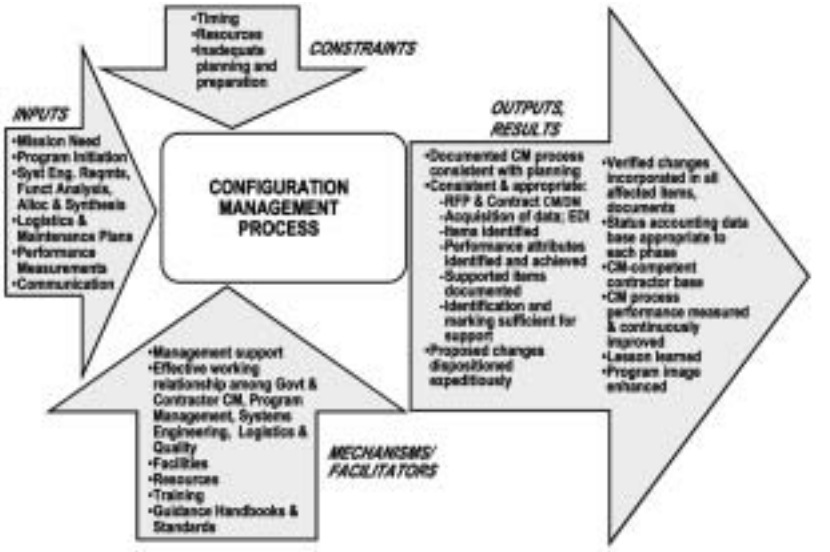

Figure 1. CM Process Model 1

Objectives

This report provides a comprehensive overview of CM requirements, methodologies, and tools currently used in the complex enterprise environment. The information is intended to provide guidance, recommendations, and resources for CM efforts as they apply to IA. The history and background provides a continuity of information to be used when considering future IA needs created by the expansion and advancement of technology.

Organization

This report is divided into eight main areas in addition to the Introduction. Chapter 2 provides the reader with—

- A historical perspective of the subject
- Background information on the four main CM principles—
  - Configuration identification
  - Configuration control
  - Configuration status accounting
  - Configuration audits
- An overview of the evolving CM structure and process
- Elements of a detailed CM plan
- Evolving change to both hardware and software CM processes.

Chapter 3 offers the reader an encapsulated view of current standards, guidance, and requirements from DoD, Federal, U.S. Commercial and International Organizations. Chapter 4 discusses the application of compliance validation considerations and methodologies. Chapter 5 illustrates how CM may be used as an enabler of IA. Chapter 6 gives insight into current training, education, and certification venues. Chapter 7 introduces considerations for evaluating CM tools. Chapter 8 provides the National Consensus Standard matrix for CM. Chapter 9 discusses developing trends and provides an assessment of future CM trends. The report concludes with appendices that provide a listing of resources from which a reader could gain more knowledge in the areas of CM compliance and validation. It also provides a listing of—

- Abbreviations
- Terms and Definitions
- Overarching CM Information Sources
- Institute of Electrical and Electronics Engineers (IEEE) CM Reference Material

- Selective CM Tools
- U.S. Department of Defense and NATO Reference Material
- U.S. Federal Government Reference Material
- International Standards Organization (ISO) CM Reference Material
- Select CM Reference Documentation
- Select CM Education and Training Course
- Select CM Conferences
- Various Societies, Institutes, and Association Documentation

Methodology

This report was based on the authors' experience and on research gathered from multiple resources. Research materials consisted of books, computer security journals, conference proceedings, white papers, and research papers available on the World Wide Web (www), Government, commercial and international standards, publications by non-profit associations, and manufacturer's literature available through their Web sites.

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Chapter 2 Background

This section briefly examines the history of CM, followed by a more detailed description of CM, its purpose, elements, structures and processes, CM plan and hardware/software elements.

CM Historical Perspective

First used in aerospace and defense, CM applications are now sought in virtually every industry. To have a better understanding of the CM process, the following paragraphs discuss some of its basic aspects. The word configuration in the dictionary is defined as "the arrangement of the parts or elements of something." The word management is defined as "the act or practice of managing." When we combine the two words, it could be stated that CM is the act of managing the arrangement of a products parts. For our purposes, "product" is the combination of hardware and software encompassing a total system.

The CM process, as we understand it today, became it's own discipline sometime in the late 1960's. The U.S. Government developed a series of military standards better known as the "480 series" that were issued in the 1970's.

In 1991, the "480 series" was consolidated into a single standard known as the MIL–STD–973. This standard has been replaced officially by MIL–HDBK–61A, Configuration Management. This is based primarily on the early 1990's to adopt non-Government standards wherever possible. This marked the beginning of what has now evolved into

the most widely distributed and accepted standard on CM, the "National Consensus Standard for Configuration Management." (ANSI–EIA–649–1998). Table 1 lists typical CM activities as identified in EIA Standard 649.

Table 1. Typical CM Activities

Elements of CM

The configuration management process is composed of four distinct disciplines. These disciplines are carried out as policies and procedures for establishing baselines and performing a standard change management process. They are—

- Configuration Identification

- Configuration Control
- Configuration Status Accounting
- Configuration Verification and Audit

Figure 2 provides the Top Level CM Activity Model established in the current DoD CM handbook [MIL–HDBK–61A (SE)].

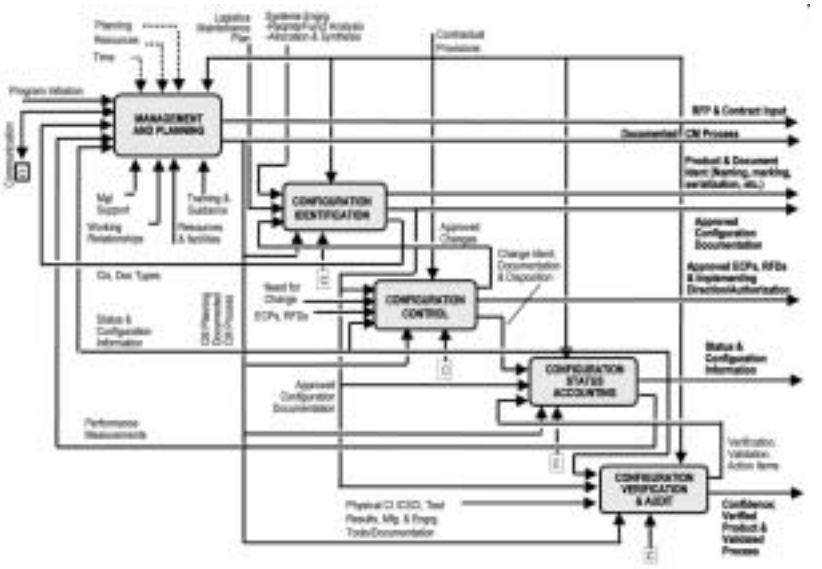

Figure 2. Top Level Configuration Management Activity Model

Each of these is further defined in the following paragraphs.

Configuration Identification

Configuration identification consists of setting and maintaining baselines, which define the system or subsystem architecture, components, and any developments at any point in time. It is the basis by which changes to any part of an information system are identified, documented, and later tracked through design, development, testing, and final delivery. Configuration identification incrementally establishes and maintains the definitive current basis for control and status accounting of a system and its configuration items (CIs) throughout their life cycle (development, production, deployment, and operational

support, until demilitarization and disposal). The process ensures that all acquisition and sustainment management disciplines have common sets of documentation as the basis for—

- Developing a new system
- Modifying an existing component
- Buying a product for operational use
- Providing support for the system and its components

This process also includes identifiers that are shorthand references to items and their documentation. Good configuration control procedures assure the continuous integrity of the configuration identification. Configuration identification includes—

- Selecting configuration items at appropriate levels of the product structure to facilitate the documentation, control, and support of the items and their documentation.
- Determining the types of configuration documentation required for each CI to define its performance, functional, and physical attributes, including internal and external interfaces. Configuration documentation provides the basis to develop and procure software/parts/material, fabricate, and assemble parts, inspect and test items, and maintain systems.
- Determining the appropriate configuration control authority for each configuration document consistent with logistic support planning for the associated CI.
- Issuing identifiers for the CIs and the configuration documentation.
- Maintaining the configuration identification of CIs to facilitate effective logistics support of items in service releasing configuration documentation.

- Establishing configuration baselines for the configuration control of CIs.

Effective configuration identification is a pre-requisite for the other CM activities (configuration control, status accounting, audit), which all use the products of configuration identification. If CIs and their associated configuration documentation are not properly identified, it is impossible to control the changes to the items' configuration, to establish accurate records and reports, or to validate the configuration through audit. Inaccurate or incomplete configuration documentation may result in defective products, schedule delays, and higher maintenance costs after delivery. Figure 3 shows the flow of the configuration identification process presented in MIL–HDBK–61A (SE).

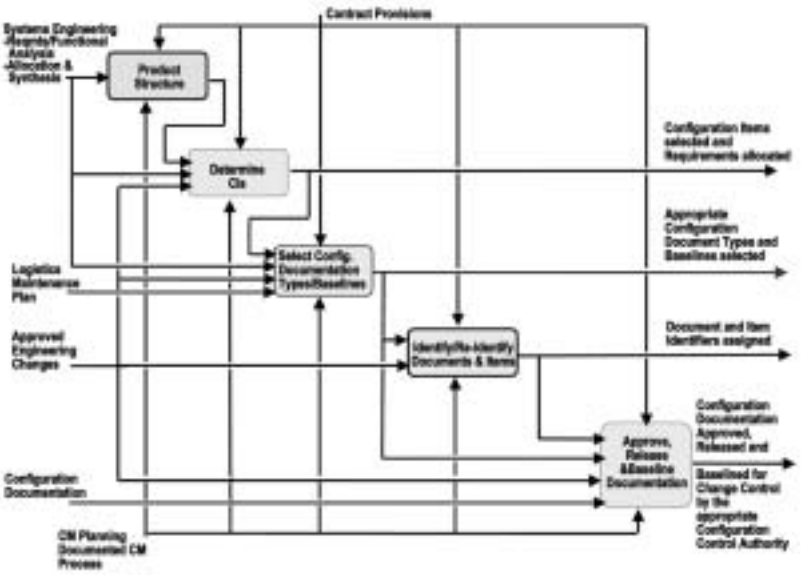

Figure 3. Configuration Identification Process Activity Model

Configuration Control

Configuration control includes the evaluation of all change requests and change proposals, and their subsequent approval or disapproval. It is the process of controlling modifications to the system's design, hardware, firmware, software, and documentation. Control involves—

- The review and evaluation of changes by the Configuration Control Board (CCB). The next section provides additional information on the CCB.

- Identifying, processing, and incorporation changes through a change management system.

- Is a dispersed activity requiring many people at a variety of locations to work in a standardized, conscientious, and disciplined way. Configuration control requires good administration to ensure—

  – Out-of-date issues and system revisions documents are removed from work areas.

  – Expeditious implementation upon change approval through close coordination with the user community.

Figure 4 provides the integrated government/contractor Configuration Control Process Activity Model. [Source: MIL–HDBK–61A (SE)]

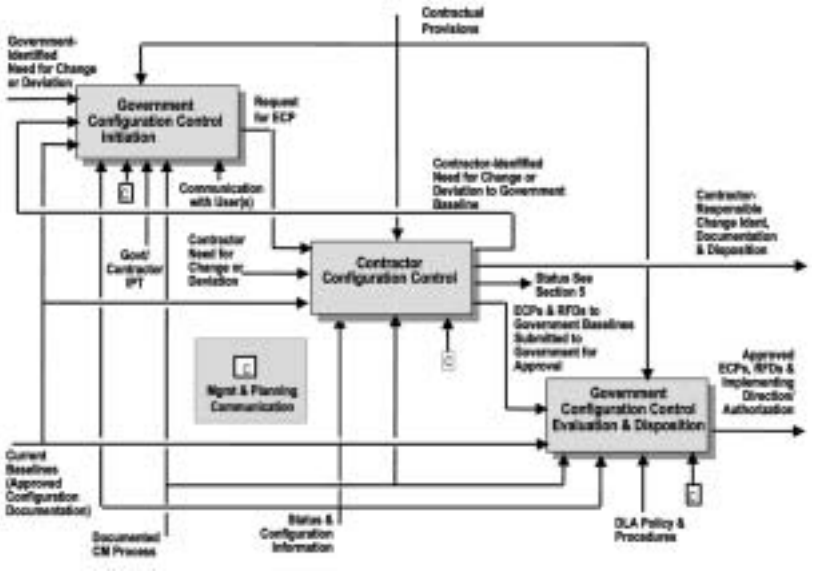

Figure 4. Configuration Control Process Activity Model

Configuration Status Accounting (CSA)

Configuration status accounting and configuration index/matrix are the recording activities of configuration management. It is the process of recording and reporting configuration item descriptions (e.g., hardware, software, firmware, etc.) and all departures from the baseline during design and production. In case of suspected problems (e.g., unauthorized access), verification of baseline configuration and approved modifications can be quickly verified.

Figure 5 summarizes the Configuration Status Accounting Process Activity Model and Figure 6 provides an overview of CSA Evolution over the System/CI Life Cycle.

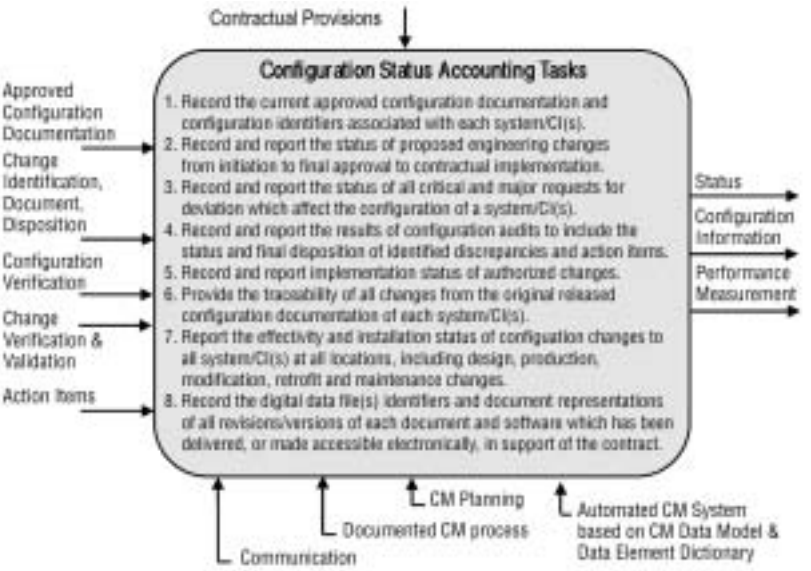

Figure 5. Configuration Status Accounting Process Activity Model

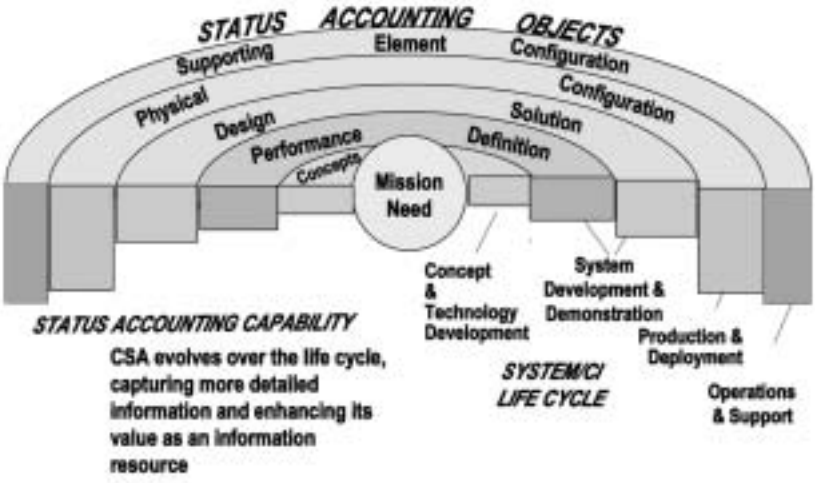

Figure 6. Configuration Status Accounting Evolution over the System/CI Life Cycle

Configuration Verification and Audit

Configuration verification and audit is an independent review of computer hardware and software for the purpose of assessing compliance with established performance requirements, commercial and appropriate Military standards, and functional, allocated, and product baselines. Configuration audits verify the system and subsystem configuration documentation complies with their functional and physical performance characteristics before acceptance into an architectural baseline. Configuration audits must be planned in accordance with MIL–HDBK–61A. Figure 7 provides an overview of each process element within the Configuration Verification and Audit Process Activity Model.

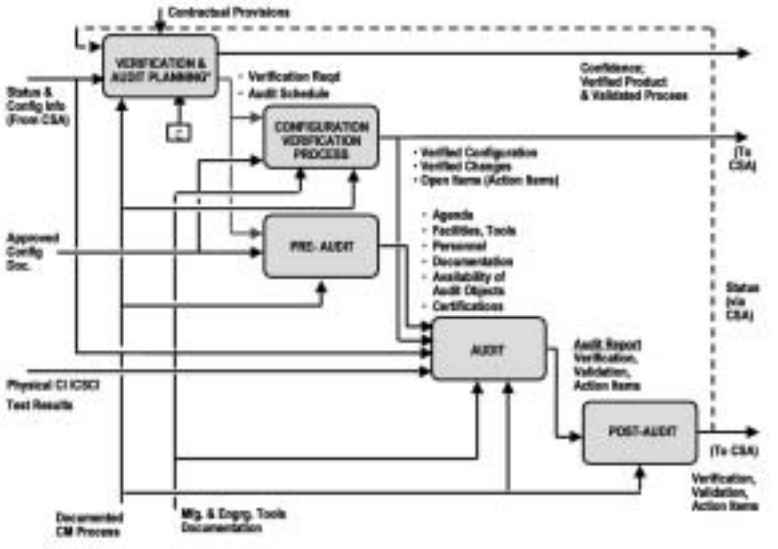

Figure 7. Configuration Verification and Audit Process Activity Model

Configuration Interface Management Process

Figure 8 provides a summary overview of the CM Configuration Interface Process Activity Model. The process is critical in the rapid development applications integration with associated capabilities and vital in establishment of effective IA.

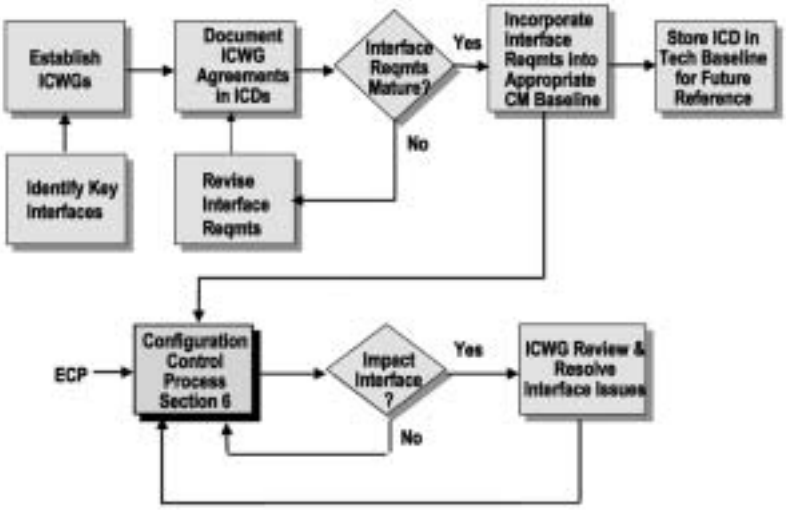

Figure 8. Interface Management Process Activity Model

Configuration Data Management and Logistics Relationship

Figure 9 provides a summary overview of the CM Related Data Management Activity Model. The process is critical to maintaining accurate documentation of system configuration.

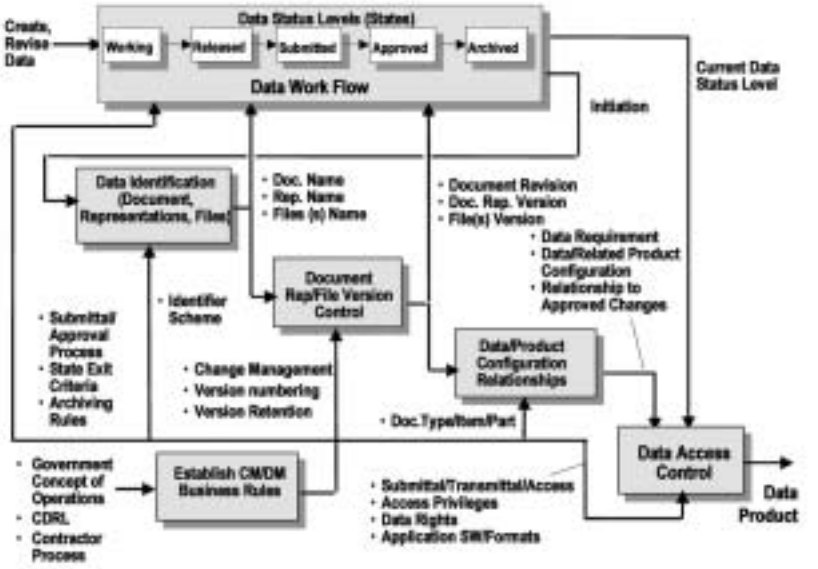

Figure 9. Data Management Process Model

Figure 10 provides a quick overview of the Integrated Product Team (IPT) process used in integrating performance requirement and, operations and maintenance needs, into the coordinated Maintenance Plan for the system life cycle.

