



GOING BEYOND DESIGN: MAKING SOLIDWORKS THE FOUNDATION OF A CLOUD-CONNECTED DESIGN-TO-MANUFACTURING PROCESS

White Paper



Integrated 3D computer-aided design (CAD) solutions increasingly hold the key to optimizing the entire product development process from design through manufacturing, enabling manufacturers to reduce inefficiencies and bring better products to market faster than the competition.

Although CAD has historically focused on design modeling, with manufacturing drawings being the final output, CAD data is now being used to streamline and automate other important downstream tasks, such as these:

- **Cost estimation and quoting, automating aspects of purchasing**
- **Virtual product simulation and design validation, reducing the need for physical prototypes**
- **Computer-aided manufacturing (CAM) programming, generating tool paths for CNC machining**
- **Additive manufacturing, or 3D printing processes, including metal and plastics**
- **Mold, tool, die, and fixture development to support manufacturing processes**
- **Shop floor documentation creation, including drawings, bills of materials (BOMs), assembly instructions, and exploded views**
- **Quality control inspection, formalizing inspection of incoming and manufactured parts**
- **Documentation development, including automating the creation of user manuals and service guides**
- **Photorealistic rendering, streamlining the development of high-quality images, videos, and interactive web content**

Connected CAD tools can support these functions in a concurrent rather than serial fashion. By helping manufacturers eliminate redundancies, unnecessary effort, and the potential for error, connected 3D CAD and product development data can serve as the cornerstone of an integrated design-to-manufacturing process, providing the efficiency, agility, and flexibility that manufacturers need to maintain a competitive edge.



EXECUTING DESIGN AND MANUFACTURING SEPARATELY INHIBITS COMPETITIVENESS

The traditional product development process, during which designers and engineers design products and create drawings that manufacturing professionals use to produce and assemble products through separate, serial, nonintegrated processes, has become obsolete. Demands for product innovation, improved quality, and faster time to market call for increased efficiency and greater automation throughout the entire process.

Historically every element of the design-to-manufacturing process was conducted sequentially. Typically, companies also completed mechanical, electrical, and electronic design sequentially using different design tools, so it made sense to wait until all design work was complete before initiating design review, validation, and production.

In today's highly competitive environment, however, anyone involved in bringing products to market can't afford to approach design and manufacturing separately with little interaction or collaboration between design and production, except when errors or issues arise. That's because the frequency of engineering change orders (ECOs), retrofits, and rework with a nonintegrated, sequential approach to design and manufacturing is much higher, adding time and cost to a company's bottom line.

Another disadvantage of this conventional approach is its reliance on several separate data streams, including CAD for design and CAM for machining. Product geometry data is the language of design and manufacturing. Separate CAD and CAM data formats inhibit communication, stifle collaboration, and can negatively affect quality; it's as if they are speaking two different languages.

SOLIDWORKS to the Cloud

Many businesses are turning to the cloud to add the flexibility and scalability needed to quickly respond to changes in the market, while maintaining a competitive advantage. SOLIDWORKS® CAD tools allow users take of the benefits of the cloud with the addition of Cloud Services as part of the Subscription offering. Connecting SOLIDWORKS CAD to the cloud allows engineers to continue using the design programs they know and love, while ensuring that the whole team can share, iterate, compare, explore, and edit data—all in one place. They also have access to the 3DEXPERIENCE® Works product innovation portfolio that leverages the cloud-based 3DEXPERIENCE platform to give customers access to the power of industry-leading tools for design, simulation, manufacturing, data management, and marketing from Dassault Systèmes.

An integrated product development process brings better products to market faster and at lower cost through greater collaboration and automation, thereby boosting a company's competitiveness. When every function from concept through production can easily access design data from anywhere, an organization can save time, control costs, increase accuracy, improve communication, foster innovation, and enhance design for manufacturability.

This approach can also bridge the gap between design and manufacturing because the 3D design data drives and automates the entire design-to-manufacturing process concurrently and provides productivity gains that today's manufacturers need to successfully compete.

