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Siemens PLM Software

# NX 9 for aerospace

Enabling enhanced design productivity, smarter decisions and better products

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*NX 9 introduces new capabilities  
and technology to accelerate  
aerospace product engineering.*







# Improving the efficiency of aerospace product design

The aggressive cost, schedule and performance goals of modern aerospace and defense programs place a premium on achieving greater productivity. With shorter development cycles and faster manufacturing and assembly times, aerospace companies must optimize product development for efficiency, leveraging advanced technologies for design, engineering and manufacturing.

Aerospace products are complex systems requiring engineering that links requirements, subsystems and physical models. Successful aerospace companies support multiple disciplines with a collaborative development environment that enables concurrent engineering.

Integrated information technology also helps to simplify complex aerospace product development. Successful companies employ advanced solutions with unified capabilities for design, simulation and manufacturing, along with discipline-specific tools for electromechanical, tooling, composites and other engineering specialties. Open, scalable solutions easily integrate with other tools used by global design teams and supply chains.

With NX™ product development software, Siemens PLM Software delivers an impressive array of tools for improving productivity, enabling aerospace companies to reach new levels of efficiency. This new production release, NX 9, introduces new capabilities and technology to accelerate aerospace product engineering.

# Efficiency in aerospace product development

NX uniquely delivers synchronous technology, an innovation that enables you to create and edit geometry with unparalleled speed and ease – even geometry created on other CAD systems.

## High-definition user experience

High-definition 3D (HD3D) is a visual analytics technology that enables companies to keep track of all product-related information, and to quickly get answers to many common questions throughout all stages of development, including release status, supplier parts and information, weight, cost targets, part and assembly attributes, validation criteria and results. In NX 9, HD3D is complemented by visual tools and provides the capabilities required to quickly create, view, publish and share a wide variety of reports.

NX 9 enhances the high-definition PLM experience by embedding Active Workspace Client, the innovative new interface for the Siemens PLM Software Teamcenter® software. You can choose the simple, graphically-engaging Active Workspace to quickly find relevant information for parts, tasks, workflows, requirements and specifications, even from multiple external data sources. This streamlined access to the right information in context dramatically reduces the time spent looking for data and improves decision-making.