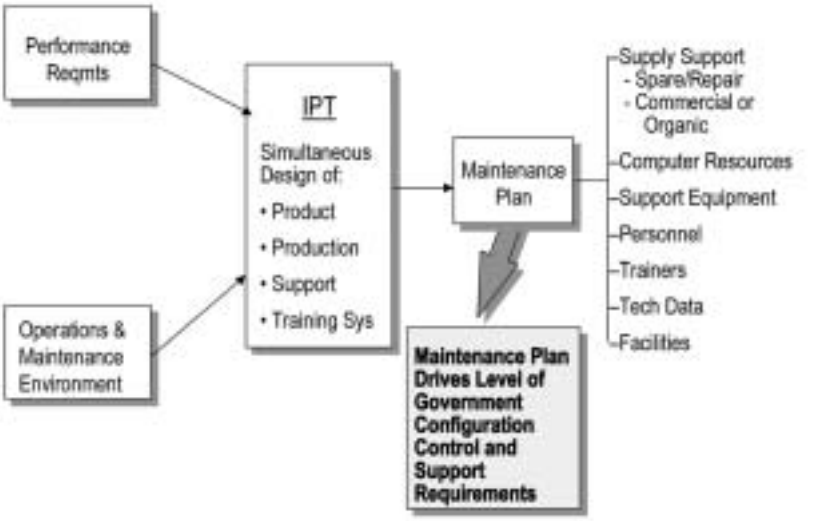

Figure 10. CM Logistics Relationship

CM Structure and Process

Configuration management structure and process is defined by three management levels for the purpose of illustrating CM objectives. It should be noted that organizations implement their own management structure, which may differ from those presented herein. Differences may include key participants and membership of boards and panels; however, the basic management functions addressed should be incorporated. A management structure for overseeing all facets of CM is fundamental to its success. Typically, it will include Executive, Operational, and Project level management.

- **Executive Management**—Responsible for policy, standards, and the Information Systems architecture for the organization. Executive Management is normally executed through the Configuration Management Board (CMB) or Configuration Control Board (CCB). Note that DoD has not standardized the use of the CMB or CCB. However, the advisory function of the CMB or CCB to organizational leadership is key to the executive management oversight.

- **Operational Management**—Responsible for the day-to-day operations of the organization (including minor changes to enhance operations). Operational Management is executed through the Configuration Management Board (CMB).

- **Project Management**—Responsible for development activities and executes these responsibilities in compliance with standards and guidance of both the executive and operational management organizational entities (e.g., CMB or CCB). For example, an organization's project lead for implementing Public Key Infrastructure (PKI) initiatives.

Configuration Management Plan (CMP)

The CMP is the framework for CM efforts. These plans vary in detail according to the complexity of the enterprise they represent. They are documents that should reflect the dynamics of each facet of the infrastructure. The CMP—

- Describes how to implement and maintain configuration of an organization's the information system assets.
- Defines how CM is implemented as it relates to identification, control, status accounting, and auditing.
- Defines the roles of designers, developers, management, the CCB, and any others in the lifecycle of present and future baseline systems and how new systems will be incorporated into the baseline.
- Defines CCB membership.

Figure 11 provides a generic sample of the CCB process in four specific areas—

- Identification and Classification
- Feasibility Assessment
- Review and Approval
- Development and Testing.

The CMP must clearly define the roles and responsibilities of key participants in the CM process with particular emphasis on the Information Systems Security Manager's (ISSM) CM role. Typically, the ISSM is responsible for the system security portions of the CMP and the system functional baseline.

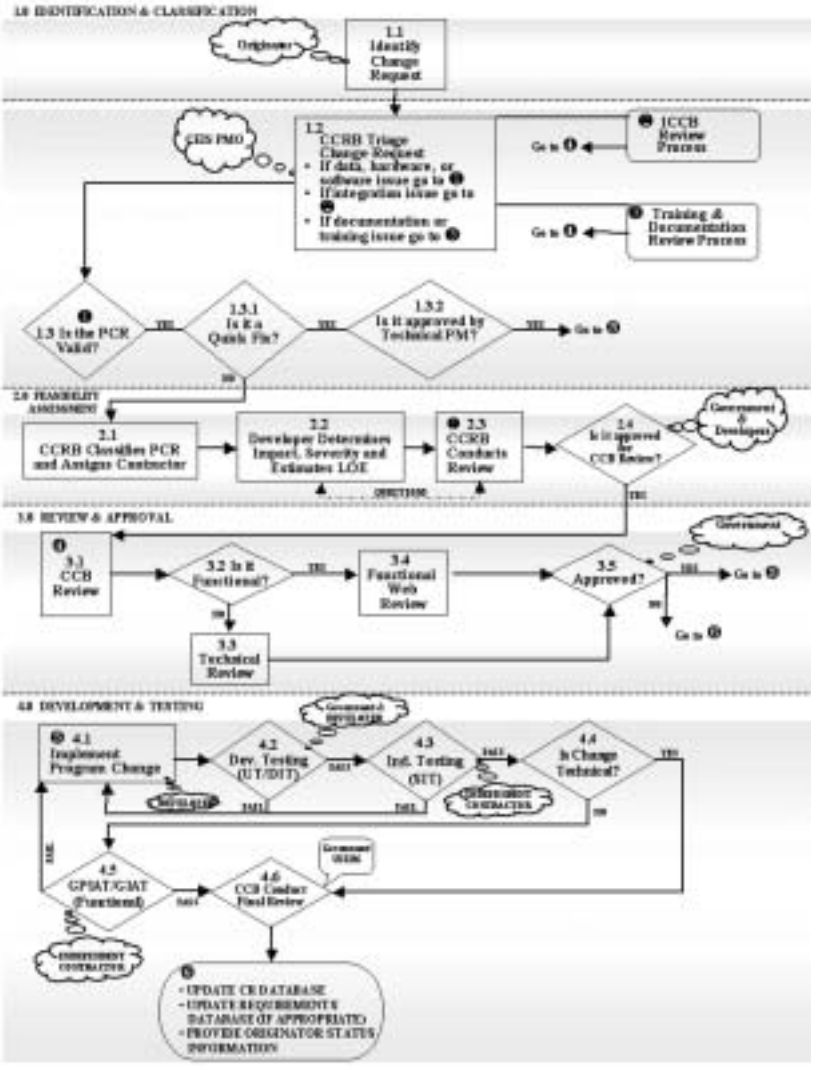

Figure 11. Sample CCB Process

The components of the CMP include the following—

- **Scope**
  - Identification
  - Purpose
  - Introduction

- **Reference Documents**

  - DoD and military standards, regulations, and plans. See Chapter 3 for further discussion of applicable reference documents.

  - Project documents and other materials (e.g., PKI Implementation Plan, command guidance, etc.)

- **Organization**

  - Organization structure and responsibilities (e.g., CMB and CCB)

  - Personnel [e.g., Commanders/Managers, System Administrators (SA), Information System Officer (ISO), ISSM, etc.]

  - Resources

- **Configuration Identification for each component system**—This constitutes the critical documentation function of CM. Absolute precision is essential.

  - Hardware configuration identification (e.g., Pentium III, 500 MHz,…)

  - Software configuration identification (e.g., Microsoft Windows 98 Operating System and associated tools)

  - Product configuration identification (e.g., serial numbers, version numbers, change numbers, etc.)

  - Project Management baselines (e.g., deployed hardware and software).

- **Configuration Control**—As with the configuration identification, this is the documentation function related to baselines, approved changes, etc.
  - Initial baselines and changes to baselines
  - Configuration review boards, including membership, review procedures, dissemination procedures, compliance procedures.
  - Change review procedures. How are changes to be implemented and who is authorized to do so (e.g., ISSM, individual user, etc.)
  - Software delivery process
  - Configuration Status
  - Configuration Audits

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Chapter 3 CM Standards, Requirements, and Guidance

As noted in the brief history the foundation of CM within DoD has its origins in the "480 series" and MIL STD 973. Over the past decade, the focus has increasingly been on adopting non-Government standards known as the National Consensus Standard for Configuration Management (ANSI–EIA–649–1998) and recognizing the complexity and inter-relatedness of information systems. The result is multiple standards extending from the international, national, federal, DoD, and local/command guidance.

U.S. Department of Defense (DoD)

In June 1994, DoD decided to transition away from Military standards and specifications to commercial versions. This decision has had and ongoing impact on DoD CM requirements and guidance as numerous Military standards are being superceeded without replacement.

Military standards and specifications traditionally have specified clear, concise, and valid requirements that are worth their weight in gold. Yet, as more standards are replaced with commercial guidance, the benefit is that the military establishment really can be flexible. One of the impacts of this transition is DoD's observation that the Department of Defense Index of Specifications and Standards (DoDISS) contains 31,000 specifications and standards, of which many are obsolete. While this is true, it is also true that it contains many

Government and non-Government standards and commercial item descriptions which are very effective and used every day by engineers throughout industry.

Within NATO Standardization Agreement (STANAG) 4149, some functions that have always been considered as systems engineering tasks have been transferred or duplicated as CM functions. Tasks such as "Formal Technical Reviews," "Baseline Management," "Decision and Control," "Specification Tree," etc., may be more properly viewed as "System Engineering Management" functions per U.S. MIL–STD–493. While this NATO approach appears sound, too much CM has the disadvantage of causing more problems and expense.

U.S. Federal Government

Federal CM standards, requirements, and guidance exist in a variety of areas and are often intricately interrelated with corresponding industry and commercial documents. The U.S. Government's interest in CM is enacted through legislation, the ongoing work of entire branches of the Government, through acquisition reform, and through specialized Military-related requirements. Together, Federal laws and agencies provide active oversight where adequate CM is vital to the smooth functioning of key sectors of the U.S. economy.

From an IA perspective, vital non-Military sectors of the economy present potential terrorist targets. Thus, the Federal Government has a vital security interest, even beyond valid safety-related and change control management concerns, for ensuring adequate CM policies are enacted in a variety of key industries. Appendix G provides some examples of key Government sectors and the associated standards and regulatory policies that have been published. Included are Air Traffic Control, Energy (including nuclear power), Food and Drugs, and Space.

The Code of Federal Regulations (CFR) is a codification of the general and permanent rules published in the Federal Register by the Executive departments and agencies of the Federal Government. The CFR online is a joint project authorized by the publisher, the National

Archives and Records Administration's Office of the Federal Register, and the Government Printing Office (GPO) to provide the public with enhanced access to Government information. GPO will continue to make the paper editions of the CFR and Federal Register available through its Superintendent of Documents Sales service.

The CFR is divided into 50 titles that represent broad areas subject to Federal regulation. Each title is divided into chapters that usually bear the name of the issuing agency. (see Alphabetical List of Agencies Appearing in the CFR (TXT 32k) (PDF 5k)—extracted from the January 1, 1998, revision of the CFR Index and Finding Aids—pp. 1001–1009.) Each chapter is further subdivided into parts covering specific regulatory areas. Large parts may be subdivided into subparts. All parts are organized in sections, and most citations to the CFR will be provided at the section level.

International Organization for Standardization (ISO)

International CM standards, requirements, and guidance are dominated by the ISO. Other large international organizations, for example, the European Space Agency (ESA) and North Atlantic Treaty Organization (NATO) also have a notably large body of CM-related regulations.

ISO

The ISO is a worldwide federation of national standards bodies from some 130 countries, one from each country. ISO is a non-governmental organization, established in 1947 to promote the development of standardization and related activities. This was implemented throughout the world with a view to facilitating the international exchange of goods and services, and to developing cooperation in the areas of intellectual, scientific, technological, and economic activity. ISO's work results in international agreements that are published as international standards.

The scope of ISO is not limited to any particular branch—it covers all technical fields except electrical and electronic engineering, which is the responsibility of International Electromechanical Commission (IEC). A joint ISO/IEC technical committee carries out the work in the information technology field. Thus, some CM-related activities may involve both the ISO and the IEC.

The ISO has established the ISO Information Network (ISONET) to assist customers with inquiries about CM-related standards, technical regulations, or related testing and certification activities. ISONET is a worldwide network of national standards information centers that have cooperatively agreed to provide rapid access to information about standards, technical regulations, and testing and certification activities currently used in different parts of the world.

Two of the most important ISO CM documents are ISO 10007, Quality Management—Guidelines for Configuration Management and ISO/IEC 12207 Software CM.

ISO 10007 is an International CM Standard that gives guidance on the use of CM in industry and its interface with other management systems and procedures. It first provides a management overview, then describes the process, organization, and detailed procedures. ISO 10007 is applicable to the support of projects from concept through design, development, procurement, production, installation, operation, maintenance, and disposal of products. It amplifies the CM elements found in ISO 9004–1, while Annex B provides a correlation between the guidance found in this international standard and the quality system standards ISO 9001, ISO 9002, ISO 9003 and ISO 9004–1. The applications of ISO 10007–CM may be tailored to suit individual projects, taking into account the size, complexity, and nature of the work.

ISO/IEC 12207, Software Life Cycle Processes

This standard is a checklist constructed around a classification scheme of physical evidence comprised of procedures, plans, records, documents, audits, and reviews. This checklist clarifies what is required for compliance by providing an easy-to-use product evidence list that

will assist any software organization in meeting the requirements of this standard. The key benefit of ISO/IEC 12207 is that it clearly defines the standards' expectation by procedures, plans, records, documents, audits, and reviews.

ISO–10303, Standard for the Exchange of Product Model Data (STEP)

STEP is the international data description standard which will provide a complete unambiguous, computer-interpretable definition of the physical and functional characteristics of a product throughout its lifecycle as shown in Figure 12.

STEP allows companies too effectively exchange information with their worldwide partners, customers, and suppliers, as well as internally. In order to remain competitive in the global marketplace, companies must ensure this exchange is consistent, accurate, and timely. The STEP standard provides a data transfer standard that is computer sensible. It supports configuration-managed design, reuse, data retention, and provides access to data across an entire lifecycle of a product. ISO–10303 is

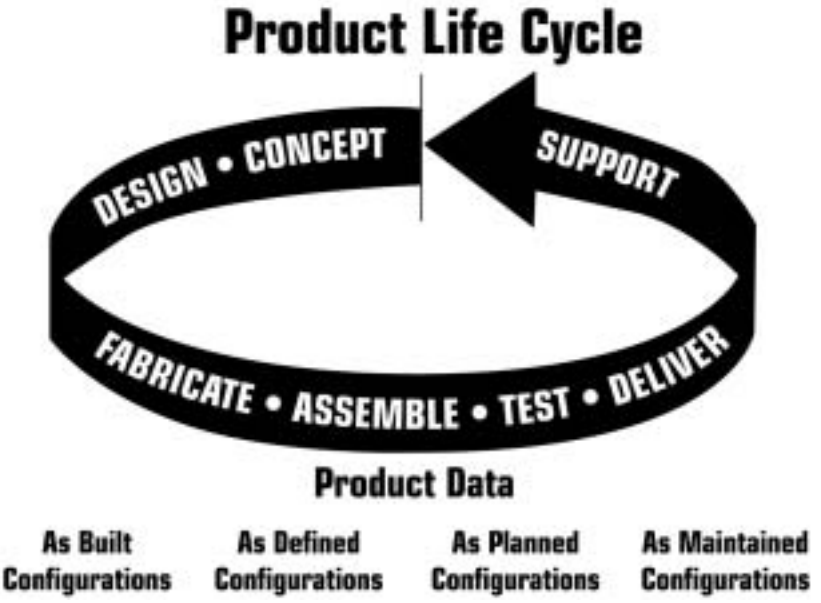

Figure 12. The ISO 10303 "STEP" Defines a Standardized System Life Cycle CM Process

the lead document in a series of ISO–10303–XXX. This series includes, ISO–10303–203, Application Protocol: Configuration Controlled Design—another important CM-related ISO document. Additional important ISO CM references are provided in the appendices.

ISO CM Requirements Methodology

Establishing a reliable methodology for assuring that the requirements are achieved consistently is only part of the first step. Maintaining those methods is also a challenge because the requirements are always changing. Thus, the ability to accommodate change should be viewed as the first building block within a CM model. This includes assurance that the requirements remain clear, concise, and valid as changes are being made.

ISO makes provisions for change. For example, within the 20 elements of ISO 9001, the subject of change is addressed in two places: Paragraph 9 of Section 4 (Design Control) and Paragraph 3 of Section 5 (Document and Data Control).

Section 4 states that "changes and modifications shall be identified, documented, reviewed and approved by authorized personnel before their implementation." Section 5 states that "changes shall be reviewed and approved by the same functions that performed the original review and approval." It also states that "where, practical, the nature of the change shall be identified in the document."

Each of the 20 elements of ISO 9001 represents requirements. They are the "what," not the "how-to." The intent of ISO 9000 is to establish a full scope of the requirements that an organization needs to satisfy in order to be successful. It is the responsibility of the individual organization to develop procedures capable of efficiently achieving those requirements.

In general, the ISO 9001 specified requirements are logical and appropriate. However, achieving those requirements can be a challenge.

There is very little argument that some kind of a guide or template is needed in order for several different individuals to achieve the same requirement in an orderly and consistent manner. To use a "procedure" as a guide or template, however, is where the differing opinions become exposed. Those who have never seen effective procedures are likely to challenge their use. Conversely, those who have will defend their use. Thus, general ISO CM requirements tend not to be viewed as an obstacle if effective CM procedures are written and implemented.

Chapter 4

CM Evolving Objectives

In the evolving world of CM, various compliance validation methodologies have been established to verify that CM processes are being properly implemented throughout an organization. Traditional approaches to CM require that design requirements be approved and released and changes be authorized and controlled. Compliance validation methodologies ensure that the selected approach is working.

Compliance validation is a two-way street. Everybody wants a configuration to be right the first time and every time. Evidence of conformance must satisfy both those that are validating compliance and those that need to have a system that works.

This section addresses compliance validation considerations and presents several methodologies.

Validation Considerations

Periodic verification of an organization's baseline is the primary key to insuring operational integrity of the data infrastructure. Change within the infrastructure is a valid requirement, therefore change management, in the form of system policies and change reporting, provide a robust validation process.

Validation Methodologies

Validation methodologies include—

- Verification of hardware and software configuration
- Review of policies and procedures that manage the change process and establish control
- Review of system reporting to discover irregularities
- Auditing as a means to verify and validate that the configuration item meets the specified criteria of the enterprise baseline. It serves as an evaluation method to verify that requirements or products conform to prescribed standards. Ordinarily, the audit function of CM is comprised of three components—
  - Functional Configuration Audit (FCA)
  - Physical Configuration Audit (PCA)
  - Formal Qualification Review (FQR).

Audits

Functional Configuration Audit (FCA)

Software-specific CM uses the FCA to insure all tests have been completed. This ensures that the requirements represented in the product baseline meet the criteria of the functional and allocated baselines. Applied to integration activities, this function serves to verify that Business Process Innovation (BPI) and Integration Change Request (ICR) have been implemented in accordance with approved funding lines. To that end, the tools of an FCA are utilized to execute an audit.

In preparation for FCA, an information systems planning and program oversight staff will develop—

- Checklists which are designed to verify the approved and funded BPI or ICR have been implemented as defined
- Questionnaires to facilitate information gathering as a means to verify the completeness and effectiveness of the implemented BPI or ICR (these may be used in personal interviews or coordinated through appropriate chains of command)
- Configuration Audit Record to track the results of the FCA.

Various forms may be utilized throughout the audit process. These include, among others, data integrity verification forms and functional requirement checklists.

Physical Configuration Audit (PCA)

Typically, the PCA is a means to verify the adequacy of the documentation and subsequent changes that comprise the product baseline. The integration process applies the PCA to verify that the documented BPI or ICR has been implemented adequately and completely. Within a system development program, various checklists are utilized to conduct a PCA. The most critical checklist for the PCA identified in this process is the change control documentation checklist. At a minimum, the change control documentation checklist identifies the change classification, associated BPIs or ICRs, discrepancies, and discrepancy action(s).

Formal Qualification Review (FQR)

The FQR establishes that the BPI or ICR performs as defined in the operational environment. If the BPI or ICR are found to perform as defined, they are certified and closed in the central tracking system. Typically, independent operational test and evaluation validate a change request. In the case of ICRs, the primary Information Systems Committee (ISC) will be cognizant of the status of an ICR upon closure.

Validation of a BPI is executed by the Information Systems Planning and Program Oversight staff. A change management plan is formulated based on projected cost, schedule, and return on investment as indicated in an approved or other economic analysis (e.g., business case).

Once complete, the change management plan for BPI implementation and verification and validation will be appended to this document.

Chapter 5 Information Assurance (IA) Perspective

The Information Systems Security Manager's Role

The Information Systems Security Manager (ISSM) has the responsibility of safeguarding all aspects of the enterprise without adversely affecting productivity. This complex effort requires diligence and system management expertise.

