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Understanding

MANUFACTURING ENGINEERING

in Windchill

ptc

Table of Contents

Why Manufacturing Engineering Matters

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Manufacturing engineering, working with model-based tools and methods, encompasses all the production preparation activities required for a successful product launch, along with operational excellence. Included are tasks connected to processes which includes collaboration with designers between projects and sites. If there is a change upstream, manufacturing engineers can understand how to address those changes downstream. Deliverables range from the manufacturing bill of materials to the process data that supports routing and planning to the authoring of work instructions to factory layout.

CHALLENGES

The time-intensive nature of preparing for production, coupled with the need to keep work instructions up-to-date across various product configurations, design centers, and manufacturing plants, is a complex issue. Adding on numerous engineering changes further complicates the role of manufacturing engineers.

When R&D and Manufacturing work in siloed systems, there is no efficient way to define and update manufacturing deliverables in parallel. Designers cannot identify or communicate how changes impact production preparation, issues are identified too late in the development process, and there is no alignment to product design changes until they are manually shared.

CONSEQUENCES

Time to Market Delays – Unilateral communication in product development impedes feedback and limits visibility into product requirements leaving manufacturing uninformed. Late-stage changes have cascading effects that cause production delays and additional costs.

Poor Quality – Poor data quality and a lack of alignment on key product characteristics lead to misconfigurations and quality issues. Appropriate quality checks are not defined ahead of time and manual data processes result in increased errors.

Lack of Efficiency – Designers don't consider plant capabilities and/or the setup for efficient manufacturing, especially handling product variability. There are further delays due to unnecessary retooling or subcontracting work.

Additional Costs – Issues or shutdowns on the production floor are extremely costly. Product rework increases costs and undermines predictability of product release cycles. Product diversity becomes the enemy of operational efficiency – complicating processes and introducing errors.

Benefits of Manufacturing Engineering

Manufacturing engineering in Windchill streamlines the transition between product design and manufacturing planning, including structures, 3D transformations, and configuration logic, keeping everyone in sync. Manufacturing engineers define and manage the manufacturing processes for parts fabrication, final product assembly and inspections / creation of the content. Unified change management and increased visibility between disciplines ensures tight collaboration and parallel tasks.

ASSOCIATIVITY & TRACEABILITY

Leverage configuration managed visualizations to create associative deliverables ready for manufacturing. The two worlds of engineering and production get a common view of their data and processes.

LEAD TIMES

Build correct first versions of products based on feedback throughout the entire development process and shared data, shown in different views (parallel vs. serial work). Make pointed changes more quickly and more often with connected process plans and work instructions.

EFFICIENCY

Reduce workloads by automating the preparation of plant specific MBOMs, process plans, and work instructions with the ability to design optimal flows based on local differences in factory automation and production lines. Configuration managed visualizations makes it easier to find a solution.

COST

Reduce costs as engineers make fact-based decisions during development, ensuring products are produced with early defined cost expectations.

QUALITY

Reduce the number of misconfigured products with improved product data quality, digital process validations, and control characteristic management.

Key Manufacturing Engineering Capabilities in Windchill

The following list of key manufacturing engineering capabilities in Windchill is not exhaustive. Both the list and definitions are intended to provide a brief overview of the tools that are among the most valuable to the typical manufacturing engineering user.

Manufacturing BOM Transformation

An MBOM holds all the parts, packaging, labels, and assemblies required to build and ship a finished product to customers. Windchill provides a graphical and associative user interface that helps the manufacturing engineer transform the BOM, leveraging 3D data and structured meta-data with systematic traceability (equivalent links) and reconciliation between related BOMs. Learn More.

Plant-Specific Definition

MBOMs can be defined to represent the way products are manufactured throughout the different plants in an enterprise. The part definition is extended to allow those departments that work at the plant level to interact with the parts and augment the part with information specific to the plant. Learn More.

Manufacturing Process Planning

Users define plant-specific process plans (e.g., operations to manufacture, assemble, repair, and inspect parts). They allocate resources/parts with drag-and-drop functionality and manage manufacturing configurations with revision control, lifecycle management, effectivity, and access control. Workflow and notification tools are shared between design and manufacturing. Learn More.

Key Manufacturing Engineering Capabilities in Windchill

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Work Instruction Authoring

Dynamically generate work instructions for a specific configuration of a process plan. Assembly work instructions define the "written" and/or "visual" procedures and steps necessary to make and/or assemble a part, component, assembly, or complete product (i.e., the definition of the manufacturing routing) prior to production. Learn More.

Manufacturing Process Verification and Simulation

Manufacturing verification and simulation are used to understand how designs perform in real-world conditions. Windchill integrates with third-party virtual manufacturing/commissioning simulation solutions (ESI, IPS, Rockwell Emulate3D) and the processes they cover (e.g., one-click integration with ESI solutions) for manufacturer and assembly simulation to enable concurrent engineering and optimization across domains including Crash, Safety, NVH, Energy, Heat Treatment, Flow, Electromagnetics, and CFD. Learn More.