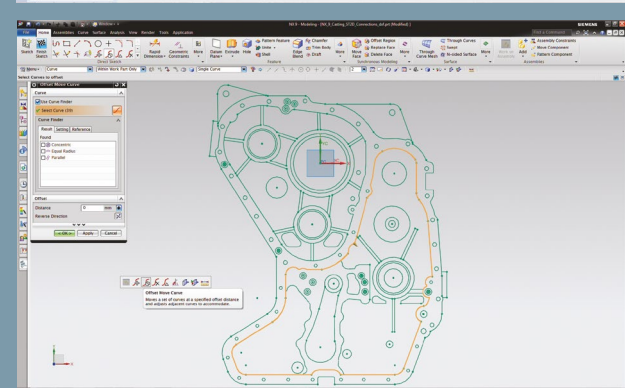
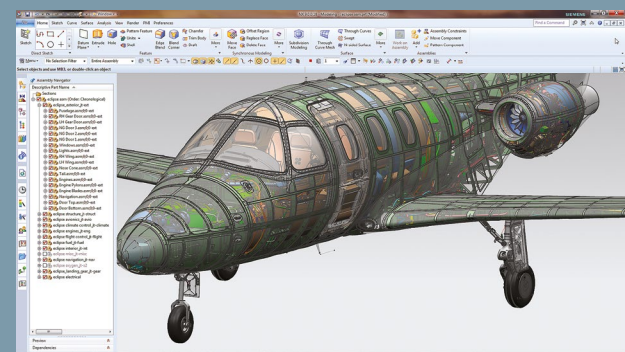
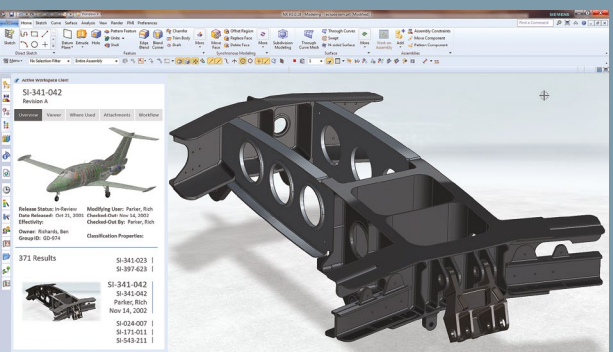
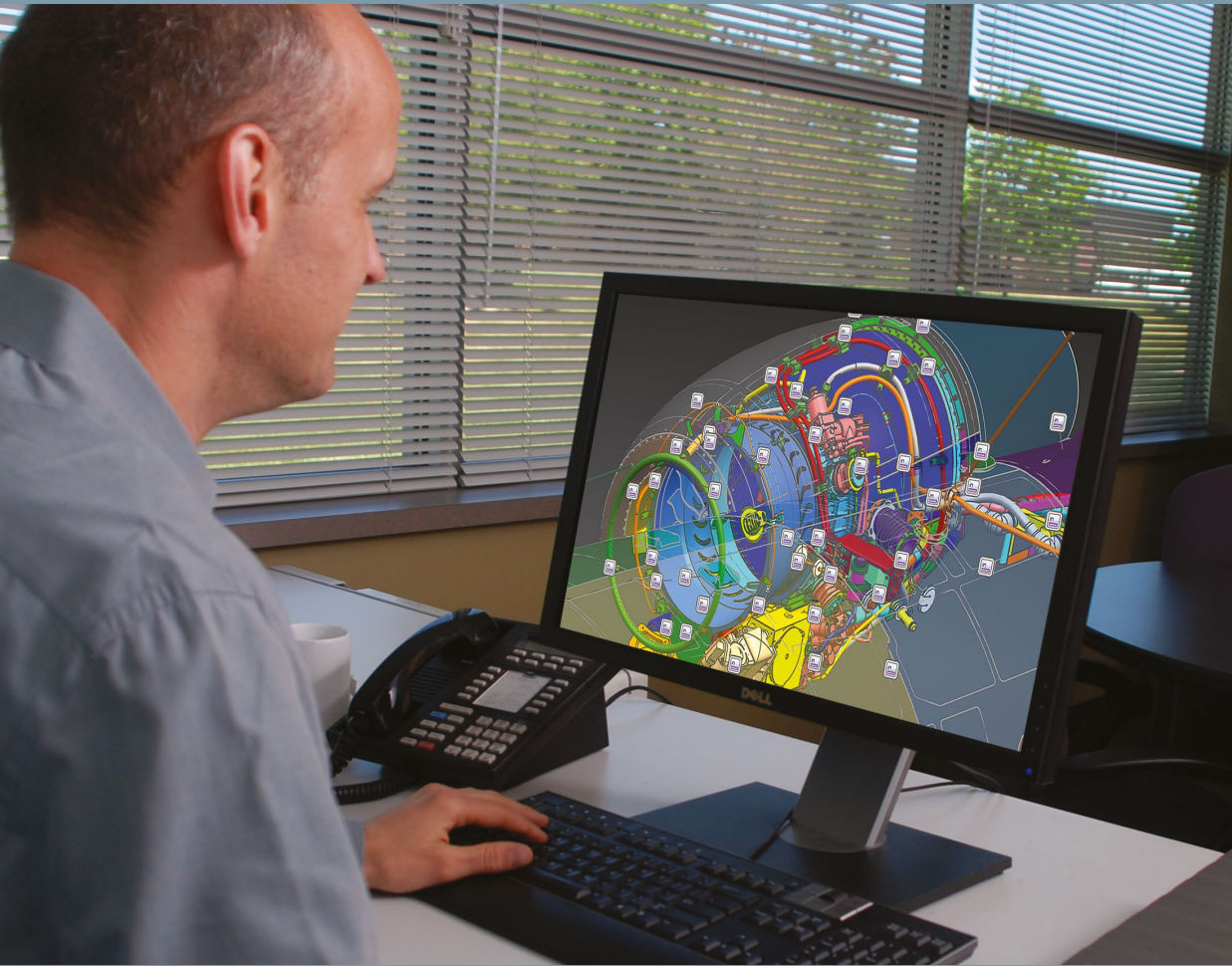
Improving the user experience is an ongoing investment for NX. The latest release introduces a fully customizable, ribbon-like user interface that is the next step in increasing user productivity and simplifying the development process.

New users of NX will be able to discover system capabilities easier, learn faster and become more productive in a shorter span of time. Existing users will find that they are more efficient because they are using a more logical layout, grouping and presentation of commands that maximizes the graphics window.

