Configuration Management ISO 10007

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Introduction

Configuration Management Overview:

What is Configuration Management?

Collection of tools, techniques and experience designed to reduce costs and improve quality

Management tool

Defines the product and controls the changes

Objective of Configuration Management

To define and control the components of the service and infrastructure that **maintains accurate configuration information**

What areas does CM apply to?

- Hardware
- Software
- Firmware
- Documentation
- Specification
- Combinations

Configuration Management Process

Defines Communication of Changes

Includes all CM functions:

- Configuration Identification
- Configuration Control
- Configuration Status Accounting
- Configuration Audit

Understanding of proposed change

- Why configuration must be changed

Feedback from participants

- Discussion and agreement configuration change is required

What is Configuration Management?

Configuration management (CM) is the field of management focused on establishing and maintaining the consistency of its system or product performance and its functional and physical attributes. The system and product requirements, design, and operational information documentation must be maintained and available throughout its life.

Through the **control of changes** the configuration process manages the security features and assurances throughout the life cycle of an information system to hardware, software, firmware, documentation, test, test fixtures, and test documentation.

Configuration Management Controls

It identifies four procedures that must be defined:

1. Configuration identification
2. Configuration control
3. Configuration status accounting
4. Configuration audits

1. Configuration Identification

Configuration identification: process of identifying the attributes that define every aspect of a configuration item.

Configuration item: product (hardware and/or software) that has an end-user purpose.

- Attributes are recorded in configuration documentation and baselined.
- Baselining attributes forces formal configuration change control processes to be effected in the event the attributes are changed.

1. Configuration Identification continued

Bill of Material (BOM) are formed with Engineering drawings and parts lists linked together in a drawing tree or engineering product structure as-designed configuration.

- **BOM** is the representation of **how** materials, components, sub-assemblies and assemblies come together to **form the end product** based on the designers' visualization of the product and its **stages of production** or based on a **functional subsystems-oriented view** of product assemblies.

2. Configuration Control

Configuration change control is a **set of processes and approval stages** required to change a configuration item's attributes and to re-baseline them.

2. Configuration Control continued

Change demand can be generated either from within the company or externally from the customer or a supplier.

Common changes:

- Correct a drawing or engineering document error
- Correct a usability, reliability or safety problem
- Fix a bug or product defect
- Improve performance and/or functionality
- Improve producibility
- Lower cost
- Incorporate new customer requirements
- Specify a new supplier or supplier part/material
- Enhance installation, service, or maintenance
- Respond to regulatory requirements

2. Configuration Control Considerations

Consider the following questions when evaluating a change:

- Inventory status of the new and old item.

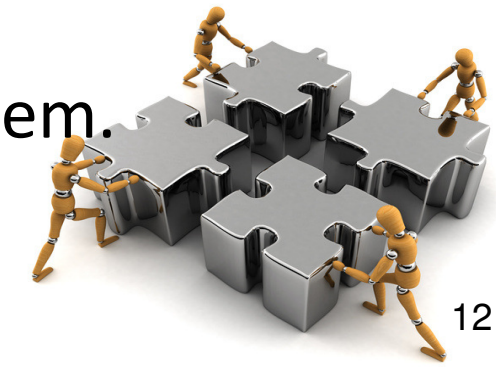
  How many of the old item are in inventory?
- Must they be scrapped or can they be used on other products or reworked?
- What is the cost to rework or scrap?

  Is the new item in inventory?
- What is the Production status of the new and old item?
- How many of the old items are in **WIP?**

2. Configuration Control Considerations continued

Questions continued:

- Can new configuration be reworked considering their current stage of completion or completed and used up before the change is effective; or must they be scrapped?
- Has production of the new items begun?
- What is the lead-time and cost for production of the new item?
- What is the additional lead-time for building tooling, fixtures and test equipment?
- Procurement status of the new and old item. And is the old item on order?