The ISSM role includes—

- Participates in the development of sites configuration management plan (CMP) in accordance with MIL–HDBK–61A (SE)
- Serves as a voting member of the CMB, with authority to veto changes which negatively impact security
- Ensures inclusion of information systems security in the CMP in all project management plan(s)
- Ensures control of project integration in the site information systems operational baseline
- Establishes, in coordination with the information systems manager, the command's information systems operational baseline and maintains the accreditation baseline
- Supports the organization program or project manager

- Previews proposed security changes that could impact the site's security posture and makes approval/disapproval recommendations
- Certifies command accreditation baselines in coordination with the appropriate certification authority (as required)
- Ensures all site security documentation is prepared and maintained (e.g., security concept of operations, security architecture)
- Ensures organization continues to operate in accordance with accreditation criteria
- Ensures receipt of all (IAVAs), providing report status and approval of changes if required.

The IA Vulnerability Alert (IAVA) Process

The IAVA process incorporates the identification and evaluation of new vulnerabilities, disseminates technical responses, and tracks compliance within the DoD community.

As the IAVA process manager, DISA, [via its DoD Computer Emergency Response Team (DoD CERT)], is responsible for disseminating the vulnerability notifications to Commander-in-Chiefs (CINCs), Service, and Agency (C/S/A) points of contact (POC). This provides an automated means for these POCs to report receipt of, and compliance with, the alerts.

The IAVA process was created because DoD recognized the need for the C/S/As to have a positive control mechanism. This ensures their system administrators received, acknowledged, and complied with vulnerability alert notifications, and that corrective actions were taken against new and critical vulnerabilities.

DISA created a three-tiered "vulnerability hierarchy" for notifications. The first tier notification (an alert, or IAVA) is disseminated when a new vulnerability to a privileged system is found that poses an immediate, potentially severe threat to DoD systems. The IAVA requires that C/S/As report receipt of the alert (after disseminating the alert to subordinate organizations) as well as their compliance with the corrective action(s).

The second tier notification (a bulletin or IAVB) addresses new vulnerabilities that do not pose an immediate threat to DoD systems, but are significant enough that non-compliance with the corrective action could escalate the threat. As with the IAVA, the IAVB requires the C/S/As report receipt of the bulletin. However, compliance reporting is not required. *(Note: the local commander makes compliance timeline requirements and decisions)*. However, the IAVB must be disseminated down to the SA level within the organization.

The third tier notification (i.e., the technical advisory) is generated when new vulnerabilities exist but are generally categorized as low risk. Potential escalation of these vulnerabilities is deemed unlikely, but the advisories are issued so that any risk of escalation in the future can be mitigated. Reporting is not required in response to a technical advisory.

The IAVA process allows for waivers of the required compliance actions to be granted in response to a specific alert. Waivers are reviewed and granted by a C/S/A's designated approval authority (DAA). The DAA must consider the risks involved, to both the local network and the greater Defense Information Infrastructure (DII), when granting a waiver.

The DoD CERT learns of new vulnerabilities through reported incidents to DoD and civilian CERTs, public Internet resources, and vendor notifications. Upon notification of a new vulnerability, the DoD CERT assesses the threat that the vulnerability poses to the DII using criteria such as—

- The type of operating system and infrastructure affected by the exploit
- The access gained by the exploit

- The number of exploits reported and what the exploit's end result could be denial-of-service (DoS), for example

After the initial evaluation, a request for comments is sent to a coordination team consisting of the Joint Task Force-Computer Network Operators (JTF–CNO), Service CERTs and joint system program managers. This team provides input in determining the type of notification to be generated. After coordination, the notification is disseminated in a variety of ways. Record message traffic (AUTODIN and DMS) is sent releasing an IAVA or IAVB to the C/S/A points of contact. This message is primarily for notification purposes as well as assigning reporting timelines. The message directs recipients to the DoD CERT Web site (http://www.cert.mil) for technical specifics and corrective action(s). E-mail containing the technical information is also disseminated to all IAVA list server addressees for the IAVA, IAVB, and the technical advisories. Registration to this list may be requested by sending an E-mail to cert@cert.mil. (This list is restricted to .mil domains)

The reporting of receipt, compliance, and waiver information is accomplished via the unclassified or classified IAVA Web site. Normal reporting timelines are five days for reporting receipt (IAVA and IAVB) and 30 days for reporting compliance (IAVA). Significant headway is being made in the automation of receipt acknowledgement and compliance reporting. As of October 4, 2000, C/S/As now have access to a greatly improved utility, providing a more robust, and effective automated mechanism to report their status information.

Chapter 6 Education and Training

CM, which solves many of today's problems associated with information management, offers methods for establishing compliance validation and ensuring the security of a networked computer system. The effectiveness of CM depends on appropriate implementation. Proper education and training is the key component to CM implementation. The best tools available cannot ensure efficacy without competent individuals employing and managing them. Education and training provide the appropriate expertise necessary to optimize the value of the CM process and tools. CM must be fully understood by those who intend to use it. It is not meant to be a corrective process, rather, it serves as a proactive solution, ensuring computer security and information integrity via compliance validation. Understanding CM from the proper perspective is the key to an effective computer security policy, and proper training is essential to obtaining this perspective.

Currently, CM is not a popular subject in universities, but appears to be slowly moving in that direction. Most of the available training is offered by private organizations, some offering certifications in the field of study. The Configuration Management Phase II (CM II) certification, offered by the Institute of Configuration Management (ICM), is one of the most recognized. A growing number of professionals worldwide have completed the 6-course series required for CM II certification. The curriculum includes the basics of CM, the CM II model, structured CM, change management, operating standards, and legal liabilities.

CM II is a process for accommodating change and keeping requirements clear, concise, and valid. This process has universal application, which every organization needs. In the case of network and computer

security, it should be effectively applied as a means to implement specific IAVA mandates issued by DISA. Those who achieve CM II certification gain a thorough understanding of how CM fits into the process of running a business, how to evaluate the effectiveness of their existing processes and how to improve those processes.

The configuration and data management certifications are others to consider. In order to be certified by the National Defense Industrial Association Technical Information Division as a configuration and data manager, or configuration and data specialist, an individual must have the required configuration and/or data management experience. Successful completion of a comprehensive examination is required. To become a certified configuration and data manager (CCDM) requires ten years of specific configuration and/or data management experience. Certification as a configuration and data specialist (CCDS) requires five years of specific configuration and/or data management experience.

Training is also available for specific CM tools. Typically, this is offered by private organizations that create the tools or specialize in CM training. This training enables the SA to have the appropriate control of the network needed to implement necessary configuration changes. DISA offers courses through the Information Assurance Education, Training, and Awareness branch (IA ETA). These classes target SAs, information system security officer (ISSO), ISSM, system certifiers, and designated approval authority (DAA). Specific courses include—

- Windows NT Security
- UNIX Security
- DITSCAP
- Introduction to Information Systems Security
- Intermediate Information System Security Operations
- DAA Basics

In the future, DISA will provide a course in System Certification. The IA ETA Branch also offers a deployable classroom to support delivery of hands-on system administrator training at an organization's site. See Appendix J for examples of some available training courses.

Chapter 7 Evaluation and Selection of CM Tools

CM is well recognized as a subset of overall executive, operational, or project management that is used to safeguard productivity and institute quality assurance measures. Clearly, the purpose of CM tools is to automate the CM process. When more than one individual or group, is responsible for CM, whether co-located or geographically separated, a configuration strategy and plan is necessary. This insures uniform utilization and coordination of the CM effort. Within the integrated information technology (IT) arena, CM beginnings are rooted within hardware control. Early CM tracked devices and their status within the IT environment. Early efforts to use hardware management methods for software resulted in lost productivity, cultural backlash, and justifiable resentment for the process. Therefore, the selection of CM products should take into consideration the culture of the organization, their users, their change management needs, corporate processes, and quality assurance needs. In particular, the change management process should be tailored for verification and validation for IA requirements.

To achieve a tailored CM process requires strong leadership, a proper vision, and a dedicated effort. Without strong leadership, program managers will resist, and potentially not support, the effort. Without a proper vision, needed support cannot be sustained. Without dedication, actual benefits may not be realized fast enough to sustain momentum of its implementation.

A better CM solution can significantly help organizations with the quality of their IT operation. However, such a solution does not magically come overnight by simply installing a new CM tool. To attain such a solution requires effort, time, resources, commitment, and sponsor-

ship. The main steps involve sensible evaluation, careful deployment, and proper implementation of CM processes. CM tools are valuable because they enable the integration of IA processes and automate them as much as possible into daily operation, thereby providing a complete workflow- or Groupware-like solutions. CM tool objectives that assist with automating IA include—

- Establishment of organizational baseline of equipment, software, and configuration
- Formalize the change management process (how bugs, problems, and enhancements are reported and fixed)
- Call tracking (help desk or customer hot line support)
- Software development and maintenance process (how software flows throughout the enterprise or project)
- Testing process (the different levels of testing carried out)
- Quality assurance (QA) processes (the certification of the quality of operation and service).

Avoid the mind set that one solution fits all. In fact, a combination of tools or a suite of tools may be required. A suite of tools is usually a combination offered by a vendor designed to work together. Effective product selection takes into consideration the level of CM (Executive, Operation, or Project), the organization's cultural mind set, and the design of the hardware, software, and enterprise. Many organizations have begun including CM in their enterprise management and deployment strategies. The advantage created here is that the baseline is continually updated.

The features of the most popular products are a good place to begin product selection. Since most organizations will not have the resources to evaluate each product, a more practical approach would be to review the product features. An organization should select the most promising from the group and evaluate the products first hand within its architecture. Probably most important to remember is one product does not

have to provide all of an organization's CM needs. A collection of tools would probably be best.

Today requirements for the overall enterprise environment, the users level of expertise, and the parts and pieces that compose the entire IT environment are all factors to be considered in tool selection.

An example of an overall consideration would be whether the tool is browser based or not. The advantage of a browser-based tool is that it can be accessed from different points in the enterprise and it is platform and operating system independent. Such a feature gives tools the greatest amount of flexibility. The tools and their features can be very complex. It does little good for a complex analysis to be completed on system changes if the user is unable to understand the output of the analysis. As with applications most tools interact with the operating system to get the job done. Therefore, each operating system must be considered.

50

Chapter 8 National Consesus Standard Matrix for CM

Within MIL–HDBK–61A, the following tables were presented using EIA Standard 649 as the baseline. Similar paragraphs and topics in the following documents are compared. MIL–STD–973 (although canceled) is included to provide a reference point for legacy programs—

- **ANSI/EIA–549**—National Consensus Standard for Configuration Management
- **EIA–836**—Consensus Standard for Configuration Management Data Exchange and Interoperability *(Note: Publishing scheduled for CY 2001)*
- **ISO–10303–203**—Application Protocol: Configuration Controlled Design
- **ISO 10007**—Quality Management: Guidelines for Configuration Management
- **IEEE STD 828–1990**—Software Configuration Man gement Plans
- **MIL–STD–973**—Configuration Management (REF)

The comparison matrix is provided in Table 2. A direct comparison of Standard 649 to Standard 2549 is not possible since 649 is a "what" (what are the components of a good CM program) and 2549 is a tailorable "how" (how to capture status accounting information in a "one face to Government" format). Standard 2549 supports all of the necessary CSA elements and relationships to satisfy the "what's" addressed

in Standard 649. A check mark in Table 2 means there is a corresponding topic area in the comparison document. [Source: Appendix F, CM Standards Comparison Matrix, MIL–HDBK–61A (SE)]

Table 2. Comparison Matrix—CM Standards

649 Para.	Title and Principle(s)	836	283	10007	828	973
5.1	**Configuration Management Planning and Management.** Plan CM processes for the context and environment in which they are to be performed and manage in accordance with the planning; assign responsibilities; train personnel; measure performance; and assess measurements/trends to effect process improvements.	TBD		√ 4.2.2 6.2 7.2.1 7.7	√	√ 4.2
5.1.1	**Identifying Context and Environment.** To determine the specific CM value adding functions and levels of emphasis for a particular product, identify the context and environment in which CM is to be implemented.	TBD		√ 6.1 6.2 7.7	√	√ 4.2
5.1.2	**Configuration Management Plan.** A configuration management plan describes how configuration management is accomplished and how consistency between the product definition, the product's configuration, and the configuration management records is achieved and maintained throughout the applicable phases of the product's life cycle.	TBD		√ 4.2.3 7.7 Annex A	√ 2.	√ 4.2f 5.2.1
5.1.3	**Implementation Procedures.** Prepare procedures to define how each configuration management process will be accomplished.	TBD		√ 4.2.3 7.2, 7.4 7.5, 7.6	√	√ 4.2f 5.2.1
5.1.4	**Training.** Conduct training so that all responsible individuals understand their roles and responsibilities and the procedures for implementing configuration management processes.	TBD		√ 6.2		
5.1.5	**Performance Measurement.** Assess the effectiveness of CM plan implementation and performance of the configuration management discipline with defined metrics (performance indicators).	TBD		√ 4.2.4 8		√ 5.5.7
5.1.6	**Supplier Configuration Management.** Performing configuration management includes responsibility for the configuration management performance of subordinate activities (e.g. subcontractors and vendors).	TBD		√ 6.2	√ 2.3.6	√ 5.6.1.1
5.2	**Configuration Identification.** Configuration identification is the basis from which the configuration of products are defined and verified; products and documents are labeled; changes are managed; and accountability is maintained.	TBD		√ 5.2	√ 2.3.1	√ 4.4 5.3.1 5.3.5
5.2.1	**Product Information.** Configuration documentation defines the functional, performance, and physical attributes of a product. Other product information is derived from configuration documentation.	TBD	√	√ 7.2.2	√	√ 5.3.1 5.3.4.1 5.3.4.2
5.2.2	**Product Structure.** The product composition (i.e. relationship and quantity of parts that comprise the product) is determinable from its configuration documentation.	TBD	√	√ 5.2.1 7.2.1	√	√ 5.3.1 5.3.2
5.2.3	**Product Identifiers.** All products are assigned unique identifiers so that one product can be distinguished from other products; one configuration of a product can be distinguished from another; the source of a product can be determined; and the correct product information can be retrieved.	TBD		√ 5.2.3 7.2.3	√	√ 5.3.6 5.3.6.1 5.3.6.2 5.3.6.4 5.3.6.5 5.3.6.7

Table 2. Comparison Matrix—CM Standards (continued)

649 Para. Title and Principle(s)		836	203	10007	828	973
5.2.3.1	**Identifying Individual Units of a Product.** Individual units of a product are assigned a unique product unit identifier when there is a need to distinguish one unit of the product from another unit of the product.	TBD	√	√ A.3		√ 5.3.6.6
	Identifying Individual Units of a Product. When a product is modified, it retains its original product unit identifier even though its part identifying number is altered to reflect a new configuration.	TBD				
5.2.3.2	**Identifying Groups of Units of a Product.** A series of like units of a product is assigned a unique product group identifier when it is unnecessary or impracticable to identify individual units but nonetheless necessary to correlate units to a process, date, event, or test.	TBD	√		√	√ 5.3.6.6
5.2.4	**Document Identification.** All documents reflecting product performance, functional, or physical requirements and other product information are uniquely identified so that they can be correctly associated with the applicable configuration of the product.	TBD		√ 5.2.3 7.2.3	√	√ 5.3.6.3
5.2.5	**Baselines.** A baseline identifies an agreed-to description of the attributes of a product at a point in time and provides a known configuration to which changes are addressed.	TBD		√ 5.2.4 7.2.4	√ 2.3.1.1	√ 5.3.3 5.3.4
5.2.5.1	**Establishing Baselines.** Baselines are established by agreeing to the stated definition of a product's attributes.	TBD		√ 5.2.4 7.2.4	√	√ 5.3.3 5.3.4 5.3.5
5.2.5.2	**Types of Baselines.** The Configuration of any product, or any document, plus the approved changes to be incorporated is the current baseline.	TBD		√ 5.2.4 7.2.4	√	√ 5.3.3 5.3.4
5.2.5 5.2.5.1 5.2.5.2 5.3.3	**Release system.** Maintain release control of documents for baseline management (inferred principle).	TBD		√ 5.3		√ 5.3.5
5.2.6	**Product Identification Recovery.** Recovery of product information may be necessary in cases where records of operational units of a product do not match the actual units (as reported by maintenance activities) or where such records do not exits.	TBD				
5.2.7	**Interface Control.** For product interfaces external to the enterprise, establish an interface agreement and a mutually agreed to documentation of common attributes.	TBD		√ 7.4.2		√ 5.3.7.
5.3	**Configuration Change Management.** Changes to a product are accomplished using a systematic, measurable change process.	TBD	√	√ 5.3	√ 2.3.2	√ 4.5 5.4 5.4.1 5.4.2.1

Table 2. Comparison Matrix—CM Standards (continued)

649 Para. Title and Principle(s)		836	293	10007	828	973
5.3.1	**Change Identification.** Each change is uniquely identified.	TBD	√	√ 5.2.3 7.2.3 7.4.1	√	√ 5.4.2
5.3.1.1	**Requesting Changes.** Changes represent opportunities for improvement.	TBD	√	√ 7.4.1	√ 2.3.2.1	√ 5.4.2
5.3.1.2	**Classifying Changes.** Classify requested changes to aid in determining the appropriate levels of review and approval.	TBD	√	√ 5.3 7.4.1	√	√ 5.4.2.2.1 5.4.2.4
5.3.1.3	**Documenting Requests for Changes.** Change requests must be clearly documented.	TBD	√	√ 5.3 7.4.1	√	√ 5.4.2.2.3 5.4.2.3.5 5.4.2.4.1
5.3.2	**Change Evaluation and Coordination.** Consider the technical, support, schedule, and cost impacts of a requested change before making a judgment as to whether the change should be approved for implementation and incorporation in the product and its documentation.	TBD	√	√ 5.3 6.2 7.4.2 7.4.3	√ 2.3.2.2	√ 5.4.2.1
5.3.2.1	**Change Impact Assessment.** Determine all potential effects of a change and coordinate potential impacts with the impacted areas of responsibility.	TBD	√	√ 5.3 7.3 7.4.2	√	√ 5.4.2.1
5.3.2.2	**Change Effectivity Determination.** Change documentation delineates which unit(s) of the product are to be changed. Change effectivity includes both production break-in and retrofit/recall, as applicable. **Change Effectivity Determination.** A changed product should not be distributed until support and service areas are able to support it.	TBD	√		√	√ D.5.1.21 D.5.1.23
5.3.2.3	**Change Cost/Price Determination.** The decision maker is aware of all cost factors in making the decision.	TBD			√	√ D.5.4.2 5.4..2.2.3. 3
5.3.2.4	**Change Approval Authority.** Change approval decisions are made by an appropriate authority who can commit necessary resources to implement the change.	TBD	√	√ 5.3 7.3 7.4.3	√ 2.3.2.3	√ 5.4.2.3.1 5.4.2.4.3- 5.4.2.4.5
5.3.3	**Change Implementation and Verification.** Implement an approved change in accordance with documented direction approved by the appropriate level of authority. **Change Implementation and Verification.** Verify implementation of a change to ensure consistency between the product, its documentation and its support elements.	TBD TBD	√	√ 5.3 7.4.4	√ 2.3.2.4	√ 5.4.2.1
5.3.4	**Change Management Process applied to Variances.** If it is considered necessary to temporarily depart from specified	TBD		√ 5.3		√ 4.5

Table 2. Comparison Matrix—CM Standards (continued)

649 Para. Title and Principle(s)		836	293	10007	828	973
	baseline requirements, a variance is documented and authorized by the appropriate level of authority.			7.3		5.4.3-5.4.4
5.4	**Configuration Status Accounting.** An accurate, timely information base concerning a product and its associated product information is required throughout the product life cycle.	TBD		√ 5.4 7.5.1	√ 2.3.3	√ 4.6 5.5.1
5.4.1	**CSA Information.** Configuration information, appropriate to the product, is systematically recorded, safeguarded, validated and disseminated. **CSA Information.** Configuration information content evolves and is captured over the product life cycle as tasks occur.	TBD		√ 5.4 7.5.2 7.5.3	√ √	√ 4.6 5.5.2 5.5.4 5.5.5 5.5.8
5.4.2	**CSA System.** Data collection and information processing system requirements are determined by the need for configuration information.	TBD		√ 5.4 7.5.2 7.5.3	√	√ 5.5.3
5.5	**Configuration Verification and Audit.** Verification that a product's requirement attributes have been met and the product design meeting those attributes has been accurately documented is required to baseline the product configuration.			√ 5.5	√ 2.3.4	√ 4.7 5.6.1 5.6.2 5.6.3
5.5.1	**Design and Document Verification.** Verification that a design achieves its goals is accomplished by a systematic comparison of requirements with the results of tests, analyses or inspections. **Design and Document Verification.** Documentation of a product's definition must be complete and accurate enough to permit reproduction of the product without further design effort			√ 5.5 7.4.4 7.6		√ 5.6.2 5.6.3
5.5.2	**Configuration Audit.** Where necessary, verification is accomplished by configuration audit	TBD		√ 7.6		√ 5.6.1 5.6.2 5.6.3
5.5.3	**Continuing Performance Audits and Surveillance.** Periodic reviews verify continued achievement of requirements, identify and document changes in performance, and ensure consistency with documentation.	TBD		√ 7.6		√ 4.7
5.6	**Configuration Management of Digital Data.** Apply configuration management principles to ensure the integrity of digital representations of product information and other data	TBD		√ 7.2.3		√ 4.3
5.6.1	**Digital Data Identification.** Apply digital data identification rules to maintain document, document representation, and file version relationships.	TBD		√ 7.2.3		√ 4.3.2
5.6.2	**Data Status Level Management.** Apply business rules using data status levels for access, change management, and archiving of digital data documents.	TBD		√ 5.3		√ 4.3.2
5.6.3	**Maintenance of Data and Product Configuration Relationships.** Maintain relationships between digital data, data requirements, and the related product configuration to ensure accurate data access.	TBD		√ 7.2.3		√ 4.3.2
5.6.4	**Data Version Control and Management of Review, Comment, Annotation, and Disposition.** Apply disciplined version control to manage document review electronically.	TBD		√ 7.2.3		√ 4.3.2
5.6.5	**Digital Data Transmittal.** Ensure that a transmitted digital data product is usable.	TBD				√ 4.3.1 4.3.2 4.3.3
5.6.6	**Data Access Control.** Effective digital data access fulfills requirements, preserves rights, and provides users with data they are entitled to in the correct version.	TBD				√ 4.3.1 4.3.2 4.3.3

Chapter 9 Current and Future Assessment of CM

State of CM in the 21st Century

The principles that drive the CM discipline have been developed over the past thirty or forty years and are now stable and well defined. The professional aspects of CM are contained in many national and internationally recognized standards.