...a case in point

STARC Systems, Inc. designs and manufactures reusable temporary containment systems that confine renovation project dust, debris, and noise. Founded in 2013, the company developed its first product with SOLIDWORKS 3D CAD software. Since then, the capabilities found within SOLIDWORKS have helped STARC grow 20 to 30 percent year over year. As the company's product line grew along with its volume of product design data, it needed an affordable solution for managing its data to sustain its growth trajectory.

In 2018 the company added 3DEXPERIENCE Works solutions and connected SOLIDWORKS to the 3DEXPERIENCE platform to strengthen workflow management and revision control, which are built into the platform. Since implementing 3DEXPERIENCE Works, the company improved its data management structure and workflows, tightened its revision controls, boosted product quality overall, and accelerated its rate of product innovation to meet growing customer demand for greater customization, while doubling in size. With an annual revenue increase of 59 percent, STARC had its best-performing year in 2020.

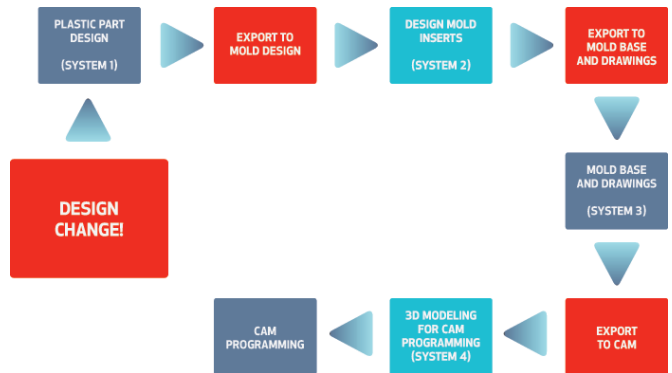
"As we get bigger, we not only need to increase product development throughput and add staff, but we also need to move towards more of a team environment—with more design iterations and greater collaboration—and less of a task-to-task approach," says Vice President of Product Development Bruce Bickford. "Working with and managing data collaboratively in the cloud via 3DEXPERIENCE Works solutions is helping us prepare to manage future growth efficiently and effectively."

Read the full story here: [STARC Systems case study](#)



LIMITATIONS OF DISCONNECTED PRODUCT DEVELOPMENT PROCESSES

Though the sequential nonintegrated approach to the product development process has worked well in the past for many manufacturers, it carries a plethora of limitations when compared with an integrated, automated approach.



The nonintegrated approach to design to manufacturing adds unnecessary time and costs related to communication barriers and iterations late in the process.

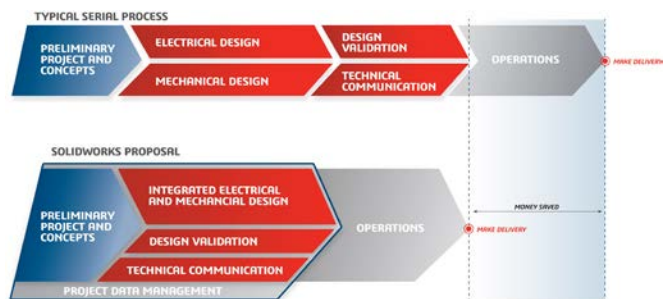
DESIGN TAKES LONGER

When organizations develop and manufacture products sequentially instead of concurrently, and separately rather than collaboratively, the process takes longer. Every function is generally performed discretely, requiring file transfers and data conversions that add time and costs to the process and can introduce errors due to poor translation from one tool to another.

Design reviews are one of the most common methods to get internal design feedback. The earlier designers can get feedback, the easier it is to incorporate it. However, getting it early can be challenging in a disconnected environment. According to a Tech-Clarity research study of 187 manufacturing companies, there are many factors associated with design reviews that consume time. Designers report the most time-consuming aspects of design reviews to be these:

- Capturing all feedback during the meeting (50%)
- Preparing design files for review (48%)
- Communicating design aspects during the meeting (44%)

What's more, disconnected tools lack real-time access to the design, and therefore do not facilitate internal or external feedback without a significant time investment from the design and engineering staff.