2. Configuration Control Considerations continued

Questions continued:

- Can it be cancelled or reworked? At what cost?
- What is the lead-time for procuring the new item?
  Are new suppliers required?
- What is the impact to distributors, dealers, customers and field service organizations? What notification is required?
  How long will the process take?
- What documentation, manuals and catalogs need to be updated? What are the implications on **spare parts requirements**?
- Testing and regulatory requirements. Are the changes significant enough to require **retesting**?
- What testing needs to be performed?
- Does the product need to be **recertified**?
  What regulatory approvals are required

2. Configuration Control - Effective Date

A change plan to identify all the required actions, responsibility, and timing may be required when change is to become effective.

- The effectivity of the configuration change typically will be specified through: **date effectivity** or **serial effectivity**.
- **Date effectivity** has been the traditional approach to defining effectivity. A change implementation date is used as the basis for planning when the **new item will be phased** into the bill of material and the old item phased out.

For low volume environments or complex assemblies **dates** can be associated with the **start of production lots** to control the configuration of the lot and of the serialized assemblies within a lot.

2. Configuration Control - Effective Date continued

- **Serial effectivity** is typically tied to the end-item serial number. Serial effectivity is sometimes the preferred technique because the planned configuration of each end-item serial number is pre-defined and not subject to shifting schedules.
- In situations with a large number of changes, a complex product structure, and low rate production, the result could be a **unique configuration for each end item serial number**.
- Block change could be a unique end-item at each block point. In these situations, the Master Production Schedule with unique end-item part numbers control the serial effectivity.

3. Configuration Status Accounting

Definition:

Configuration status accounting is the **ability to record and report on the configuration baselines** associated with each configuration item at any moment of time. (Traceability)

3. Configuration Status Accounting continued

As changes are requested or proposed, a **unique identifier** is assigned to the product.

The information should be maintained in an ERP system.

Status should be tracked as the proposed change moves through the evaluation and approval process

Status information is to include:

- completed steps
- the information accumulated at each step
- the physical location of the ECP

3. Configuration Status Accounting continued

When the change is approved, an ECO/ECN is prepared and distributed; it is to include:

- As-designed and as-planned configurations: historically for items already built as well as prospectively for items planned to be built
- As-built configurations including authorizations for any variances from the as-planned configuration
- The status of both proposed and approved changes
- Change traceability: track changes proposed, approved, and implemented for an item number (including effectivity); and the items affected by a given proposed, approved or an obsolete change

4. Configuration Audits

Configuration audits are separated into **functional** and **physical configuration** audits.

Occur either at delivery or at the moment of effecting the change.

Functional configuration audits verify that the functional and performance attributes of a configuration item are achieved.

Physical configuration audit ensures that a configuration item is **installed in accordance with the requirements of its detailed design documentation.**

4. Configuration Audits

Configuration Audit system requirements:

Data has to be captured in a **system** maintained with all the information for the **configuration verification process**

The goal of the verification process data collection is to assure that the as-built configuration can be **reconciled** to the as-designed configuration