Currently, best business practices mandate good CM. Practitioners, however will be challenged to break new ground in designing and implementing processes, particularly within computerized systems.

Increasingly, organizations are seeking to integrate functions across the spectrum of their activities. Entire businesses, must often configure and reconfigure products, to meet constantly changing customer expectations, increasing product variety, and massive technological change. This new level of integration or coordination is the essence of enterprise management today.

Today, there are CM professionals with 10–20 years of experience, many with professional certifications, that are adept at making the CM process work. These CM professionals are a key resource if not the very foundation executing effective CM.

There are also powerful, enterprise CM software products that provide tools and data to perform CM. In some cases, the tools contain CM rules to support the process and dynamic data exchanges. These software products can be tailored to your environment yet maintain the integrity of the CM process. Many such tools are presented in Appendix E.

The value of CM has not been fully realized, it will be appreciated most when recognized as a process that makes other core business processes work. That is the understanding currently in many organizations. Training brings such dependencies into proper perspective. Such training will someday begin in the university or apprenticeship training.

It is said that CM, in its best scenario would be transparent, totally embedded in an enterprise business model because the process just makes good business sense. We are not there yet, and will not be there until the talents required for the CM process are understood completely and educated in the modern systems life cycle process.

Assessment of Future Developments and Trends

CM is now and will continue to be driven by changes and advancements in the computer industry. By exploiting the capabilities of CM techniques, IA personnel can garner powerful methods to verify and validate each facet within the infrastructures operation. By using CM probing, packet sniffers, infrastructure attacks and scanning techniques, CM personnel can map the "n" state, or baseline of their equipment. These same techniques are also used to validate changes once implemented. The vision of where IA and CM are headed is directly linked with the vision of change.

It is probably best that we examine the nature of change. The addition of new capabilities, the discovery of problems, and the reduction of vulnerability all create the need for change. Operating systems periodically require newer file versions, additional drivers, and service packs. Hardware may require modifications through engineering change orders (ECOs) and field change orders (FCOs). Infrastructures and architectures may require reconfiguration of equipment. Communication equipment may require protocols to be updated or firmware replacement. If the timeline for information technology development is examined, the quantity, type and rate of change is ever increasing and creates a new challenge for CM to keep pace.

Now that we have a better understanding of the nature of change, we can now speculate on the direction that change may take. Early computing environments were homogeneous operating systems, conducting multi-tasking to dumb terminals. Change, CM, and verification and validation were less complex. Dumb terminals required hardware and firmware changes. Operating system and application changes were made on the mainframe. IA managers could physically check, inventory, and assess the "n" state of their operation. Notifications and updates were received by mail. Each was manually installed, many with a matrix of complicated parameters. The CM team had to provide for recovery in the event that these changes created a negative effect on the operation of their system.

The advancement in capabilities of the personal computer and practicality of reliable high-speed local area networks created a major shift in architecture to distributed processing. With this shift, new CM requirements were created. Today we have hybrid operating systems with intelligent peripherals participating in an enterprise environment. This complex environment requires advanced tools. These tools evaluate system configuration before they install themselves, link back to parent sites for additional resources, provide automated recovery, and detailed event logging. This clearly establishes the direction of technology as becoming more complex and yet easier to operate. With the objective to keep the users minimum required skill set low, effective tools will require advanced capabilities with small amounts of user activity.

Combining the timeline of development with future requirements results in the quantity and speed of change to increase and creates a new challenge for CM to keep pace. On the horizon are two new architecture shifts wireless and Internet II. New protocols and capabilities create potential challenges of new vulnerabilities. Internet II, promises to provide user protocols with quality of service information. Wireless devices already can interface with PC's using an authentication process and update them. The vulnerability exists when unauthorized devices emulate the network switch or PC and gather information about the network or record the wireless devices response.

Smart software (such as operating system, applications, browsers, plug-ins, search engines, and virus checking) with "just in time" modular-

ity and automatic update capability also provides new challenges. The automatic update features have the potential to install unauthorized code.

Our vision to this point has been rooted in industry advances that shape CM and drive requirements for change. A comprehensive look at change management's future requires an examination of its impact on the workforce.

What is change management's effect on the industry? First, although advancement in technology has made CM tools easier to use, the challenge, to maintain qualified personnel in this expanding field is growing. To date we have seen downsizing and right sizing that has resulted in greater responsibility per position. The IT industry has long used the philosophy of recruiting the expertise it needs to fulfill IT requirements. A shortage of available expertise in the industry has resulted in home growing as a popular option to meet demands. This option is not without risk. There are many incentives for personnel to migrate to better opportunities once they receive valuable training. An alternative that is growing in popularity is outsourcing of IT requirements. The value of outsourcing may be determined by conducting a business case analysis or total cost of ownership study.

The growth and importance of IT where we live and work requires sound IO and IA techniques. CM is a broad based pallet of capabilities that manage, document, and report the "cradle to grave" aspects of the IT environment. Therefore it is a given these tools should be exploited to their full potential when available.

Appendix A Abbreviations

Abbreviation	Acronym
AUTODIN	Automated Digital Network
BPI	Business Process Innovation
C/S/A	Commander in Chief, Service, and Agency
C4I	Command, Control, Communications, Computers, and Intelligence
CCB	Configuration Control Board
CCDM	Certified Configuration and Data Manager
CCDS	Certified Configuration and Data Specialist
CCRB	Configuration Control Review Board
CERT	Computer Emergency Response Team
CFR	Code of Federal Regulations
CI	Configuration Identification
CINC	Commander in Chief
CM	Configuration Management

CM/DM	Configuration Management/Data Management
CMB	Configuration Management Board
CMII	Configuration Management Phase II Process
CMP	Configuration Management Plan
CR/TA	Critical Review/Technology Assessment
CSA	Configuration Status Accounting
CSCI	Computer Software Configuration Identification
DAA	Designated Approval Authority
DISA	Defense Information Systems Agency
DIT	Design Interface Test
DITSCAP	Department of Defense Information Technology Security Certification and Accreditation Process
DMS	Defense Messaging System
DoD	Department of Defense
DoDISS	Department of Defense Index of Specifications and Standards
DoS	Denial of Service
ECO	Engineering Change Order
EIA	Electronic Industries Alliance
ESA	European Space Agency
FCA	Functional Configuration Audit

FCO	Field Change Order
FQR	Formal Qualification Review
GEIA	Government Electronics & Information Technology Association
GIAT	Government Installation Acceptance Test
GPIAT	Government Pre-Installation Acceptance Test
GPO	Government Printing Office
IA	Information Assurance
IA ETA	Information Assurance Education, Training, and Awareness
IAVA	Information Assurance Vulnerability Alert
IAVB	Information Assurance Vulnerability Bulletin
ICCB	Interface Configuration Control Board
ICD	Interface Control Document
ICM	Institute of Configuration Management
ICR	Integration Change Request
ICWG	Interface Configuration Working Group
IEC	International Electromechanical Commission
IEEE	Institute of Electrical and Electronics Engineers
IM	Interface Management
IPT	Integrated Product Team

ISO	International Standards Organization
ISO	Information Security Officer
ISONET	International Standards Organization Information Network
ISSM	Information Systems Security Manager
ISSO	Information Systems Security Officer
IT	Information Technology
JTF–CNO	Joint Task Force-Computer Network Operators
MIL–STD	Military Standard
NATO	North Atlantic Treaty Organization
OS	Operating System
PCA	Physical Configuration Audit
PCR	Problem Change Request
PDF	Portable Document Format
PKI	Public Key Infrastructure
POC	Points of Contact
QA	Quality Assurance
RFP	Request for Proposal
SA	System Administrator
SIT	System Interface Test

STEP	Standard for Exchange of Product Model Data
UT	Unit Test

Appendix B Terms and Defintions

Terminology is a key factor in ensuring a common understanding. Terms used throughout the report have the same meaning as the terms presented in this Appendix.

Audit—An independent examination of a work product/process, or set of work products/processes to assess compliance with specifications, standards, contractual agreements, or other criteria set.

Baseline—A baseline is a Configuration Identification (CI) formally designated and applicable at a specific point in an item's life cycle. Baselines plus approved changes from those baselines, constitute the current configuration identification. A CI document or set of such documents formally designated by an appropriate authority at a specific time during a CI life cycle.

Configuration Control Board (CCB)—A board composed of technical and administrative representatives who approve or disapprove proposed engineering changes to an approved baseline.

Configuration Identification (CI)—The current approved or conditionally approved technical documentation for a configuration item as set forth in specifications, drawings, associated lists, and documents referenced therein.

Configuration Management (CM)—A management process for establishing and maintaining consistency of a systems' performance, functional and physical attributes with its requirements, design, and operational information throughout its life. A discipline applying technical and administrative direction and surveillance to—

- Identify and document the functional and physical characteristics of CI. Audit the CIs to verify conformance to specifications, interface control documents and other contract requirements
- Control changes to CIs and their related documentation
- Record and report information as needed to manage CIs effectively, including the status of proposed changes and the implementation status of approved changes.

Configuration Management Plan (CMP)—The configuration management plan defines the implementation (including policies and methods) of configuration management on a particular program/project.

Configuration Status Accounting—The recording and reporting of information needed to manage configuration effectively, including—

- A listing of the approved configuration identification
- The status of proposed changes, deviations, and waivers to the configuration
- The configuration of all units of the CI in the operational inventory.

Information Assurance (IA)—Information Operations that protect and defend information and information systems by ensuring their availability, integrity, authentication, confidentiality, and non-repudiation. This includes providing for restoration of information systems by incorporating protection, detection, and reaction capabilities.

Information Assurance Vulnerability Alert (IAVA)—The IAVA is a process that incorporates the identification and evaluation of new vulnerabilities, disseminates technical responses, and tracks compliance within the DoD community.

Life cycle—A generic term covering all phases of acquisition, operation, and logistics support, of an item, beginning with concept definition and continuing through disposal of the item.

Risk management—An organized process to identify what can go wrong, to quantify and access associated risks, and to implement/control the appropriate approach for preventing or handling each risk identified.

Systems security engineering—An element of system engineering that applies scientific and engineering principles to identify security vulnerabilities and minimize or contain risks associated with these vulnerabilities. It uses mathematical, physical, and related scientific disciplines, and principles and methods of engineering design and analysis to specify, predict, and evaluate the vulnerability of the system to security threats.

Appendix C

Overarching Configuration Management (CM) Information Sourses

CM Groups, Associations, and Related Professional Web Sites

- American Society for Engineering Management
  http://www.asem.com
- American Society for Quality
  http://www.asq.org
- Association for Configuration and Data Management
  http://www.acdm.org
- Association For Enterprise Integration
  http://www.afei.org
- Boston Metro ClearCase User Group
  http://www.penguin-inc.com/BMCCUG
- Configuration Management Benchmarking Group
  http://www.cmbg.org/index.htm
- CM Certification Team
  http://spiderweb.btg.com/Spider2?CMCert
- CMII User Group
  http://www.cmiiug.com
- Data Management Association International
  http://www.dama.org

- Government Electronics and Information Technology Association
  http://www.geia.org

- Institute of Configuration Management
  http://www.icmhq.com

- International Council on Systems Engineering
  http://www.incose.org

- International Organization for Standardization
  http://www.iso.ch

- International Society of Logistics
  http://www.sole.org

- National Defense Industrial Association
  http://www.ndia.org

- Nuclear Information and Records Management Association
  http://www.nirma.org

- Standards Engineering Society
  http://www.ses-standards.org

CM Resource Guides

- Defense Information Infrastructure Common Operating Envelope
  http://DoD-ead.mont.disa.mil/cm/cm_page.html

- Defense Information Systems Agency Links
  http://www.itsi.disa.mil/links.html

- Hal Render's Bibliography on Software Configuration Management
  http://liinwww.ira.uka.de/bibliography/SE/scm.html

- Steve Easterbrook's Incredible CM Resource Guide
  http://www.cmiiug.com/Sites.htm

- SCM Definitions
  http://www.enteract.com/~bradapp/acme/scm-defs.html

CM Information Centers

- Carnegie Mellon—Software Configuration Management (SCM)at the Software Engineering Institute (SEI)
  http://www.sei.cmu.edu/legacy/scm)(http://www.sei.cmu.edu

- Configuration Management Information Center
  http://www.pdmic.com/cmic

- Defense Standardization Program
  http://www.dsp.dla.mil/reform/improve.html

- Department of Defense (DoD) Configuration and Data
  http://www.acq.osd.mil/io/se

- Department of Defense Single Stock Point for Military Specifications, Standards and Related Publications
  http://www.DoDssp.daps.mil

- Department of the Navy IM/IT On-Line Resources
  http://www.don-imit.navy.mil/basicSearch.asp?txtSearch=Configuration+Management

- Government Change Management Center
  http://cmckc.meridianksi.com/kc/login/login.asp?kc_ident=kc0001

- Government Software Configuration Management at the Software Technology Support Center
  http://www.stsc.hill.af.mil/cm/index.asp

- Navy Configuration Management
  http://www.acq-ref.navy.mil/turbo2/index_nn.html

- Product Data Management Information Center
  http://www.pdmic.com

- Software Deployment Information Clearinghouse
  http://www.cs.colorado.edu/~rickhall/deployment

- U.S. Army Integrated TrainingArea Management
  http://www.army-itam.com/main.htm

CM and Related Standards and Plans

- Configuration/Change Management
  http://www.ogc.gov.uk/ogc/ogchelp.nsf/pages/redirect.html

- Configuration Management Plan (sample)
  http://sparc.airtime.co.uk/users/wysywig/cmp.htm

- Configuration Management standards (list of)
  http://www.12207.com/test.htm

- Defense Information Systems Standards Document Library
  http://www-library.itsi.disa.mil

- Institute of Electrical and Electronics Engineers
  http://www.standards.ieee.org/index.html

- International Standards for Quality Assurance
  http://www.isoeasy.org

- Managing Standards V4.5
  http://sparc.airtime.co.uk/users/wysywig/wysywig.htm

- Space and Naval Warfare Systems Command CM
  http://sepo.spawar.navy.mil/sepo/index1.html

- U.S. Government Information—Standards and Specifications
  http://lsounix1.library.yale.edu/govdocs/stand.html

CM and Related Links

- Brad Appleton's CM links
  http://www.enteract.com/~bradapp/links/scm-links.html#SCM

- Configuration Management Frequently Asked Questions (FAQ)
  http://www.iac.honeywell.com/ichome/Rooms/DisplayPages/LayoutInitial

- Pascal Molli's excellent CM page
  http://www.loria.fr/~molli/cm-index.html

- SEweb Software Configuration Management
  http://see.cs.flinders.edu.au/seweb/scm

- Yahoo links on Configuration Management
  http://www.yahoo.com/Computers_and_Internet/Software/Programming_Tools/Software_Engineering/Configuration_Management

Process-Based Configuration Management

- Computer Associates—CCC/Harvest (Multiplatform)
  http://www.cai.com/products/ccc_harvest.htm

- Computer Associates—Endevor (OS/390)
  http://www.cai.com/products/endevor_mvs.htm

- Continuus—Continuus/CM and WebSynergy (Multiplatform)
  http://www.continuus.com/products/productsBB.html

- ExpertWare—CMVision (Multiplatform)
  http://www.cmvision.com

- Intasoft—Allchange (Multiplatform)
  http://www.intasoft.net/

- McCabe & Associates, Inc.—TRUEchange (Multiplatform)
  http://www.mccabe.com/products/truechange.htm

- Merant—Dimensions (Multiplatform)
  http://www.merant.com/products/pvcs/dimensions/index.asp

- Prosoft—XStream (Multiplatform)
  http://www.prosoftcm.com

- Rational—ClearCase (Multiplatform)
  http://www.rational.com/products/clearcase/index.jsp

- Serena—Change Man with eChange Man (Multiplatform)
  http://www.serena.com/html/changeman.htm

- Softlab—Enabler (Multiplatform)
  http://www.softlab.com/technology/frm_tech00.asp

- Visible Systems—Razor (Multiplatform)
  http://www.razor.visible.com

- Vertical Sky (Multiplatform)
  http://www.verticalsky.com/products/scm/unix-nt

- http://www.datadesign.com/solutions

- http://www.starbase.com/

CM and Version Control Systems Web Sites

- +1 Software Engineering—+1CM (Solaris)
  http://www.plus-one.com/+1CM_fact_sheet.html

- AccuRev—AccuRev/CM (Multiplatform)
  http://www.accurev.com/i_prod.html

- Agile Software Corporation
  http://www.agilesoft.com

- Aldon
  http://www.aldon.com

- BitMover, Inc.—BitKeeper (Multiplatform)
  http://www.bitmover.com/bitkeeper

- British Aerospace—LifeSpan
  http://www.lifespan.co.uk

- Burton Systems—TLIB (Windows)
  http://www.burtonsys.com

- ComponentSoftware—CS–RCS (Windows)
  http://www.componentsoftware.com/csrcs

- Configuration Data Services—ECMS
  http://www.configdata.com/w002product.htm

- Data Design Systems—PrimeCode
  http://www.datadesign.com/solutions

- DuraSoft—Revision Control Engine (Multiplatform)
  http://wwwipd.ira.uka.de/~RCE

- George James Software—VC/m
  http://www.georgejames.com

- Giant Technologies—Visual SourceMail (Windows)
  http://www.giant-technologies.com/sourcemail

- Industrial Strength Software—ChangeMaster (AS/400)
  http://www.industrial-strength.com

- Inroads Technology—Rapid Implementation Technology
  http://www.inroadstech.com/index_help.html

- Interwoven—TeamSite
  http://www.interwoven.com

- JavaSoft—JavaSafe (Solaris, Windows)
  http://www.javasoft.com/marketing/collateral/java_safe_ds.html

- JSSL—Librarian (Windows)
  http://www.winlib.com

- Lockheed Martin—EagleSpeed (Linux, Unixes)
  http://www.lockheedmartin.com/syracuse/eaglespeed

- Lucent Technologies—Sablime (HP, NCR, SUN)
  http://www.bell-labs.com/project/sablime

- Mainsoft Corporation—Visual SourceSafe (Unix)
  http://www.mainsoft.com/products

- Merant—PVCS (Multiplatform)
  http://www.merant.com/products/pvcs

- Microsoft—Visual SourceSafe (Windows 9)
  http://msdn.microsoft.com/ssafe

- MKS
  http://www.mks.com/products/scm/unix-nt

- NCI—Control (Multiplatform)
  http://www.nci-sw.com/software_tools.html

- Perforce Software—Perforce Fast SCM System (Multiplatform)
  http://www.perforce.com/perforce/products.html

- Quality Software Components, Ltd.—GP-Version (Windows)
  http://www.qsc.co.uk

- Qumasoft—QVCS (Windows)
  http://www.qumasoft.com

- Realcase—Multi-Platform Code Management (Multiplatform)
  http://www.realcase.com

- Reliable Software—Code Co-op (Windows)
  http://www.relisoft.com/co_op

- Sequel UK—Alchemist
  http://www.sequeluk.com/alchemist/default.htm

- SiberLogic—SourceTrack (Multiplatform)
  http://www.siberlogic.com

- SoftLanding Systems—TurnOver (AS/400)
  http://www.softlanding.com/sourcecode.html

- Software Ever After—R-Sea-Yes (Windows)
  http://www.s-e-a.com.au

- SourceGear—SourceOffSite (Windows)
  http://www.sourcegear.com/sos

- Sun—Forte TeamWare (Multiplatform)
  http://www.sun.com/forte/teamware/
  ;$sessionid$L3LD1EIAADN35AMTA1FU45Q

- Synergex—PVCS (Multiplatform)
  http://www.merant.com/products/pvcs

- Tesseract—Lifecycle Manager
  http://www.tesseract.co.za

- Ultracomp—Red Box
  http://www.ultracomp.co.uk/products/redbox.html

- UNI Software Plus—VOODOO (Macintosh)
  http://www.unisoft.co.at/products/voodoopersonal.html