## Faster, easier design with synchronous technology

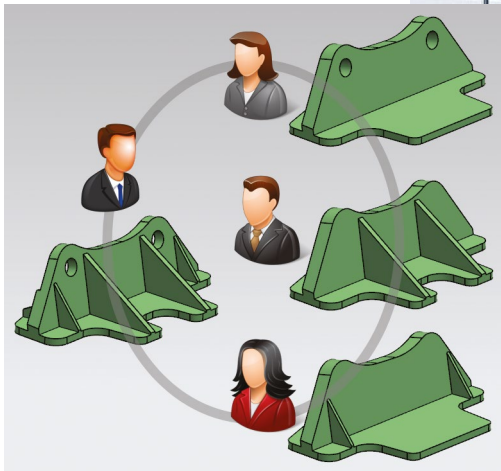
NX uniquely delivers synchronous technology, an innovation that enables you to create and edit geometry with unparalleled speed and ease – even geometry created on other CAD systems. Synchronous technology enables faster idea capture and design changes, improved use of multi-CAD and unprecedented ease of use.

Now in its sixth release, this capability has been expanded in NX 9 with the introduction of synchronous technology 2D, giving you the same freedom and speed in 2D as previously available in 3D. You can easily change the design intent of 2D geometry – from profile sketches to large 2D layouts – while preserving integrity. Synchronous technology 3D has also been enhanced to enable editing of shapes by directly modifying edges as well as faces. Synchronous design is invaluable in the multi-CAD system environments of aerospace global design teams and supply chains.





# Productive technologies for aerospace design



*Modular design facilitates concurrent engineering, enabling engineers to work more efficiently.*



### Modular design for concurrent engineering

Modular design facilitates concurrent engineering, enabling aerospace designers to work more efficiently on complex models as the product design evolves. NX recently introduced part modules, a capability that enables multiple designers to collaborate more easily on a single component, designing complex part models as groups of isolated, self-contained functional elements that evolve independently. Such an approach reduces feature dependencies within the model, enables simpler design modifications and considerably enhances performance, making it much easier for designers to understand how a model was created. Since the design team can work in parallel on the part, the overall time it takes to complete the final design can be greatly reduced. Customers using modular design report a 50 percent reduction in model creation time, and a 90 percent reduction in modification time.

Each designer adds detailed geometry based on the reference geometry provided in the linked part module. Once the geometry definition is complete, each designer creates output geometry, which is automatically transferred back to the master part. Therefore, the lead designer can always see the geometry being created within the linked part modules. In turn, each of the other designers has the ability to see the master part, as well as

any of the other linked modules, by simply adding them as components to their linked part. This workflow is essential for enabling designers to work concurrently, and to have access to up-to-date data.

An important improvement in NX 9 enables the same body to be shared with multiple designers. At any point, work from all designers can be merged with the main part. This enhancement enables a number of new work distribution workflows, such as for blending and sheet metal design.

### Performance for large assembly design

NX delivers large assembly capacity and performance for the complexity of aerospace products. Large assembly modeling in NX offers lightweight loading of components to significantly improve performance, especially when working with large datasets. Designers can work in the context of full assembly models and create virtual mockups that use components from multiple CAD systems. By digitally simulating complete assemblies and processes, aerospace companies can avoid the costs of creating prototype models and eliminate assembly errors and rework. Assembly design benefits from improved performance and updates to inter-part linking in NX 9.

# Automating airframe-specific workflows

Pocket blending tools in NX enable designers to specify which cutting tools will be used to machine the part.

Workflow automation is the ultimate solution to significantly improve speed, consistency and quality of many design tasks. Automation is best achieved through clear understanding of customer work processes and requirements. The experience of Siemens PLM Software with a broad aerospace customer base enables us to offer capabilities that capture the required inputs, apply them in a realistic workflow and deliver the desired results. NX 9 applies this type of automation to airframe parts to help aerospace firms dramatically reduce design and engineering time.

## **Design for manufacturing – airframe components**

Expensive, late-stage design changes can be minimized when designers consider the manufacturability of components during the design process. NX 9 introduces new tools for aligning design and manufacture of machined pockets typical of many airframe parts.