HANDOFF-TO-MANUFACTURING FUMBLES

When paper 2D drawings are the vehicle for the handoff to manufacturing instead of integrated 3D data, the transition is often anything but smooth. 2D drawings are difficult to read, extrapolate, and manage. Creating G-code for machining and developing tooling with nonintegrated data adds time to the process. But perhaps most importantly, gaining an understanding about whether a design can be manufactured cost-effectively at volume and at a profit using available production techniques is often done after the fact. This leads to late design changes that are much more costly to make, in terms of both costs and time to market.

INCREASED NUMBER OF ECOS, MANUFACTURING REWORK

Without the input and collaboration of manufacturing experts during initial product design, manufacturers often execute a greater number of engineering change orders (ECOs) and require more manufacturing rework, with the attendant costs and delays, than they would with an integrated design-to-manufacturing platform. Furthermore, ECOs take longer to execute when the design and machining and production data reside in different formats, and the likelihood for error increases.

RELUCTANCE TO MAKE LATE-PROCESS CHANGES

With a lack of integration between design and manufacturing data comes an organizational reluctance to make design changes late in the process because they are too expensive. Late-process design changes can be made quickly, easily, and cost-effectively in an integrated design-to-manufacturing environment, enabling manufacturers to make improvements whenever they are needed.

COMPLETING FUNCTIONS SEPARATELY COSTS MORE, LENGTHENS TIME TO MARKET

Accelerating time to market is vital to a product's success. With a connected system that propagates changes to the 3D model in real time, completing functions simultaneously is more than possible: It's fast, easy, and collaborative.

...a case in point

Migma Packtron is India's leading manufacturer of commercial vehicle dashboards and automotive interior components, and the preferred vendor of leading automotive original equipment manufacturers (OEMs) of commercial vehicle dashboards. The company recently developed more cost-effective and attractive snap-fit automotive interior components that are easier to install and remove and have no visible hardware, thus creating a more aesthetically pleasing vehicle interior.

"SOLIDWORKS has helped us speed up our development process and deliver high-quality products to customers more quickly. After we began using SOLIDWORKS, we have been able to shorten delivery times by 20 percent," says Director Nitin Raut. "Building on this success, we decided to utilize SOLIDWORKS on the cloud-based 3DEXPERIENCE platform by acquiring 3DEXPERIENCE Works solutions." By adding the affordable cloud-based data management to its SOLIDWORKS implementation, Migma Packtron cut its design cycles by 30 percent.

"The combination of SOLIDWORKS design software and the 3DEXPERIENCE platform enables our teams to plan, execute, and monitor project status in real time," Raut stresses. "By empowering team members to efficiently collaborate from anywhere, the platform enables them to easily share tasks and define deliverables, dependencies, and key milestones. Revision control minimizes errors, and because we can work in the cloud, our IT overhead, infrastructure, software maintenance, and future hardware investment costs are all reduced."

Read the full story here: [Migma Packtron case study](#)



ADVANTAGES OF CLOUD-CONNECTED CAD AS FOUNDATION FOR PRODUCT DEVELOPMENT PROCESS

With 3D CAD data at the center of the product development process, design and manufacturing organizations reap a host of productivity improvements across every related function. Making design data available across the ecosystem 24/7/365 can add a range of automation-driven benefits to help a company revitalize its product development and manufacturing operations and achieve its product, manufacturing, and business goals.

SHORTER DESIGN CYCLES AND TIME TO MARKET

With a connected design-to-manufacturing ecosystem, a manufacturer can shorten product development cycles because design changes automatically update across all downstream functions. The expansion of design data to the cloud allows all stakeholders in the product development process to view, share, annotate, discuss, and manage designs from anywhere at any time.

