

White Paper
CMII-800D

**Configuration Management:
Traditional CM Versus CMII**



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Revision Record

<i>Revision</i>	A	B	C	D
<i>Released by</i>	WWG	WWG	WWG	WWG
<i>Release date</i>	2007	07/17/09	12/29/09	05/17/10
<i>Authority</i>	061-WP	062-WP	063-WP	063A-WP
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Purpose of This White Paper

To convey the differences between traditional CM and CMII as clearly as possible and thereby ensure that readers fully understand the strengths and weaknesses of both approaches.

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About Traditional CM, Its Scope and Emphasis

Configuration management was introduced in the 1960s by the Department of Defense to resolve the inability of defense contractors to build a second unit identical to the first. Design documents used to build the second unit did not accurately represent the first unit.

The problem was further exposed when another company won the follow-on contract. The 2nd contractor often had to reverse engineer an as-built unit in order to fix design definition from the 1st contractor. This, in a nutshell, is the problem the Department of Defense was trying to solve. The traditional approach to CM evolved out of this effort.

Major Activities of CM (per Traditional CM)

Traditional CM	CM Planning: <i>Tailor CM for each application and identify the Configuration Items;</i>
	Configuration Identification: <i>Define, document and baseline the product and its design attributes;</i>
	Change Control: <i>Control product changes and variances;</i>
	Status Accounting: <i>Maintain the status of changes and historical versions of the product;</i>
	Audits: <i>Confirm that the product conforms to its design.</i>

Traditional CM considers identification, change control, status accounting and audits to be its major activities. That, in itself, is not an issue. The issues are in how those specific activities are performed. The deficiencies begin with scope and emphasis.

The scope of traditional CM is limited to managing design definition and ensuring that physical items conform to the design. The emphasis is on maintaining consistency between products and their designs.

It is very difficult to verify conformance and/or achieve consistency when the design, itself, is not clear or concise or valid. There are no provisions for ensuring design integrity. To do so, a fast and efficient change process is a prerequisite. Traditional CM has no provisions for making the change process fast and efficient.

As a result, those using traditional CM are destined to operate in the corrective action mode and live with inflated costs.

Further Insight to Traditional CM Practices

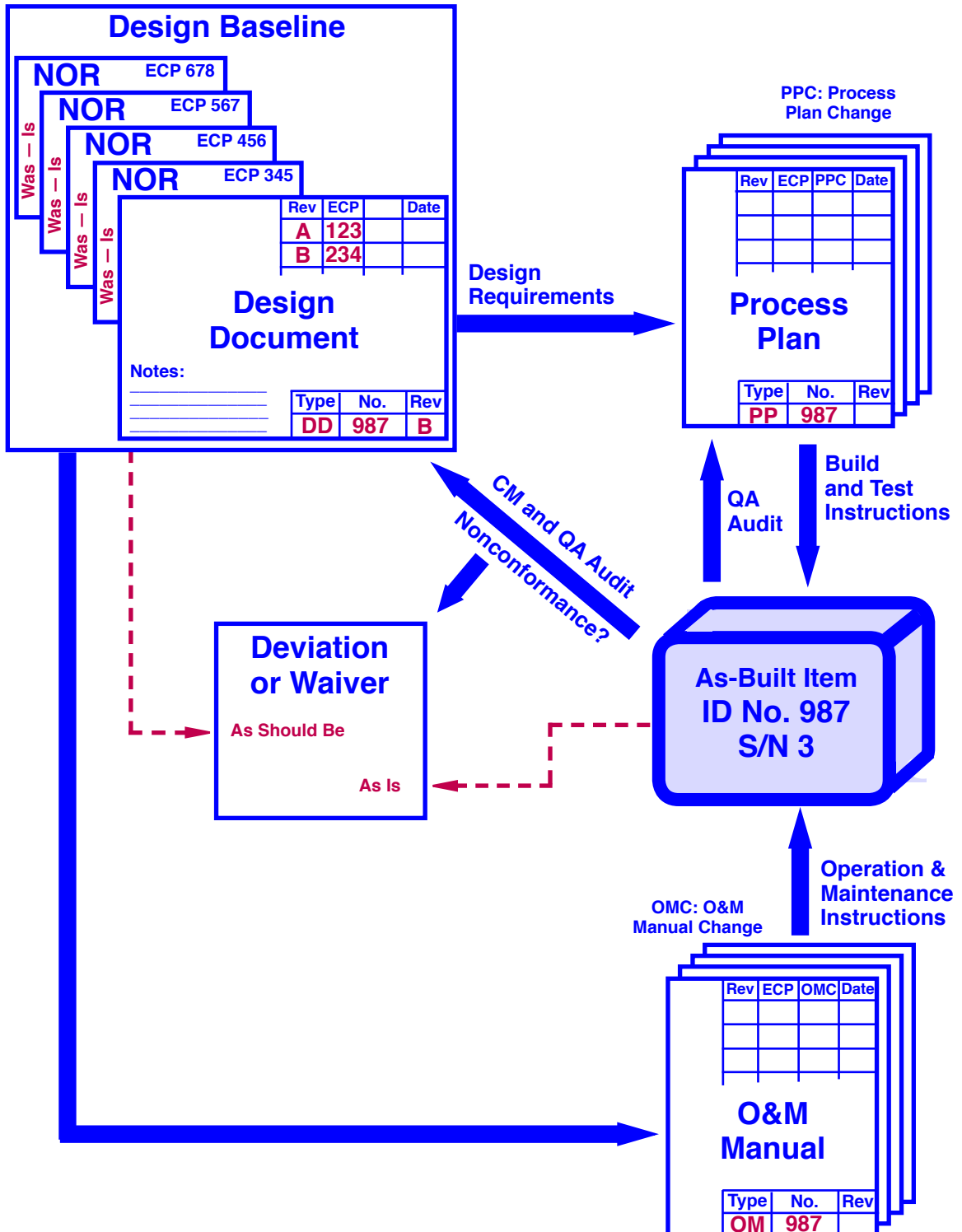
To understand why deficiencies in design definition continue to prevail in traditional CM environments, it is necessary to understand how designs and changes are managed and how "fixed baselines" are used.

