SIEMENS

Ingenuity for life

GEOMETRIC SOLUTIONS

Siemens PLM Software

NX for Aerospace and Defense

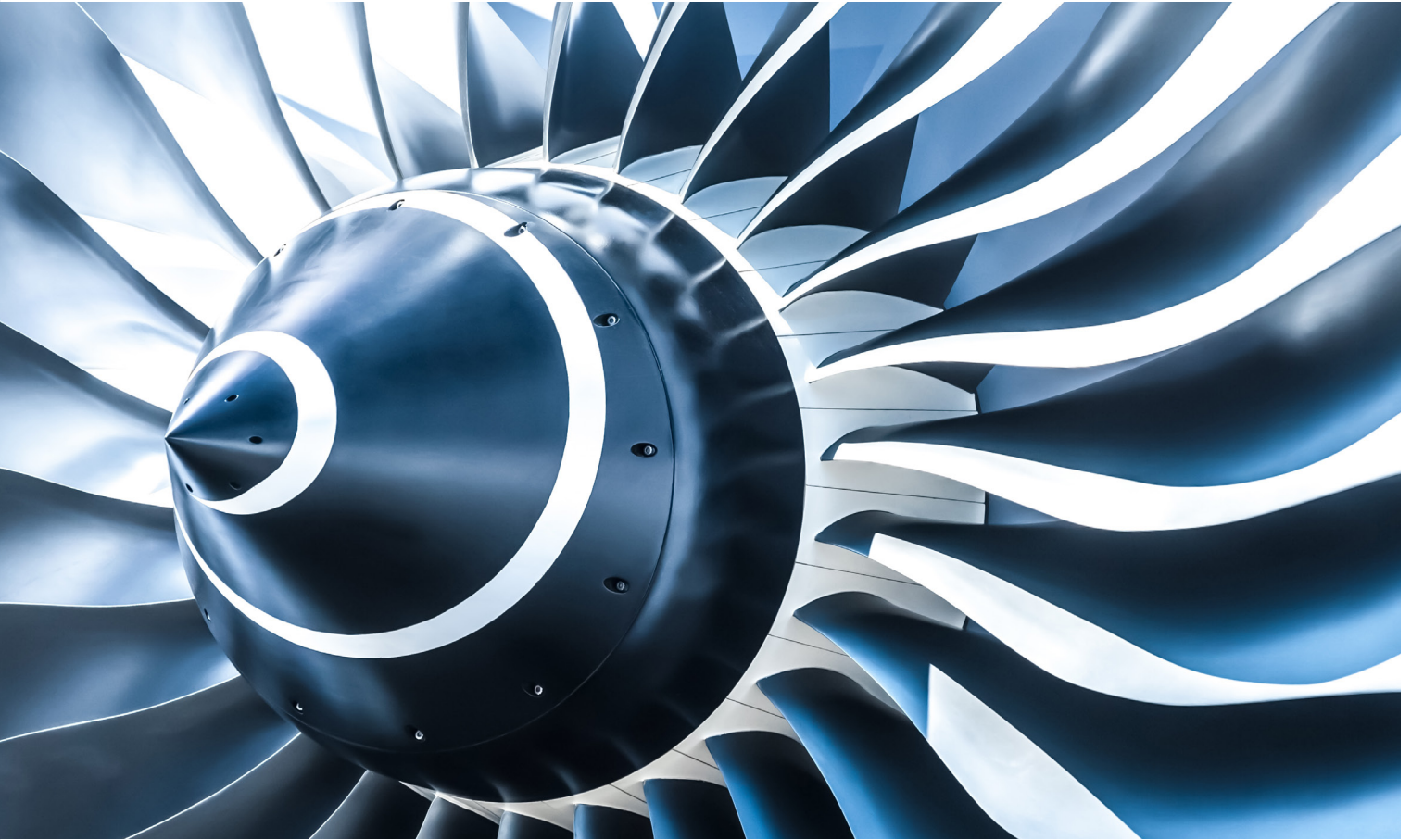*To remain competitive, companies must transform all phases of their business through digitalization.*

In today's digitalized world, aerospace companies face disruption from existing companies as well as new market entrants. To remain competitive, companies must transform all phases of their business through digitalization. Siemens NX™ software provides a flexible, powerful and integrated solution that helps you deliver better products faster and more efficiently. Most importantly, NX delivers the next generation of design, simulation and manufacturing solutions that enable companies to realize the value of the digital twin.

