DASSAULT SYSTEMES

SUPER CHARGE INNOVATION WITH COLLABORATIVE PRODUCT DEVELOPMENT

EXECUTIVE OVERVIEW

Transportation & Mobility manufacturers are under more pressure than ever. That is because traditional business models are no longer viable in the modern world. Products are more complex. Supply chains are more complex. Regulations are more stringent. Customers are demanding highly customized goods. Product development and delivery cycles are faster than ever before.

Many transportation & mobility companies still rely on decades-old tools and processes to manage this growing complexity. These companies struggle to keep pace due to miscommunication, slowed development cycles and overall inefficiency. Yet even in this increasingly competitive market, there is nearly unlimited opportunity for organizations that prioritize collaboration, innovation and agility.

This report discusses the challenges and opportunities facing transportation & mobility product development teams that still apply this traditional approach. It examines the struggles of key project stakeholders through the lens of effective design collaboration:

- Improved engineering capabilities – Validate up-front more innovation with concurrent engineering and traceability on the **3D**EXPERIENCE® platform. Leverage your existing CAD investments beyond traditional PLM capabilities and use 3D as the universal language across the organization

- Managing several teams and disciplines on the same product definition

- Manage dependencies between the different design teams

- Accelerate release workflows by removing silos between organizations

Replacing this file-based approach with a data-centric approach mitigates many of these problems and brings digital continuity to the development process. The **3D**EXPERIENCE platform enables teams of all kinds to collaborate more effectively. The platform provides a single development environment compatible with leading CAD applications.

Teams use the **3D**EXPERIENCE platform to create a virtual twin that continuously integrates data into the design throughout its lifecycle.

COLLABORATION CHALLENGES OF MODERN DEVELOPMENT

Product development for transportation & mobility has become increasingly complex as innovation and technologies have advanced. Once-simple products are now smart and connected. Competition has grown fiercer and companies must work harder than ever to keep up.

Companies must rely on teams to work effectively, concurrently and without friction to help get products to market quickly. Collaboration must be effortless regardless of where team members are located. That said, ineffective collaboration presents risks, especially for teams that communicate by passing files back and forth. Data is often lost or becomes outdated, increasing the chances of errors and rework. In turn, this leads to excess costs, delays and lost opportunities.

The **3D**EXPERIENCE platform offers a revolutionary way to bring data and teams together. By doing away with a file-based approach to collaboration, the platform enables anybody to work with real-time data, traceable and accessible. In short, **3D**EXPERIENCE helps industrial equipment companies overcome the many traditional challenges of working collaboratively.

This section of the report looks at some of the people mechanical engineers collaborate with during the product development process. Each case presents its own challenges:

- Other mechanical engineers must work concurrently on the same CAD files.

- Engineers from other disciplines, such as electronics and software, use incompatible software.

- Outside departments and suppliers need visibility into the project as development progresses.

- Distributed team members need constant connectivity.