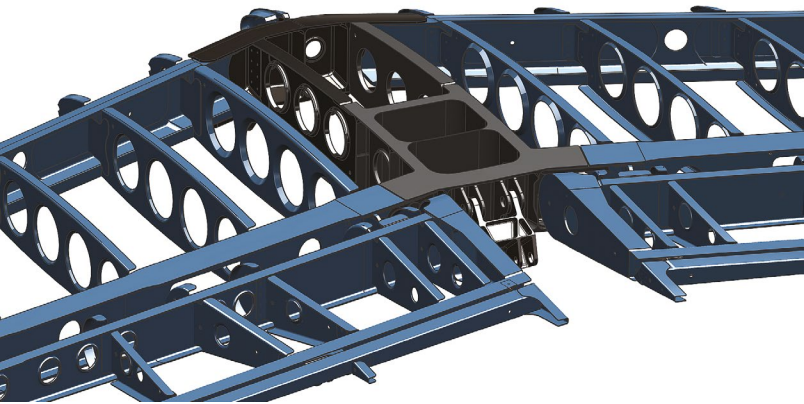
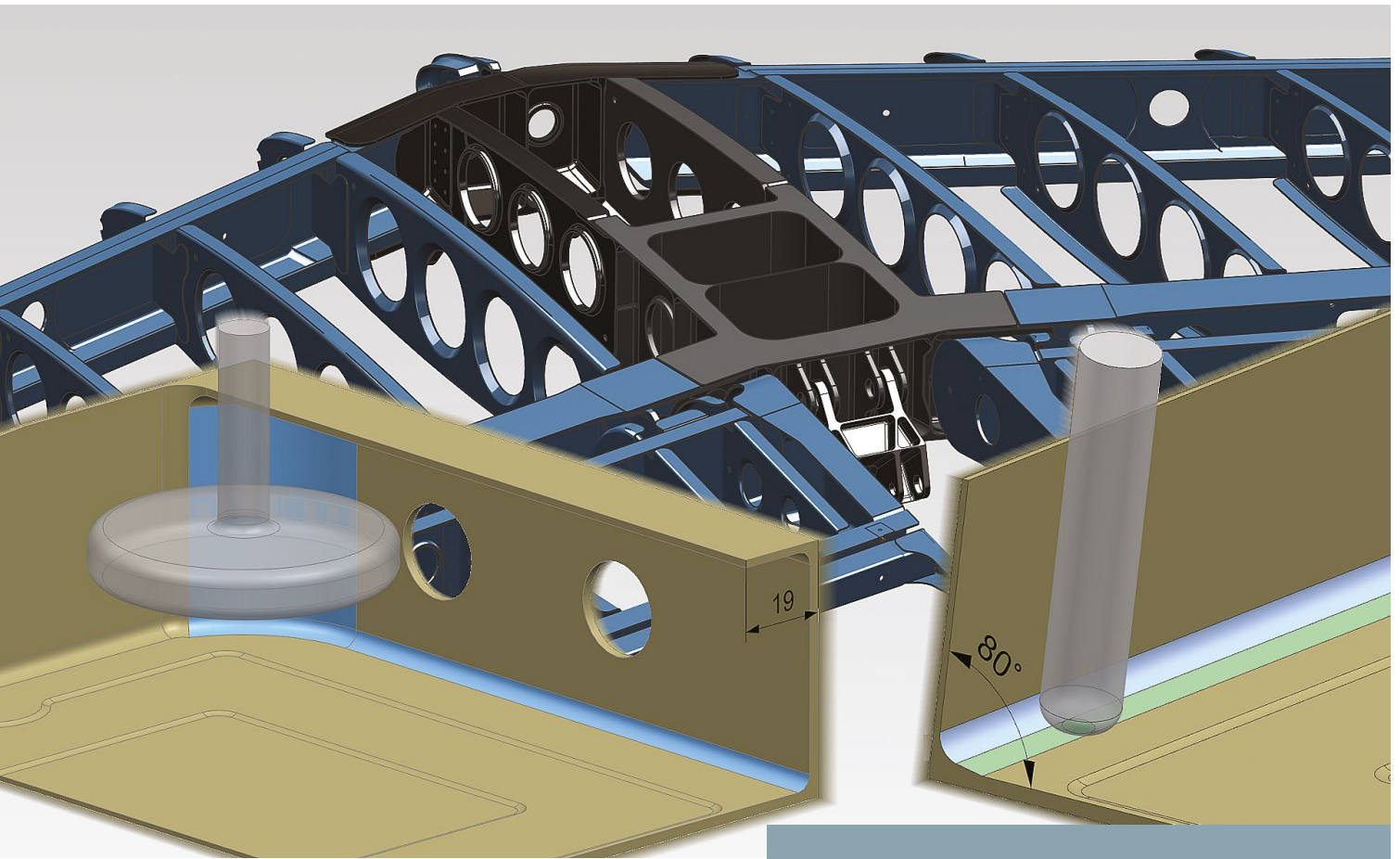
Conventional computer-aided design (CAD) systems lack this industry-specific capability, leaving the manufacturing engineer to determine production details after the design is complete. New manufacturability checks and blend modeling tools in NX 9 enable designers to define

manufacturing criteria, rather than just engineering intent, when specifying how the parts with machined pockets needs to be blended.

Pocket blending tools in NX enable designers to specify which cutting tools will be used to machine the part, as well as the parameters of these cutters, such as type, size and radius. A new manufacturing check analyzes pockets on the component to find acutely angled walls, undercuts and areas where the cutting tool won't fit. The designer can then quickly model pocket blends on the airframe part that automatically apply fill geometry and ramps based on the cutter parameters. The blends accurately represent the final shape of the machined parts, and weight calculations from the CAD model are much more accurate.