MANUFACTURING IS INVOLVED EARLY IN PROCESS

When design data is easily accessible, production professionals get involved earlier in the development process. Instead of waiting for the release of 2D paper drawings, manufacturing personnel can evaluate and provide the essential input on the manufacturability of a design, develop CAM programming (G-code), and create tooling far sooner in the process. Getting real-time feedback and iterating on your work is as easy as sharing a link.

FEWER ECOS, FASTER AND EASIER EXECUTION

Because product developers and production personnel engage sooner and speak the same language (relying on the same geometry data and integrated tools), they can pinpoint and rectify potential design or production problems and reduce the number of ECOs. And any ECOs can be executed quickly and easily because systems update automatically. Connecting to the cloud also provides tools to help manage data, work through formal change actions and approvals, and keep project tasks in check.

LATE-PROCESS DESIGN CHANGES ARE NO LONGER TIME- AND COST-PROHIBITIVE

Deploying a connected approach to design and manufacturing makes engineering and manufacturing departments more agile and flexible, enabling them to make changes very late in the process that may improve a product's performance, increase customer satisfaction, and lead to a product's success. Late-process design changes are fast and easy and viewed as opportunities to be innovative, leading to higher quality overall.

...a case in point

dddop B.V. takes its name from a popular Dutch drop licorice candy and 3D. The company has launched innovative advancements in 3D printing systems since it introduced its first 3D printer, the Recon, in 2012. At that time the market offered only two categories: large machines that delivered industrial results but were out of budget, and smaller affordable machines unable to deliver reliable results.

When COVID hit in early 2020, dddop was already considering adding cloud-based solutions to the [SOLIDWORKS](#) product development ecosystem to integrate its geographically dispersed development team. "We needed a solid method for collaborating remotely on product development and for launching products, both of which [3DEXPERIENCE](#) solutions provide," says dddop owner and CEO Alfred Uytdewilligen. "With these solutions, we were able to meet all of our development deadlines despite the pandemic."

Uytdewilligen continues: "The [3DEXPERIENCE](#) platform represents an entirely new way of working that has allowed us to reshape the company to support greater collaboration, innovation, and productivity." dddop now collaborates in a way that was simply not possible before.

By utilizing [SOLIDWORKS](#) and [3DEXPERIENCE](#) solutions, dddop cut its development cycle in half, streamlined production of modular configurations, completed development despite COVID-19 lockdowns, and added innovative printer capabilities and features. Using the combination of [SOLIDWORKS](#) desktop tools and [3DEXPERIENCE](#) solutions provides the company with the best of both worlds.

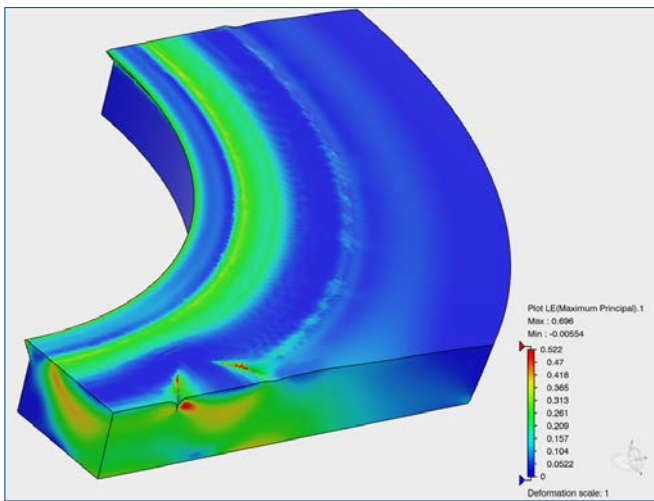
Read the full story here: [dddop 3D printer case study](#)



AUTOMATE DEVELOPMENT THROUGH PRODUCTION WITH SOLIDWORKS PREMIUM PLUS CLOUD SERVICES

SOLIDWORKS is well known for its 3D design modeling capabilities, but it also offers a wide range of integrated applications that can help a manufacturer transform and automate how it designs and manufactures products. Known as “standard” products, and included with SOLIDWORKS Premium, these capabilities provide benefits at each phase of the development and production process.

