PTC®

the product development company

Addressing the Change and Configuration Management Imperative

HOW TO OVERCOME YOUR FIVE TOUGHEST CHALLENGES

Mention "Change and Configuration Management" (CCM) to even the boldest manufacturing executives, and they'll tell you it's a serious and complex issue that is frequently a stumbling block. More often than not, companies wistfully hope CCM can be magically solved by a set of patchwork solutions.

With the current pace and intensity of global competition, today's business leaders can no longer put CCM on the backburner. Progressive companies that have successfully tackled CCM are now able to develop a greater number of high-quality, highly innovative products faster than the competition. What's more, they're significantly increasing productivity and profitability along the way.

So, why has the CCM process become so difficult and complex in just the past decade? What are the ramifications for companies that don't deal intelligently with the issue? What best practices are top companies applying to solve the CCM riddle?

Thankfully, with today's advanced Product Lifecycle Management (PLM) technology, there is a clear and comprehensive solution that can finally resolve the CCM issue.

In this white paper you'll learn about:

• the five toughest CCM challenges manufacturers face

• why and how leading organizations are tackling the CCM process

• proven best practices supported by real-world examples

With this information, your team will be well equipped to start the process of confronting the CCM issue—once and for all.

"An efficient change process can cut up to 33% off the typical product development cycle time."

—McKinsey and Company

Agility and speed-to-market are critical competitive weapons in manufacturing today. Manufacturers must be able to rapidly introduce new products, update existing features, reducecosts and improve quality if they expect to maximize market opportunities. Product innovation is the key to satisfying market demands, but can also be disruptive to product developers, suppliers, and manufacturing. Manufacturers in today's challenging global market must embrace agility, but can't afford to lose control.

Companies that can manage change effectively via sound change and configuration management processes can quickly meet changing market needs with confidence. These two critical, integrated processes now serve as the foundation for defining manufactured products:

- Configuration Management is a process to manage product definitions and content to ensure that all interested parties have a common understanding of what is being designed, verified, released, purchased, built, sold, and serviced.

- Change Management is a complementary, integrated process that controls and tracks design changes, and how product configurations evolve over their lifecycles.

"54% of companies lack a single repository to re-view, analyze, approve and track changes across products."

– Gartner Group

These processes are essential to ensure efficient production and lifecycle support of high quality products. Today's fast-paced, global markets no longer allow for these processes to be merely "good enough." Manufacturers need to adopt best practices for change and configuration management to remain competitive. Otherwise, they will suffer from inefficiency, cost overruns, quality issues, and delayed time-to-market. Today, manufacturers not only require strong configuration management, but also robust, flexible control, coordination, and communication to support their change processes.

Efficient, well-structured change and configuration management processes have a positive impact on the competitiveness of manufacturers, suppliers, and their customers. The benefits extend from early product innovation through design, to service and support, allowing companies to:

- Improve product quality and safety

- Eliminate costly errors

- Reduce scrap and rework

- Eliminate confusion in manufacturing

- Synchronize support information with the latest product changes

- Provide an audit trail and traceability of design decisions

So, how do you identify 'effective' change management processes? Effective change and configuration management demands tight team cooperation and coordination, and a clear understanding of what is needed at any given point in the development lifecycle. Today's increasingly complex products simply can't be managed effectively through manual, paper-based processes. Likewise, information cannot be silo'ed, and enterprise systems cannot be disparate and disconnected. Today, the status quo is a surefire recipe for launch delays, compromised product quality, and high development costs, all of which negatively impact revenue and profitability.

The pace and complexity of global business today requires the intelligent use of advanced technology to streamline these processes, giving companies the control they need to deliver high quality, innovative products ahead of the competition. Product Lifecycle Management (PLM) software is designed to manage complex product configurations, and provide the platform to control, collaborate, and communicate product information, so you can develop, produce, and support world-class products.

Business Drivers of Change and Configuration Management

Today's manufacturers rely more heavily on change and configuration management (CCM) due to increased demands on product developers, suppliers, and manufacturers to get to market faster to drive profitability. This trend is caused by a number of factors:

Customized Products. Demand for more customizable products, with multiple options, increases the number of product configurations, which complicates design changes. Offering multiple product variants, based on modular product designs, can deliver a competitive advantage, but adds to the complexity that must be managed.