- http://www.lucent.com/search97cgi/vtopc?querytext=
  configuration+management

- http://www.synergex.com/solutions/dev_tools/pvcs.htm

CM Build Web Sites

- +1 Software Engineering—+1Base
  http://www.plus-one.com/+1Base_fact_sheet.html

- Catalyst Systems Corporation
  http://www.catsyscorp.com/products.html

- Cleanscape Software International—qef
  http://www.cleanscape.net/stdprod/index.html

- G7x—Build Manager 2000 (build management and dependency analysis for Visual Basic)
  http://www.g7x.com

- Kinook Software (build management software for Windows software and web developers)
  http://www.kinook.com

- Lucent Technologies—nmake
  http://www.bell-labs.com/project/nmake

- Web Tools International
  http://www.wticorp.com

- Wind River—Sniff+ (source code analysis and cross-platform development environment)
  http://www.windriver.com/products/html/sniff.html

Software Programming Environments Web Sites and Partial CM Versioning Capabilities

- Associated Computer Experts—CADESE
  http://www.ace.nl/products/cadese.htm

- Compaq—DECset
  http://www.openvms.compaq.com/commercial/decset/decset_index.html

- Genitor Corporation—Genitor
  http://www.genitor.com/

- Hewlett-Packard—Softbench
  http://devresource.hp.com/softbench/sb_description.html

- Metrowerks—CodeWarrior
  http://www.metrowerks.com

- OTI
  http://www.oti.com

Product Data Management Web Sites

- Auto-Trol Technology Corporation—Centra 2000
  http://www.centra2000.com

- CMSTAT—CM/PDM v
  http://www.cmstat.com

- Eigner + Partner—CADIM/EDB
  http://www.ep-ka.de

- Integware—Engineering Change Controller
  http://www.integware.com

- ISS—InSync
  http://www.isscorp.com/insync.html

- Matrix One—eMatrix
  http://www.matrixone.com/products/ematrix.html

- Parametric Technology Corporation—Windchill
  http://www.sherpa.com

- Prosoft—XStream
  http://www.prosoftcm.com

- Sherpa—SherpaWorks
  http://www.sherpa.com

- SDRC—Metaphase
  http://www.sdrc.com/metaphase/index.shtml

- UniGraphics Solutions, Inc.—IMAN
  http://www.ugs.com/products/iman

- http://www.ace.nl/products/cadese.htm#chaneproduct

- http://www.acseni.com

- http://www.axalant.com

- http://www.compaq.com/showroom

Diff/Merge Tools Web Sites

- Araxis—PMdiff (Windows)
  http://www.araxis.com/pmdiff/index.html

- DuraSoft—Byte Differencing Engine (Multiplatform)
  http://wwwipd.ira.uka.de/~RCE

- Guiffy Software—Guiffy (Multiplatform)
  http://www.guiffy.com

- Prescient Software—Merge Right (Multiplatform)
  http://www.prescient.com

- Scooter Software—Beyond Compare (Windows)
  http://www.scootersoftware.com

Miscellaneous CM Information Web Sites

- Catalyst Systems Corporation—okcatalyst
  http://www.catsyscorp.com

- Eslog—Andromede
  http://perso.club-internet.fr/eslog/anglais/index_Eng.htm

- Igatech—FileCM
  http://www.igatech.com/filecm

- Interface Technologies—TeamVizor
  http://teamvizor.iftech.com

- Ives Development—TeamStudio
  http://www.teamstudio.com

- Kintana
  http://www.kintana.com

- MBR Technologies
  http://www.mbrtechnologies.com/index_nn.asp

- MEARS
  http://dpd18.redstone.army.mil:93/home.HTM

- Patriate—Access*Rite
  http://www.patriate.com

- Perforce—WebKeeper
  http://www.perforce.com/perforce/webkeeper.html

- Pocket Soft—.RTPatch
  http://www.pocketsoft.com/products.html

- Serena
  http://www.serena.com/html/home.htm

- SCM International—LifeLine for PVCS
  http://www.scmint.com/life_i.html

- http://www.aperture.com/PRODINFO/prodinfo.htm

CM Issue Tracking/Workflow Systems

- +1 Software Engineering—+1CR
  http://www.plus-one.com

- Abacus Systems—Aegis
  http://www.abacus-systems.com

- Archimedes, Inc.—Archimedes BugBase
  http://www.bugbase.com/newhome.htm

- Continuus
  http://www.continuus.com

- Cybersource—FAULT
  http://www.cyber.com.au/cyber/product/fault

- Elsinore Technologies, Inc.
  http://www.elsitech.com

- GLOBEtrotter—GLOBEtrack
  http://www.globetrotter.com/globetrack/globetrack.shtml

- KeyStone
  http://keystone.whitepj.net

- McCabe & Associates, Inc.
  http://www.mccabe.com/main.html

- Merant—PVCS Tracker
  http://www.merant.com/products/pvcs/tracker/index.asp

- MetaQuest Software
  http://www.metaquest.com

- NetResults Corporation—Problem Tracker
  http://www.netresultscorp.com/pt_home.html

- New Object—Active Report
  http://www.new-object.com

- Nortel Networks
  http://www.clarify.com/products/l1_fo.htm

- NuMega
  http://www.numega.com

- Platinum—Apriori
  http://www.platinum.com/products/dataw/applsres.htm

- Pragmatic Softtware—Defect Tracker
  http://www.pragmaticsw.com/Pragmatic/DefectTracker.asp

- Rational—ClearDDTS
  http://www.rational.com/products/clear_ddts/index.jsp

- Rational—ClearQuest
  http://www.rational.com/products/clearquest/index.jsp

- Remedy—Action Request System
  http://www.remedy.com/solutions/core/datasheets/arsystem.htm

- Seapine Softare
  http://www.seapine.com

- Sesame—ExtraView
  http://www.sesame.com

- Soffront
  http://www.soffront.com

- Software with Brains, Inc.—SWBTracker
  http://www.softwarewithbrains.com/swbtrack.htm

- Softwise—PR-Tracker
  http://www.halcyon.com/softwise/prtracker.html

- Sparta Systems
  http://www.sparta-systems.com

- TeamShare
  http://www.teamshare.com/products

- Threerock Software—Threerock BugBase
  http://www.threerock.com/products_bugbase.asp

- Unipress—Footprints
  http://www.unipress.com/footprints/index.html

- Vertical Sky
  http://www.mks.com/welcome.shtml

- Visible Systems—Razor
  http://www.razor.visible.com

Public CM Version Control

- Aegis
  http://www.canb.auug.org.au/~millerp/aegis/aegis.html

- CERN—CMZ
  http://wwwinfo.cern.ch/cmz

- CVS
  http://www.cvshome.org

- DVS
  http://www.cs.colorado.edu/serl/cm/dvs.html

- Inversion
  http://inversion.tigris.org

- Keep-It
  http://www.keep-it.com

- ODE
  http://www.accurev.com/ode/index.html

- PRCS
  http://www.XCF.Berkeley.EDU/~jmacd/prcs.html

- RCS
  http://www.gnu.org/software/rcs/rcs.html

- SCCS (free implementations)
  http://www.cvshome.org/cyclic/cyclic-pages/sccs.html

- TCCS
  http://www.oreilly.com/homepages/tccs

- tkCVS
  http://www.twobarleycorns.net/tkcvs.html

Public CM Build Web Sites

- Ant build tool that utilizes XML descriptions
  http://jakarta.apache.org/ant

- Bake
  http://bake.werken.com

- bras
  http://wsd.iitb.fhg.de/~kir/brashome

- ClearCase Build Management System
  http://www.centralus.com/products.htm

- Cons—Unix make alternative
  http://www.baldmt.com/cons

- Cook
  http://www.canb.auug.org.au/~millerp/cook/cook.html

- imake
  http://www.primate.wisc.edu/software/imake-stuff

- Jam—Make(1) Redux
  http://www.perforce.com/jam/jam.html

Miscellaneous Public CM Web Sites

- Bonsai
  http://www.mozilla.org/bonsai.html

- CWCVS
  http://www.electricfish.com/products/CWCVS

- ExamDiff
  http://www.nisnevich.com/examdiff/examdiff.htm

- FtpVC
  http://www.nisnevich.com/ftpvc/ftpvc.htm

- TkDiff
  http://www.accurev.com/free/tkdiff/index.html

- Xdelta
  http://www.xcf.berkeley.edu/~jmacd/xdelta.html

Public Domain or Free Problem CM Tracking Systems

- The Bug Database
  http://world.std.com/~rsh/robert2.html

- Bugzilla
  http://www.mozilla.org/projects/bugzilla

- GNATS, GNU Bug Tracking System
  http://www.alumni.caltech.edu/~dank/gnats.html

- Debbugs, the Debian Bug Tracking System
  http://benham.net/debbugs

- JitterBug
  http://samba.anu.edu.au/cgi-bin/jitterbug

- Open Track Defect and Enhancement Tracking System
  http://www.accurev.com/ot/index.html

- Req—An E-mail based request tracking system
  http://www.ccs.neu.edu/software/ccs/req

- Request Tracker
  http://www.fsck.com/projects/rt

- RUST
  http://www.eng.utah.edu/rust/docs

- Mort Bay Consulting—Tracker
  http://www.mortbay.com/mortbay/mbindex.html

- wreq
  http://www.math.duke.edu/~yu/wreq

CM Consulting and Education

- A Better Solution, Inc.
  http://www.abs-consulting.com/abs_consulting.html

- Aspen Software Consultants, Inc.
  http://www.aspenconsult.com

- Bradley Enterprises, Ltd.
  http://www.BradleyEnterprises.com

- Brand Consulting Group
  http://www.bcgiso.com/cmm/cmm.html

- BOBEV Consulting
  http://www.bobev.com

- CCG Solutions, Australia
  http://www.ccg-solutions.com.au

- Center for Systems Management—Integrating Project Management, Systems Engineering, and Process Improvement
  http://www.csm.com

- Central U.S. Consulting Corp.
  http://www.centralus.com

- Charles Maier Associates, United Kingdom
  http://freespace.virgin.net/charles.maier

- Configuration Management, Inc.
  http://softwareconfiguration.com

- Dave Clarke
  http://www.dhcl.demon.co.uk

- Collective Technologies
  http://www.colltech.com

- Common Sense Systems, Inc.
  http://www.common-sense.com

- Configuration Management Training Foundation
  http://www.cmtf.com

- Dart Technology Strategies Inc. (Vendor strategies—planning, marketing. User strategies—tools, process, Web engineering)
  http://www.susandart.com

- Davis Systems
  http://www.DavisSys.com

- Documentation Control Courses at the University of Wisconsin, Milwaukee
  http://www.uwm.edu/UniversityOutreach/catalog/ENG/index.shtml

- Domain Systems, Inc.
  http://www.domainsi.com

- ecm5tools
  http://www.ecm5tools.com

- GfKM—Gesellschaft fuer KonfigurationsManagement mbH, Germany
  http://www.gfkm.de

- Flagship, Inc.
  http://www.flagship-software.com

- Footprint Consulting (UK)
  http://www.fpcl.co.uk

- GIOS—Software Development Process Innovation
  http://www.giosinc.com

- The Highview Group
  http://www.highviewgroup.com/welcome/?World_Class_Solutions

- Inspect (UK), Ltd.
  http://www.inspect-uk.com

- Institute of Configuration Management
  http://www.icmhq.com

- Integrated Support Systems, Inc., Training and Services
  http://www.isscorp.com/train.html

- Interwoven
  http://www.interwoven.com

- Intracoastal Software Consulting, Inc.
  http://www.intracoastal.com

- James Tykal and Associates, Inc.
  http://people.ce.mediaone.net/jtykal/index.html

- Kaiasoft Corporation
  http://www.kaiasoft.com

- Learning Tree
  http://www.learningtree.com

- Raven Configuration Management
  http://www.configuration.org

- MERANT University
  http://www.merant.com/services/training

- Parrus Technologies LLC
  http://www.parrus.com

- Patriate
  http://www.patriate.com

- Penguin Computing, Inc.
  http://www.penguin-inc.com

- Productivity GmbH (Germany)
  http://www.productivity.de/Frames.htm

- Pretzel Logic Software, Inc.
  http://www.pretzel.com

- Process Improvement Associates
  http://www.processimprovement.com

- QIS Systemhaus GmbH
  http://www.qis-systemhaus.de/consulting/index.php?lang=en

- Questcon Technologies
  http://www.questcon.com

- ReleaseTEAM
  http://www.releaseteam.com

- Robbins-Gioia, Inc.
  http://www.robbinsgioia.com

- SCM International
  http://www.scmint.com/index_n.html

- SCM Labs, Inc.
  http://www.scmlabs.com

- SoftFrame
  http://www.softframe.com

- Software Configuration Solutions, Inc.
  http://www.softconfig.com

- Intelligent Resources (Software Process Solutions)
  http://www.intelligentresources.net/sps.htm

- Software Productivity Center (Canada)
  http://www.spc.ca

- Space Coast Information Systems, Inc.
  http://www.spacecoastis.com

- Spazio ZeroUno S.p.A., Italy
  http://www.spaziozerouno.it/english/e_presentazione.htm

- System Technology Institute
  http://www.stitraining.com

- Straycom Technical
  http://www.straycomtechnical.com/sys-tmpl/door

- Technology Training Corporation CM Courses
  http://www.ttcus.com

- Timefold
  http://www.timefold.com

- Vaccaperna Systems Ltd. (SCM Process consulting specializing in Perforce)
  http://www.vaccaperna.co.uk

- W.E.C.A.N., Inc.
  http://www.wecaninc.com

Software Configuration Management (SCM) Hosting and Issue Tracking Web Sites

- e-CM.net
  http://www.e-cm.net

- FreePository
  https://www.freepository.com

- Merant ASaP
  http://www.merant.com/solutions/asap

- Mesa Vista
  http://www.mesavista.com

- Source Forge
  http://sourceforge.net

- SourceHosting.net
  http://www.sourcehosting.net

- teamTrack Online
  http://www.teamshare.com/products/index.htm

CM Research Web Sites

Systems Web Sites

- Advanced Configuration Management System
  http://adcoms.finmeccanica.it

- IIT Software Engineering Group
  http://wwwsel.iit.nrc.ca/projects/scm

- Department of Computer Science at the University of Calgary
  http://www.cpsc.ucalgary.ca/Research

- Department of Computer Science University of Colorado, Bolder
  http://www.cs.colorado.edu/serl/cm/NUCM.html

- Proteus Configuration Language (PCL)
  http://www.comp.lancs.ac.uk/computing/research/cseg/projects/PROTEUS/PCL.html

- Ragnarok
  http://www.daimi.aau.dk/~hbc/Ragnarok

- Software Engineering Research Group—ShapeTools
  http://swt.cs.tu-berlin.de/~shape/index.html

- Department of Computer Science University of Colorado—Bolder Software Dock
  http://www.cs.colorado.edu/serl/cm/dock.html

- Department of Computer Science University of Colorado—Bolder Software Release Management (SRM)
  http://www.cs.colorado.edu/serl/cm/SRM.html

- Vesta
  http://www.research.compaq.com/SRC/vesta

- Virtual Collaboratorium
  http://www.extreme.indiana.edu
  http://www.extreme.indiana.edu/pseware/vc/overview.html

- http://www.sei.cmu.edu/activities/legacy/scm/scmDocSummary.html

Other Related Web Sites

- University of California, Irvine—Working Group on Versioning and Configuration Management of World Wide Web Content
  http://www.ics.uci.edu/~ejw/authoring

- http://www.virginia.edu/~risk

Appendix D Institute of Electrical and Electronics Engineers (IEEE) CM Reference Material

1. IEEE Standard for Software Configuration Management Plans
   IEEE 1998.
   ISBN: 0–7381–0331–4
   Product No: SH94653–TBR;
   IEEE Standard No: 828–1998

2. IEEE Standard for Software Configuration Management Plans
   IEEE 1998.
   ISBN: 0–7381–0447–7
   Product No: SS94653–TBR
   IEEE Standard No: 828–1998

3. ANSI/ISO/ASQ Quality management and quality assurance standards Part 3: Guidelines for the applications of ANSI/ISO/ASQC Q9001–1994 to development, supply installation and maintenance of computer software IEEE 1997; Softcover; 1997.
   Product No: SH94727–TBR
   IEEE Standard No: Q9000–3–1997

4. Standard Software Quality Management System Part 1: Requirements IEEE 1992.
   ISBN: 0–7381–0422–1
   Product No: SS15966–TBR
   IEEE Standard No: 1298–1992 PDF

5. IEEE Standard for Application and Management of the Systems Engineering Process IEEE 1998.
ISBN: 0–7381–1543–6
Product No: SH94720–TBR
IEEE Standard No: 1220–1998

6. IEEE Standard for Application and Management of the Systems Engineering Process IEEE 1998; Web; 1998.
ISBN: 0–7381–1544–4
Product No: SS94720–TBR
IEEE Standard No: 1220–1998

7. IEEE Standard for Software Life Cycle Processes—Risk Management IEEE 2001; Softcover; 2001.
ISBN: 0–7381–2834–1
Product No: SH94925–TBR
IEEE Standard No: 1540–2001

8. IEEE Standard for Software Project Management Plans IEEE 1998.
ISBN: 0–7381–1447–2
Product No: SH94690–TBR
IEEE Standard No: 1058–1998

Appendix E Selective CM Tools

CM tools help to automate the process of establishing a baseline, assessing the current state of the established baseline, and providing updates to the baseline.

The following examples are descriptions of tools taken from vendors Web sites of tools that can be used by an organization to automate their CM process.

Title	+1CM: Configuration Management
Company	+1 Software Engineering
URL	http://www.plus-one.com
Contact	+1 Software Engineering 2510–G Las Posas Road, Suite 438 Camarillo, CA 93010 Phone: 805.389.1778
Product Type	Version Control
System Requirements	Platforms: Supported Sun Workstations OS: Solaris (1.x and 2.x) GUI: OpenWindows, Motif, and CDE Licensing: Per user, floating, or domain name license
Discussion	This product is one of a suite of fifteen products available by Plus-One Software Engineering. Supports multiple users working on a common project.

- Supports all basic CM commands, such as check in and check out of a file and displaying differences between two versions of a file. Can maintain source code, HTML, shell scripts, and other types of files.
- Supports baselines.
- Supports several predefined CM reports, such as: ACL Report, All CM Fields Report, CR Numbers Report, Detailed Reports, Files Checked Out Report, Status Report, and Version Description Document (VDD).

- Allows you to create your own, customized CM reports.

- Supports graphical view paths. A view path is an ordered list of directory names that are searched by +1CM to locate a desired file. View paths allow multiple users to work on the same project in a controlled manner. View paths support private user workspaces, compiles, loads, and assist with project management.

- Supports default editing, which allows you to select a file to edit from the calling structure, and if the file is checked in, automatically checks out the correct version of the file. This capability is applicable while working on a revision build as well.

- Can check out previous versions of a file, baseline a project, build version libraries, delete latest update, undo previous check outs, and maintain access control lists.

- Can check out previous versions of a file, baseline a project, build version libraries, delete latest update, undo previous check outs, and maintain access control lists.

- Enhances the functionality provided by the Source Code Control System (SCCS), an automated CM tool.

Title	+1CM: Change Request
Company	+1 Software Engineering
URL	http://www.plus-one.com
Contact	+1 Software Engineering 2510–G Las Posas Road, Suite 438 Camarillo, CA 93010 Phone: 805.389.1778
Product Type	Change request administration
System Requirements	Platforms: Supported Sun Workstations OS: Solaris (1.x and 2.x) GUI: OpenWindows, Motif, and CDE Licensing: Per user, floating, or domain name license
Discussion	+1CR supports problem report management capabilities that allow a user to submit, list, view, query, print, and administer change requests. Each change request may contain—

- Change Request Number (automatically generated)
- Short Description
- Version Information (Version Found In, Fixed In, Closed In)
- Status (Submitted, Reviewed, Approved, Assigned, Fixed, Closed, Not Approved, or Deleted) for each level, the individuals assigned, date, and whether the date is actual or expected can be stored.

- Priority (e.g., 1 represents an urgent change request)
- Category (e.g., Software)
- Classes (e.g., Class 1. Customer Approval Required)
- Detailed description of problem
- Corrective actions taken to fix problem or implement enhancement
- Users can customize change requests to record additional information as well. Wild card characters (e.g., "core") and qualifiers (e.g., "<") can be used to query and review change requests entries that meet the criteria you specify. Users can generate change request reports in a tabular, summary, and detailed format.
- +1CM supports process management. When a file is checked in using the program, the problem report number exists and its status allows for check ins.
- Using Metrics4Project,™ problem report metrics including the number of open, closed, and total number of problem reports organized by status, priority, category, class, and longevity can be calculated. Metrics4Project™ can be run in the background on a daily, weekly, or monthly basis continuously and the output can be imported into a spreadsheet program.