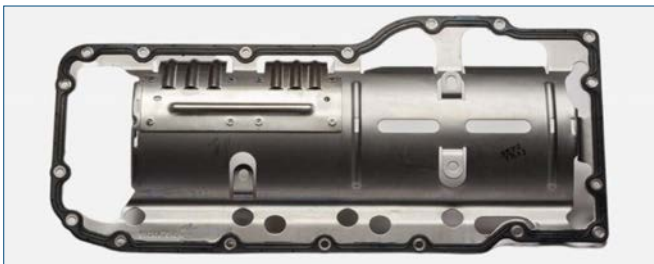
When adding Cloud Services to connect your CAD data to the 3DEXPERIENCE platform, you can accelerate the design-to-manufacturing process by enhanced 3D sharing, markup, data storage, design review, and collaboration tools ready to help you leverage the expertise of your entire business ecosystem.



At the center of an integrated solution is a shared 3D CAD model, enabling design or manufacturing changes to be effectively managed and allowed to propagate automatically to all related downstream systems.

CONCEPTS

With the robust, easy-to-use sketching capabilities of SOLIDWORKS Premium and the integrated browser-based design tools in 3DEXPERIENCE SOLIDWORKS Premium, conceptual designs are easily captured and shared with stakeholders via a simple link. Teams can also tap the 3D Interconnect capabilities included with SOLIDWORKS Premium to import or work on concepts created in other CAD design formats.



MECHANICAL DESIGN

SOLIDWORKS Premium helps transform concepts and sketches into accurately dimensioned 3D mechanical design models. The foundational 3D model data can be leveraged by a variety of downstream functions, such as these:

- Conducting linear static stress simulations
- Completing tolerance stackups with the TolAnalyst™
- Creating photorealistic renderings with SOLIDWORKS Visualize
- Estimating manufacturing costs with the Costing module
- Assessing manufacturability with DFMXpress
- Making prototypes on a 3D printer

ELECTRICAL DESIGN

Adding SOLIDWORKS Electrical 3D to a SOLIDWORKS Premium installation integrates mechanical and electrical design inside a single 3D environment. This can lead to increased collaboration between mechanical and electrical designers as well as improved efficiencies in estimating, purchasing, manufacturing preparation, and sourcing associated with a single, unified bill of materials for all mechanical and electrical components. SOLIDWORKS Premium can also help automate the routing of electrical cables, wiring, and harnesses. Does your electrical design team have a need for intelligent electrical schematics? If so, Electrical Schematic Designer helps electrical designers efficiently create schematics and control panel drawings, reports, and documentation. Electrical Schematic Designer is part of the 3DEXPERIENCE Works portfolio, which means you can safely store, find, and share your data from any browser.

SIMULATION

The ability to answer tough questions as early as possible in the design process enables an increasing number of teams to spend less time and money on physical prototyping, as well as speed time to market.

Simulation tools provide insight into real-world product performance—long before manufacture—along with design guidance that can increase product quality and efficacy. With simulation-driven design, engineers can quickly validate designs early and often to prevent downstream issues that can be expensive and delay delivery dates.

Engineers need enhanced insight to make the right design decisions with confidence, which includes better awareness into product performance to manage multiple design criteria while still meeting deadlines, cost targets, and quality requirements. SOLIDWORKS and the expanded capabilities in the 3DEXPERIENCE Works portfolio combine to provide a range of tools, from structural analysis and computational fluid dynamics to injection-molding simulation and advanced, cloud-enabled capabilities powered by Abaqus®.