A digital twin is a virtual representation of a physical product or process, used to understand and predict the physical counterpart's performance characteristics. Digital twins are used throughout the product lifecycle to simulate, predict and optimize the product and production system before investing in physical prototypes and assets.

The next generation of design with NX

NX breaks down the barriers to innovation and efficiency so that you can deliver reliable products to market faster than your competitors, and with more confidence than ever before. The next-generation design capabilities of NX replace the fragmented and redundant technologies of today with a best-in-class integrated technology platform.

Supporting every aspect of product development, from concept design through engineering and manufacturing, NX gives you an integrated toolset that coordinates disciplines, preserves data integrity and design intent and streamlines the entire process. We help the aerospace industry deliver solutions faster to solve their business problems in ways that could not have been done before. Next-generation design is built upon core principles that enable you to change the way products come to life, are realized and evolve.

Multidisciplinary design

In the past, the mechanical, electrical and software features of the product were integrated through rounds of prototyping. But given today's time-to-market constraints, aerospace manufacturers have realized that this practice is a luxury they can no longer afford. Recent efforts have moved integration resolution upstream into design, where mechanical, electrical and software engineers work together to avoid product prototype issues altogether.

Due to the increased demand for complex and highly customized products involving mechanical, electrical and software systems, the need for an integrated and multidisciplinary approach to product design is essential in order to reduce risk and increase confidence in product performance.

Key features
- NX delivers best-in-class engineering functionality together with seamless data flows and workflow orchestration

- Provides a clear understanding of the impact of requirements on product designs

- A fully integrated 3D electrical harness routing application allows users to design and route harnesses in complex assemblies

- NX integrated mechanical, electrical and electronic solutions ensure complete traceability from logical diagram to the full digital twin
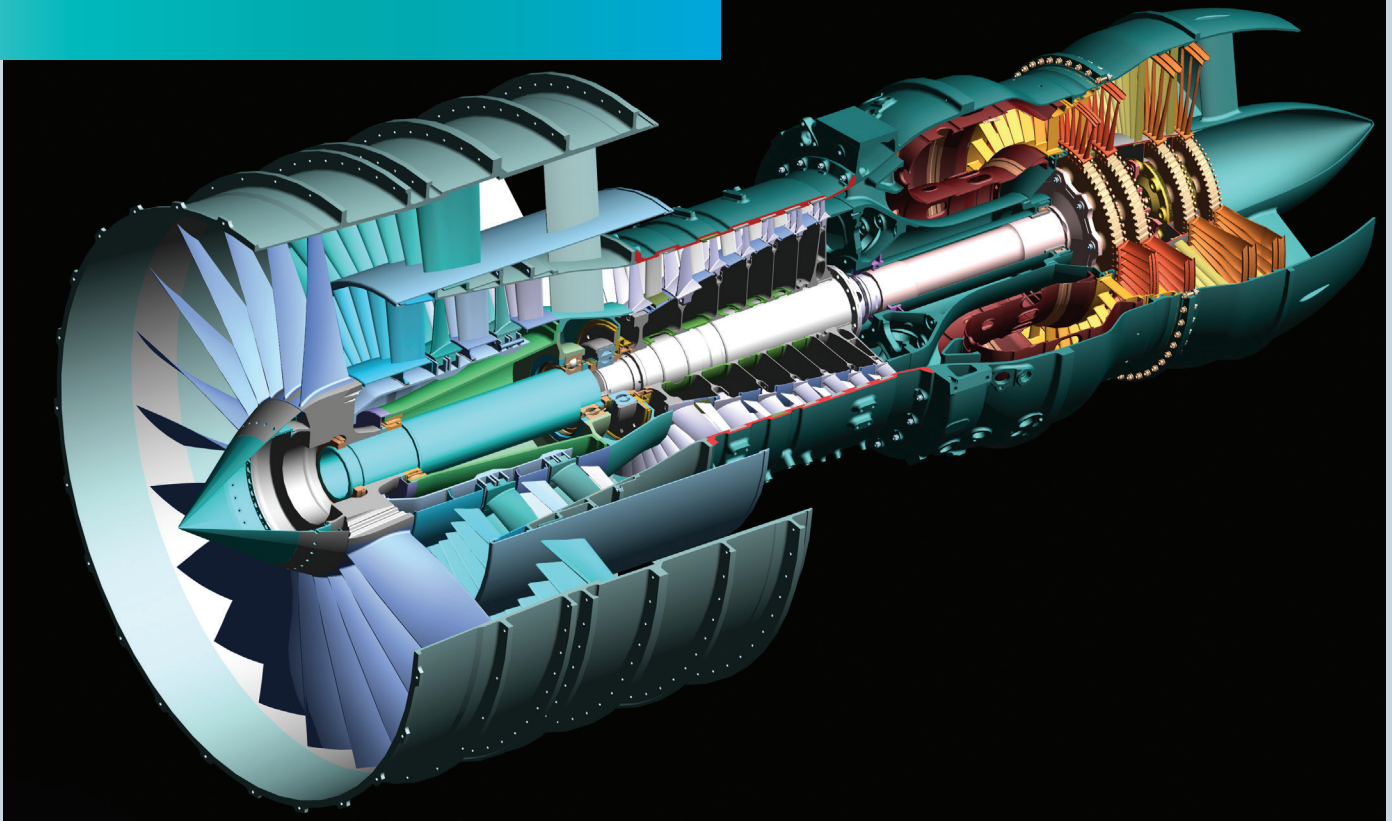
NX delivers best-in-class engineering functionality