Globalization and Global Competition. Increased global competition is now driving the need for shorter development cycles, cost efficiency, and rapid innovation. Globalization and outsourcing of product development and manufacturing demand greater control and better communication, so you can avoid producing the wrong revision, or misinterpreting designs.

Product Complexity. Today's products are more complex due to miniaturization and the introduction of smarter products. Many products today include mechanical, electrical, firmware, and software components that must all be integrated and synchronized.

Regulatory Oversight. Growth in regulations, including environmental compliance mandates, require that key employees now have an accurate understanding – and instant access to – relevant product content. Certain industries and customers specifically dictate product configuration management and traceability, such as mandates for "device master records" for medical devices.

These market trends are driving the need for better control of change and product configurations. Even if CCM is not mandated, trusted configurations represent core knowledge for manufacturers, and are crucial to support processes such as change impact analysis, manufacturing planning, environmental product compliance, outsourcing and costing.

A Best Practice Approach to Change and Configuration Management

CCM seems like a simple concept, but in practice is complicated due to product complexity and the importance of getting configurations right. Managing product information, from early requirements through design, sourcing, manufacturing, and service, is difficult. Different people need different pieces of information, and all of it needs to be synchronized. Effective control requires a thoughtful, disciplined process that's efficient, without placing an undue burden on product developers.

"Companies now recognize that better change processes can deliver top-line benefits...and are therefore developing change management with an eye towards improving speed to market."

- Aberdeen Group

Aerospace exemplifies the challenge of mastering a complex range of product configuration requirements and related change processes.

To address these challenges, PTC helps customers improve the efficiency of critical product development processes, enabled by robust PLM technology. For instance, PTC's Windchill® platform helps manufacturers efficiently and effectively manage their CCM needs by offering:

- Robust, flexible support for simple or complex levels of configuration management.

- A flexible, automated, closed-loop change process that instantly connects key stakeholders to secure, accurate, actionable information. Change activities are always synchronized with product design data in a single, integral system, and enabled by powerful and traceable electronic workflows.

- Fast, accurate change across disciplines, with a single, integrated process to update the complete product definition.

- A tailored change process integration that fosters effective partner and supplier collaboration while protecting intellectual property (IP).

- Concurrent development of the engineering BOM (eBOM) and manufacturing BOM (mBOM) with Windchill MPMLink™ that integrates manufacturing stakeholders early in the design process.

In its 25 years of designing advanced product development solutions, PTC has developed best practices and software to help manufacturers develop world-class CCM processes. Implementing effective CCM requires consistent, efficient processes enabled by integrated, flexible software. The ideal solution provides rapid communication and broad, but controlled access to product data across the enterprise and the supply chain.

PTC Windchill provides a proven foundation and capabilities to enable companies to benefit from the best practices needed to address today's significant CCM challenges. Here's how PTC is solving the five toughest challenges to optimizing CCM.

Overcoming the Five Challenges of Change and Configuration Management

Over thousands of customer engagements worldwide, PTC has identified five significant challenges when implementing CCM, and the best practices required to address them. Addressing these challenges directly impacts a company's ability to enhance productivity, lower overall cost, improve quality, and accelerate time-to-market.

1 MANAGING A PRODUCT'S CONFIGURATION

THE CHALLENGE: Inability to accurately create, understand and track product configurations and their change history over time.

People across the company need to have "a single source of truth" when working with product information. They must have an accurate, up-to-date definition of product configurations and related information throughout the numerous engineering changes during the product lifecycle. Keeping this information in sync is incredibly difficult given the complexity of today's products and the varied information needs of Engineering, Suppliers, Purchasing, Manufacturing, service technicians, and countless other stakeholders.

Different versions, variants, and change history must be readily accessible to provide traceability and ensure that product designs are not subject to misinterpretation.

THE SOLUTION: Enable the enterprise to create, understand and track product configurations.

Provide a common understanding of the complete product definition across the enterprise to ensure quality, and to prevent costly errors. This one-source approach ensures that people can quickly and confidently retrieve and share accurate information at any time in the product's history. Your configuration management process must support engineering best practices, including product platforms and modular product design to allow companies to better reuse designs, manage change, and rapidly develop variant designs from a common base.

Best Practices:

A. Product Configuration Lifecycle Management. Create, understand and track product configurations and related changes in a single system. Ideally, anyone looking for information about a product should have a common source of trusted information – one version of the truth – for products. This single definition should provide views into future and pending changes, as well as a detailed, accurate history of past changes and their related configurations.

