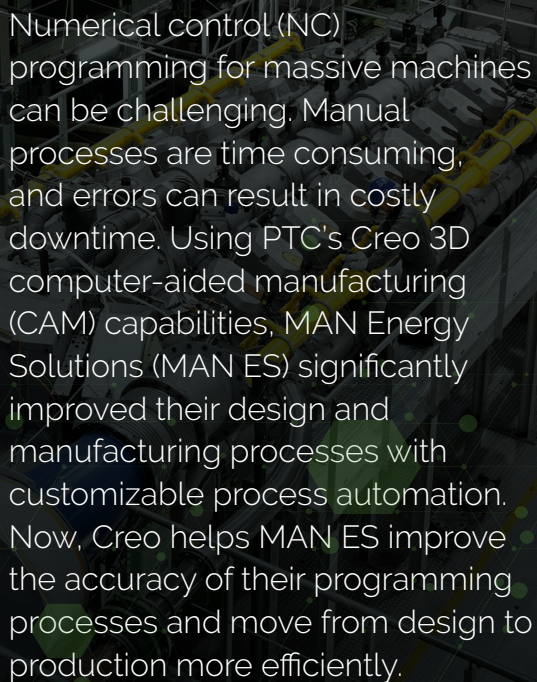# MAN Energy Solutions Uses PTC Creo's NC Automation Capabilities to Optimize the Design and Manufacturing Process

Saving Time and Increasing Productivity with Customizable Process Automation and Efficient Knowledge Capture

Numerical control (NC) programming for massive machines can be challenging. Manual processes are time consuming, and errors can result in costly downtime. Using PTC's Creo 3D computer-aided manufacturing (CAM) capabilities, MAN Energy Solutions (MAN ES) significantly improved their design and manufacturing processes with customizable process automation. Now, Creo helps MAN ES improve the accuracy of their programming processes and move from design to production more efficiently.

MAN Energy Solutions creates energy solutions for sustainable progress and prosperity

MAN ES is an energy solutions and services company helping to bring the global economy into a carbon-neutral era. A leader in the industry, they have paved the way in advanced engineering for more than 250 years and are the world's top provider of large-bore diesel and gas engines and turbomachinery for the maritime and energy industry. Headquartered in Augsburg, Germany, MAN ES employs more than 14,000 people at over 120 sites around the world. Their portfolio includes two-stroke and four-stroke engines for marine and stationary applications, turbochargers, and propellers, as well as gas and steam turbines, compressors, and chemical reactors.

Looking ahead, MAN ES recognized how making industrial processes more efficient and reliable

with digital transformation would be a crucial step in building climate-friendly industries. To that end, they began developing new technologies for the generation and storage of electric energy to help cope with fluctuating renewable energies and lower the carbon footprint of their power plants. For MAN ES, their own digital transformation—and the evolution of their industry—began with how they design and manufacture parts.

Designing and manufacturing large machine parts is a challenging process

The MAN ES production facilities in Augsburg manufacture complex parts of all sizes—from less than a kilo to more than 120 metric tons—meaning they can't afford to make any mistakes on NC programming or production. Additionally, nearly every engine they make is manufactured to meet unique customer requirements. Especially with their larger products, it's important they get it right the first time as it's costly and time consuming if they're built incorrectly.

Previously, MAN ES relied on manual, outdated processes that slowed down design, NC programming, and part production. They used 2.5D CAM software to create every part, which led to inefficiencies and slowed time to market. For example, one process required engineers to manually record the coordinates of more than 2,000 points in the 2.5D CAM system, an inefficient and time-consuming process. Furthermore, MAN ES relied on many legacy machines from different original equipment manufacturers (OEMs)—all with different control systems—which made the engineering and programming steps even more complex.

This added complexity meant costly errors were more likely. For example, a manual system increases the likelihood a mistake will be made in the handoff between the design and programming stages, which can lead to a collision—an extremely expensive error. Additionally, repairing these complex, massive machines requires extended downtime; it can take months to get them running again.

MAN ES's design and manufacturing teams recognized they needed a more strategic approach to meet unique requirements in a precise and timely manner. Specifically, they needed more efficient, automated tools with added personalization aspects to increase productivity in the creation of toolpaths. MAN ES decided to transition to a 3D CAM tool to optimize their legacy systems. Leveraging automation and repeatable processes would make their NC programming process faster and more efficient.

MAN ES leveraged Creo CAM to automate processes and improve throughput

In 2015, MAN ES decided to leverage Creo to transition from 2D sketches to a full 3D-model approach. Creo's broad range of toolpath and automation capabilities would help save time in the programming of toolpaths for large, complex pieces of machinery. Creo is PTC's 3D modeling software which delivers a comprehensive suite of 2D and 3D solution capabilities supporting computer-aided design (CAD) and CAM. It offers a full-spectrum solution that helps maximize efficiencies from design through production. Creo's CAM software—Creo NC and Tool Design solutions—gives manufacturers everything they need to achieve the highest quality precision machining in the fastest possible time. This

enables them to handle every aspect of the production process from mold/cast design and advanced NC to 3D simulation and verification.