World's most productive modeling environment

Barriers arise when companies are forced to use multiple, disconnected solutions to complete the entire design, validation and manufacturing process. There can be communication issues within teams and a lack of traceability of requirements from design to validation and manufacturing. NX removes the barriers to productivity by giving your design team the most complete and easy-to-use platform on the market today. NX can open immense assemblies quickly to enable designers to review the entire product.

You can re-use data efficiently by finding parts similar to what you need and being able to edit them without the need to understand complex part histories. This allows for downstream use of manufacturing information. We have always led the way in assembly performance and modeling, getting your data loaded in the most efficient manner possible, and allowing your team to work in the context of your assembly. Superior designer productivity equals accelerated product innovation.

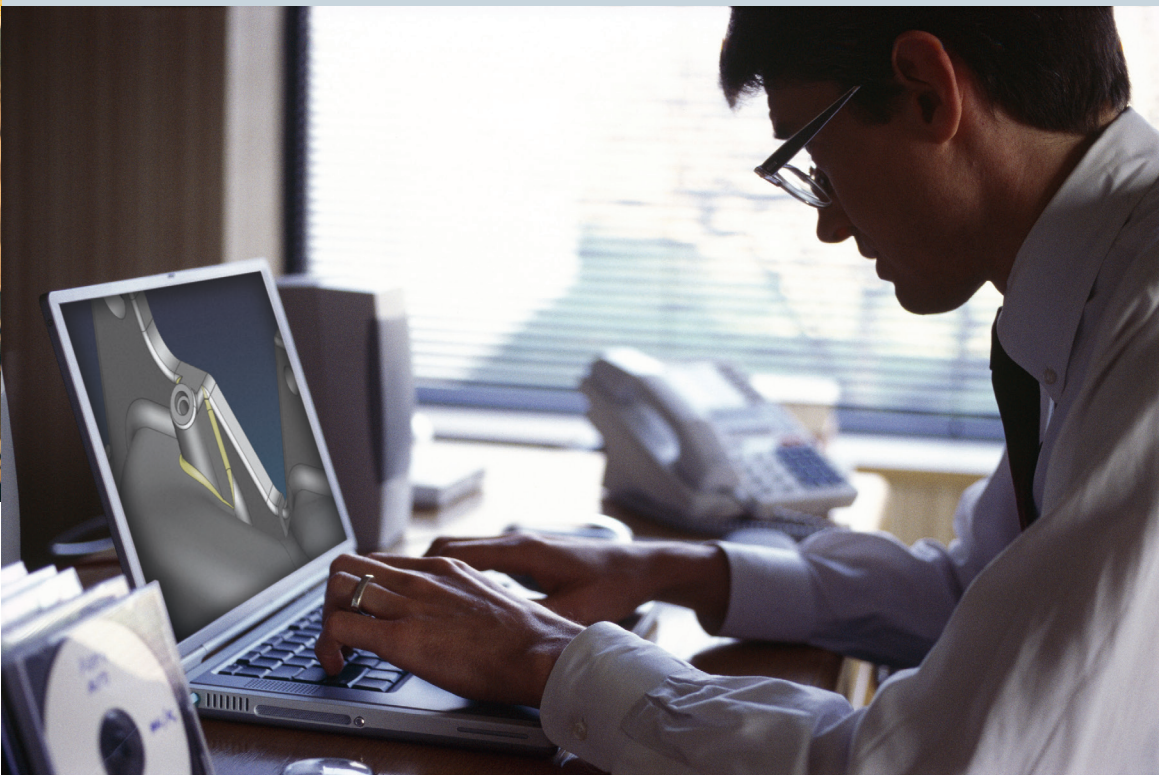*Superior designer productivity equals accelerated product innovation.*

It is imperative that companies transform their engineering and design thinking and processes.