Managing product configurations across the product lifecycle includes:

- Creating BOMs in Windchill from CAD data or from Microsoft Excel®

- Easily defining and navigating products by baselines, release level, and effectivity

- Creating rules-driven variants—quickly—while maximizing data reuse for Configure-to-Order and Engineer-to-Order products

- Easily creating, managing and sharing option sets for Assemble-to-Order products

- Integrating navigation, design and visualization of option combinations

B. Modular Product Architecture Definition. Take a systematic approach to organizing products into interchangeable modules. Formalize product module interfaces to better manage the transfer and reintegration of design data, while preserving its integrity. This allows design activities to occur independently and concurrently in a highly synchronized approach.

Implementing a modular product architecture involves:

- Organizing and analyzing platform and variant requirements

- Translating requirements into required functions

- Organizing the means into a logical set of modules

- Identifying appropriate interfaces

C. Generic Product Platform Design. Capture and manage a modular product architecture definition and the associated, detailed product platform design as it is developed. Windchill manages the high-level platform structure, including related product options, together with the required interfaces. The Windchill solution also manages the detailed CAD structure during development, by associating it with the product structure. By managing and synchronizing modular product structure, supporting interfaces and modular design content, the distributed team is kept on the same page throughout development, which minimizes integration surprises.

Enabling a generic product platform design requires:

- Capturing and managing a high-level platform architecture

- Defining module interfaces, and controlling changes

- Managing the coordinated development of a detailed product structure with CAD designs

2 STRUCTURING A FLEXIBLE, RELIABLE CHANGE PROCESS

THE CHALLENGE: Difficulty in structuring a reliable, flexible change process that supports rapid and accurate design changes.

Product developers and downstream functions, such as manufacturing and service, need to play a role in evaluating, approving and implementing changes. This requirement is particularly challenging with product changes that impact multiple designs or design variants.

THE SOLUTION: Implement a flexible, automated process that always delivers accurate, actionable information.

Provide a clear, predictable, repeatable process that is flexible enough to cover the spectrum of changes, from new product release to service updates. An effective process provides decision-makers with the right context to understand the proposed change and its implications, and it must be efficient, so participants can focus on innovation, and not on change administration. This automated process reduces change cycle times and results in fewer downstream issues that typically lead to rework and scrap.

Best Practices:

A. Standardized, Automated Change Processes. Adopt an integrated decision management process that supports accurate, controlled changes, within a single system that's connected to product data. Here, everyone involved with the change process must be able to quickly understand the proposed changes, and review the associated product information to make better business decisions.

A well-defined, standardized, automated change process allows:

- Synchronizing change with product configuration data in a single, integral system

- Providing problem reporting, deviation/waiver requests, as well as change requests, notices and activities

- Applying predefined and configurable change process workflows, activities and process roles

- Automating change routing and task notifications

- Offering flexible support for both simple and complex changes

- Providing enterprise visibility to pending and approved changes throughout the lifecycle

3 MANAGING CHANGE AND CONFIGURATIONS ACROSS DISCIPLINES

THE CHALLENGE: Ineffective and inefficient change control processes, and difficulty synchronizing design changes, so they can be leveraged across the entire enterprise.

Today's products have increasingly complex design relationships. The integration of mechanical design, electrical design, software, firmware, and requirements is driving the need for users to better understand product configurations and related information. Changes to products can have far-reaching impacts throughout the product lifecycle. Understanding the impact on the whole product is challenging, yet critical to ensuring that changes are fully understood and implemented accurately across all disciplines.

THE SOLUTION: Enable the whole enterprise to work with and view integral product data and configurations, so changes can be synchronized quickly and accurately across disciplines.

Link data from across the enterprise to product configurations, applying changes to the complete product definition. Provide an integrated change management process to keep designs, specifications, quality plans, manufacturing processes, compliance data, documentation, and other product information synchronized. Managing change in an integrated way reduces errors and rework that can result from implementing change incompletely, incorrectly, or at different times.

CASE IN POINT

Automated Change Process Transforms Kirloskar Oil Engines Ltd. (KOEL)

KOEL, India's leading manufacturer of diesel engines, engine bearings, and generators for a broad range of industrial applications, replaced their manual change process, implementing an automated process for tracking and managing engineering changes. The company introduced separate processes for managing change in different phases of the product lifecycle, with differing approaches for prototype and production. As a result, they have a centralized change management process using PTC's Windchill across their different locations, and now can easily track and monitor engineering changes across their enterprise.