It is necessary to understand how changes are proposed and how Notices of Revision (NORs) are used to define the impact on designs. It is necessary to understand how deviations and waivers are used and why they are needed. It is also necessary to understand how process plans are used to build and test products.

<p><i>Design Reviews and Fixed Baselines</i></p>	<p><i>Designs are reviewed at the end of each development phase. The backlog of approved changes is incorporated at this time and design documents are "re-baselined." As the next phase begins, approved but unincorporated changes are appended to the design. The current configuration is the newly fixed baseline plus the appended changes.</i></p>
<p><i>Engineering Change Proposals (ECPs) and Notices of Revision (NORs)</i></p>	<p><i>A 7-page ECP form is used to propose and approve design changes. NORs are used to describe the "was-is" impact of each ECP on each design document. NORs, which represent the major cost of a change, are created before the ECP is approved. Once an ECP is approved, the NORs are attached to their respective documents. Up to five NORs are commonly allowed. Design definition becomes increasingly confusing with each NOR.</i></p>
<p><i>Deviations and Waivers</i></p>	<p><i>As-built products that do not conform to their designs are routinely accepted (with customer approval) on a deviation or waiver. A deviation is a planned waiver. Both define the "as-is" versus "as-should-be" condition.</i></p>
<p><i>Build-to-Print Versus Step-by-Step Process Plans</i></p>	<p><i>Build-to-print environments use engineering drawings as their build instructions. Other environments use step-by-step process plans as derived from the drawings. Changes during the build cycle are routinely incorporated into the process plans but the drawings are not always updated — which explains the frequent need for reverse engineering.</i></p>

Traditional CM Practices Illustrated

Design definition drives all downstream activities and exerts a significant burden on all parties when it is not clear, concise and valid.



Eight Key Observations about Traditional CM

Observation #1: Most design resources required to propose and implement changes are spent in the proposal phase on NORs. Spending resources to create was-is definition for design changes before change approval is a bad business practice that results in waste.

Observation #2: Many NORs may impact common documents but the opportunity to combine and implement two or more approved changes as one change is no longer available. By the time that decision point is reached, each change already has its own set of NORs. (More waste).

Observation #3: Process engineers that create process plans must decipher the design and attached NORs. The challenge is to create clear, concise and valid instructions regardless of the clarity of the design.

Observation #4: Personnel that create O&M manuals face the same challenge. They too, must make the instructions clear, concise and valid, regardless of the clarity of the design.

Observation #5: Traditional CM participates in design reviews. Such reviews are actually performed by Design Engineering. CM's role is to manage the documents and status changes on their behalf.

Observation #6: Traditional CM participates in configuration audits. Audits are actually performed by Quality Assurance. CM's role is to coordinate the processing of resulting changes and waivers.

Observation #7: Traditional CM's stated goal is to maintain consistency between products and their design definition. Ensuring that design definition is clear, concise and valid is not a stated goal.