Integrated design optimization and validation

Aerospace companies are faced with shorter lead times, more regulation, and greater competitive disruption on a global basis. To deal with these challenges it is imperative that companies transform their engineering and design thinking and processes. Many aerospace companies have a set of disconnected systems for product design and validation that decrease efficiency and increase time to market.

Key features
- NX digitally represents the entire product from both mechanical and electrical disciplines with an integrated set of tools for CAD/CAM/CAE

- With design-integrated motion, structural and thermal simulation tools in NX, you can quickly compare design alternatives and optimize performance characteristics from the earliest stages of the design process

- NX provides the world's first offering to integrate the entire additive manufacturing process from automated performance-driven design optimization to advanced 3D printing

- NX enables companies to reshape everything for optimal performance at a reduced cost
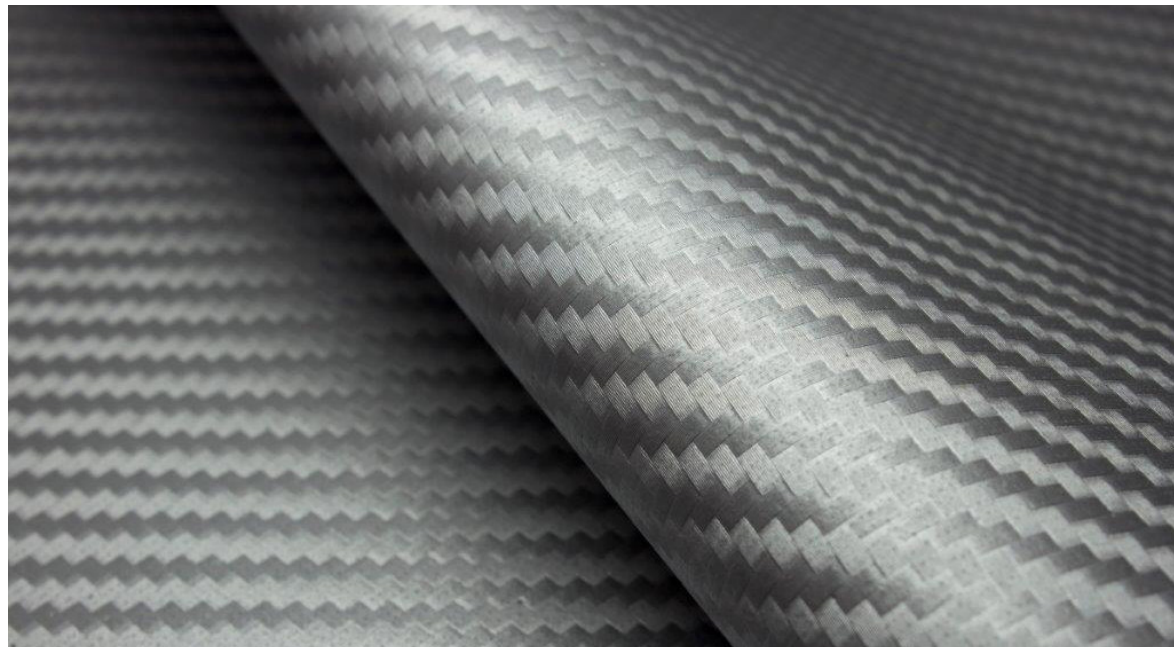
Composites engineering and manufacturing

Despite the increased use of composite materials, effectively designing and manufacturing aerospace composite products remains a challenge. The true promise of composites has been largely unfulfilled due to the high cost and complexity of designing and manufacturing with these unique materials. Successful aerospace composite product development requires effective communication among multidiscipline teams throughout the lifecycle of a product.