...a case in point

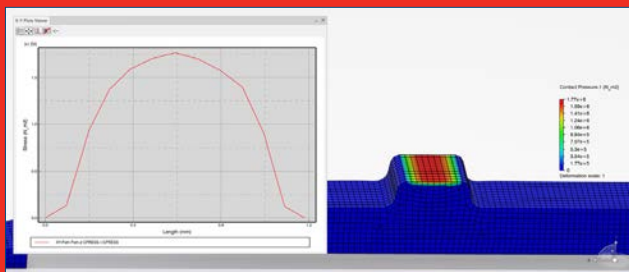
Morgan Polymer Seals (MPS) delivers 100 million custom gaskets and seals for power train, fuel, and electrical applications each year to Ford, GM, Nissan, Hyundai, and other automotive original equipment manufacturers and tier 1 supplier customers in North America, Europe, and China.

MPS has utilized the SOLIDWORKS 3D design system for many years to develop seal concepts, designs, and tooling. MPS typically outsourced finite element analysis (FEA) studies. The increasing demand related to the development and growth of the electric vehicle and hybrid vehicle markets, however, created opportunities for more business, prompting the seal manufacturer to bring complex FEA simulation studies in-house to improve efficiency and reduce costs. MPS chose 3DEXPERIENCE Works Simulation.

According to Design Engineer Thomas Morgan, "We chose 3DEXPERIENCE Works Simulation because it's cloud-based, which supports our remotely located engineering organization, works seamlessly with SOLIDWORKS design data, and incorporates the Abaqus Explicit solver, which is best suited for the types of simulation studies that we need to conduct on our parts, which can involve hyperelasticity, creep, fatigue, and contact."

MPS has cut simulation turnaround time from two weeks to one day—enabling the company to cut costs as it runs a substantially greater number of complex FEA studies, and the company can now support their remotely located engineering organization with the cloud-based 3DEXPERIENCE platform. They also seamlessly work with SOLIDWORKS design data and realized capacity for increased simulation volume due to the electric vehicle boom.

Read the full story here: [Morgan Polymer Case Study](#)



MANUFACTURING DRAWINGS

Detailing manufacturing drawings as well as updating views due to design changes can be a thing of the past with SOLIDWORKS Premium, which automatically generates accurate, fully dimensioned manufacturing drawings from the 3D CAD model. Just like other downstream functions, design changes to the model propagate to any associated

drawings, eliminating the unnecessary, time-consuming task of updating different drawing views. Instead of managing paper manufacturing drawings in a cabinet or drawer, with data connected to the cloud, you can search, explore, and select relevant design contexts from a web browser, and perform life cycle operations including revise, release, and lock/unlock.

CAM AND MANUFACTURING

With an active subscription and SOLIDWORKS Premium, robust CAM tools facilitate tooling development and machining capabilities integrate and improve the design-to-manufacturing process. For example, there are several CAM tools that are fully integrated with SOLIDWORKS to enable integrated design and manufacturing processes under one system.

With SOLIDWORKS connected to the 3DEXPERIENCE Works portfolio, you gain a complete and powerful set of manufacturing tools to tackle any challenge. For example, DELMIA CAM and robotics applications increase collaboration between designers and NC programmers by reusing engineering data without extra translation steps. This allows engineering and manufacturing to have a common language to communicate and collaborate. Factory Simulation Engineer, another manufacturing solution in the 3DEXPERIENCE Works portfolio, enables companies to create virtual models of their production facilities and simulate the reconfiguration of play layouts for optimized flow—all without moving a single piece of physical equipment.

PRODUCT DATA MANAGEMENT

SOLIDWORKS Premium comes with SOLIDWORKS PDM Professional, a full-featured product data management (PDM) solution that can meet the needs of workgroup environments in a single geographic location, as well as meet the needs of larger organizations with multiple locations.

With Cloud Services for SOLIDWORKS, product development teams benefit from real-time access to SOLIDWORKS design data from any location via a web browser. Data and life cycle management capabilities in the 3DEXPERIENCE Works portfolio ensure you and your team are always working on the most up-to-date file versions. It allows you to do these tasks:

- Leverage built-in revision and version control with no additional IT investments
- Connect with stakeholders to easily get feedback
- View, markup, manage, and share designs from anywhere, at any time, and on any device
- Create dashboards to connect people and data in one place to empower collaboration

As designs change, the single product structure updates so everyone across the organization automatically remains in sync. The 3DEXPERIENCE platform enables speedy, secure collaboration on real-time data with all team members, including partners, customers, and suppliers.