Observation #8: Variances (NORs, deviations and waivers) are seen as an acceptable means for achieving consistency between products and their designs. Eliminating the need for variances is not seen as a value-added activity.

Further insight to traditional CM and how it compares to CMII is provided on the next two pages.

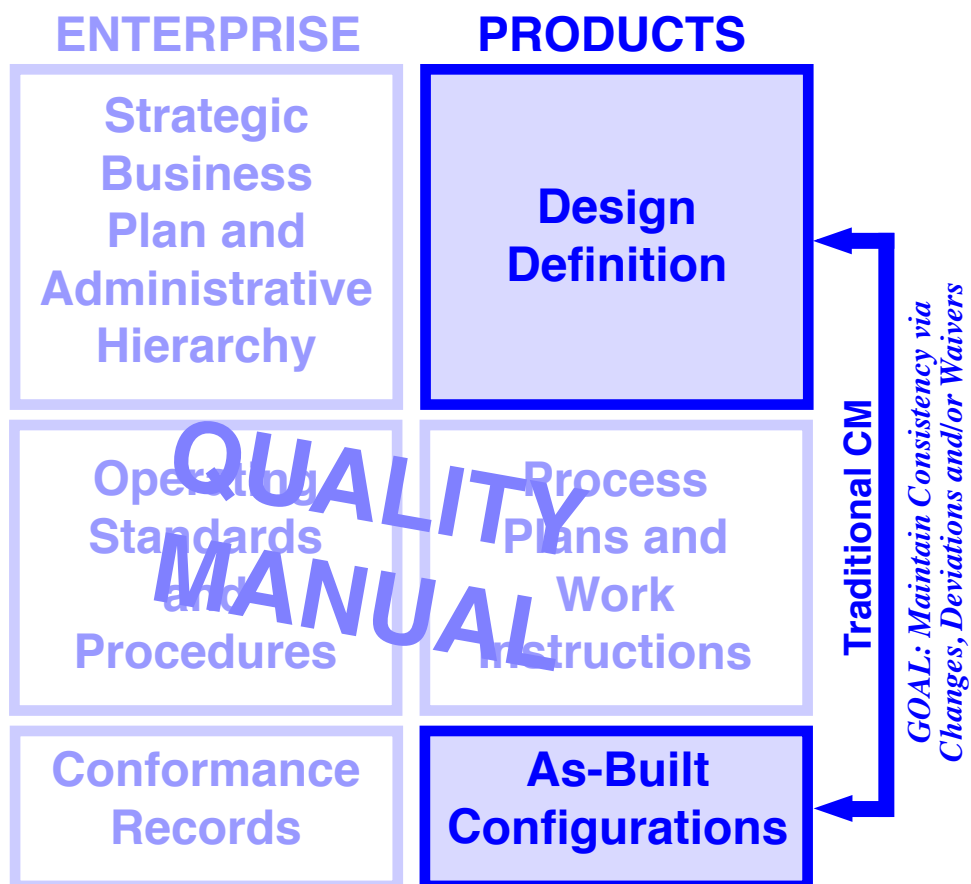
Traditional CM from an Enterprise Perspective

The goal of CM, per traditional CM, is to maintain consistency between products and their designs as shown below. The scope of traditional CM is therefore limited to design definition. Methods for managing the other information assets and achieving quality are left to a quality manual.

Quality systems used by most organizations are certified against evolving versions of the international quality standard, ISO 9001 — which simply states that design and development changes shall be controlled. CM's role, per ISO 9001:2008, is to maintain identification and traceability.

Traditional CM promotes the use deviations and waivers to maintain consistency between products and their design. Ensuring that designs are clear, concise and valid is not a priority.

