



**SME initiative**

## Configuration Management Training

### Section 1

# Explaining Configuration Management

prepared and lectured under ESA contract by

INGENIEURBURO WOLFGANG WEISS

INDUSTRIEBERATUNG

## Section 1 - Explaining Configuration Management

- About the term “Configuration”
  - ECSS-M-40A and ISO10007:1995 define “Configuration” as the functional and physical characteristics of a product as defined in technical documents and achieved in the product
  - ANSI/EIA-649-1998 defines “Configuration” as
    - (1) the performance, functional, and physical attributes of an existing or planned product, or a combination of products; and
    - (2) one of a series of sequential created variations of a product
  - MIL-STD-973(N3) defines “Configuration” as the functional and physical characteristics of existing or planned hardware, firmware, software or a combination thereof as set forth in technical documentation and ultimately achieved in a product

## Section 1 - Explaining Configuration Management

- A variety of definitions for CM from worldwide accepted standards
  - ECSS-M-40A (per ECSS-P-001A, Rev. 1)  
Configuration Management: Technical and organizational activities comprising (a) configuration identification; (b) configuration control; (c) configuration status accounting; (d) configuration audit (*or verification review in ECSS CM terms*)
  - ISO10007:1995
    - A) In para 3.9 (definitions) - same as in ECSS-M-40A
    - B) In para 4.1 (general) - Configuration Management (CM) is a management discipline that applies technical and administrative direction to the development, production and support life cycle of a configuration item. This discipline is applicable to hardware, software, processed materials, services, and related technical documentation. CM is an integral part of life-cycle management.

## Section 1 - Explaining Configuration Management

- A variety of definitions for CM from worldwide accepted standards (contd)
  - ISO/IEC TR15846:1998 - Software Configuration Management (SCM):
    - The process of applying Configuration Management (see ISO10007) throughout the software lifecycle to ensure the completeness and correctness of SCIs
  - ISO/IEC/(JTC1) SC 7/WG8 - N1181 (Committee Draft.2) as of 24 January 1995 (which evolved to ISO/IEC TR15846) contained a very valuable statement, supplementary to the definition of SCM:
    - “Note: Compared with classic hardware CM, SCM is an active discipline which is integral and concurrent to the software engineering process and must support the definition and implementation of the software process itself. SCM must manage changes to all project components as they move through their approval life cycle and must meet the needs of both engineers and management. Modern SCM must manage the evolving process model applied to the objects under control. The definition of modern SCM carries the implicit requirement that it must be automated.”

## Section 1 - Explaining Configuration Management

- A variety of definitions for CM from worldwide accepted standards (contd)
  - ANSI/EIA-649-1998
    - Configuration Management (CM): A management process for establishing and maintaining consistency of a product's performance, functional, and physical attributes with its requirements, design and operational information throughout its life.
  - MIL-STD-973(N3)
    - Configuration Management (CM):
      - a) As applied to configuration items, a discipline applying technical and administrative direction and surveillance over the life cycle of items to:
        - (1) Identify and document the functional and physical characteristics of configuration items
        - (2) Control changes to configuration items and their related documentation
        - (3) Record and report information needed to manage configuration items effectively, including the status of proposed changes and implementation status of approved changes
        - (4) Audit configuration items to verify conformance to specification, drawings, interface control documents, and other contract requirements

## Section 1 - Explaining Configuration Management

- A variety of definitions for CM from worldwide accepted standards (contd)
  - MIL-STD-973(N3) (contd)
    - Configuration Management (CM): (contd)
      - b) As applied to digital data files, the application of selected configuration identification and configuration status accounting principles to:
        - (1) Uniquely identify the digital data files, including versions of the files and their status (e.g., working, released, submitted, approved)
        - (2) Record and report information needed to manage the data files effectively, including the status of updated versions of files

## Section 1 - Explaining Configuration Management

- A very general, yet good explaining definition for CM
  - Configuration Management represents a technical-administrative discipline which ensures that all parties to the acquisition of a product,
    - the buyer,
    - the developer / designer,
    - the producer, and
    - the user

have a common understanding about

- how the product looks like (physical shape / software code)
- what the product is supposed to do (functionality, performance)
- how the product can be operated (mission profile / capabilities); and
- how the product is to be maintained (supportability)

CM accomplishes this through entire control of the product defining technical data