Title	+1CM: Reports
Company	+1 Software Engineering
URL	http://www.plus-one.com
Contact	+1 Software Engineering 2510–G Las Posas Road, Suite 438 Camarillo, CA 93010 Phone: 805.389.1778
Product Type	Documentation Generator
System Requirements	Platforms: Supported Sun Workstations OS: Solaris (1.x and 2.x) GUI: OpenWindows, Motif, and CDE Licensing: Per user, floating, or domain name license
Discussion	+1Reports helps to address these areas by allowing users to print up-to-date, customized project reports. +1Reports extracts information stored in the models, documentation files, source code, configuration management system, +1DataTree, and other sources to generate its reports. +1Reports lets you write an introduction and conclusion for each report. By selecting which entries to include, +1Reports will generate the bulk of a user's reports. A large number of reports and documents can be generated, saved, and maintained using +1Reports. If any of the print options between Module Description and Actual Test Results are selected, the contents for each module will be included. For example, if there are twenty modules defined, there will be twenty Module Descriptions printed, one for each module defined in the +1Environment model.

- +1Reports generates a number of customized, always up-to-date project reports in HTML or text format.

- +1Reports lets you customize each report; and by selecting which print options, +1Environment models, and modules to incorporate, +1Reports generates the bulk of a user's reports. Create new reports and load in existing reports.

Title	Concurrent Version
Company	OpenAvenue, Inc.
URL	http://www.cyclic.com
Contact	Ray Love VP Site Production and Product Management OpenAvenue, Inc. 10 Victor Square, Suite 250 Scotts Valley, CA 95066
Product Type	Version Control
System Requirements	Server: most Unix variants Non-client/ Server CVS: most Unix variants, Windows NT/95 Client: most Unix variants, Windows NT/95, OS/2, VMS. Modest CPU and memory requirements Windows 95/NT Platforms: Supported Sun Workstations OS: Solaris (1.x and 2.x) GUI: OpenWindows, Motif, and CDE Licensing: Per user, floating, or domain name license
Discussion	Version Control Software—CVS is the Concurrent Versions System, an open-source network-transparent version control system. CVS is useful for everyone from individual developers to large, distributed teams. The client-server access method lets developers access the current code from anywhere there's an Internet connection. The unreserved check-out model to version control avoids artificial conflicts.

The source code for CVS 1.11 is available in a browsable and searchable format. Client/server CVS enables developers scattered by geography or slow modems to function as a single team.

- The "editinfo" configuration file tells CVS how to screen developers' log messages. For example, the script could ensure that a bug number mentioned in the log message is valid.

- The "rcsinfo" and "editinfo" configuration files allow CVS to interface to external bug tracking systems. CVS provides reliable repository access to remote hosts using Internet protocols, facilitating collaboration with distant employees and contractors.

Title	AccuRev™
Company	Accurev Inc.
URL	http://www.accurev.com
Contact	Lakeside Office Park 591 North Avenue, #2 Wakefield, MA 01880 Phone: 800.383.8170 +1.781.246.1562 Fax: 781.246.1817 E-mail: info@accurev.com
Product Type	Software Change Management
System Requirements	OS: Linux, Unix, NT, and Windows 9x
Discussion	Portable—AccuRev/CM was designed with portability in mind. If AccuRev/CM is not currently supported on one of your platforms, will port it for you. Client/Server Model—AccuRev is based on the client/server model. All communications are via TCP/IP sockets. A network file system is not required. Complete Reproducibility—With AccuRev, all important information is versioned and it is impossible to change the past giving the user the ability to use information exactly as it was at any point in time. Usability—For basic work, you need to know a few commands and options and AccuRev remembers how projects are structured. You don't have to remember how projects are structured either.

Resources—Use AccuRev today with the resources you currently have.

Multiple Site Development—Developers at multiple sites can all work on the same stream (branch). AccuRev makes it seem like all of your sites are one big site.

Development—AccuRev enables users to work in isolation from each other, sharing changes only as desired. Users can keep as many private versions of their work as they want without having to make it public. They can retrieve previous versions of their work without having to continually make their changes public and possibly disrupting other people's work.

Transaction Based Fault Tolerance—All operations in AccuRev are based on transactions. An operation either completes or it does not.

If a transaction has reached the commit stage and the power goes out or you run out of disk space on the server, AccuRev will continue the transaction when the problem is resolved. If something interrupts a transaction prior to the commit, it is as if the transaction was never started.

Transactions also prevent broken builds and broken web site links.

Scalability—AccuRev is adaptable to a variety of needs.

Process Management—You can customize AccuRev with event triggers. These event triggers can interface with any tool that has a command line interface including issue-tracking tools. Our

triggers they fire once per transaction instead of once per file.

When a trigger is called, it is called with a list of all elements participating in the transaction. If there is a problem processing any of the elements, the transaction is not processed.

AccuRev has both client and server side event triggers. Server side triggers can start a build, update a web site, update your issue-tracking database, send mail, etc.

Backups—AccuRev uses Hot Backup technology. Before starting your backup, let AccuRev know by running one command. AccuRev will make an update to the repository. Add the command to your backup script and you are done. You can continue to use AccuRev while the backup is running.

If something should happen to your disk drive which requires restoring from backups, you restore the repository and run one command which puts everything back the way it was at the time the backup was made.

Title	Acuserver™	
Company	Acucorp Inc.	
URL	http://www.acucorp.com/Products/	
Product Type	Software Change Management	
System Requirements	OS:	Solaris Sparc v2.6,7 and Solaris Intel v2.6,7

Discussion

Acucorp offers application development tools with service for solving critical business issues, extending the life of legacy COBOL applications, and improving programmer productivity.

AcuServer gives COBOL applications remote file access support in client-server environments. AcuServer gives your application the ability to create and store data files on any network system equipped with AcuServer. Applications get full function remote access to indexed, relative, and sequential files, complete record locking support of indexed and relative files, and transparent access to remote and local files. AcuServer does not require recompilation or changes to the existing application code.

Title	Adaptive Framework	
Company	Adaptive Limited	
URL	http://solutions.sun.com/catalogs/all/Software_Development_Tools/Configuration_Management/25541.html	
Contact	See Web site	
Product Type	Enterprise Management	
System Requirements	OS:	Solaris Sparc v2.6,7 and Solaris Intel v2.6,7

Discussion

The Adaptive Framework product set provides the tools necessary to design, build, and deploy an Enterprise Repository Solution. This technology allows customers to manage complex information from disparate sources by providing impact analysis, traceability and architecture management. The Adaptive Framework product set enables the deployment of Enterprise Repositories supporting applications such as component based development, meta-data management and change management. Adaptive's products integrate with development tools from leading vendors including Rational, Princeton Softech, Popkin and Merant. Adaptive also works closely with partners including Unisys and Visio.

Adaptive Framework builds and deploys enterprise repository solutions, reducing the skills needed, and bridging the gap between business processes and IT. The product set comprises four elements, Adaptive Workshop, enterprise, Web and Library.

Title	Aldon/CMS
Company	Aldon Computer Group
URL	http://www.doggeddesign.com/pages/aldon_home.html
Contact	Aldon Computer Group 1999 Harrison Street, Suite 1500 Oakland, CA 94612 Fax: 510.839.2894 E-mail: info@aldon.com
Product Type	Change Management
Discussion	Aldon/CMS frees programmers from clerical tasks like change documentation, data file conversions, object copying and creation, etc., so they can focus on application development and innovation. Aldon/CMS knows—

- Where to find them and where to move them
- How to create them and what authority assignments are necessary
- What dependent or prerequisite objects also must be created or moved
- What data conversions must be performed (does them automatically)
- Whether change documentation is required (automatically creates the documentation)
- Who is authorized and accountable for the move.

Title	AllChange
Company	IntaSoft Inc.
URL	http://www.intasoft.net/
Product Type	Change Management
System Requirements	OS: MS Windows based product
Discussion	AllChange provides a Configuration Management system. AllChange provides an active environment for development, but does not impose constraints or bottlenecks. AllChange provides information about the make-up of your product or project and helps project managers and developers by— ■ Ensuring that your procedures are carried out according to your specification ■ Tracking the progress of change ■ Securing components of a product against unauthorized access ■ Allowing your developers to work together but without getting in each others way ■ Making information available to those people that require it ■ Browse and control files on remote platforms from your PC

FTP functionality has been integrated into the command structure of the software enabling FTP commands to be issued without user intervention. This means that remote access to any platform that supports a standard FTP implementation can be granted (subject to the usual security controls, such as password authorization, being required) from any AllChange NT client. Directory structures on the remote platform can also be browsed to assist with the selection of those files that are to be checked in.

Attach files to Change Requests and Release Definitions—Any type of file can be linked to any type of change request or release definition. This facility could be used by testers to attach screen dumps or other test evidence to the error reports they create. Also, by Release Managers to attach release notes to the relevant release. Further flexibility is provided by allowing the attachment to be defined as a simple link to the location of the original file or, that a copy of the file be taken and secured within AllChange.

Build relationships between Configuration Items to help your Impact Analysis Process—Relationships can be created between any of the configuration items held in the AllChange database either manually or, automatically by the tool upon certain actions or conditions being met. Following the relationships directly supports the impact analysis process. It is also possible for the tool to highlight or warn that relationships exist whenever a configuration item is accessed.

Title	BriefCase 3 Toolkit
Company	Applied Computer Sciences, Inc.
URL	http://www.applied-cs-inc.com/bcintro.html
Contact	Applied Computer Sciences, Inc. Attn: Contract Services PO Box 8003 Cave Creek, AZ 85327 Phone: 623.465.8865 Fax: 623.465.1078
Product Type	Software Development and Configuration Management
System Requirements	Unix/Linux systems with the generally available versions of the Korn Shell (11/88) and awk (1985).
Discussion	The /BriefCase 3 Toolkit expands the basic capabilities of the Revision Control System (RCS) commands to manage software system component revisions throughout their development, release and maintenance life-cycles. As part of their commitment to the OpenSource movement, Applied Computer Sciences, inc. (ACSi) has announced the OpenSource availability of /BriefCase Release 3, their advanced, enterprise Software Configuration Management (SCM) solution for Unix/Linux software development, for free download from their Web site. Release 3 implements a client/server interface to an RCS-based central repository. Project directory structure integrity is preserved automatically through built-in work-directory/repository mapping.

/BriefCase 3 commands provide comprehensive, support for project organization, revision control and release management central repository management of shared project files client/server support for multiple developers isolation of bug-fix work from enhancement work branch revisions and merging integrated product build facility based on "make" integrated defect/enhancement tracking software release life cycle management.

Title	Tivoli IT Director
Company	IBM
URL	http://www.tivoli.com
Product Type	Enterprise Management
System Requirements	Platform: PC based OS: NT Windows
Discussion	Tivoli is composed of a Java based code for platform independence. The Tivoli integrated technology director— ■ Inventory, Remote workstation control, Software distribution, Process Management, Resource Monitor, Event Management, Application Management, II S Management, SNMP Management

Title	Tivoli Business Systems Manager
Company	IBM
URL	http://www.tivoli.com
Product Type	Enterprise Management
System Requirements	Platform: PC based OS: NT Windows
Discussion	Business systems management allows customers to manage groups of related applications that underpin and enable critical business functions, such as ERP, CRM or E-business environments (E-marketplace or E-procurement, etc). Tivoli Business Systems Manager gives customers a single point of management and control and allows them to utilize the concept of end-to-end business systems management to organize related components and give business context to management decisions. Tivoli Business Systems Manager is compatible and integrates with other Tivoli products to provide the ability to view systems management events, and assist the user in managing the OS/390 and distributed systems from any Windows NT in the enterprise. Tivoli Business Systems Manager and its components are system management applications that integrate all S/390 and distributed platform management disciplines into a cohesive and extensible object model and provides a single console for managing and viewing all resources.

Title	Tivoli Enterprise Console
Company	IBM
URL	http://www.tivoli.com
Product Type	Enterprise Management
System Requirements	Platform: PC based OS: NT Windows

Discussion

The Tivoli Enterprise Console (TEC) provides a centralized point of control that keeps your IT staff in control of events happening across all systems—a "mission control" center for your entire distributed environment. The TEC processes and responds to the events and alarms that occur daily from network devices, hardware systems, relational database management systems and partner and customer applications. The Tivoli Enterprise Console has three primary features—

- Comprehensive event integration
- Powerful event processing and correlation
- Secure, automated event response and notification

The TEC can provide "business process views," or overall consolidated management status of your most important business applications and business processes.

Title	Tivoli Netview
Company	IBM
URL	http://www.tivoli.com
Product Type	Enterprise Management
System Requirements	Platform: PC based OS: NT Windows
Discussion	Tivoli NetView discovers TCP/IP networks, displays network topologies, correlates and manages events and SNMP traps, monitors network health, and gathers performance data. Tivoli NetView accomodates large networks by providing the scalability and flexibility to manage mission-critical environments. Tivoli NetView accomplishes this through functionality that— ■ Provides a scalable distributed management solution ■ Identifies the root cause of network failures ■ Builds collections for management of critical business systems ■ Integrates with leading vendors ■ Maintains device inventory for asset management ■ Measures availability and provides fault isolation for problem control and management ■ Reports on network trends and analysis

Title	Tivoli SecureWay Security Manager
Company	IBM
URL	http://www.ibm.com
Product Type	Enterprise Management
System Requirements	Platform: PC based OS: NT Windows
Discussion	Provides a role-based, centralized mechanism for managing and implementing access control policy. By ensuring the consistent configuration of access rights on operating systems from PC LANs to Mainframes. Tivoli SecureWay Security Manager integrates with Tivoli SecureWay Policy Director for centralized management of Web access, Tivoli SecureWay User Administration for integrated user account and user access management, and leverage the Tivoli Enterprise Console and Tivoli SecureWay Risk Manager for centralized security event management. The product user interface or the command line can be used to "teach" your policy Tivoli SecureWay Security Manager. Various tools are included to speed up this process such as a Role-based population function which helps configure a role-based access control model based on the existing configuration of one or more users and/or groups. Tivoli SecureWay Security Manager provides a single, manageable interface to the variety of access control engines provided by different platforms, modifying native data, thus allowing local management tools to continue to operate.

Appendix F U.S. Department of Defense and NATO Reference Material

Reference Document	Title
DOD 5000.1	Defense Acquisition
DOD 5000.2	Defense Acquisition Management Policies and Procedures
DOD Cataloging Handbook H6	Federal Item Identification Guides for Supply Cataloging
DOD Cataloging Handbook H7	Manufacturers Part and Drawing Numbering Systems for Use in the Federal Cataloging System
DoDISS	Department of Defense Index of Specifications and Standards
MIL–STD–12	Abbreviations for Use on Drawings, Specs, Standards, and Technical Documents (will eventually be replaced by ANSI Y14.38)
MIL–HDBK–59	Computer Aided Acquisition and Logistics Support (CALS) Program Implementation Guide (CALS is now known as Continuous Acquisition and Life Cycle Support)
MIL–HDBK–61A	CM
MIL–STD–100	Engineering Drawing Practices
MIL–STD–109	Quality Assurance terms and Definitions
MIL–STD–1168	Lot Numbering of Ammunition
MIL–STD–130	Identification Marking of US Military Property

MIL–HDBK–245,	Preparation of Statement of Work
MIL–STD–280	Definition of Item levels, Item Exchangeability, Models and Related Terms
DOD–HDBK–287	A Tailoring Guide For DOD–STD–2167A
MIL–HDBK–454,	Standard General Requirements for Electronic Equipment
MIL–STD–498 (canceled)	Software Design and Development (replaces DOD–STD–2167, DOD–STD–7935, and DOD–STD–1703).
MIL–STD–881	Work Breakdown Structure for Defense Material Items
MIL–STD–961	Military Specifications and Associated Documents, Preparation of
MIL–STD–969	Specifications CM Notice 3
MIL–STD–973	(canceled)
MIL–STD–974	CITIS (Contractor Integrated Technical Information Service, is being transitioned to a non-government standard).
MIL–STD–1309	Definitions of Terms for Test, Measurement and Diagnostic Equipment
MIL–STD–1465	CM of Armaments, Munitions and Chemical Production Modernization
MIL–STD–1520	Corrective Action and Disposition System for Non Conforming Material
DOD–STD–1700	Data Management Program
MIL–STD–1767	Procedures for Quality Assurance and Configuration Control of ICBM Weapon System Technical Publications and Data
MIL–STD–1840	Automated Interchange of Technical Information

MIL–STD–2084	General Requirements for Maintainability of Avionics and Electronic Systems and Equipment
DOD–STD–2168	Defense System Software Quality Program
MIL–STD–2549	Configuration Status Accounting
MIL–I–8500	Interchangeability and Replaceability of Component Parts for Aerospace Vehicles
MIL–T–31000	Technical Data Packages, General Specification for
MIL–S–83490	Specification, Types and Forms

DoD Initiatives

Reference Document	Title
AD–A278–102	Blueprint for Change (regarding use on commercial standards, obtain through NTIS)

DoD Draft

The following CM related documents are currently in draft.

Reference Document	Title
MIL–STD–499	Systems Engineering
MIL–STD–CNI	Coding, Numbering, and Identification
SD–15	Performance Specification Guide

NATO Reference Documents

Reference Document	Title
STANAG 4159 NATO	Materiel Configuration Management Policy and Procedures for multi-national Joint Projects,
Allied Configuration Management Policies (ACMP)	Series
ACMP–1	Requirements for Preparation of CM Plans
ACMP–2	Requirements for Identification,
ACMP–3	Requirements for Configuration Control,
ACMP–4	Requirements for Configuration Status Accounting,
ACMP–5	Requirements for Configuration Audits,
ACMP–6	NATO CM Terms and Definitions,
ACMP–7	Guidance on Application of ACMPs 1–6
NATO Standardization Agreement (STANAG) 4427,	Introduction to Allied CM, *Note: This STANAG was created to define the configuration management requirements which are to be selectively applied, as required, throughout the lifecycle of any configuration item for NATO projects.*

Appendix G U.S. Federal Government Reference Material

Federal Aviation Administration (FAA)

CM Document	Document Title
Title 14	Code of Federal Regulations, Parts 1–59
FAA–STD–002	Facilities Engineering Drawing Practices
FAA–STD–005	Preparation of Specification Documents
FAA–STD–018	Computer Software Quality Program (1977)
FAA–STD–021	CM (contractor requirements)
FAA Order 1800.8	National Airspace Systems CM
FAA Order 6030.28	National Airspace Systems CM

Food and Drug Administration (FDA)

CM Document	Document Title
FDA 8541–79	Good Manufacturing Practices, Food & Drug Administration

FDA	Center for Devices & Radiological Health, Food & Drug Administration (HFZ 265), 5600 Fishers Lane, Rockville MD 20857

Code of Federal Regulations (CFR)

CM Document	Document Title
10 CFR50	(Title 10 to Code of Federal Regulations, Part 50—Domestic Licensing of Production and Utilization Facilities)
10 CFR 50.2	Definitions (Includes the following term: "Design bases") NEI 97–04 notes that this is a subset of the engineering design bases.
10 CFR 50.34	Contents of applications; technical information (requires a PSAR to specify the principal design criteria (PDC) and to specify the relation of the design bases to the PDC (10 CFR 50.34(a)(3)).)
10 CFR 50.54(f)	A provision that requires licensees to submit responses under oath if requested by the NRC. In CMBG, refers to NRC request in 1996 for most utilities to describe their CM programs under oath.
10 CFR 50.59	Changes, tests and experiments * describes evaluation process for making changes to nuclear plants
10 CFR 50.65	Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants
10 CFR 50.71	Maintenance of Records making reports

10 CFR 50,	Appendix A General Design Criteria for Nuclear Power Plants (Some plants pre-date the GDCs) * 64 criteria in six categories—cover everything from QA records to Containment design basis
10 CFR 50,	Appendix B Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants. (Criteria VI—Document Control, Criteria XVII—Quality Assurance Records)
10 CFR 54, May, 1995	Requirements for Renewal of Operating Licenses for Nuclear Power Plants (Section 54.3 includes a regulatory definition of "Current Licensing Basis" which includes the plant-specific design-basis information defined in 10 CFR 50.2...)
10 CFR 61, December, 1982	Licensing Requirements for Land Disposal of Radioactive Waste (10 CFR 61.12, Specific technical information, includes discussion of "design features," "principal design criteria," and "design basis natural events")
10 CFR 71, September, 1995	Packaging and Transportation of Radioactive Material
10 CFR 72, August, 1988	Licensing Requirements for the Independent Storage of Spent Nuclear Fuel and High-Level Radioactive Waste ("Design Bases" is defined in subpart A)
10 CFR 100	Reactor Site Criteria
10 CFR 830	Energy

Department of Energy (DOE)

http://www.explorer.gov

http://www.ac-incorp.com/CM_Standards.html

CM Document	Document Title
DOE Order 430.1	Life Cycle Asset Management
DOE Guide G–830–120	Implementation Guide for 10 CFR Part 830.120, QA
DOE Order 4330.4A	Maintenance Management Program
DOE Order 4700.1	Project Management System (will be phased out)
DOE Order 5480.19	Conduct of Operations Requirements. for DOE Facilities
DOE Order 5700.6C	Quality Assurance
DOE Order 6430.1A	General Design Criteria
DOE–STD–1073–93 Parts 1 & 2,	Guide for Operational CM Program Including the Adjunct Programs of Design Reconstitution and Aging Management (found on the web as two PDF files) (Also Ref DOE Order 5700.6C)
NPO 006–100	DOE Office of New Production Reactors CM Plan

U.S. Nuclear Regulatory Commission (U.S. NRC)

CM Document	Document Title
NRC Policy Statement 8/10/92	Availability and Adequacy of Design Bases Information at Nuclear Power Plants
NUREG/CR–5147	

June 1988	Fundamental Attributes of a Practical Configuration Management Program for Nuclear Plant Design Control
NUREG–1397 February 1991	Assessment of Design Control Practices and Design Reconstitution Programs in the Nuclear Power Industry
NUREG–1412 July 1990	Foundation for the Adequacy of the Licensing Bases. A Supplement to the Statement of Considerations for the Rule on Nuclear Power Plant License Renewal (10 CFR Part 54).
NUREG–1536 January 1997	Standard Review Plan for Dry Cask Storage Systems * Includes a definition of "Design Basis" that refers to ANSI 57.9. * Section 2, "Principal Design Criteria" includes discussion of "Design Bases" and "Design Criteria" as they relate to 10 CFR Part 72.
GL 83–28 July 8, 1983	Required Actions Based on Generic Implications of Salem ATWS Events (Vendor Interface for Safety Related Components) Ref NUREG–0977 & NUREG–1000 * Imposed new requirements on equipment classification and vendor interface, among others. Item 2 requires programs for assuring that all components required for safety related functions are properly identified. It also addresses establishment and maintenance of a program to ensure that vendor information for safety related components is complete.