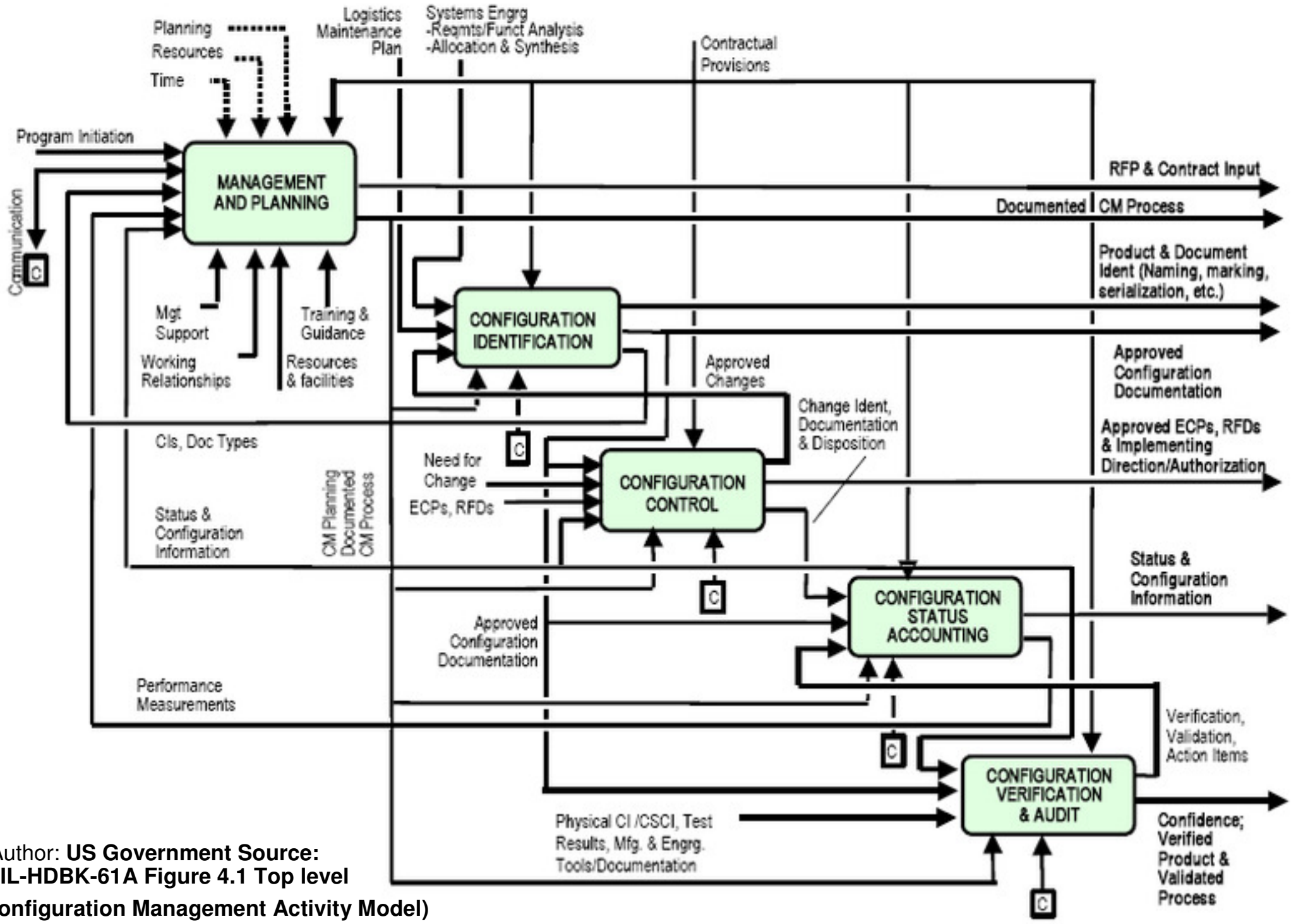
Information about the deviations and waivers which temporarily authorize a change in configuration on the as-planned BOM and order BOM data must be available to support the **next step** in the configuration verification process which is **the reconciliation of the as-planned and as-built configuration**.

4. Configuration Audits

Configuration Audit system requirements continued:

The **final step is the physical verification** of the product to the as-built configuration records through inspection or product tear-downs if required

CM Process Example



(Author: **US Government Source: MIL-HDBK-61A Figure 4.1 Top level Configuration Management Activity Model)**

Configuration Baseline

Baseline = Configuration Identification document or set of documents formally designated by the organization at a specific time during a CI's lifetime.

Baseline plus approved changes constitute the current approved CI.

Configuration Baseline is composed of 3 Baselines:

Functional: Usually system requirements

Allocated: Decomposition of system functional requirements into smaller "packages"

- **Product:** Physical characteristics like dimensions and composition

Functional Baseline

Configuration **Functional Baseline**:

Drafted during “Concept Exploration Phase”

Established by the “System Design Review” (SDR)

Foundation for Configuration Management by the organization during subsequent phases of the product/system development cycle.