The net result for Kirloskar Oil is a set of comprehensive reports that help users create a "knowledge bank" of their designs. By improving their process, KOEL was also able to reduce change cycle time by 40%.

Improving Global Change Management at Stryker Navigation

As a leading innovator of medical products in orthopedics, implants, physiotherapy, traumatology and biotechnology, Stryker needed to establish a global product lifecycle platform to manage its change processes to conform to FDA regulations.

Windchill PDMLink gave Stryker employees access to all product-related data from one source, resulting in a 20% reduction in time taken for change and release of documents and document search.
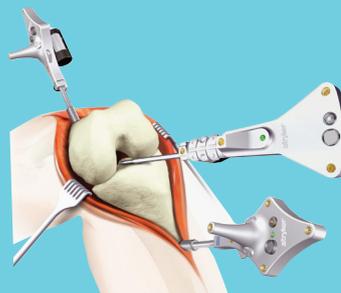
Windchill PDMLink transformed Stryker's global change management process.

Best Practices:

Integrated Cross-Discipline Change Management. Implement fast, accurate change across disciplines with a single, integrated process to update the complete product definition. Windchill provides the ability to create, manage, and deploy a complete product definition in a single integral tool.

An integrated change management process that supports multiple disciplines includes:

- A single source for product data

- A single, global BOM, which integrates all product data, including heterogeneous MCAD, ECAD, software, documents, requirements, and visualization

- Robust configuration traceability

- Product data that's integrally connected to change info via a powerful, flexible PLM toolset

- Global, enterprise visibility

- Formal change impact and root cause analysis

4 INTEGRATING PARTNERS INTO THE CHANGE PROCESS

THE CHALLENGE: How to integrate partners into the change progress while protecting valuable intellectual property (IP).

Manufacturers must balance the need to provide transparent access to change information across their supply and design chains, with the need to protect proprietary product knowledge.

THE SOLUTION: Enable external parties to seamlessly and securely interact with product configurations and changes throughout product development.

Third parties are increasingly critical to the timely development and delivery of high quality products. Keeping these resources informed and including them in critical decisions helps improve product designs and ensure smooth downstream operations. Doing so in a well-controlled manner helps manufacturers improve quality and reduce waste by ensuring that partners have access to up-to-date, accurate information, without putting their IP at risk.

Best Practices:

Partner Change Integration. Automate processes, so information moves quickly and efficiently. Capture digital data

CASE IN POINT

Data Traceability and Visibility Fosters Collaboration and Quality at Cochlear

Cochlear is the global leader in innovative, implantable hearing solutions. Cochlear implemented Windchill PDMLink to control and audit their complete "Bill of Information," accelerating time-to-market by allowing their global development teams to better manage product data. Users now manage all product data in a single data vault, and provide online traceability and visibility to the information.

The result for Cochlear included increased speed and efficiency of document reviews and change control using electronic signatures. The company also achieved accurate tracking of product configurations across departments. Cochlear now executes design changes centrally and visibly across teams, thereby reducing errors, enforcing version control, and driving product change quality through clear workflows.

The change process at Cochlear was transformed through better visibility to data, resulting in higher quality and faster time-to-market for new products.

content in a single, secure environment, so you can control and share it, so as to manage change and product configurations over the product's lifecycle.

A well-managed process allows third parties to have the appropriate level of access, ranging from "arms length" relationships, such as a component supplier, to a trusted strategic partner who may be involved in complete system development.

Successfully integrating partners into the change process involves:

- Sharing change and product data information in a controlled manner appropriate to the specific relationship with a partner

- Integrating partners into change review, approval and implementation activities

- Exchanging design and change information offline

- Using rich visualization to enhance collaboration, for instance, in design reviews

- Tracing history of what was sent and when

5 COORDINATING CHANGES ACROSS ENGINEERING AND MANUFACTURING

THE CHALLENGE: **Difficulty in connecting Engineering and Manufacturing in a single, concurrent change process.**

One of the most critical connections in CCM is between Engineering and Manufacturing. Accurate and timely communication between the people that design the product and the people that produce it is critical to quality, cost, and time-to-market. The Manufacturing group requires product data in different formats than Engineering, so accurate translation of information is needed for effective communication. The challenge is keeping these different views of the same information in sync, while still providing the right information to each organization in a way that makes sense.