MAN ES chose to use Creo for several key reasons. First, many of Creo's capabilities are easy to learn and easy to use and can boost efficiency for experts and non-experts alike. Additionally, it has seamless integrations with all products in the Creo suite to help establish a single source of truth. For example, changes to the CAD model can be easily and automatically proliferated throughout downstream deliverables. The integration between CAD and CAM also saves time and helps reduce future errors as Creo recalculates the toolpath.

Creo also provides advanced numerical control process planning capabilities through a broad range of customizable automation capabilities—including Creo NC and Tool Design—which allow users to create a process once and replicate it without having to recreate the same steps again and again. This ultimately reduces time spent correcting errors and on miscommunication. Finally, Creo allows for better tracking and version control, which means quicker access to drawings, parts, and files for teams across the organization, so they can quickly and accurately form workplans and revisit versions over time.

Advanced NC process planning automation capabilities drive efficiency and reduce costs

Creo provided MAN ES with the tools to create custom applications that make the design and manufacturing process more optimized and efficient. With Creo, users have templates to help them automate the creation of deliverables for operators around a specific piece. Instead of

manually inputting information, measurements such as part diameter, length, and position are automatically extracted from the design. When creating toolpaths, users can fully control where the tool will engage with the material to create the final part. Creo CAM allows users to not only create efficient toolpaths, but also capture design and manufacturing knowledge so it can be replicated for future use, which helps everyone leverage the expertise of design and manufacturing experts.

Manufacturing templates enable more agile and efficient processes

Advanced NC process planning automation capabilities like Creo's manufacturing templates make knowledge capture possible. A manufacturing template allows users to have the information necessary to perform an NC Toolpath. This functionality enables the user to create an unlimited and self-defining library so that manufacturing departments can easily read and share data. The container helps capture knowledge from the more experienced programmers in the company, so that junior

manufacturing engineers can see and reuse best practices—resulting in greater consistency across the organization.

Manufacturing templates can contain one or more features stored in a separate file, a capability that allows users to repeatedly place them in the same or different models. By doing the work once and reusing templates, users more easily and quickly create complex toolpaths, measurements, and sequences. These features aren't model-specific, but can be applied to many different models, parts, products, and more, after only being defined once. As a result, this reduces time spent in production, errors, and rework, as well as improves the efficiency and agility of the design and CAM programming process. By creating complex templates for their machines to analyze, MAN ES also leverages data from their design department for quality improvements (such as refining the drilling process).

Gposts give users greater flexibility

Additionally, Creo has a Gpost post-processor generator that is included free of charge in each license. Gposts are easy to learn and allow users to make as many posts as they need. Unlike other CAM solutions, Creo's post-processor can be configured for any machine by the user. To configure the post-processor, users start by filling out checkboxes in a questionnaire, giving them around 80% to 90% completion of the post to start. The integrated material removal simulation in Creo allows users to validate the toolpath so the team can make corrections as needed. Because Gposts are easy to learn and offer everything MAN ES might need to create a specific post, it gives users greater flexibility and allows them to be more efficient with CAM.

Windchill allows engineers to enhance data and release management

MAN ES engineers also use PTC's Windchill to manage design and manufacturing data for greater consistency and productivity. For example, users can see what has changed and note why they've made those changes. Data management in Windchill includes Creo designs as well as CAM-related parts and assemblies, such as raw material parts, fixtures, and more.

Furthermore, release management capabilities capture the history of the programming process, so all changes and iterations are embedded in the system. Users can restore old versions, see the complete history of improvements, and compare versions. Creo API's also allow MAN ES to interface with third-party software tools and drive further efficiencies. Currently, they're using APIs to manage tools and improve simulations of fabrication to avoid collisions.

MAN ES successfully made complex processes more efficient

MAN ES has improved the accuracy of their programming tasks and can now move from design to production with more efficiency. Previously, they allotted three weeks for production of the first machine part when manufacturing larger products. Now, with Creo, they only need one week. Moreover, since switching to 3D CAM, they have had zero cases of incorrect points from miscalculations or incorrect coordinates. "We're saving a lot of money—thousands of Euros. It costs up to €100,000 when we have a collision between the machine and the part. Since we began using 3D CAM, we've had no

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Thanks to Creo's 3D CAM software, MAN ES has decreased programming time by 33%. The process has gone down from 12 to nine days after the first part has been programmed, and then from nine days to five. In the end, Creo has given MAN ES a competitive advantage as they can design and produce large and complex machine parts faster than their competitors.

MAN ES will continue to use Creo to optimize their digital processes

MAN ES is excited to continue their partnership with PTC into the future. "We have very good communication with the PTC team," says Reiter. "They've provided industry-leading support, which really enables our community success."

MAN ES is planning to upgrade to Creo 7 in 2021, to keep refining their processes and continue to help them leverage CAD data more efficiently for producing the first machine part. Moving forward, they are also interested in establishing new KPIs that allow them to look at the entire process more holistically. As their digital journey progresses, MAN ES will look to PTC and Creo to help make their manufacturing processes increasingly more efficient.