PHOTOREALISTIC RENDERING

With SOLIDWORKS Premium 3D CAD data and SOLIDWORKS Visualize Professional, users can leverage advanced rendering capabilities to create photorealistic marketing content that is print- and web-ready in minutes. From static images to animations to immersive web content, SOLIDWORKS Visualize produces photographic content that clearly depicts products in the real world.

WIN RACE TO MARKET

As a leading 3D design technology provider, SOLIDWORKS understands the importance of helping product development teams, from designers and engineers to simulation analysts and manufacturing professionals, work smarter to develop innovative products that help their companies maintain a competitive edge. That's why SOLIDWORKS 3D design solutions and expanded product development portfolio place SOLIDWORKS CAD data at its foundation.

With SOLIDWORKS Premium's integration with downstream engineering and manufacturing applications, manufacturers can take advantage of a design-to-manufacturing process solution that allows designers and engineers to bring better products to market faster. Connecting the 3D CAD data to the cloud with Cloud Services drive every function from concept through production, organizations can save time, control costs, and produce higher-quality products.

Our 3DEXPERIENCE® platform powers our brand applications, serving 12 industries, and provides a rich portfolio of industry solution experiences.

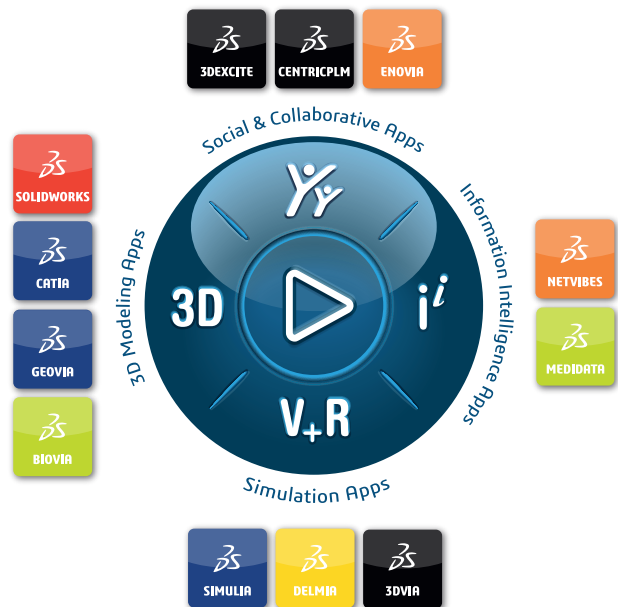
Dassault Systèmes, the 3DEXPERIENCE Company, is a catalyst for human progress. We provide business and people with collaborative virtual environments to imagine sustainable innovations. By creating virtual twin experiences of the real world with our 3DEXPERIENCE platform and applications, our customers can redefine the creation, production and life-cycle-management processes of their offer and thus have a meaningful impact to make the world more sustainable. The beauty of the Experience Economy is that it is a human-centered economy for the benefit of all – consumers, patients and citizens.

Dassault Systèmes brings value to more than 300,000 customers of all sizes, in all industries, in more than 150 countries. For more information, visit www.3ds.com.

With 3DEXPERIENCE Works solutions, you not only can share and manage your SOLIDWORKS CAD data from anywhere, but you also have access to powerful tools that can manage all facets of your product development process, while reducing infrastructure costs, IT overhead, software maintenance, and overall complexity.

Built on the same foundations that helped SOLIDWORKS customers succeed, 3DEXPERIENCE Works scales to provide access to Dassault Systèmes industry-leading tools for product development. When every stakeholder has real-time access to the right tools and information, businesses can increase collaboration, improve productivity, and accelerate innovation.

To learn more about how our connected design-to-manufacturing solutions can improve your product development processes today and into the future, [contact your local reseller](#).



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