These new capabilities dramatically reduce the time required to model as-machined pockets, and improve the detail, accuracy and manufacturing planning for the CAD model.





*These new capabilities dramatically reduce the time required to model as-machined pockets.*

# Streamlining aircraft panel design

This workflow-based approach is quite useful for supporting manufacturing processes.

New tools in NX 9 also automate and simplify the design of most common elements in aircraft exterior panels. These offer designers powerful and efficient methods of modeling and validating the required geometry. The supporting tools were specifically engineered to support aircraft design.

Aircraft panels are typically modeled from ruled surface geometry. NX 9 adds a modeling option for developable surfaces that ensures that the panels can be flattened or formed without deformation. As-designed and as-manufactured representations of panel parts can be easily created with new NX capabilities for wrapping and unwrapping curves on ruled surfaces.

Aircraft skin components are further developed by adding and removing material from defined regions of the aircraft skin. NX 9 provides the tools needed to create skin pockets, pads and cutout features, enabling designers to account for engineering as well as manufacturing requirements in a streamlined workflow.

In a typical workflow, the designer defines boundaries and locations of holes in the aircraft skin. Using the unwrap

curve command, the designer flattens the developable surface and reference geometry. Next, 2D profiles for pockets, pads and cutouts are created in the context of the flattened geometry. Using new capabilities in NX 9, designers can quickly create the skin elements, such as pockets, pads, cutouts and holes. In many cases, most of these design elements can be created in a single operation, including the definition of multiple thicknesses.

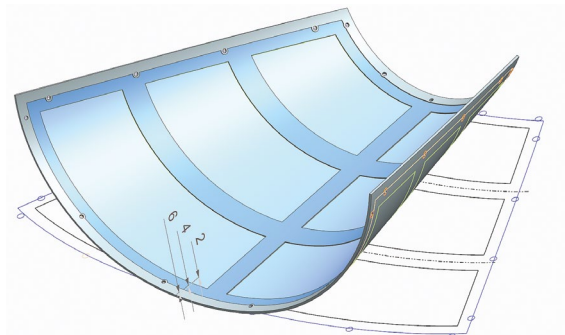
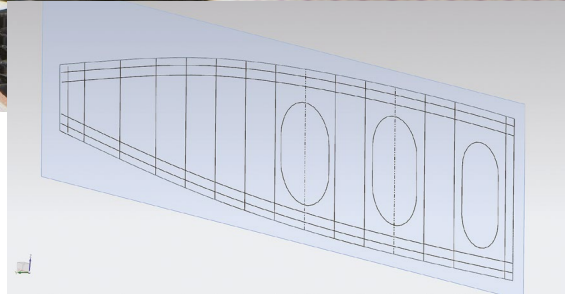
NX prompts the user to define the desired thicknesses, and determine if a pocket, pad or a cutout needs to be created. Such an approach simplifies the construction of these design elements, and greatly improves the designer's speed and efficiency. Siemens PLM Software engineered these capabilities specifically to support airframe design workflows.