Manufacturing Resource Management

Manufacturing resource management is the management of the resources needed on the shop floor during the production, maintenance, inspection, or repair of parts. They normally have cost, time, or technical constraints associated with them. Resources can be physical (e.g. work centers, tooling, process materials) or skills.

Key Manufacturing Engineering Capabilities in Windchill

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Raw Material and Semi-Finished Parts

Tighter design and manufacturing planning collaboration on semi-finished parts reduces NPI time with better management of manufacturing resources. Define the raw material and semi-finished parts BOM for fabricated parts, process plans for raw material and semi-finished parts, and scrap and mounting parts for raw material. Define the co-produced BOM for parts fabricated simultaneously. Learn More.

ERP/MES Integration

Enterprise integration of the flows (process plans/routings) and not just the data (part/BOM) is enabled by publishing from Windchill into your MES and ERP systems. This avoids having multiple systems mastering the same data at a given time. Learn More.

Quality Inspection with Control Characteristics

In a process, part, assembly, or system, control characteristics are any functional features, geometrical or material properties that can be qualified, measured, or quantified, and for which variation or deviation control is necessary. Control characteristics are allocated to process plan operations for quality control purposes. In production, machine readable control characteristics are paired with IoT data to correlate process parameters with quality results using statistical analysis & machine learning. This drives closed-loop feedback on both product & process design/simulation. Learn More.

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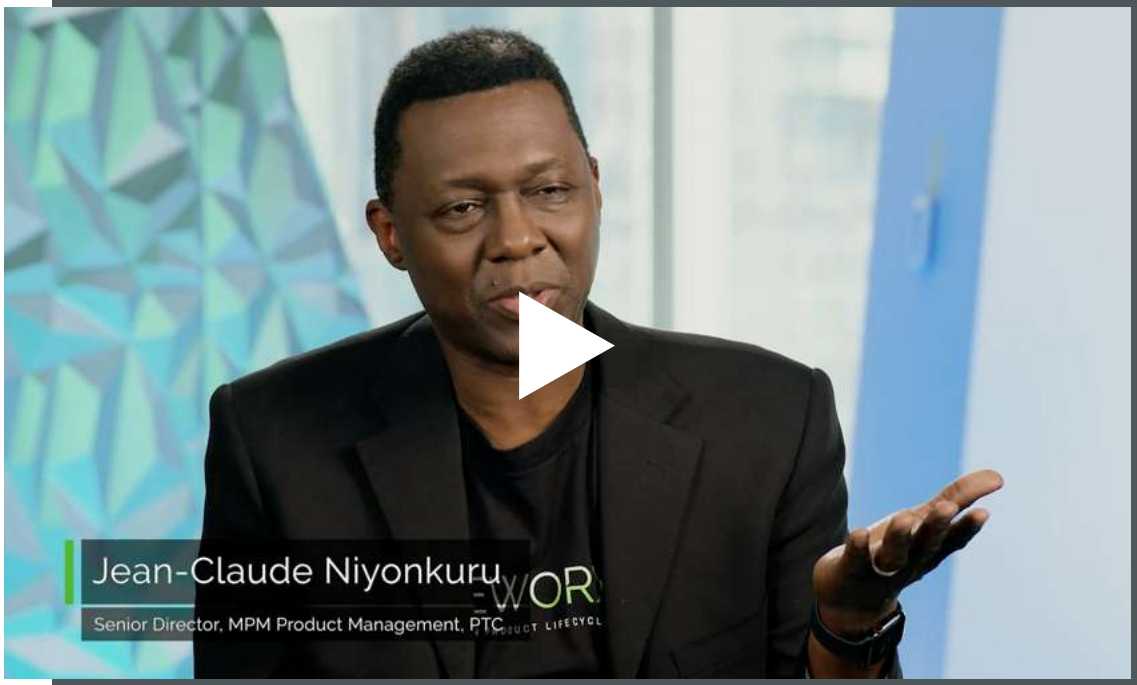
Expert Insights

JEAN-CLAUDE NIYONKURU
Senior Director, Manufacturing Process Management, PTC



"One of the biggest challenges with manufacturing transformation is that it can seem overwhelming. Keep it simple, start small, and grow into it."

Manufacturing process management is not only about the small portion where you do process planning, but also about the big picture of how you go from the design to the shop floor. Windchill provides a platform where all the deliverables can be achieved by the entire global enterprise, enabling design anywhere, manufacture anywhere, and service everywhere.

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Customer Perspective

SIMON STORBJERG
Head of Digital Product Lifecycle,
Vestas

"Now we can rely on a digital thread from our engineering data to manufacture."

To successfully deliver products at a global scale, Vestas must execute product development and manufacturing engineering in parallel, which requires collaborative development of the engineering and manufacturing BOMs at the same time. With Windchill as the authoritative source of truth, Vestas has accelerated the process of preparing data for manufacturing and reducing errors in the MBOM with increased traceability. Vestas has also automated processes such as data integration with ERP and generating work instructions.

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Realized Benefits Case Study

FRESENIUS MEDICAL CARE (FMC)

Fresenius Medical Care (FMC) is an integrated health care provider of products and services for people facing chronic kidney disease or even kidney failure. They operate around 40 production sites on all continents to provide dialysis products such as dialysis machines, dialyzers, and related disposables.

