

# W H I T E P A P E R

## ***Configuration Management: Traditional CM Versus CMII***

### **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.

- *About Traditional CM, Its Scope and Emphasis*
- *Further Insight to Traditional CM Practices*
- *Traditional CM Practices Illustrated*
- *Eight Key Observations About Traditional CM*
- *Traditional CM Versus CMII Methodologies*
- *CM Paradigms Relative to CMII Principles*
- *CMII: An Enterprise Approach to CM*
- *CMII: The Path to Integrated Process Excellence*

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**CMII Research  
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(Creator of CMII)**



**ICM – CMII North America  
GfKM – CMII Europe  
ConfigOnline – CMII South Africa  
To Follow – CMII Elsewhere  
(Authorized CMII Providers)**

## 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	<b>CM Planning:</b> <i>Tailor CM for each application and identify the Configuration Items;</i>
	<b>Configuration Identification:</b> <i>Define, document and baseline the product and its design attributes;</i>
	<b>Change Control:</b> <i>Control product changes and variances;</i>
	<b>Status Accounting:</b> <i>Maintain the status of changes and historical versions of the product;</i>
	<b>Audits:</b> <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 applied. The deficiencies begin with scope and emphasis.

The scope of traditional CM is limited to design definition and conformance of physical items to the design. Emphasis is on the traditional elements described above. Problems with design definition continue to prevail in traditional CM environments.

Traditional CM does not address the factors driving organizational performance (enterprise-wide process excellence). As a result, those using traditional CM are destined to operate in the corrective action mode.

## Further Insight to Traditional CM Practices

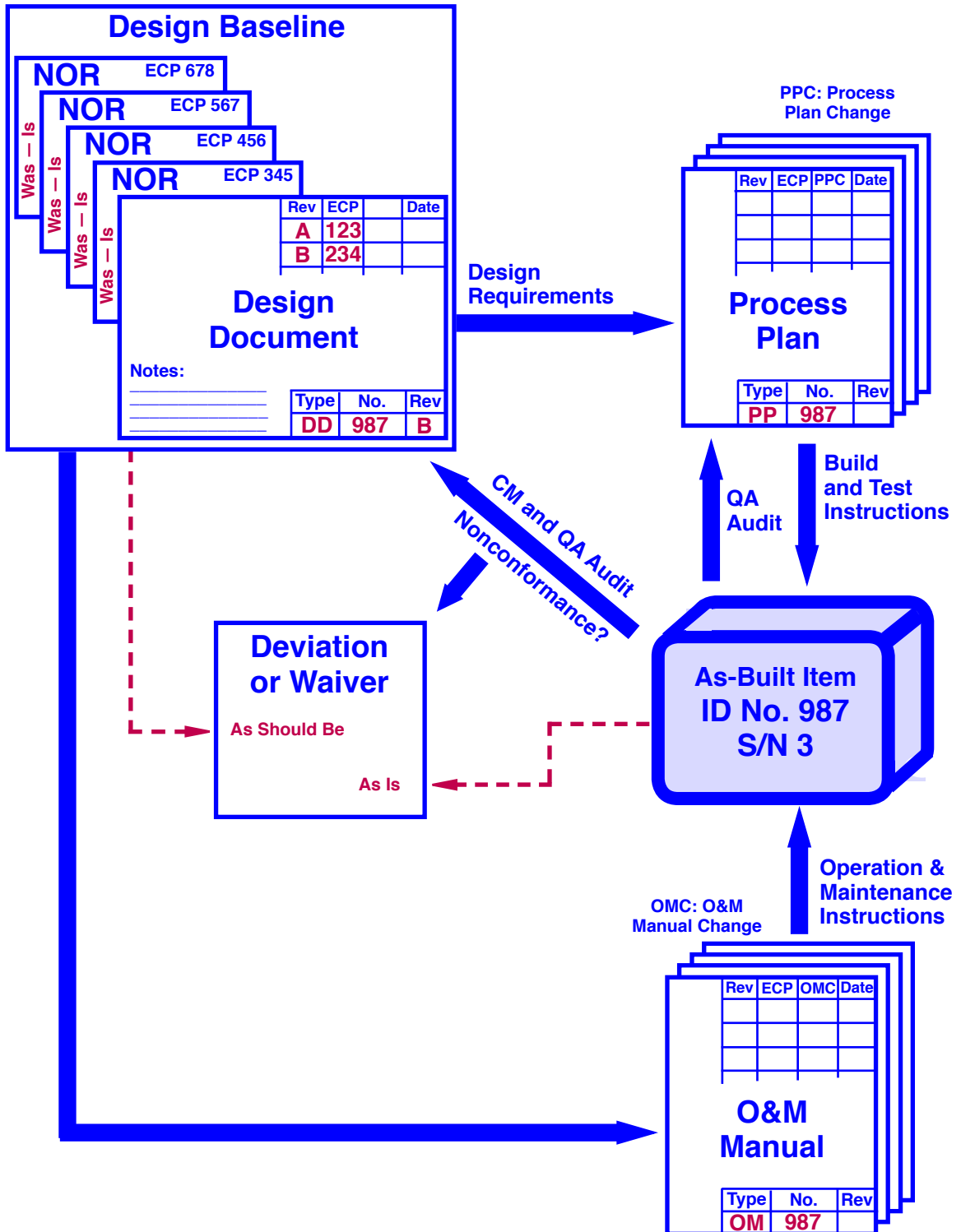
To understand why deficiencies in design definition continue to prevail in traditional CM environments, it is necessary to understand how designs and changes are managed and how "fixed baselines" are used.