## Section 1 - Explaining Configuration Management

- The evolution of CM as a technical-administrative discipline
  - The raising demand of product technical data for their iterative control
    - Prior to about 1850, products utilized rather simple technology that was easily understood by its developers and which very few technical documentation involved utilizers products were often uniquely developed and built as one-of-a-kind (e.g., ships, buildings, rifles)
    - As products became more complex, a greater range of technologies was applied to the individual product's design and production processes
    - By the early 1900, user documentation became necessary (technical data were extended to the users)
    - During and immediately after World War II, the technology became increasingly complex
    - Extensive product design data had become necessary (technical communication was extended within the organizations)
    - By late 1950, systems had become so complex that not even very large companies could design and build an entire system on their own

## Section 1 - Explaining Configuration Management

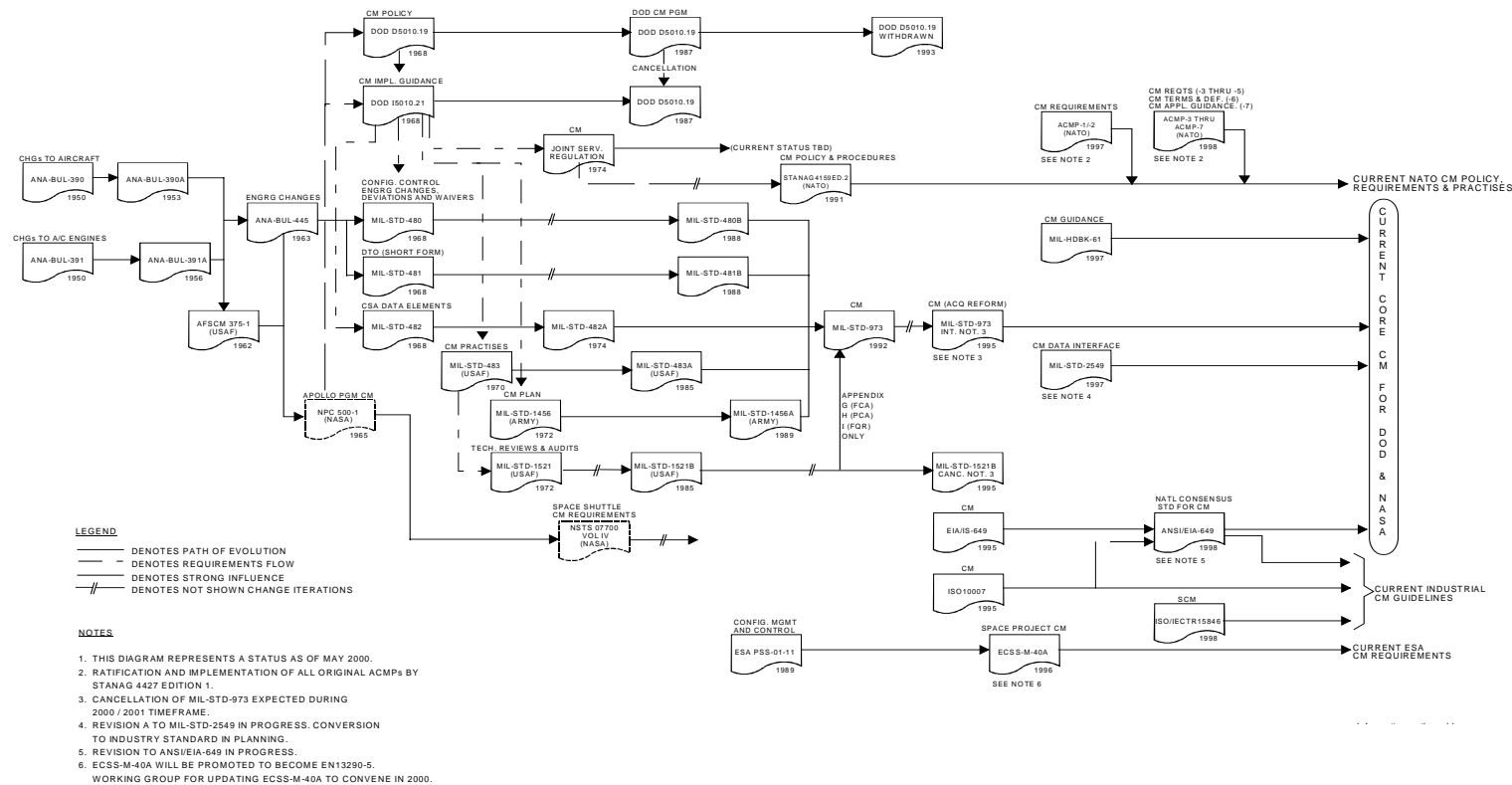
- The evolution of CM as a technical-administrative discipline (contd)
  - The raising demand of product technical data for their iterative control (contd)
    - Accordingly, technical design data had to be exchanged among many different organizations (technical communication exchange was extended to other design and producing enterprises)
    - In the late 1960's, computers became portable; products now included computers and software
    - Only a few of the old-style design organizations understood software technical data (technical communication exchange was extended for radically new products)
    - Formal CM was first used in the 1950's to control the technical documentation for complex space and weapons systems. (booster rockets, satellites, supersonic airplanes, nuclear submarines, guided missiles, etc.)