CM SCOPE & PRACTICES PER TRADITIONAL CM

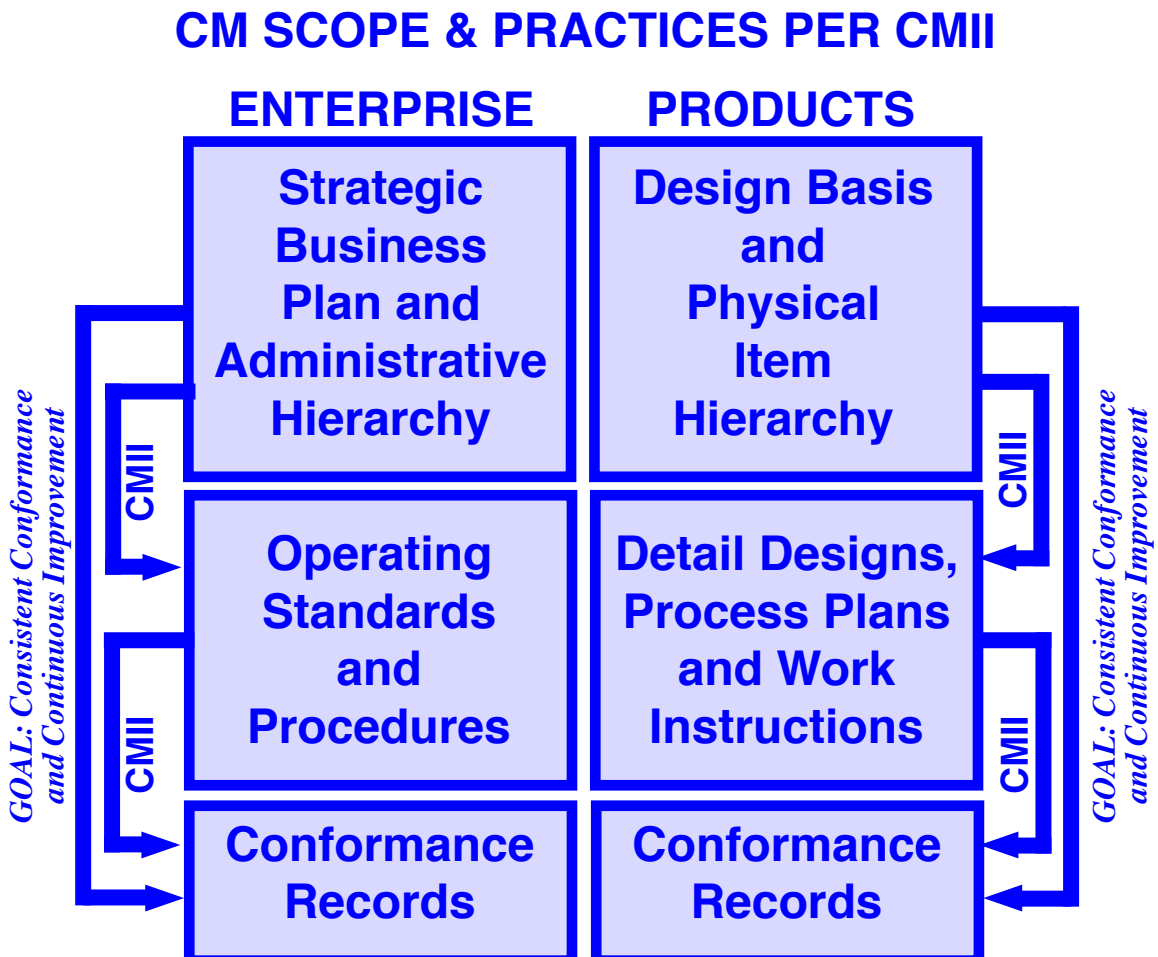


CMII from an Enterprise Perspective

With CMII, CM is lifted out of its design orientation and given an enterprise-wide perspective, as shown below.

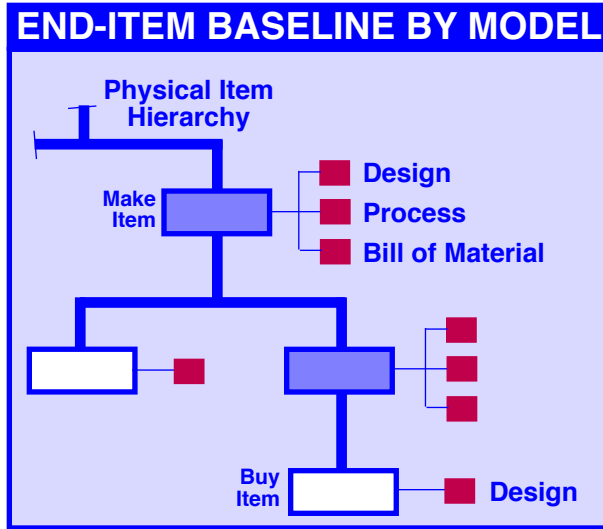
The Strategic Business Plan for the enterprise is equivalent to the Design Basis for a product. The administrative hierarchy is equivalent to a physical item hierarchy. Operating standards equate to detailed designs. Administrative procedures equate to process plans and work instructions. Conformance records are retained in both cases.