Fibersim transforms – and ultimately reduces – the entire composite product development process for aerostructures, aero-engines, and space systems by providing an open architecture that allows concurrent engineering and easy exchange of information between analysts, designers and manufacturing engineers. It automates the tedious design and iterative tasks associated with making changes, so composite products can be developed faster and without errors. F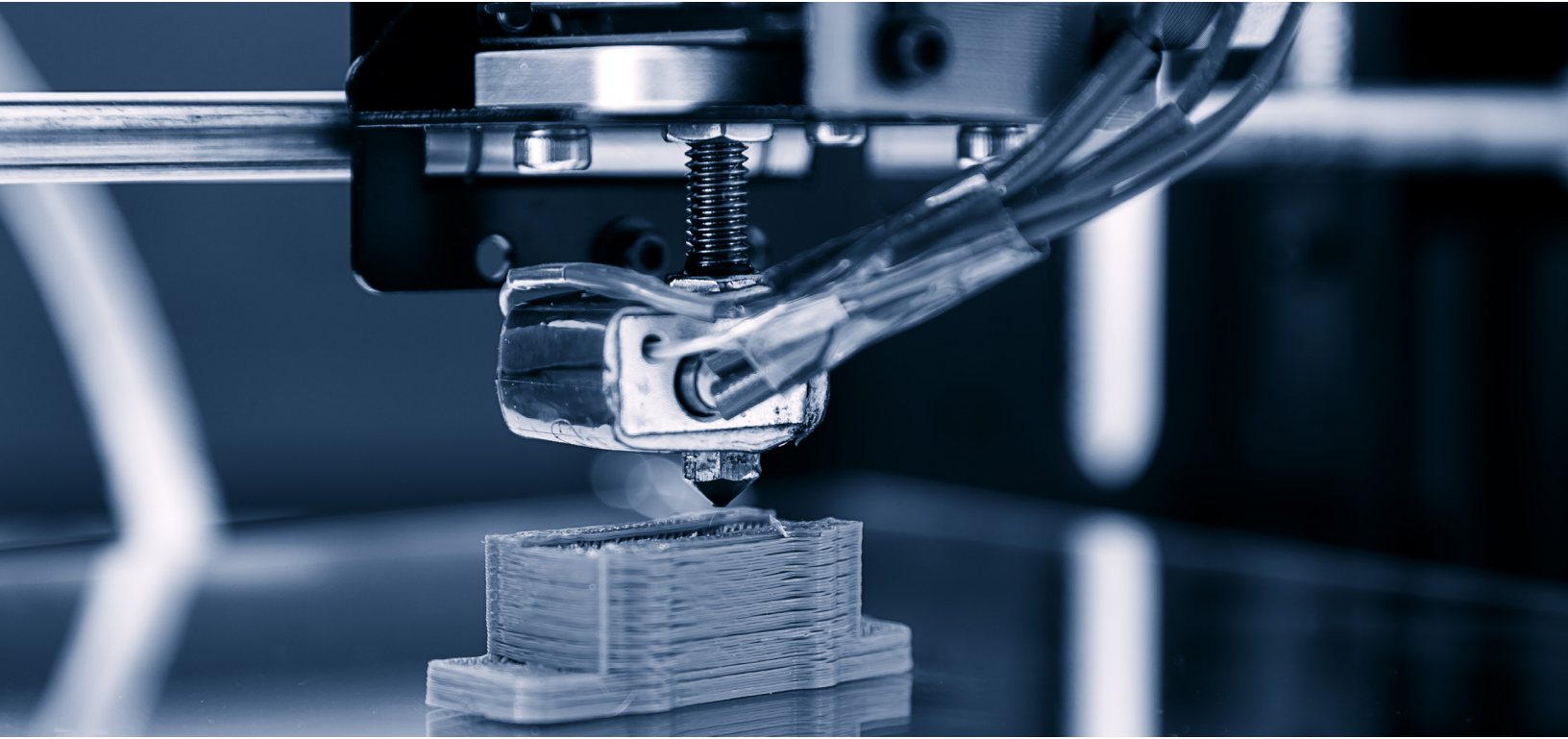ibersim also improves product quality and throughput data directly from the design to the factory floor, ensuring a repeatable manufacturing process. The combination of these unique features makes Fibersim the best tool available to deliver innovative, optimized composite products that meet all specifications, on time and within budget.

Key features
- Data can be shared with analysts, designers and other employees on the manufacturing floor
- Enables a concurrent engineering process where analysis and design are performed in the context of the manufacturing process
- Provides access to best-in-class industry solutions for the complete digital definition of the composite part
- Enables OEMs to meet requirements for schedule, strength, weight, durability, manufacturing first-time yield and field repair for the most challenging applications

Industrialize additive manufacturing

Additive manufacturing is the process of layering physical materials to create a completed product or component based on a digital twin. The most common example is 3D printing, in which printing aluminum or other materials into parts is revolutionary for component manufacturing.