THE SOLUTION: **Tightly align manufacturing processes to engineering design by integrating Engineering and Manufacturing in the same change management process.**

Provide manufacturing with associative views of engineering data to plan and execute closed-loop changes quickly. Eliminate miscommunication that can lead to increased inventory and slow cycle times.

Best Practices:

Associative eBOM/mBOM. Translate engineering BOMs (eBOMs) into manufacturing BOMs (mBOMs) while maintaining bi-directional associativity and linkages between these two views of the product. Link the two in order to better analyze and implement change in manufacturing as engineering designs change.

Associating eBOMs to mBOMs in an integrated change process includes:

- Enabling concurrent development of eBOM and mBOM

- Implementing a common change process for Engineering and Manufacturing teams

- Associating manufacturing process data with change records

- Easily synchronizing eBOM and mBOM product structure changes

CASE IN POINT

HP®, ITT, and Plug Power® Realize Productivity Benefits of Change Management Solutions

HP's Imaging and Printing division spans 23,000 products and tens of thousands of suppliers across 160 countries. By implementing a PTC-based change management process, HP's Imaging and Printing division realized an 80% improvement in design and process reuse; increased productivity between 20–30%; reduced time-to-market, product costs and warranty costs; and experienced a 2% decline in part counts.

ITT Industries—the world's premier supplier of pumps, systems and services to move and control water and other fluids—implemented a global engineering change process with a one-year payback. In addition, the company reduced the time to implement engineering changes by 50%, eliminating significant scrap and rework costs.

Plug Power designs, develops and manufactures on-site electric power generation systems utilizing Proton Exchange Membrane fuel cells for stationary applications. The company was able to cut its ECN cycle time by 62% and reduce variability in the time to complete an ECN by 76%.

- Managing variance decisions and incorporating deviations and waivers using the same change process for Engineering and Manufacturing

- Providing fully traceable change history

Conclusion

Taking the next step toward change and configuration management excellence

Change and configuration management in product development is critical for today's fiercely competitive global markets. "Good enough" practices simply won't help any organization grow their business and capitalize on new and emerging markets.

Applying best practices is now a must-have that impacts quality, time-to-market and product cost, which in turn fuel revenue, market share, and profitability. As products become

more complex, and as product development becomes more distributed, a fast, reliable, automated change process – supported by robust PLM technology – is the only way to master market demands for tailored product configurations that meet customer needs.

Change and configuration management challenges are magnified when complex products are developed globally with a network of dispersed internal and external design partners, suppliers and manufacturers. Getting participants synchronized with common data and integrated processes is critical. At stake is a company's ability to enhance productivity, lower overall cost, improve quality and accelerate time-to-market. CCM has to be rigorous across the enterprise, in collaboration both with partners and with dependent downstream stakeholders in manufacturing and service support.

Creating the "Single Source of Truth"

PTC excels at all levels of CCM because, with PTC solutions, change activities are always synchronized to product design data, in a single, integral system–creating the single source of truth that's essential to coordinated CCM. Add to this a powerful, automated workflow, and teams can collaborate more efficiently and securely. No doubt, CCM is a complex problem, but best practices and supporting technology from PTC can simplify and streamline operations, enabling you to speed innovation to market while maintaining control and confidence.

So how do you get started? Review PTC's Value Roadmap, an invaluable tool that many successful PTC customers have used as a first step to evaluating their current processes, and then developing a strategy to improve CCM in their business.

See the PTC Value Roadmap at http://ptc.com/go/ccmpvr

CASE IN POINT

Grand River Group (GRG) Unifies Engineering and Manufacturing Change Processes

GRG is China's largest motorcycle manufacturer, with a production capacity of three million engines and three million motorcycles per year, and is the largest partner of Suzuki Motor Corp. in China. GRG implemented Windchill PDMLink and Windchill MPMLink (Manufacturing Process Management) to shorten time-to-market by accelerating the engineering-to-manufacturing change process. GRG used PTC solutions to streamline and standardize manufacturing engineering deliverables and implement a closed-loop change process.

As a result, GRG increased production and manufacturing engineering efficiency while improving product quality and consistency of manufacturing data. They also dramatically reduced the time to propagate a new product derivative to manufacturing, and improved reliability of manufacturing data, process plans and work instructions.

Grand River Group leveraged Windchill MPMLink® to accelerate its engineering-to-manufacturing change process.