This section also discusses special considerations for traceability and offers an approach for better collaboration throughout virtual product development.
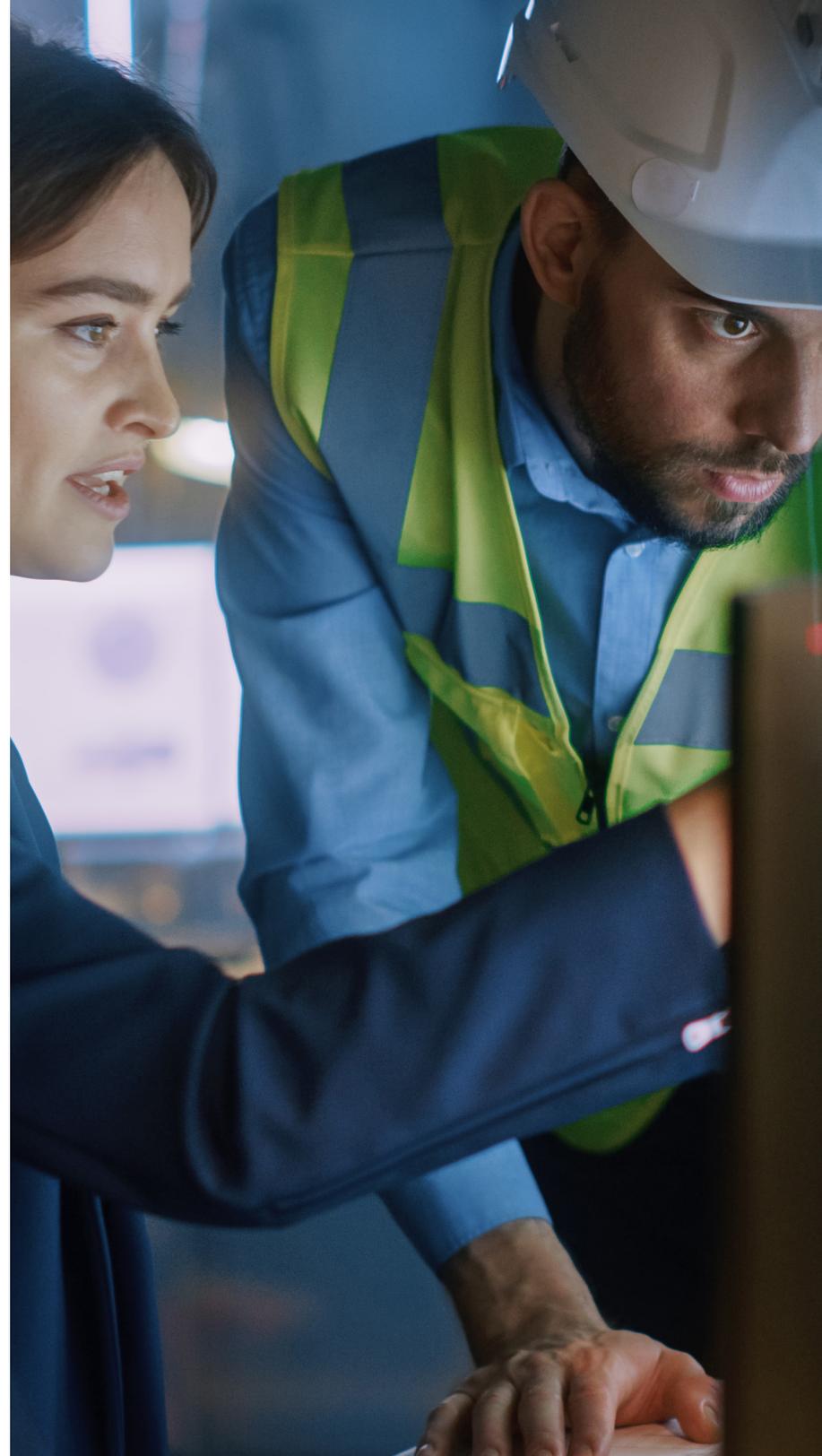
Working with Others in Mechanical Design

Engineers often work in parallel when they design mechanical assemblies. For example, let's imagine a group working on a motorcycle assembly in CATIA V5®. Team members take on different parts of the assembly. Some focus on the shock system, while others take on the tracks, and so forth. Working in parallel, they bring their respective strengths to the project and create a better assembly than if they had worked sequentially.

It is worth noting, however, that these teams traditionally take a file-based approach to collaboration. They create and organize their work in files they download, update and share as needed. Yet, as mentioned, these files can be lost or become outdated.

2D engineering drawings are especially vulnerable. Engineers typically derive these files from the most recent 3D model and mark them up with manufacturing information for other parties. Unfortunately, there is often no good way to know whether a file is up to date once it leaves the CAD system.

Product Data Management (PDM) and Product Lifecycle Management (PLM) systems have long been the solution to keep files aligned. Still, they are only reliable if busy team members are diligent about locking and unlocking their files.

Data-driven design is a better approach for engineering teams. With it, cross-functional teams (mechanical, electrical, systems, software, etc.) are all able to work on the same model. Using a cloud-based platform, these team members get the data they need in a centralized location through a browser.

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Working with Electronics and Software Engineers

Continuing with the motorcycle example from the previous section, modern transportation & mobility companies now embed sensors, printed circuit boards (PCBs), transmitters and software into the assembly. These added components allow the company to collect data, perform remote diagnostics and optimize performance. To take advantage of these capabilities, the mechanical design team must collaborate with electronics and software engineers.

These roles present unique challenges. Electronics engineers apply specialized design software, such as Cadence® Allegro®. But if electronics and software engineers can't visualize how the mechanical designs work, they might make parts that don't fit together well with the rest of the product assembly. Traditionally, these engineers were sent 3D CAD files in a neutral file format for visualization. Unfortunately, these files quickly become out of sync with the primary in-house model as it changes.

A cloud-based, data-driven platform significantly improves this situation. Electronics and software engineers access the most current design using their browsers. There are no files to pass around. They can even access and mark up 3D CAD models directly on the platform without the need for a costly CAD license. Most importantly, they always see the latest version of the design. With the context of the design readily accessible, electrical and software engineers work seamlessly alongside the mechanical engineering teams.