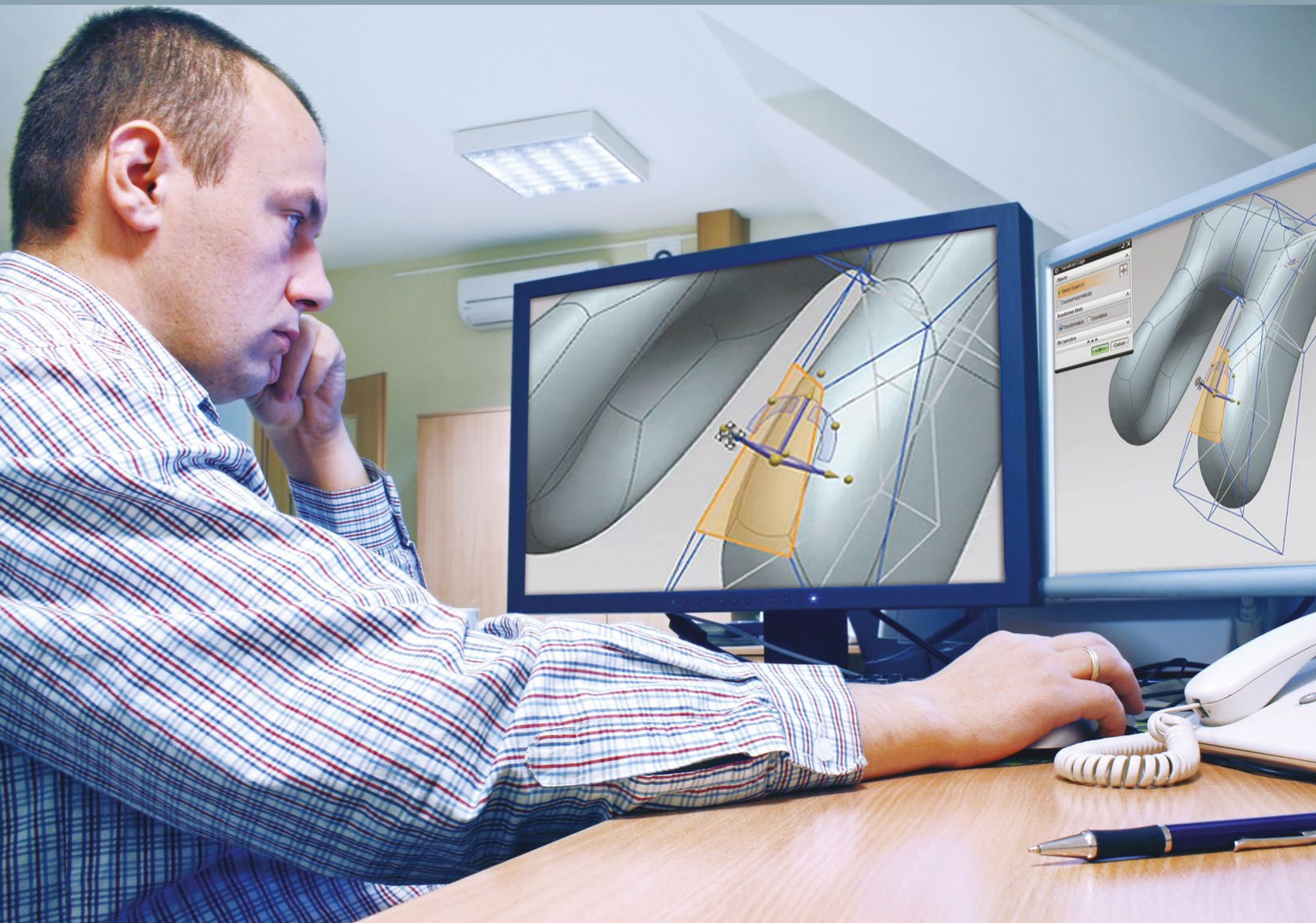
This workflow-based approach is quite useful for supporting manufacturing processes, such as chemical milling. The design steps produce the geometry and information required for this process, thus further helping to reduce cost and errors.





*In a typical workflow, a designer defines boundaries and locations of holes in the aircraft skin.*





*It makes it much faster and easier for designers to create shapes using a number of basic techniques.*



# Simplifying the entire design process

## A new tool for freeform modeling

Subdivision modeling technology has been used for a number of years in the conceptual stage of product design. It is intended to help develop designs faster than traditional surfacing technologies. NX 9 adapts subdivision modeling technology, and introduces a new task environment called Realize Shape. It makes it much faster and easier for designers to create shapes using a number of basic techniques, which are intuitive and require only simple interaction. The end product is high-quality B-surfaces in an editable feature. Subdivision modeling enables rapid conceptualization of ideas without the need for expert knowledge. It can be used in combination with other surfacing and design tools, and in many cases, it can replace them.

To assist with making products look realistic in a virtual design environment, Siemens PLM Software has introduced Ray-traced Studio in NX 9. This new capability delivers a real-time ray-traced rendering that displays inter-object reflections and refractions to help optimize product aesthetics.