Allocated Baseline

Configuration **Allocated Baseline**:

- Initial Configuration Item (CI) identification describing functional and interface characteristics, interface requirements, design constraints and verification required.
- Drafted during the Demonstration/ Validation Phase and established by the Preliminary Design Review (PDR)

Product Baseline

Configuration **Product Baseline**:

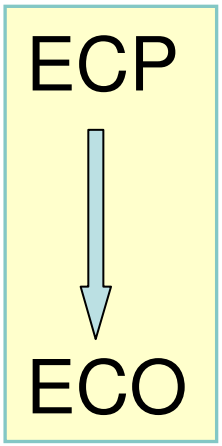
- Describes all functional, physical, interoperability, production, test and support characteristics for the Configuration Item (CI).
- Drafted during the **F**ull **S**cale and **E**ngineering **D**evelopment (**FSED**) Phase and is established by the Production Configuration Audit (PCA).

Purpose of Change Control

- To manage changes to CI and CI's configuration identification documentation
- To Maintain/Enhance Reliability, Performance, Interoperability, Supportability and Operational Readiness
- To prevent unnecessary or marginal changes
- To establish change priorities
- To assure prompt action with:
  - Control the change
  - Document the change
  - Control the release system

Engineering Change Process

- Determine need for change
- Establish classification: Class I or Class II
- Prepare ECP: Preliminary or formal
- Submit ECP to Configuration Control Board
- Chairman and functional review ECP
  - Class I: approves, disapproves, requests formal ECP
  - Class II: concurs/ non-concurs with classification
- **Change incorporated:** Complete CI and Configuration Identification Documentation



Types of Changes

Engineering Changes (ECP)

- Approved configuration identification of CI changes
- May / may not involve a specifications/ drawing change

Deviation

- Authority, before the fact to intentionally build a CI that does not comply with approved technical documentation
- Approved for a specific number of units or period of time

Waiver

- Permit to deliver a Non-conforming CI
- After discovery by inspection or test

Classification of Engineering Change Proposal (ECP)

ECP Types: Preliminary or Formal

Class I: effect form, fit or function

Class II: mainly administrative (no cost)

Priorities

Justifications Codes for ECPs

D = Correction or Deficiency

S = Safety

B = Interface

C = Compatibility

O = Operations or Logistics Support

R = Cost Reduction

V = Value Engineering

P = Production Stoppage

A = Record only

Standard Service Levels:

Emergency - 24 hours

Urgent - 7 days

Routine - 30-45 days

Status Accounting–What happened?

Records the configuration or actual items

Provides a track of configuration changes and documents the configuration of the item

Includes:

- A listing of approved configuration identifications
- Status of proposed changes, waivers & deviations
- Implementation status of change approvals
- Configuration status of items in the operational inventory

Why Status Accounting

Management Information Systems help with:

- **Traceability**
- Identify the configuration
- Update technical publications
- Kit shipments on time
- Ship correct units to correct locations
- Install correct items
- Provide proper training

Configuration Audits

Functional Configuration Audit (FCA):

- Verifies achievement of performance specified in functional and/or allocated configuration identification

Physical Configuration Audit (PCA):

- Established CI's initial product configuration identification examining the "As Built" configuration against its technical documentation

Functional Configuration Audit Tasks

- Ensure testing satisfies program requirements
- Establish and record accomplishments
- Determine need to be accomplished
- Initiate appropriate design corrections as required
- Establish a complete record of data/ documentation used
- Develop checklist for use at PCA

- Test plan(s)
- Test procedures
- Test reports
- List of completed functional tests and status (go/no-go)
- List of tests not accomplished
- Analysis and/or simulation data
- PDR and CDR minutes