GL 88–18 October 20, 1988	Plant Record Storage on Optical Disks * Outlines appropriate quality controls for storing QA records
GL 90–03 March 20, 1990	Relaxation of staff position in generic letter 83–28, Item 2.2 Part 2 "Vendor Interface for Safety-Related Components" * Acknowledges INPO initiatives on Nuclear Plant Reliability Data System (NPRDS) and Significant Event Evaluation and Information Network (SEE–IN), both managed by INPO.
GL 99–XX (Proposed)	Guidance on the Storage, Preservation, and Safekeeping of Quality Assurance Records in Electronic Media * Updates GL 88–18 * Endorses NIRMA Technical Guides: TG15, TG11, TG16 & TG21
Reg Guide 1.33, Rev 2 February 1978	Administrative Controls and Quality Assurance for the Operational Phase of Nuclear Power Plants (Ref ANSI/ANS 3.2 (1988))
Reg Guide 1.64, Rev 2 June 1976	Quality Assurance Program Requirements for the Design of Nuclear Power Plants (withdrawn—See 56 FR 36175, 7/31/1991)
Reg Guide 1.74, Rev (February 1974)	Quality Assurance Terms and Definitions (withdrawn—See 54 FR 38919, 9/21/1989)
Reg Guide 1.88 Rev 2 October 1976	Requirements for Collection, Storage, and Maintenance of Quality Assurance Records for Nuclear Power Plants (Ref ANSI N45.2.9 (1979))
Reg Guide 1.123,	QA Requirements. for Control of Procurement of Items & Services for Nuclear Power Plants
Reg Guide 1.152,	Criteria for Programmable Digital Computer System Software in Safety-

	Related Systems of Nuclear Power Plants
Reg Guide 1.169 September 1997	Configuration Management Plans for Digital Computer Software Used in Safety Systems of Nuclear Power Plants

National Aeronautical and Space Administration (NASA)

CM Document	Document Title
GMI 8040.1A	CM (for satellite or ground system projects)
JSC 30000	includes CM Requirements (for space station)
JSC 31010	CM Requirements
JSC 31043	CM Handbook
KHB8040.2B	CM Handbook
KHB 8040.4	Payloads CM Handbook
KPD 8040.6B	CM Plan, National Space Transport System
MM8040.5C	CM Accounting & Reporting System
MM 8040.12	Contractor CM Requirements
MM8040.13A	Change Integration & Tracking System
MM1 8040.15	CM Objectives, Policies & Responsibilities
MMI 8040.15B	CM
MSFC–PROC–1875	Contractor CM Plan Review Procedure
MSFC–PROC–1916	CM Audit Procedures for MSFC Programs/Projects
NSTS 07700, Vol. IV	Configuration Requirements., Level II Program Definition & Requirements.

SSP 30000	Program Definition & Requirements Document, Configuration Management Requirements, Space Station Project Office,10/29/90

Appendix H Internationl Standards Organization (ISO) CM Reference Documents

This appendix is included to provide additional resources of information regarding ISO CM documentation.

CM Document	Document Title
ISO 8402	Quality Management & Quality Assurance Vocabulary
ISO 9000–1	Guidelines for Use of the ISO 9000 Series
ISO 9000–2	Guidelines for Applying ISO 9000 to Services
ISO 9000–3	Guidelines for Applying ISO 9000 to Software
ISO 9001	Model for Quality Assurance in Design/Development, Production, Installation, & Servicing
ISO 9002	Model for Quality Assurance in Production & Installation
ISO 9003	Model for Quality Assurance in Final Inspection & Test
ISO 9004	Quality Management & Quality System Elements—Guidelines
ISO 10007	Guidelines for CM
ISO 10011–1	Guidelines for Auditing Quality Systems, Audit
ISO 10011–2	Guidelines for Auditing Quality Systems, Qualification Criteria

ISO 10011–3	Guidelines for Auditing Quality Systems, Managing Audit Programs
ISO 10013	Guidelines for Preparing a Quality Manual
ISO/IEC 12207	Software CM
ISO 10303	Product Data Exchange (International STEP)
ISO 10303–41	Production Description
ISO 10303–42	Geometric & Topographical Representation
ISO 10303–43	Representation Structures
ISO 10303–44	Product Structure Configuration
ISO 10303–46	Visual Representation
ISO 10303–203	Application Protocol: Configuration Controlled Design

Appendix I

International Reference Material

This appendix makes no endorsements concerning particular books. The books listed below are examples of those available commercially. They are included to provide additional resources of information regarding CM.

Title	A Guide to Software Configuration Management (Artech House Computer Library)
Date	2000
Author	Alexis Leon
Publisher	Artech House
ISBN	1580530729
Description	From Book News, Inc.—Explains how to use software configuration management (SCM) to identify the configuration of software at discrete points in time and the systematic control of changes to the identified configuration for the purpose of maintaining software integrity, traceability, and accountability throughout the software life cycle. Configuration control, auditing, documentation, and implementation are discussed. An appendix lists SCM vendors and capabilities of the tools available. Book News, Inc.®, Portland, OR.

Title	Software Configuration Management Strategies and Rational ClearCase: A Practical Introduction (The ADDP9 Object Technology Series)
Date	2000
Author	Brian A. White, Geoffrey M. Clemm
Publisher	Addison Wesley Professional
ISBN	0201604787
Description	This book is about the engineering discipline of software configuration management (SCM) and how the widely used SCM product, Rational

	ClearCase, automates and supports SCM best practices through a model called unified change management (UCM). This book covers basic SCM concepts, typical SCM problems encountered as projects and software systems grow in size and complexity, and how you can apply SCM tools and processes to solve these problems.
Title	Anti-patterns and Patterns in Software Configuration Management
Date	1999
Author	William J. Brown, Hays McCormick, Scott W. Thomas
Publisher	John Wiley & Sons
ISBN	0471329290
Description	Anti-Patterns and Patterns in Software Configuration Management describes what you need to significantly reduce software development failures before they become fatal and how to repair their causes so they don't resurface. Rise above the industry-wide malaise of mass denial and realize that you too can, and definitely must, master Software Configuration Management (SCM) for successful software engineering. In this book, the authors provide 16 new Anti-Patterns covering the most common SCM mistakes and pitfalls. They also supply you with solution strategies including 3 Process Patterns and other approaches. As in Anti-Patterns, they present each Anti Pattern and Pattern using the same practical approach. Anti Patterns and Patterns in Software Configuration Management arms you with the knowledge that SCM is neither too hard, nor too

	complicated, for software engineers, developers, architects, and project managers.

Title	Practical CM: Best Configuration Management Practices for the 21st Century
Date	1999
Author	Lyon
Publisher	David Douglas Raven Publishing Company
ISBN	0966124847
Description	Practical CM—Best Configuration Management Practices for the 21st Century presents both basic and advanced CM instruction. This book includes money-saving CM control methodologies and provides how-to guidelines for the transition from paper-based CM systems to electronic Product Data Management (PDM) systems. It guides the CM practitioner through the establishment of a CM system and CM processes appropriate for the transition into the 21st Century.

Title	Software Release Methodology
Date	1999
Author	Michael E. Bays
Publisher	Prentice Hall
ISBN	0136365647
Description	Software release methodology is a field that unifies a number of previously abstract endeavors

	that occur during software product development. By unifying these abstract endeavors, we provide a path from development to product release. The field focuses on the release activity as the driving force behind all development endeavors.
Title	Ovum Evaluates: Configuration Management
Date	1998
Author	Clive Burrows and Ian Wesley
Publisher	Ovum, London
ISBN	1898972249
Title	Practical Software Configuration Management: The Late Night Developer's Handbook
Date	1997
Author	Tim Mikkelsen and Suzanne Pherigo
Publisher	Prentice-Hall PTR Upper Saddle River, NJ
ISBN	0132408546
Description	Book News, Inc. Until now, only large companies could afford the configuration management systems that can help software developers improve both quality and efficiency. This guide to professional configuration management demonstrates how individual developers and small teams can use simple techniques, strategies and procedures for tracking and managing source code, help files and all the other elements associated with soft-

	ware projects. The CD-ROM includes the complete Revision Control System (RCA) for PC, with source code and executables. Copyright © 1999 Book News, Inc., Portland, OR. All rights reserved.
Title	Software Configuration Management: ICSE '97 SCM–7 Workshop, Boston, MA., USA. May 18–19, 1997: Proceedings
Date	1997
Author	Conradi, Reidar O., ed.
Publisher	Springer, Berlin
ISBN	3540630147
Title	Implementing Configuration Management: Hardware, Software, and Firmware
Date	1996
Author	Fletcher J. Buckley
Publisher	IEEE Computer Society Press, Los Alamitos, CA
ISBN	0818671866
Description	From Book News, Inc, June 1, 1996 Details configuration management (CM) for those in commercial and government environments, focusing on cost-effective implementations of the process and tailoring implementations to specific organizational needs. Coverage includes CM identification; configuration control of hardware and software; documentation, and audits. This second edition breaks down the configuration management

	process into separate steps, allowing individual procedures to be written to support each step, and offers expanded coverage of CAD/CAM, plus exercises. Annotation c. by Book News, Inc., Portland, Or. This text refers to an out of print or unavailable edition of this title.
Title	CM: The Changing Image
Date	1996
Author	M.V. Kelley
Publisher	McGraw-Hill, UK
ISBN	0077079779
Telephone	01628 23432
Title	Configuration Management: Trends in Software No. 2
Date	1995
Author	W.F. Tichy
Publisher	John Wiley & Sons
Description	The publisher, John Wiley & Sons Presents Software Configuration Management (SCM) by leaders in the field. Gives a comprehensive survey of industrial SCM tools; specific integrated SCM systems such as Adele; plus novel SCM algorithms and techniques.

Title	Configuration Management [Software]
Date	1994
Author	W.F. Tichy (Editor)
Publisher	John Wiley & Sons Ltd. Baffins La Chichester, W Sussex P0191UD
ISBN	471942456

Title	Achieving Successful Product Change
Date	1994
Author	J. Inness
Publisher	Pitman Publishing Freepost, 128 Long Acre, UK WC2E 9AN
ISBN	0273605615
Telephone	071 379 7383

Title	CM for Software
Date	1994
Author	S. B. Compton & G. Conner
Publisher	Van Nostrand Reinhold
ISBN	0442017464

Title	CM within PRINCE
Date	1993
Author	C. Bentley
Publisher	NCC Blackwell
ISBN	1855541734

Title	Software Configuration Management (Wiley Series in Software Engineering Practice)
Date	1991
Author	H. Ronald Berlack, Ronald Berlack
Publisher	John Wiley & Sons
ISBN	0471530492
Description	Editorial Reviews. The publisher, John Wiley & Sons. Designed for software product developers, provides comprehensive coverage of the theory, practice, and techniques of good software configuration management and a structured approach to implementing these practices on large software development projects. As such, it serves as a step by step guide for project managers who need to plan, implement, and control the process associated with data control. Features include a chapter on software configuration management and automation, including software tools; the teaching of procedures for identifying the code, documents, and data to be controlled as the product definition; and a systematic approach to maximizing reuse of software and implementing change control. A glossary plus an appendix on

procedures, forms, and form control completes this work.

Title	CM Deskbook: Vol 2, Instruction Supplement
Date	1988
Author	T.T. Samaras
Publisher	Advanced Application Consultants, Inc. 7113 Jayhawk Street Annandale, VA 22003–5851
ISBN	0934321108
Telephone	703.329.2633

Title	CM Deskbook: Vol 1
Date	1988
Author	T.T. Samaras
Publisher	Advanced Application Consultants Inc. 7113 Jayhawk Street Annandale, VA 22003–5851
ISBN	093432094
Telephone	703.329.2633

Title	Configuration Management Procedures Manual
Date	1984
Author	J. H Lieblich

Publisher	Global Engineering, Irvine, CA
ISBN	0912702257

Title	Configuration Management Procedures
Date	1984
Author	J. Powers
Publisher	Global Engineering Documents 2625 South Hickory Street P.O. Box 2504 Santa Ana, CA 9270
ISBN	0912702257
Telephone	800.854.7179

Title	Audit & Control of Systems Software
Date	1983
Author	I. J. Douglas
Publisher	NCC Publications, Manchester, U.K.

Title	CM Manual
Date	
Author	Roth-Donleigh 29002 La Carreterra Laguna Niguel, CA 92677
Telephone	714.364.5907

Key Europeam Space Agency (ESA)

Title	Reference Documents
Software Engineering Standards	ESA PSS–05–0
Guide to Software CM	ESA PSS–05–09
	ISSN 0379–4059
CM Service Definition	ECMA–TR 47

Appendix J

Education and Training Courses

This appendix makes no endorsements concerning particular education and/or training courses. The following listing provides examples of the courses available in the field of CM.

Title	CDM Certification Program
Description	Preparation for the NDIA Certification exam. The entire range of activities in the CM and DM disciplines. CDM applications in the commercial, government, and international environments. The course specifically includes information on all exam subject areas which allows applicants to focus on many CDM areas in which they may not have practical knowledge, or in various application areas where they may not have direct experience. The course is updated annually. More than 1000 individuals have been certified by NDIA since 1990 when the program was initiated. Names of those certified each year are published in National Defense Magazine and entered in the NDIA Book of Honor at NDIA Headquarters in Arlington, VA. The Book of Honor may be viewed at NDIA in Arlington, VA.
Institution	National Defense Industrial Association (NDIA), Technical Information Division
URL	http://www.ndia.org
Contact	Joe Hylan 2111 Wilson Blvd., Suite 400 Arlington, VA 22201 Phone: 703.247.2583 E-mail: jhylan@ndia.org
Corporate Fee	$250.00

Title	Configuration Management II Certification
Description	Configuration Management II certification Enterprise wide approach. Covers traditional CM and expands the CM process to take into account all CM, quality, safety, environment, industry and regulatory related initiatives. CMII is CM plus continuous improvement in the ability to change faster, document better, and communicate. CM is the management of physical items, software, facilities, and supporting processes through the management of documents, records, and data (information), including changes. Successful completion of the series of 6 CMII courses including an exam at end of each course. This program has been available since 1986. Over 2,600 people have been certified through the 3 week series.
Institution	Institute of Configuration Management (ICM)
URL	http://www.icmhq.com
Contact	ICM P.O. Box 5656 Scottsdale, AZ 85261–5656 Phone: 888.816.2644 or 602.998.8600 E-mail: info@icmhq.com
Corporate Fee	$6,000.00

Title	CM Boot Camp, Hands-on CM Training from ISS
Description	CM Boot Camp takes a model product though the total life cycle processes, describing the CM principles involved in each of the phases. Each trainee will create the data and manage the product-associated information in their own functional software application. The actual hands-on implementation of the CM identification, accounting, and control elements re-enforces the leaning and application of the CM principles. Practical application to real data in an actual software tool brings a higher level of understanding and comprehension than lecture and demonstration alone.
Institution	Integrated Support Systems, Inc. (ISS)
URL	http://www.isscorp.com
Contact	Tim Howard or Julie Houff 934 Old Clemson Highway Seneca, SC 29672 Phone: Tim—864.654.1284, ext. 138 Julie—864.654.1284, ext. 110 E-mail: training@isscorp.com

Title	Exec briefings, courses, workshops and textbooks on CM, SCM, Data Management, Logistics Management
Description	Provide education in CM, SCM, Data Management, and Logistics Management. Both basic and advanced training is available in lecture or workshop format.
Institution	AACI (Advanced Applications Consultants, Inc.)
Contact	M. A. Daniels AACI 7113 Jayhawk Street Annandale, VA 22003–5851 Phone: 703.642.2224 E-mail: aaci1@aol.com

Title	CM Basics Seminars from ISS
Description	This overview CM seminar will cover the major elements of configuration management—identification, accounting, audits, and control. It will provide the attendee a basic understanding of how implementation of the CM principles and practices will facilitate a business to— ■ Meet ISO, FDA, or GMP requirements ■ Manage their product structure ■ Synchronize work and communications between departments ■ Match engineering drawings with manufacturing plans ■ Provide latest design requirements to company purchasers ■ Ensure consistent change flow process ■ Control document revisions ■ Decrease time to market ■ Reduce production costs
Institution	Integrated Support Systems, Inc. (ISS)
URL	http://www.isscorp.com
Contact	Tim Howard or Julie Houff 934 Old Clemson Highway Seneca, SC 29672 Phone: Tim—864.654.1284, ext. 138

Julie—864.654.1284, ext. 110

E-mail: training@isscorp.com

Title	Basic Configuration Management Seminar
Description	To provide in-depth, comprehensive and understandable coverage of the basic elements of Configuration Management. The entire life cycle of the product with special emphasis on the interaction and linkage between CM and the design development, manufacturing, quality assurance, and product support processes and methodologies. Designed to address any application perspective, including military, commercial, nuclear facility, hardware, or software.
Institution	Raven Publishing Company
URL	http://www.configuration.org
Contact	David D. Lyon President 163 Balance Rock Road Pittsfield, MA 01201 Phone: 413.443.6533 E-mail: d_lyon@compuserve.com

Title	Advanced Configuration Management Seminar
Description	Provide tools, approaches, and processes to deal with the 21st Century business environment with special emphasis on the evolution from paper-based CM systems to computer-based CM systems. The entire life cycle of the product. Designed to address any application perspective, including military, commercial, nuclear facility, hardware, or software.
Institution	Raven Publishing Company
URL	http://www.configuration.org
Contact	David D. Lyon President 163 Balance Rock Road Pittsfield, MA 01201 Phone: 413.443.6533 E-mail: d_lyon@compuserve.com

Title	Management introduction to STEP (ISO 10303)
Description	Product Data Technology (electronic solutions for areas such as PDM, ERP, MRP, CM, ILS, GIS, etc.) is considered vital for enterprise integration needed to meet the changing market requirements. STEP or ISO 10303 is considered a generic solution for "product data representation and exchange" and is today implemented in most industries. Develop an understanding for the concept of the STEP standard and the business benefits; be introduced to the EXPRESS data definition language; and learn about application protocols. This class introduces STEP, the technology, and a walk-through of case studies in different industries.
Institution	EPM Technology
URL	http://www.epmtech.jotne.com
Contact	Kjell A. Bengtsson EPM Technology P.O. Box 6629 Etterstad N–0607 OSLO Norway Phone: +47.23.17.17.17 E-mail: info@epmtech.jotne.com

Title	Introduction to the EXPRESS language (ISO 10303 Part 11)
Description	As part of STEP or ISO 10303, the EXPRESS data definition language has an essential position for defining all parts of the standard that are targeted at implementation. There are more than 30 industry-specific data models available in STEP today. The use of the EXPRESS language is also emerging outside STEP. This class gives a well-balanced introduction to introduce the language and the objective is to give the student basic knowledge about EXPRESS data models. Hands-on training with tools is also available.
Institution	EPM Technology
URL	http://www.epmtech.jotne.com
Contact	Kjell A. Bengtsson EPM Technology P.O. Box 6629 Etterstad N–0607 OSLO Norway Phone: +47.23.17.17.17 E-mail: info@epmtech.jotne.com

Title	Express/SDAI/Express-X Implementation Course
Description	This class gives a well-balanced introduction to introduce implementation methods and the objective is to make the student able to interface existing or new applications with STEP and learn to make use of the SDAI and Express-X functionalities. Ability to develop own Express data models; implement data models; integrate data exchange packages through mapping with Express-X; and validate data.
Institution	EPM Technology
URL	http://www.epmtech.jotne.com
Contact	Kjell A. Bengtsson EPM Technology P.O. Box 6629 Etterstad N–0607 OSLO Norway Phone: +47.23.17 E-mail: info@epmtech.jotne.com