## Managing configurations and variants

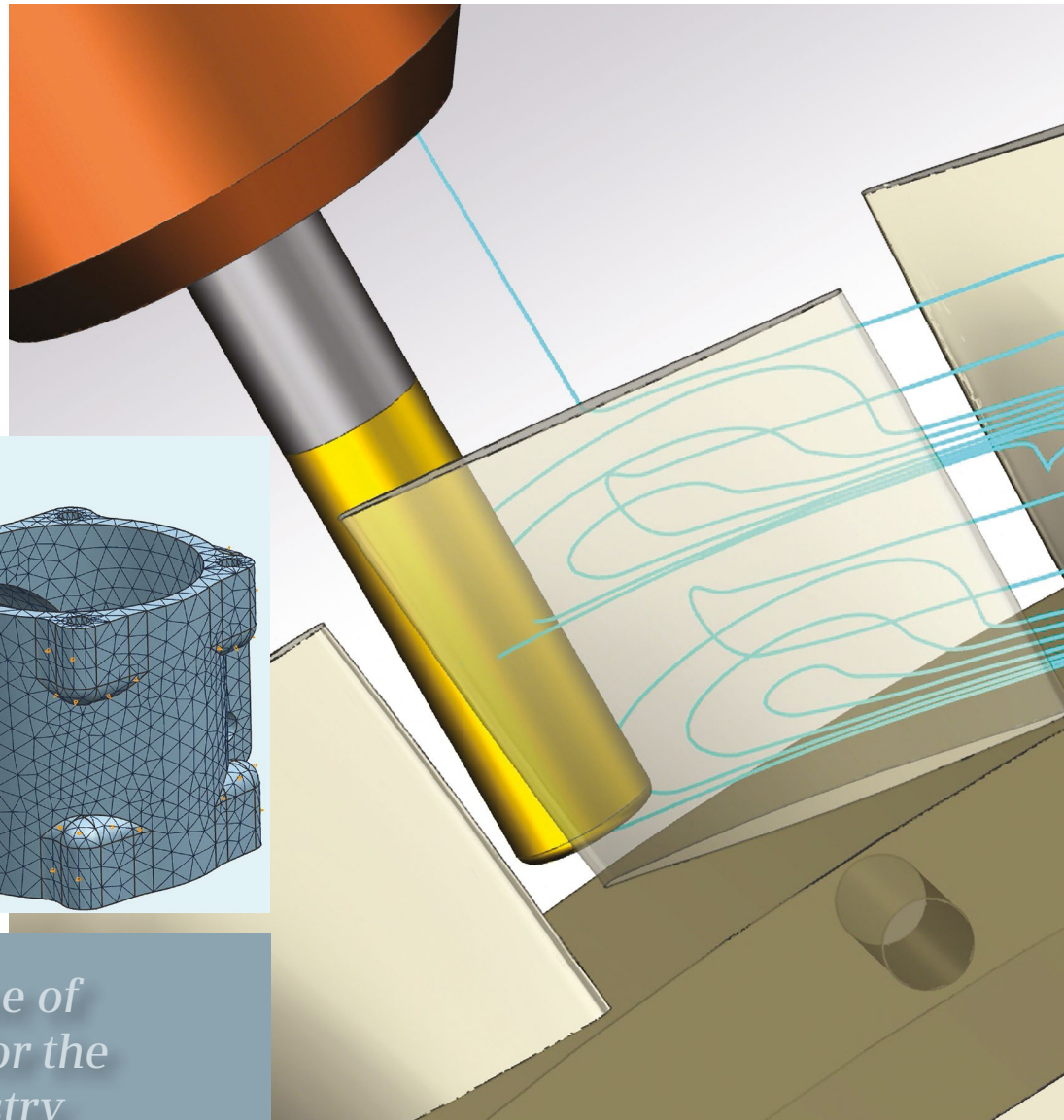
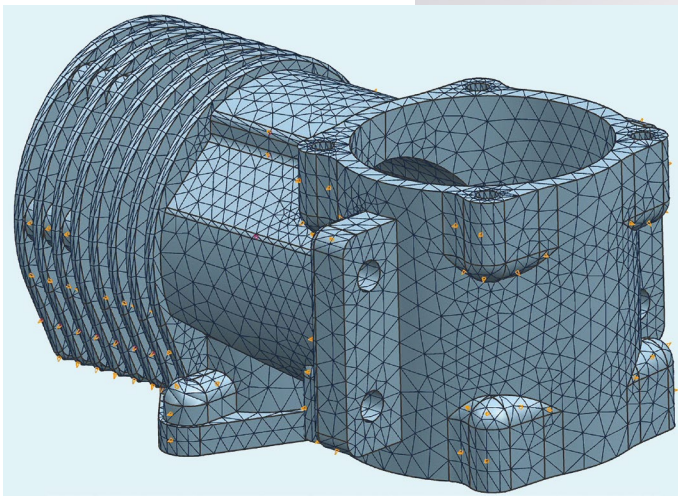
NX and Teamcenter assist aerospace manufacturers with occurrence effectivity for configurations and variants. For example, if you are designing a line of aircraft having different tail numbers, you can take advantage of the Teamcenter occurrence effectivity to manage a single product structure containing all of the aircraft. Inside NX, the designer can load the components needed for a specific tail number. Then the user creates assembly-level product and manufacturing information (PMI) in that design context. The authored PMI will be visible only for that specific tail number. Authoring, PMI and reference geometry filtering can be applied based on variant conditions during the authoring process. Additionally, if the associated component is suppressed due to a variant condition, then the corresponding PMI and/or reference geometry will be suppressed as well.