## Section 1 - Explaining Configuration Management

- The evolution of CM as a technical-administrative discipline (contd)
  - The raising demand of product technical data for their iterative control (contd)
    - Prior to the mid 1970's, software CM did not exist as a formal discipline
      - » Software was coded for, and installed on large mainframe computers
      - » Software evolution / enhancement was controlled by the "computer centers" within an enterprise, and under its sole authority
      - » Functional requirements stipulated by software programme users were satisfied in software design by best ability of the programmer - the user had no means to request the change of codes
    - The CM philosophy and objectives, and its success during the 1960's have caused other industries beyond aerospace and defence to adopt CM. It is nowadays used by the automobile industry, the nuclear power industry, consumer products companies, pharmaceutical industry, and many others

## Section 1 - Explaining Configuration Management

- The evolution of CM as a technical-administrative discipline (contd)
  - 50 years of documenting CM requirements



50 YEARS IN MAJOR CM STANDARDIZATION EFFORTS

X1358-33900153

## Section 1 - Explaining Configuration Management

- The objectives of CM
  - Know at any moment the technical description of a system and its components, using approved documentation
  - Control effectively and continuously evolutions in the technical description and provide traceability of such evolutions throughout the life-cycle of the product
  - Facilitate the consistency of the system's components (control of external interfaces) and the products that make up these components (control of internal interfaces)
  - Verify that documentation is and remains the exact image of the products it describes
  - Identify the desired configuration and the as-built configuration, in order to recognize discrepancies detected during production, delivery or operation of the product
  - Enable any user to know the operational capabilities and limitations of each product item and, in case of variances or nonconformances, to know which items are affected

## Section 1 - Explaining Configuration Management

- The objectives of CM (contd)
  - Configuration Management is a product control function that provides surveillance through all phases of the product life-cycle, encompassing:
    - Concept Evaluation
    - Development
    - Design
    - Verification / Qualification
    - Production
    - Operation
    - Maintenance
    - Modification / Enhancement
    - Disposal

## Section 1 - Explaining Configuration Management

- Benefits for an enterprise gained through application of CM
  - Conclusive and current information; knowing at any time what the enterprise is
    - developing
    - building
    - testing
    - delivering
  - Assured product consistency; being enabled to
    - deliver identical items
    - repeat performance
    - support the delivered product remotely
    - modify the product without the need of reverse engineering

## Section 1 - Explaining Configuration Management

- Benefits for an enterprise gained through application of CM (contd)
  - Control of cost; CM helps a project to stay within the authorized budget frame
    - Product changes may involve high cost considerations. The right processing of changes and analysis of costs can keep expense per change at its lowest rate
    - Unauthorized changes will be prevented
    - Thorough identification of all affected documentation and product elements reduces cost of search and analysis of effects
    - Approved changes can be immediately incorporated in the technical documentation, but released for implementation into the product in accordance with an authorized budget schedule
    - Proper identification and change control allows least cost of maintenance and reuse

## Section 1 - Explaining Configuration Management

- Benefits for an enterprise gained through application of CM (contd)
  - Visibility in planning; CM helps project planning by ensuring that
    - Any schedule effect of a proposed change is reviewed prior to disposition of the change
    - Interface requirements are assessed for effect of the change on other design organization's schedules
  - Compliance with requirements; CM ensures the intended configuration by
    - supporting internal and formal design reviews
    - performing the functional and physical configuration verifications (audits)
    - maintaining traceability of software configurations to functional requirements
    - controlling changes to the approved documentation
    - communicating change status to all involved parties

## Section 1 - Explaining Configuration Management

- Benefits for an enterprise gained through application of CM (contd)
  - Agreement in interfaces; CM ensures that
    - Interface requirements are identified, documented and baselined
    - All change proposals are analyzed for effect on interface criteria
    - Changes to the interface definitions are controlled and incorporated in the same manner as other changes