PCA Functions – Product Configuration Audit

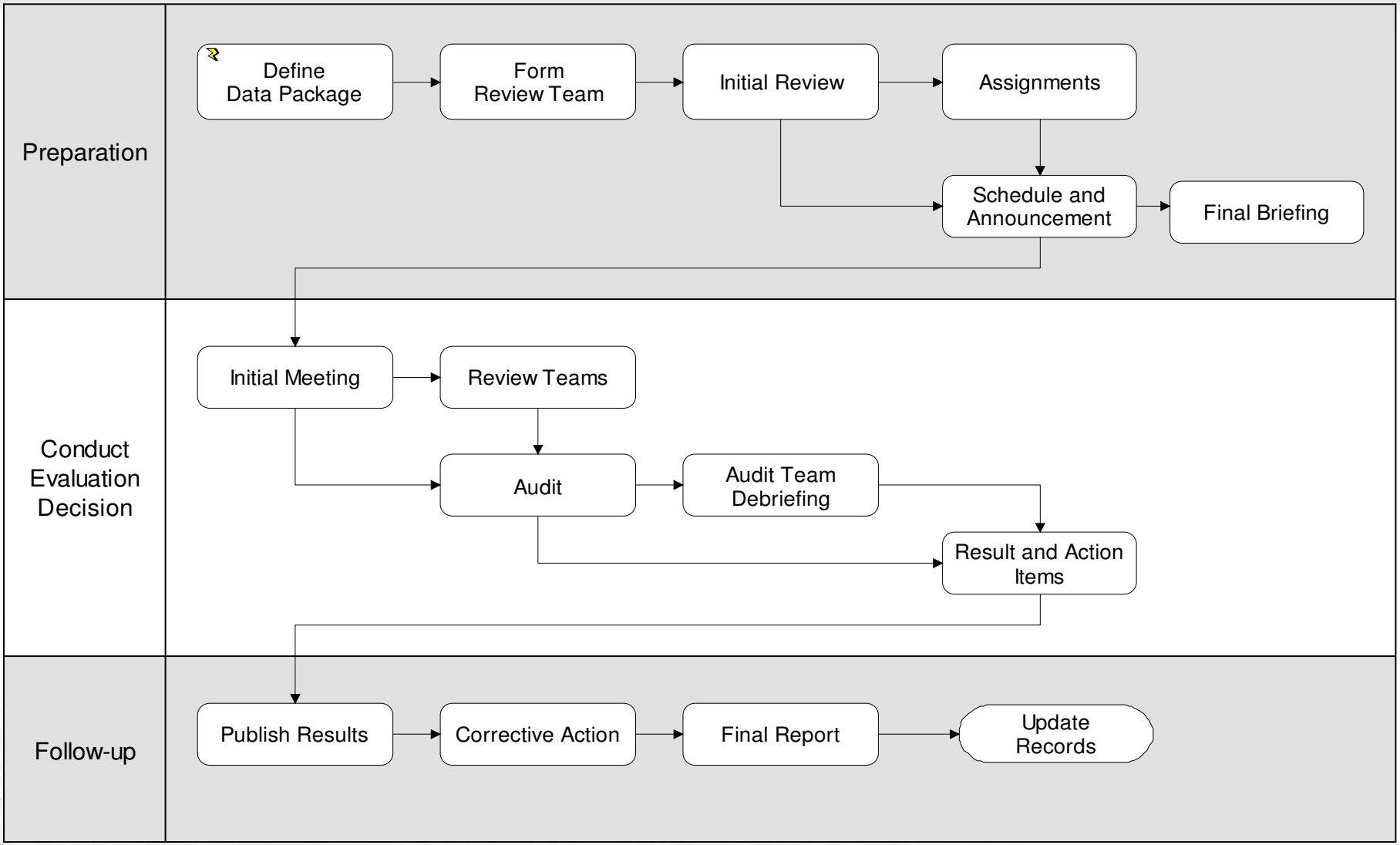
Compare final released drawings to the actual product