With CMII, the hierarchy of administrative requirements used to run the business is subjected to the same controls used to manage products. With CMII, all parties use one common change process. The goals of CMII are to achieve consistent conformance and continuous improvement. Deviations and/or waivers are rarely, if ever, needed.



CMII Practices Illustrated

For a change process to be fast and efficient, items and documents being changed must be properly identified, structured, linked and owned.



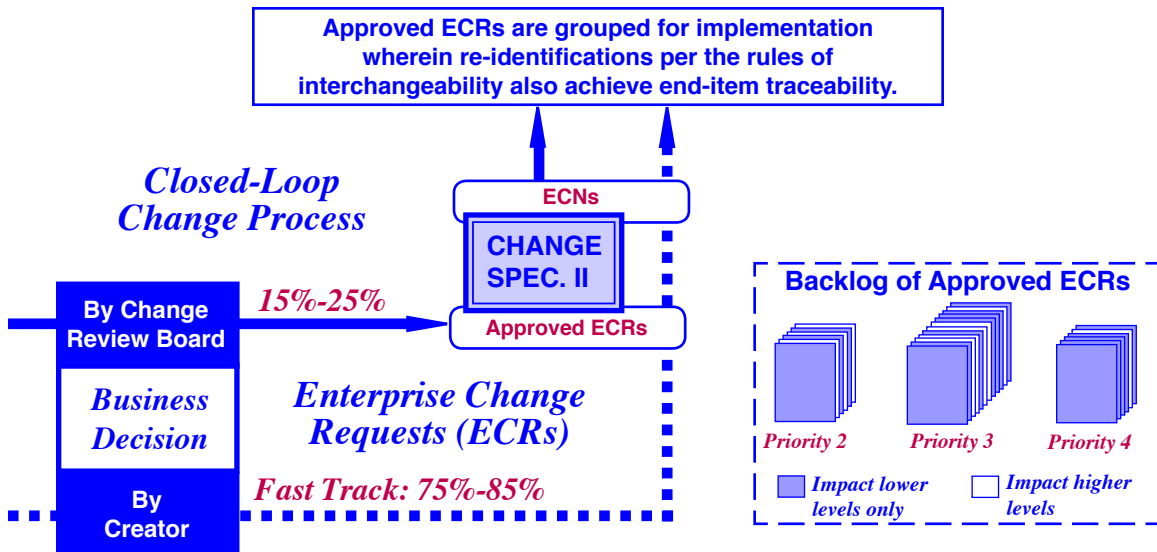
Each model has its own baseline which contains its entire hierarchy of physical items.

Each physical item is linked to its own unique set of design and process-related requirements.

Each document is co-owned by its creator (or author) and one or more designated users.

Approved ECRs that impact one or more of the same documents and which can share the same effectivity are implemented as one ECN.

Documents are fully upgraded and validated by designated users in every case. There are no NORs. Documents must lead and physical items must fully conform. There are no deviations or waivers.



CMII: An Enterprise-Wide Approach

CMII expands the scope of CM to include any information that could impact safety, security, quality, schedule, cost, profit or the environment.

CMII shifts the emphasis to integrated process excellence and provides the how-to for:

- (1) accommodating change;
- (2) optimizing the reuse of standards and best practices;
- (3) ensuring that all requirements remain clear, concise and valid;
- (4) communicating (1), (2) and (3) to users promptly and precisely;
- (5) achieving conformance to requirements in each case.

CMII also promotes continuous improvement in (1) through (5).

CMII: The Path to Integrated Process Excellence

CMII is an integration of configuration management and other closely related activities as shown below.

CMII	Configuration Management:	<i>Ensures that configurations conform to released requirements;</i>
	Requirements Management:	<i>Ensures that documented requirements are clear, concise and valid;</i>
	Release Management:	<i>Ensures that documents are authorized and released prior to use;</i>
	Change Management:	<i>Keeps released documents and data up to date;</i>
	Data Management:	<i>Ensures data bases are accurate and deliverable data is secure;</i>
	Records Management:	<i>Retains traceability of work and proof that work products conform;</i>
	Document & Library Control:	<i>Protects knowledge assets and prevents unauthorized changes;</i>
	Enabling Software Tools:	<i>Serve to enhance overall process reliability and efficiency.</i>

The power of CMII is derived from how these activities are integrated and organized to meet the overall objectives per the definition stated above. The magic is in the how-to.

Once achieved, consistent conformance and continuous improvement are by-products. To achieve consistent conformance is to eliminate the need for intervention resources. Continuous improvement becomes most robust after intervention resources are driven to zero.

Traditional CM or CMII? The differences are now clear.