Working with Other Departments

Various departments must also collaborate on projects to ensure designs can be sourced, manufactured and serviced. Even non-engineering teams require access to designs so they can give useful feedback to validate requirements, optimize maintenance and more. However, collaborating with these teams using a traditional file-based approach presents challenges. Typically, these non-technical participants do not have access to CAD systems to review designs. This process requires engineers to spend time creating screenshots or difficult-to-interpret 2D drawings to fit this need. Yet since the files they provide are disconnected from the master document, the method is slow and error-prone.

Returning to the motorcycle example, say the mechanical engineering team updates the assembly by adding a purchased shock system. Procurement looks into the part and notifies the design team that the shocks are about to be discontinued. This feedback allows the design team to replace the shock without issue. If procurement never sees the updated file, this issue could go undiscovered until prototyping and manufacturing, when it costs more to resolve.

When organizations apply a cloud-based platform and data-driven design, every contributor can access the latest design and provide feedback early in development. There are no hard-to-launch and difficult-to-read design files, and reviewers are sure to always be working with the latest version of the data.
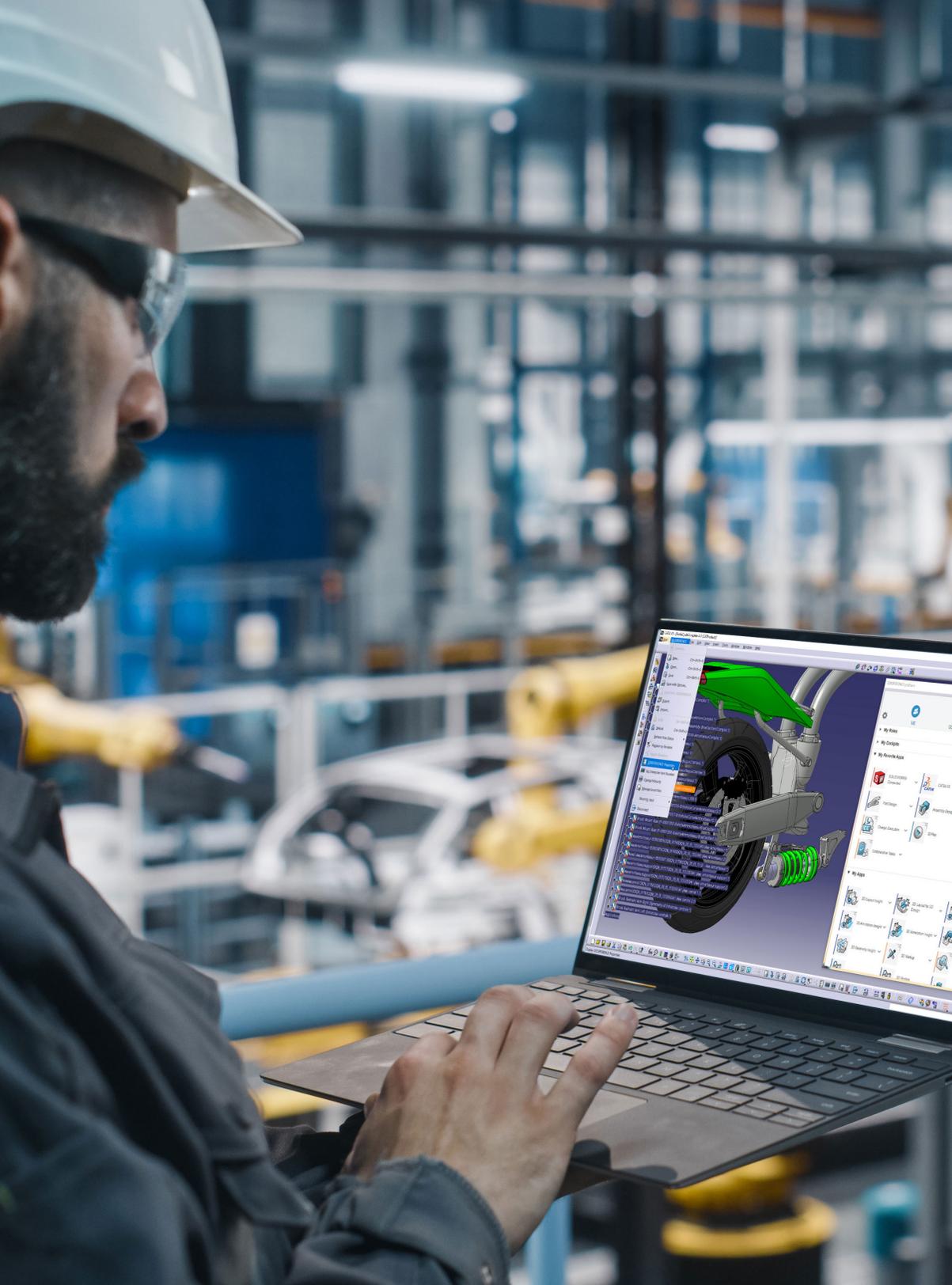
Working with Customers and Suppliers