Review completeness of all documentation

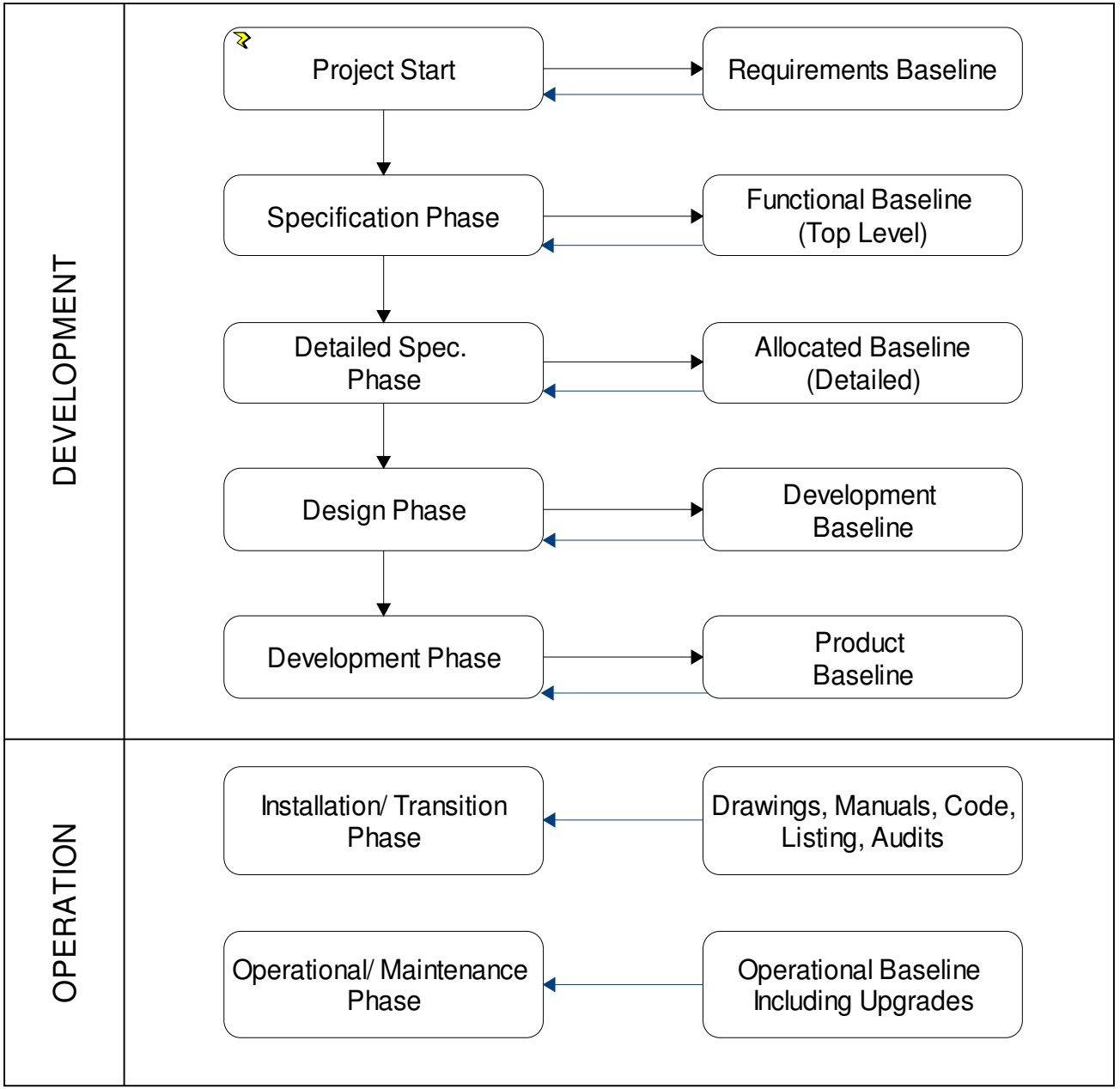
- Product specifications
- Engineering drawings
- Manufacturing data
- Quality controls records
- Description manuals