Title	Configuration Management
Description	Provide education in Configuration Management. This outstanding two-day seminar provides attendees with a comprehensive examination of the tools, methods, processes, and procedures of CM Applications in the Commercial, Government, and International Environment.
Institution	Technology Training Corporation
URL	http://www.ttcus.com
Contact	Dana Marcus 1960 East Grand Avenue, Suite 1000 El Segundo, CA 90245 Phone: 310.563.1223 E-mail: wbudding@ttcus.com

Title	Advanced Configuration Management
Description	Provide education in Advanced Configuration Management. This intensive three-day course is designed for the CM professional and delivers state-of-the-science strategies and methodologies that will enable participants to successfully deal with advanced CM issues. CM Applications in the Commercial, Government, and International Environment.
Institution	Technology Training Corporation
URL	http://www.ttcus.com
Contact	Dana Marcus 1960 East Grand Avenue, Suite 1000 El Segundo, CA 90245 Phone: 310.563.1223 E-mail: wbudding@ttcus.com

Title	Software Configuration Management
Description	Provide education in Software Configuration Management. This two-day seminar provides a comprehensive blueprint for fully integrating Software Configuration Management (SCM) into all aspects of software development and maintenance. SCM Applications in the Commercial, Government and International Environment.
Institution	Technology Training Corporation
URL	http://www.ttcus.com
Contact	Dana Marcus 1960 East Grand Avenue, Suite 1000 El Segundo, CA 90245 Phone: 310.563.1223 E-mail: wbudding@ttcus.com

Title	Advanced Software Configuration Management
Description	Provide education in Software Configuration Management. A primary focus of ASCM is on tools and techniques to automate the various disciplines of SCM. Attendees will learn about and see demonstrations of automated SCM tools to round out the program and reinforce the learning process. SCM Applications in the Commercial, Government and International Environment.
Institution	Technology Training Corporation
URL	http://www.ttcus.com
Contact	Dana Marcus 1960 East Grand Avenue, Suite 1000 El Segundo, CA 90245 Phone: 530.873.2734 E-mail: wbudding@ttcus.com

Title	Configuration Management
Description	2 Day training course. Fundamentals of CM, Impact of new standards, Closed-loop CCBs, How to write CM Plans, How to conduct Audits.
Institution	Configuration Management Training Foundation
URL	http://www.cmtf.com
Contact	Phone: 310.563.1223 E-mail: tracie@cmtf.com
Corporate Fee	$1,195.00
Government Fee	$1,095.00

Title	Advanced Configuration Management
Description	2 Day Training Course—This is the Advanced CM course developed and taught by Mr. John Roberts in twelve countries on five continents. Thoroughly updated, it reflects the needs of today and tomorrow. Topics include— ■ Your CM maturity ■ Process improvement ■ CM life cycle ■ work flows ■ In service CM ■ Tools.
Institution	Configuration Management Training Foundation
URL	http://www.cmtf.com
Contact	Phone: 310.563.1223 E-mail: tracie@cmtf.com
Corporate Fee	$1,195.00
Government Fee	$1,095.00

Title	Software Configuration Management
Description	This 2-day course is one of the most comprehensive SCM seminars available. Thoroughly updated, it includes demos of popular SCM tools and prepares students for the optional Level II certification exam available at the end of each course. No prior software experience required. How to apply SCM principles, the latest standards and trends, the complete SCM process, how to run basic reports, and how to conduct SCM audits.
Institution	Configuration Management Training Foundation
URL	http://www.cmtf.com
Contact	Phone: 310.563.1223 E-mail: tracie@cmtf.com
Corporate Fee	$1,195.00
Government Fee	$1,095.00

Title	Implementing Configuration Management
Description	This new 2-day course is for the CM professional looking to stay current with the latest changes in CM implementation. All the new "CM Best Practices," standards, and tools are covered. If you are already certified but want to stay current, or are not interested in certification and just want to know how to implement CM in today's environment, this is the course for you. The latest standards and trends, CM process improvement, EIA/IS 649 guidelines, the impact of MIL–STD–2549, and how to implement CM.
Institution	Configuration Management Training Foundation
URL	http://www.cmtf.com
Contact	Phone: 530.873.2734 E-mail: tracie@cmtf.com
Corporate Fee	$1,095.00
Government Fee	$1,095.00

Title	ClearCase Fundamentals
Description	Two days. This course provides the student with an understanding of the ClearCase Configuration Management (CM) tools. ClearCase is used for version control, workspace management, build management, and process control. This course is designed for the end-user or programmer. Students should have working knowledge of the operating system (NIX or Windows NT) process management. Students learn how to check files in and out, create branches, perform merges, and use the Clearkmaker utility (optional).
Institution	Configuration Management, Inc.
URL	http://softwareconfiguration.com/
Contact	140 Broad Street Red Bank, NJ 07701 Phone: 732.450.1100 or 800.550.5058 E-mail: training@softwareconfiguration.com

Title	ClearCase Administrator
Description	Two days. This course provides the student with a complete understanding of a ClearCase Configuration Management (CM) implementation. Through process and hardware analysis, project planning, configuration, installation, and day-to-day maintenance. At the completion of this course, the student will be able to configure, install, and maintain the ClearCase product within a systems development group. This course is designed for ClearCase experienced users, configuration managers, systems administrators, project managers, and quality control managers. ProTech ClearCase Fundamentals course or equivalent experience. Student should also have at least six months of systems administration experience with the operating system (UNIX or NT).
Institution	Configuration Management, Inc.
URL	http://softwareconfiguration.com/
Contact	140 Broad Street Red Bank, NJ 07701 Phone: 732.450.1100 or 800.550.5058 E-mail: training@softwareconfiguration.com

Title	ClearCase Metadata
Description	One day. This course provides the end-user with an understanding of the ClearCase Configuration Management (CM) product in a team environment using the Metadata tool. Students learn how to monitor development, enforce policies, automate individual or group communications, and organize development data to achieve team and project goals. At the completion of this course, the student will be able to: Create and modify Metadata, know how to monitor the development process, enforce policies, and know how query to query the database. This course is designed for ClearCase experienced users, configuration managers, systems administrators, project managers, and quality control managers. ProTech ClearCase Fundamentals course or equivalent experience. Student should have a working knowledge of shell programming and the operating system (UNIX or NT).
Institution	Configuration Management, Inc.
URL	http://softwareconfiguration.com/
Contact	140 Broad Street Red Bank, NJ 07701 Phone: 732.450.1100 or 800.550.5058 E-mail: training@softwareconfiguration.com

Title	ClearDDTS™ Administration & Configuration
Description	Two days. This course provides the student with an understanding of the ClearDDTS Configuration Management (CM) product used for defect tracking management and reporting. Students learn how to administer, configure, and customize the product to optimize software development time. At the completion of this course, the student will be able to: Customize the defect form and life cycle, and administer distributed projects, using the ClearDDTS tool. This course is designed for ClearDDTS Administrators. Minimum of one year experience working and programming with UNIX.
Institution	Configuration Management, Inc.
URL	http://softwareconfiguration.com/
Contact	140 Broad Street Red Bank, NJ 07701 Phone: 732.450.1100 or 800.550.5058 E-mail: training@softwareconfiguration.com

Title	Technical Training: Software Configuration Management
Description	The purpose of this workshop is to provide students with a forum where they can review their current configuration management processes and compare those to essential elements required for configuration management. This will be presented in the class, to put together a plan for how they will perform configuration management in the future. After completing the course, the student should be able to understand the essential elements of configuration management, understand the strengths and weaknesses of their current CM process, and be able to put together a configuration management plan.
Institution	Rainbow Analysis Systems Group, Inc.
URL	http://www.rasgroup.com/training/index.shtml
Contact	RAS Group Headquarters and Training Facility Training Coordinator 8800 Business Park Drive Austin, TX 78759 Phone: 512.346.7998, ext. 23 E-mail: training@rasgroup.com
Corporate Fee	$385.00
Government Fee	$385.00

Title	Software Configuration Management—Enterprise Planning
Description	1 Day Lecture & Lab—This course is an exploration of Enterprise Software Configuration Management. It is intended as an education and planning session in order to understand the challenges facing information system organization's involved in concurrent and/or parallel development, release management and/or concurrent development. This course is intended for Information Systems directors, managers, SCM project leaders, and personnel involved in SCM product technology evaluation. ■ Definitions and level-setting the goals ■ Strategic technology direction and requirements ■ What are our process requirements ■ SCM requirements ■ SCM evaluation and selection ■ SCM implementation There are no prerequisites for this course.
Institution	Pro Tech Professional Technical Services, Inc.
URL	http://www.protechtraining.com/training/
Contact	E-mail: webmaster@protechtraining.com

Title	Software Configuration Management Fundamentals
Description	3 days
Institution	System Technology Institution, Inc.
URL	http://www.stitraining.com
Contact	P.O. Box 6907 Malibu, CA 90264–6907 Phone: 310.456.5446 E-mail: STIclass@aol.com
Corporate Fee	$1,395.00
Government Fee	$1,395.00

Title	Practical Implementation of Software Configuration Management
Description	4 days
Institution	System Technology Institution, Inc.
URL	http://www.stitraining.com
Contact	P.O. Box 6907 Malibu, CA 90264–6907 Phone: 310.456.5446 E-mail: STIclass@aol.com
Corporate Fee	$1,595.00
Government Fee	$1,595.00

Title	The Basics
Description	Any professional will tell you that their success is built on mastering the basics. This Course will help engineers grasp "The Basics" of the ClearCase® paradigm, allowing them to work comfortably & efficiently within a ClearCase® development environment. Course Topics— ■ Command Line Interface & GUI ■ Command Summary & Overview ■ Managing Views ■ Managing Builds ■ Parallel Development Issues
Institution	Penguin Computing, Inc.
URL	http://www.penguin-inc.com
Contact	87 East Broadway Derry, NH 03038–2019 Phone: 603.425.7770 or 877.724.4726 E-mail: info@penguin-inc.com

Title	Process Control and Meta Data
Description	Every development team needs to know how to fine-tune ClearCase® for their specific needs. This course will lay the foundation for implementing Process Control in a ClearCase® development environment using Meta-Data. Course Topics— ■ Process Control ■ Labels ■ Attributes ■ Hyperlinks ■ Triggers ■ Data Organization ■ Searching
Institution	Penguin Computing, Inc.
URL	http://www.penguin-inc.com
Contact	87 East Broadway, Derry, NH 03038–2019 Phone: 603.425.7770 or 877.724.472 E-mail: info@penguin-inc.com

Title	System Administration
Description	A team is only as good as its weakest player. The same is true of the ClearCase® Environment; you must properly plan the hardware and software layout for a successful implementation. This course is designed to cover the many issues involved in designing a ClearCase® implementation, and the know how to successfully maintain it. Course Topics— ■ Process Analysis—Understanding your current environment ■ Hardware analysis—Determining if additional resources are needed ■ ClearCase® Licensing—Planning & Maintaining ■ System Setup, Installation & Configuration ■ Database Conversion and/or Creation ■ Swimming in the Storage Pools ■ View & VOB Administration ■ View & VOB Backup Issues
Institution	Penguin Computing, Inc.
URL	http://www.penguin-inc.com
Contact	87 East Broadway Derry, NH 03038–2019 Phone: 603.425.7770 or 877.724.4726 E-mail: info@penguin-inc.com

Title	Individual Coaching and Training
Description	Often times a team will lose an essential player, or be growing so rapidly that you need additional important players. Our Individual Coaching & Training Course is based on: ■ Your ClearCase® Environment, ■ Your CM Process needs or desires.
Institution	Penguin Computing, Inc.
URL	http://www.penguin-inc.com
Contact	87 East Broadway Derry, NH 03038–2019 Phone: 603.425.7770 or 877.724.4726 E-mail: info@penguin-inc.com

Appendix K Conference Listings

This appendix makes no endorsements concerning particular conferences. These conferences represent examples of those available in the field of CM.

Title	Configuration Management Benchmarking Group
Description	Often times a team will lose an essential player, or be growing so rapidly that you need additional important players. Our Individual Coaching & Training Course is based on— ■ Your ClearCase® Environment, ■ Your CM Process needs or desires.
URL	http://www.cmbg.org/
Description	Annual Conference

Title	Configuration and Data Management: Strategic Components for Improving Business Processes
URL	http://www.acdm.org/meet.html
Description	Annual Conference—The ACDM 2001 conference provides an opportunity for Configuration Management and Data Management professionals to reflect on the discipline's accomplishments, new developments, and future directions, which are captured in the conference theme "Configuration and Data Management: Strategic Components for Improving Business Processes." ACDM's 6th Annual Technical and Training Conference was specifically designed for program and project managers, engineers, software developers, and CM and DM practitioners and professionals from academic, industry, and government activities. This conference is highly recommended for those who wish to broaden their understanding of the disciplines of CM and DM, those interested in learning about automated tools and document management solutions, and anyone that would like to improve their business practices in a cost-effective manner.

Title	Annual CMII Conference
URL	http://www.cmiiug.com/conferen.htm
Description	Annual International Configuration Management II (CMII) Conference. Hosted by ICM, CMII Users Groups, and other industry leaders. Open to anyone.
Conference Host	ICM, CMII Users Groups, and other industry leaders Conference
E-mail	CMIIUGs@aol.com

Title	Tenth International Workshop on Software Configuration Management (SCM–10)
URL	http://www.ics.uci.edu/~andre/scm10

Title	CMII 2001 Conference September 23–26, 2001 San Diego, CA
URL	http://www.cmiiug.com/cmii2001.htm

Appendix L

Various Societies, Institutions, Associations, and Documentation

American Nuclear Society (ANS)

CM Document	Document Title
ANSI/ANS 3.2 1994 (1994)	Administrative Controls and Quality Assurance for the Operational Phase of Nuclear Power Plants ($82.00)

American Society of Mechanical Engineergs (ASME)

CM Document	Document Title
ANSI/N45.2.9 1974 (1974)	Requirements for Collection, Storage, and Maintenance of Quality Assurance Records for Nuclear Power Plants • Endorsed by Regulatory Guide 1.88
ANSI/N45.2.10 1973 (1973)	Quality Assurance Terms and Definitions
ANSI/N45.2.11 1974 (1974)	Quality Assurance Requirements for the Design of Nuclear Power Plants Endorsed by Regulatory Guide 1.64 • Outlines the design process

	• Defines Design, Design Inputs, Design Outputs • Lists examples of Design Inputs
ANSI/N45.2.13 1976 (1976)	Quality Assurance Requirements for Control of Procurement of Items and Services for a Nuclear Power Plant
ANSI/ASME NQA 1c (1982)	Addenda to ANSI/ASME NQA 1979, Quality Assurance Program Requirements for Nuclear Power Plants
ANSI/ASME NQA 1 1986 (1986)	Quality Assurance Program Requirements for Nuclear Facilities
ASME NQA 1 1989 (August 30, 1989)	Quality Assurance Program Requirements for Nuclear Facilities (NQA 1) Terms used in this Standard that require unique definition are included in Supplement S 1, Terms and Definitions ($83.00, ISBN 0791820386, ASME Order # A10589)
ASME NQA 1a 1989 (March 31, 1990)	Addenda to ASME NQA 1 1989 Edition, Quality Assurance Program Requirements for Nuclear Facilities
ASME NQA 1b 1989 (April 15, 1991)	Addenda to ASME NQA 1 1989 Edition, Quality Assurance Program Requirements for Nuclear Facilities
ASME NQA 1 1992 (September 30, 1992)	Addenda to ASME NQA 1 1989 Edition, Quality Assurance Program Requirements for Nuclear Facilities
ANSI/NQA 1 (July 25, 1994)	Quality Assurance Program Requirements for Nuclear Facilities (NQA 1) ($125.00, ISBN 079182229X, ASME Order # A10594)
ASME NQA Technical Report 1993 (September 15, 1993)	Comparison of ASME NQA 1 and ISO 9001 There are many areas where NQA 1 contains additional requirements. Hence, a quality program that meets the requirements of ISO 9001 may not meet the requirements of

NQA 1. ($30.00, ISBN 079182232X, ASME Order # A13793)

Electric Power Research Institute (EPRI)

CM Document	Document Title
(the "TERI" document)	Guidelines for Commercial Grade Dedication
TR–106828 (July 1996)	Use of Electronic Media Authorization and Electronic Document Storage in the Nuclear Power Industry
TR–103586–R1 (October 1998)	Guidelines for Optimizing the Engineering Change Process for Nuclear Power Plants • Provides decision criteria to select level of administrative and technical effort for engineering changes (update to R–0 issued March 1994)
NP–6295 (May 1989)	Guidelines for Quality Records in Electronic Media for Nuclear Facilities (NCIG–10)
NCIG–05 (May 1988)	Guidelines for Piping System Reconciliation, Rev 1

Institute of Nuclear Power Operations (INPO)

CM Document	Document Title

INPO 84–010 (March 1984)	Nuclear Utility Action Committee (NUTAC) Report Discusses the Vendor Equipment Technical Information Program (VETIP)
INPO 85–013 (Good Practice TS–402) (May 1985)	Plant Modification Control Program
INPO 85–016 (Good Practice TS–412) (February 1988)	Temporary Modification Control
Good Practice TS–415 Preliminary (March 1986)	Technical Review of Design Changes
INPO 87–006 (July 1987)	Report on Configuration Management in the Nuclear Utility Industry
INPO 87–009 (DE–102) (August 1987)	Control of Vendor Manuals, Good Practice
INPO 88–022 (TS–403)	Vendor Manual Specification and Procurement
INPO 90–015 (August 1990)	Performance Objectives and Criteria for Operating and Near-Term Operating License Plants (Section ES.3 Plant Modifications Section OA.8 Configuration Management)
INPO 97–002 (September 1997)	Performance Objectives and Criteria for Operating Nuclear Electric Generating Stations (A working reference for INPO evaluators. Section PS entitled "Plant Status and Configuration Control" provides performance objectives and criteria for INPO evaluators and for member utilities to use in self-evaluations)
AP–905 (November 1996)	Configuration Change Process Description (See INPO AP–929)
AP–906 (Prelim) (May 1996)	Design Change Process Description (See INPO AP–929)

AP–922	Design Basis Change Process Description (See INPO AP–929)
AP–929 (May 1998)	Configuration Control Process Description features include— • "bulls-eye" diagram showing relationship of Design Bases, Design Requirements and Operational Configuration • nested flowcharts showing work flow process for Configuration Changes, Design Changes and Design Basis Changes • relationship between design bases and licensing requirements—Figure A–1 (compare with definitions in 10 CFR 50 Appendix B and NEI 97–004) • outlines graded approach to maintain configuration information in four levels of documents

Nuclear Information and Records Management Association (NIRMA)

CM Document	Document Title
NYA–1995 (November 15, 1995)	NIRMA Recommendations for Voluntary Utility EIE (Electronic Information Exchange)With NRC (Task Force White Paper, Version 3.0)
PP 02–1994 (protected)	Configuration Management • Defines CM • Outlines classical principles • Flow chart on change control

	• Describes three methods for Design Basis Documents
PP 03–1992 (protected)	Implementing CM Enhancement in a Nuclear Facility • How to establish and implement a CM program • Lists functional areas of a nuclear plant • Good definitions appendix with references to regulatory standards • Figures show simplified process flows
PP 04–1994 (protected)	Configuration Management Information Systems
TG 06–1984	Preparation of Technical Manuals
TG 11–1998 (protected)	Authentication of Records and Media
TG 13–1986 (protected)	Records Turnover
TG 14–1992 (protected)	Support of Design Basis Information Needs
TG 15–1998 (protected)	Management of Electronic Records
TG 16–1998 (protected)	Software Configuration Management and Quality Assurance
TG 17–1993 (protected)	Management of Nuclear Training Records
TG 18–1994 (protected)	Guideline for Implementing Vendor Information Programs
TG 18–1999 (protected)	Guideline for Implementing Vendor Information Programs (Exhibit 1 contains a cross reference of Industry Guidance)
TG 19–1996 (links to a PDF file)	Configuration Management of Nuclear Facilities • proposed ANSI standard on configuration management • provides definitions and functional criteria for configuration management • Includes graphic showing CM objective that design require-

	ments, physical configuration and facility configuration information must conform
TG 20–1996 (protected)	Drawing Management Program Principals and Processes
TG 21–1998 (protected)	Electronic Records Protection and Restoration
TG 22–draft	Identifying Quality Assurance Records

Nuclear Energy Institute (NEI)

CM Document	Document Title
NEI 97–04 (September 1997)	Design Bases Program Guidelines • Discusses genesis of term "design bases" as defined in the regulations (10CFR50.2) • Clarifies reportability requirements associated with design basis information • Provides additional examples to assist licensees in identifying design basis information (NEI 97–04 is an update to NUMARC 90–12 "Design Basis Program Guidelines" dated October 1990)
NEI 96–07	Guidelines for 50.59 Evaluations
NEI Report October 1998	A Standard Nuclear Performance Model • A model for evaluating performance measures and costs against nuclear power plant processes. Configuration Control is one of the processes addressed.
NEI 98–03 (Rev 1) June 1999	Guidelines for Updating Final Safety Analysis Reports

Nuclear Utility Software Management Group (NUSMG)

CM Document	Document Title
NUSMG1	Guidance Document for Electronic Document Management Programs

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