CHALLENGE

FMC became successful by growing heterogeneously, and very locally, which was the right answer at that time. However, today, it no longer makes sense to develop only one device, for one region, for one market. They need a global approach to gain efficiency and increase their pace of innovation. Engineering and manufacturing have to work together during development across their sites around the world.

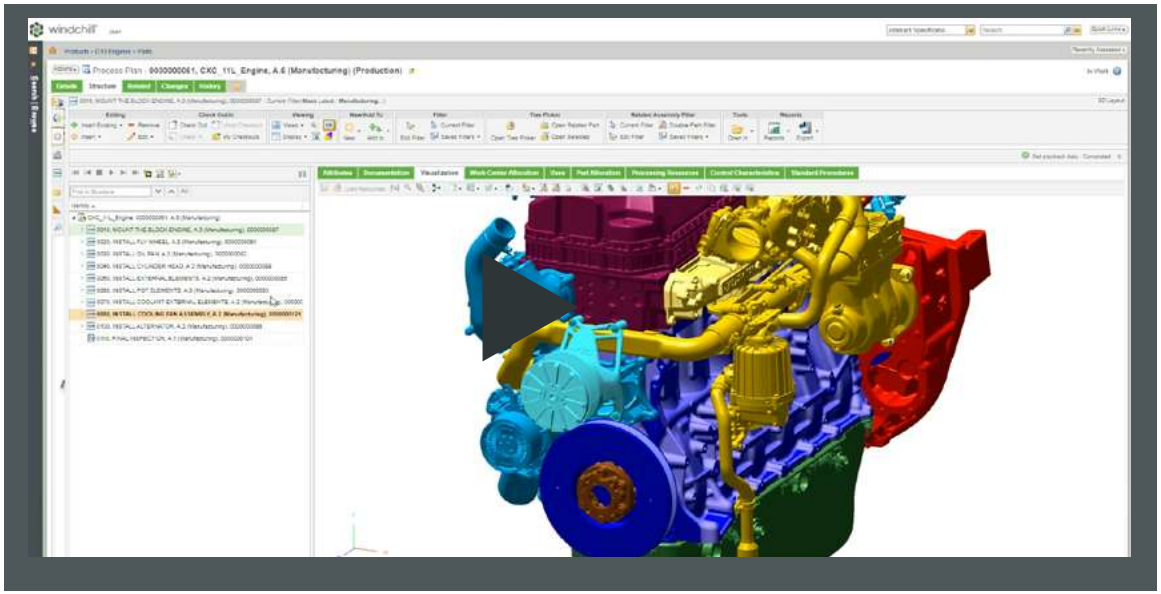
SOLUTION:

With the benefit of top management support, FMC implemented the MBOM together with manufacturing process management in Windchill, as a shared platform with engineering and the entire enterprise. Corporate engineers are globally responsible for their products and oversee how the network of production works. Factory engineers also have the flexibility to localize how, for example, a machine is being produced in plant A versus plant B.

"Better and more affordable products and, with that, more affordable treatment for our patients. Windchill is really helping us for global collaboration and to design anywhere, build anywhere, ship anywhere. Being able to introduce product changes faster in a more cohesive, in a more transparent way is a big benefit for us, because our product changes are often targeted at bringing on new features, replacing components that were not so reliable with more components that have a higher reliability, certain product changes that will bring down product cost, and with that also treatment cost." Learn More

See Manufacturing Engineering at Work

Allowing information to flow between engineering and manufacturing is crucial for continuous improvement. See how Volvo Trucks leverages Windchill to enable this collaboration while speeding time to market and lowering costs.



- CONFIGURABLE EBOM
- CHANGE NOTICE
- VISUAL BOM COMPARE
- MBOM UPDATE
- VERIFICATION & SIMULATION
- PROCESS PLAN UPDATE
- WORK INSTRUCTION UPDATE
- CLOSED-LOOP QUALITY

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A Guide to Connected Systems

In today's dynamic world of discrete manufacturing, companies face relentless competition and shifting consumer expectations. To thrive in this environment, they must innovate, elevate product quality, and manage costs while navigating supply chain disruptions and demand fluctuations.

Digital transformation is the cornerstone of how manufacturers tackle these challenges. Success in digital transformation hinges on aligning technology with overall business strategies, focusing on the seamless integration of PLM, ERP, and MES systems.

This white paper serves as your essential guide to achieving this alignment. Inside you'll discover:

Learn More >

- How to accurately assess your company's unique needs, tailored to your business model and product complexity.
- A step-by-step roadmap for building a solid foundation to integrate and configure your PLM, ERP, and MES environments.
- Best practices for harnessing real-time, reliable information to drive swift and seamless global execution.

Learn More

Click here to explore more of these topics

BOM Management

Collaborative Product Development

Engineering Change Management

Manufacturing Process Management

Model-Based Systems Engineering

Parts Classification

Product Configuration Management

Product Data Management

Product Variability Management

Quality Management

Requirements and Test Management

Service Process Management

Supply Chain Collaboration

121 Seaport Blvd, Boston, MA 02210 : ptc.com