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>An 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 definition.

**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 pages 6 and 7.

## Traditional CM Versus CMII Methodologies

<i>TRADITIONAL CM</i>	<i>CMII</i>
<p><i>CM's scope is limited to design definition and CM resides in engineering.</i></p>	<p><i>CM is lifted out of design engineering and given an enterprise-wide perspective.</i></p>
<p><i>The scope of CM is further limited to items designated as Configuration Items (CIs).</i></p>	<p><i>All design and process information is base-lined and under CM. There are no CIs.</i></p>
<p><i>The goal is to maintain consistency between as-built products and their design definition.</i></p>	<p><i>The goal is to accommodate change, keep requirements clear, concise and valid and ensure that results conform in every case.</i></p>
<p><i>Business decisions and implementation plans for approved changes are addressed in the same CCB meeting.</i></p>	<p><i>Meetings for making business decisions are kept separate from meetings for creating detailed implementation plans.</i></p>
<p><i>Several meetings are often required to achieve full consensus on each change.</i></p>	<p><i>Full consensus is routinely achieved in the first meeting in each case.</i></p>
<p><i>The engineering change process coexists with several other change processes.</i></p>	<p><i>The entire enterprise uses one common change process.</i></p>
<p><i>Was-is definition for each impacted design document is created and submitted along with each proposed change.</i></p>	<p><i>Proposed changes are approved before documents are revised and before was-is records are created.</i></p>
<p><i>Once a change is approved, was-is definition is attached to each affected document. Up to five attachments are allowed.</i></p>	<p><i>Once a change is approved, impacted documents are fully upgraded. A was-is record is retained for each revised document.</i></p>
<p><i>The current configuration is the fixed (and approved) baseline plus approved (and unincorporated) changes.</i></p>	<p><i>The moving baseline is always current and ratchets forward with each approved and implemented change.</i></p>
<p><i>The option to combine changes and minimize implementation costs is lost because was-is definition is created before each change is approved.</i></p>	<p><i>Changes that impact one or more of the same documents and which can share the same effectivity are implemented as one change.</i></p>
<p><i>After-the-fact design reviews and configuration audits are an attempt to compensate for original processes not being formally controlled.</i></p>	<p><i>After-the-fact design reviews and configuration audits are unnecessary. All requirement documents are properly managed and conformance records are retained.</i></p>

## CM Paradigms Relative to CMII Principles

<i>CM PARADIGMS</i>	<i>CMII PRINCIPLES</i>
<i>Assuming life cycles begin and end with physical items.</i>	<i>Knowing life cycles begin and end with documented requirements.</i>
<i>Assuming the primary product of engineering is a prototype.</i>	<i>Knowing the primary product of engineering is documentation.</i>
<i>Assuming the purpose of a prototype is to prove the design works.</i>	<i>Knowing the purpose of a prototype is to validate the documentation.</i>
<i>Assuming changes to documentation are too slow and physical items must be changed first.</i>	<i>Knowing documentation must lead and physical items must conform. A document that is not released may not be used.</i>
<i>Assuming a few errors in each data set is insignificant and the effort to prevent such errors would not be cost effective.</i>	<i>Knowing decreasing accuracy in data sets used in-series causes the need for intervention resources to increase exponentially.</i>
<i>Assuming continuous corrective action is continuous improvement.</i>	<i>Knowing corrective actions are reactions to nonconformances.</i>
<i>Assuming the elimination of defects (and the need for waivers) is not economically feasible.</i>	<i>Knowing defects are caused by the process and defects can be eliminated by fixing the process.</i>
<i>Assuming the validity of any document is enhanced with each additional signature.</i>	<i>Knowing the integrity of lower level documents decreases as the number of signatures go beyond two.</i>
<i>Assuming computerization will solve most deficiencies in the document and change management process.</i>	<i>Knowing the process must be right before significant benefits from computerization can be realized.</i>
<i>Assuming each change will be the last change; any effort to improve the change process would be a waste.</i>	<i>Knowing an organization that continually "changes faster and documents better" will eventually win.</i>
<i>Assuming that the ability to accommodate change compromises the ability to maintain consistency between an as-built product and its design definition.</i>	<i>Knowing that the ability to accommodate change is a prerequisite for keeping requirements (including design definition) clear, concise and valid.</i>

## CMII: An Enterprise Approach to CM

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 of CM 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.

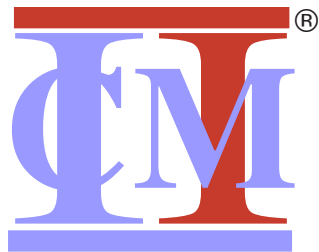
<b>CMII</b>	<b>Configuration Management:</b>	<i>Ensures that configurations conform to released requirements;</i>
	<b>Requirements Management:</b>	<i>Ensures that documented requirements are clear, concise and valid;</i>
	<b>Release Management:</b>	<i>Ensures that documents are authorized and released prior to use;</i>
	<b>Change Management:</b>	<i>Keeps released documents and data up to date;</i>
	<b>Data Management:</b>	<i>Ensures data bases are accurate and deliverable data is secure;</i>
	<b>Records Management:</b>	<i>Retains traceability of work and proof that work products conform;</i>
	<b>Document &amp; Library Control:</b>	<i>Protects knowledge assets and prevents unauthorized changes;</i>
	<b>Enabling Software Tools:</b>	<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 as stated above. The magic is in the how-to. Once achieved, consistent conformance and continuous improvement are by-products.

Traditional CM or CMII? The differences are now clear.



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