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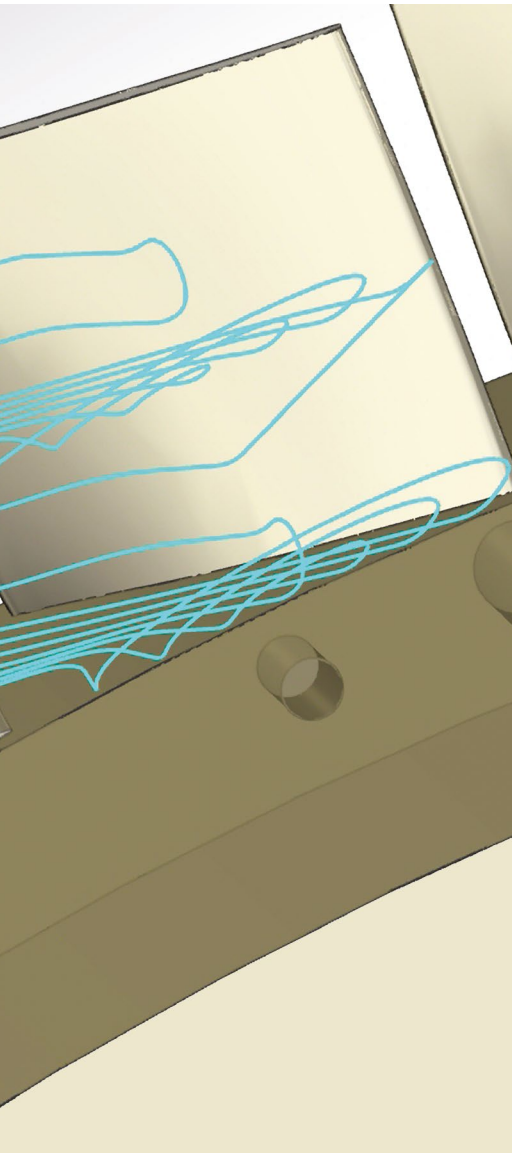
# Value throughout aerospace product development

A seamless flow of information from concept through detail design, simulation and manufacturing reduces engineering time.



*The latest release of NX adds value for the aerospace industry throughout product development.*





NX is a unique product development solution for aerospace firms because it offers breakthrough design technology, multidiscipline simulation and complete manufacturing support – optionally managed by Teamcenter, the world's leading product lifecycle management (PLM) platform.

The seamless flow of information from concept through detail design, simulation and manufacturing reduces engineering time. By integrating design and simulation, NX helps achieve early analysis of designs and fewer physical prototypes. With integrated tooling, numerical control (NC) programming and inspection, aerospace companies can reduce manufacturing time and costs. NX makes possible increased levels of re-use and adaptation to achieve overall cost reductions. It supports increased innovation through continuous collaboration within a managed environment.

The latest release of NX continues to add value for the aerospace industry throughout product development:

#### **NX 9 for simulation productivity**

NX computer-aided engineering (CAE) delivers an advanced multidiscipline simulation environment. NX 9 includes many enhancements to improve modeling efficiency and reduce simulation process time. Mesh morphing and new meshing controls accelerate the creation and modification of analysis models in fewer steps.

New capabilities for rotor dynamic analysis with NX™ Nastran® help predict the dynamic behavior of rotating systems, such as aircraft engines. A new laminate composite dynamic solution process provides an accurate and efficient means for evaluating the performance of composite parts when they are subjected to base-driven random vibrations, which are prevalent in the aerospace industry. Solver enhancements reduce memory usage and simulation time. New motion analysis methods assist in interactive interference checking at critical parts of the motion envelope.

#### **NX 9 for manufacturing productivity**

NX 9 increases manufacturing productivity with enhanced NC programming that supports better cut control and faster program creation. Enhanced 5-axis roughing and finishing for turbomachinery milling improve machining efficiency and surface finish. New modeling and analysis capabilities help reduce the time required to prepare tooling designs for downstream machining. Improved inspection programming works with a wider range of parts, including sheet metal components.

## About Siemens PLM Software

Siemens PLM Software, a business unit of the Siemens Digital Factory Division, is a world-leading provider of product lifecycle management (PLM) software, systems and services with nine million licensed seats and 77,000 customers worldwide. Headquartered in Plano, Texas, Siemens PLM Software helps thousands of companies make great products by optimizing their lifecycle processes, from planning and development through manufacturing and support. Our HD-PLM vision is to give everyone involved in making a product the information they need, when they need it, to make the smartest decisions. For more information on Siemens PLM Software products and services, visit [www.siemens.com/plm](http://www.siemens.com/plm).

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