Review results of the FCA – Functional Configuration Audit

Generic Configuration Audit Process



Baseline Management Process



Systems Life Cycle Technical Activities

Determination of Need	Concept Exploration and Definition	Demonstration and Validation	Engineering and Manufacturing Development	Production and Distributions	Operations Support
Decision Points	MS0 Phase 0	MSI Phase I	MSII Phase II	MSIII Phase III	MSIV Phase IV
Systems Engineering	**Systems Level** ▪ Functional Analysis ▪ Synthesis ▪ Trade-off ▪ Description	**CI Level** ▪ Functional Analysis ▪ Synthesis ▪ Trade-off ▪ Description	Component Detailed Design	Preliminary Modification/ Integration	Modification and Support
Software	Systems Requirements Allocation	Computer Software Configuration Item Requirements Allocation	▪ Design ▪ Code ▪ Test	Modifications	▪ Modifications ▪ Maintenance
Reviews and Audits	Systems Requirements Review (SRR)	System Design Review (SDR)	▪ Production Readiness Review (PRR) ▪ Functional Configuration Audit (FCA) ▪ Production Configuration Audit (PCA)	Follow-on Qualifications Review (FQR)	Engineer Change Proposal (ECP)
Manufacturing	Production Strategy	Manufacturing Plan	Prototype Low Rate Initial Production	Manufacture	Modify

Conclusion

SUMMARY

Configuration management is a critical discipline in delivering products that meet customer requirements and that are built according to approved design documentation. Your systems provide the tools to support configuration management.

Appendix

ISO 10007 Requirements 3

Terms and Definitions

INTERNATIONAL STANDARD - ISO 10007

Definitions given are from ISO 9000

ISO 9000 Terms and Definitions

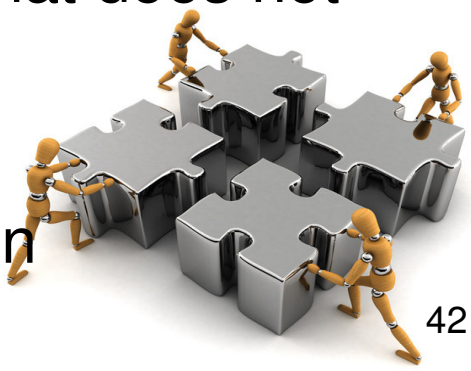
3.1 Change Control - activities for control of the product after formal approval of its product configuration information (3.9)

3.2 Concession - permission to use or release a product that does not conform to specified requirements

NOTE 1 - A concession is generally limited to the delivery of the product that has nonconforming characteristics within specified limits for an agreed time or quantity of that product. ISO 9000:2000, definition 3.6.11

NOTE 2 - Concessions do not affect the configuration baseline (3.4) and include permission to produce a product that does not conform to specified requirements.

NOTE 3 - Some organizations use terms such as "waivers" or "deviations" instead of "concession"



Definitions given are from ISO 9000

ISO 9000 Terms and Definitions

3.3 Configuration interrelated functional and physical characteristics of a product defined in product configuration information

3.4 Configuration baseline approved product configuration information (3.9) that establishes the characteristics of a product at a point in time that serves as reference for activities throughout the life cycle of the product

3.5 Configuration item entity within a configuration (3.3) that satisfies an end use function

Definitions given are from ISO 9000

ISO 9000 Terms and Definitions

3.6 Configuration Management coordinated activities to direct and control configuration

NOTE Configuration management generally concentrates on technical and organizational activities that establish and maintain control of a product and its product configuration information (3.9) throughout the life cycle of the product.

3.7 Configuration Status Accounting formalized recording and reporting of product configuration information (3.9), the status of proposed changes and the status of the implementation of approved changes

Definitions given are from ISO 9000

ISO 9000 Terms and Definitions

3.8 Dispositioning Authority - person or a group of persons assigned responsibility and authority to make decisions on the configuration – 3.3

NOTE 1 Dispositioning authority can also be called a "configuration control board"

NOTE 2 Relevant interested parties within and outside the organization should be represented on the dispositioning authority

3.9 Product Configuration Information requirements for product design, realization, verification, operation and support

Definitions given are from ISO 9000

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