Manufacturing parts on small or large scales has never been easier. Three-dimensional printing techniques used for the development of jet turbines and rocket engines have become a focus area for aerospace companies. Prototyping and producing specific parts on a small scale is a common and often expensive challenge for players in the aerospace industry.

Through additive manufacturing, NX provides an integrated, rapid, and cost-effective way of producing specific parts, regardless of production scale.

Key features
- Accelerates design validation and tool production for printing simple or complex parts
- Allows designers to create a digital twin of products to confirm that components meet specifications
- Provides understanding of how the product will perform in various conditions before the first iteration is printed

Immersive design and visualization

Virtual reality (VR) is a computer-generated simulation of a real-life environment that enables the user to be immersed in a first-hand experience of a simulated reality. NX integration with VR gives users the capability to easily interact with, review, update and provide feedback to full-sized jet engines and other complex components.

Key features
- Fully embedded VR environment
- Enables users to directly immerse themselves in a rendered world of virtual models
- Presents the digital twin of any component from the inside out, and also enables simulations
- Increases designers' comprehension of the products and parts they design

Data management and collaboration with NX

NX product data management (PDM) tools manage product data and process-related information in a single, centralized system, Teamcenter® software. This information includes computer-aided design data, models, parts information, manufacturing instructions, requirements, notes and documents. NX enables consistency and streamlines the design process, thereby reducing errors and lead time.

Key features
- Accessible by multiple applications and multiple teams across your organization
- Provides solutions for secure data management, process enablement and configuration management
- Rapid search and access of parts, assemblies and drawings to find and share product information
- Eliminates unnecessary change orders on wings, turbines and other components by ensuring that all collaborators are working from the latest information

Automating airframe-specific workflows

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 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 provides 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.

NX enables consistency and streamlines the design process, thereby reducing errors and lead time.

Manufacturability checks and blend modeling tools in NX enable designers to define manufacturing criteria, rather than just engineering intent, when specifying how the parts with machined pockets needs to be blended.

Key features

- 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

- Dramatically reduce the time required to model as-machined pockets, and improve the detail, accuracy and manufacturing planning for the CAD model

Streamlining aero structural design

NX automates and simplifies 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.

NX provides standard aerospace specific features to simplify and streamline design. NX includes design features for machined parts such as bulkheads, wingbox, ribs and spars. It also includes

features for skins such as components that comprise the outer mold line surface of the aircraft including fuselage, wings, nose, tail and nacelle. NX also incorporates tools to create and flatten sheet metal components and includes aerospace features such as step, flange, rib, shelf, machined blends and the aerospace sheet metal functionality.

Aircraft panels are typically modeled from ruled surface geometry. NX 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 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 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.

Key features

Pocket Blending Tools

- Pocket blending tools enable designers to specify which cutting tools will be used to machine the part, as well as the parameters of these cutters

- Dramatically reduce the time required to model as-machined pockets, and improve the detail, accuracy and manufacturing planning for the CAD model

Lofts and Sweeps

- Development of the primary aero surfaces can be created using loft and sweep tools
- Aero sections can be defined using a variety of methods from non-inflecting linear, circular and conic shapes, to cubic or user defined

Aero Skin Panel Design

- Several tools enhanced to support flattening of developable and mixed convexity surfaces
- Thicken enhanced to support multiple thickness values

Aero Design for Machined Parts

- *Aero Rib*
  - Create ribs (and stringers) based on input faces and profile
  - Ribs defined by height, thickness and end limits
- *Aero step*
  - Allows users to add clearance offset for overlapping parts at the end or middle of the flange
  - Add and remove material to increase/decrease weight and stiffness
- *Aero Shelf*
  - Add or remove material at the end or middle of a support structure
  - Options to define width, offset, and transition ramps
- *Aero Flange*
  - Specialized airframe Flange feature that adjoins to the skin of the aircraft
  - Flange defined by width, thickness and limits

About Siemens PLM Software

Siemens PLM Software, a business unit of the Siemens Digital Factory Division, is a leading global provider of software solutions to drive the digital transformation of industry, creating new opportunities for manufacturers to realize innovation. With headquarters in Plano, Texas, and over 140,000 customers worldwide, Siemens PLM Software works with companies of all sizes to transform the way ideas come to life, the way products are realized, and the way products and assets in operation are used and understood. For more information on Siemens PLM Software products and services, visit www.siemens.com/plm.

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