As we've discussed, product development requires extensive collaboration. In the modern world, this requires the engagement of more contributors than ever before. Customers, suppliers and contractors are all potential stakeholders to the final design. In an ideal world, the mechanical engineers who add a pump to the transmission in the previous example would immediately incorporate supplier 3D CAD models into their larger CATIA V5 assembly.

But exchanging files is complicated. What if a designer didn't create the part in CATIA V5? Mechanical design teams sometimes work with others using another CAD system such as SOLIDWORKS® Creo®, Solid Edge® or NX® to complete their work. Importing and exporting CAD files takes time and risks the introduction of geometry and data errors. With so many intermediary files stored across various locations, tracking the most recent data version is more complicated than ever.

The **3D**EXPERIENCE platform centralizes product data. That way, teams can better track and manage design changes. External stakeholders can access the data regardless of what CAD applications other organizations use. Everyone stays aligned, in real-time.

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Keeping an Eye on Traceability

Throughout product development, companies commonly struggle to track and trace requirements, functions, logical architectures and more as the design gets more complex. Although a challenge, it remains an essential task to ensure that the system remains consistent and all requirements are implemented as intended.

Historically, companies have relied on tools like spreadsheets and documents to collect this information. Unfortunately, these files lack connectivity to other mechanical, electrical and software design inputs. This means that definitions can quickly diverge from each other, causing significant problems when testing or manufacturing the product.

The **3D**EXPERIENCE platform helps here as well. Requirements remain in one place. The platform serves as a single source of truth so definitions stay consistent. Projects also include robust traceability. If an engineer experiments with modifying a requirement, it is immediately apparent which designs are affected. If a different engineer considers changing a design, they can see which requirements are impacted. Such visibility enables powerful, informed decision-making.

Supporting the Remote Workforce Future

Since 2020 and the COVID pandemic, companies have adjusted to work from dispersed locations. The engineers and designers building the hypothetical transmission now login from anywhere. Many organizations have no plans to return to a central office. This is the new normal.

What's challenging is that remote work also strains collaboration. Engineers might find checking in or asking questions difficult when the team isn't sitting in nearby work spaces. In addition, communication with other engineering domains, departments, customers and suppliers is impaired. If a remote engineer makes changes on outdated files, it can lead to extensive delays and cost overruns.

As with the other scenarios described above, a data-driven approach with the **3D**EXPERIENCE platform resolves the challenges of remote collaboration. All product data resides on a cloud-based platform so engineers, non-engineers, customers, suppliers and others can work together using a single source of truth. Nobody transmits files back and forth. Nobody works on outdated material.

File-Based Collaboration Holds Back Product Development Teams

In an increasingly competitive landscape, collaboration by means of file sharing may no longer be the best choice for product development. Products are more complex, as are the technologies and teams needed to build them. Traditional collaboration methods lead to several shortfalls:

Part and assembly incompatibility: Teams need a way to accurately model new designs and check for compatibility across the various components and assemblies. Without alignment, companies face extensive rework, often late in the design cycle.

Application incompatibility: Team members must seamlessly combine data from diverse applications. Conflicting tools cause delays as teams work to translate files and sometimes even recreate them for the final assembly.

Multiple sources of truth: Stakeholders need access to the most up-to-date data. With files dispersed throughout the company and beyond, critical information quickly becomes lost or outdated.

Siloed teamwork: Mechanical, electrical and software engineers must collaborate seamlessly on smart, connected products—despite their use of different tools.

Too-late collaboration: For best results, design teams must collaborate early in the project. Too often, key stakeholders can't see the design progressing until late in development.

The results can negatively impact the business in several ways. Here are just a few costly scenarios:

- Prototyping and testing require multiple rounds.
- Procurement orders incorrect manufacturing components.
- The number of change orders skyrockets after design release.
- Companies competitive advantage takes a hit when go-to-market plans slip.
- Companies purchase multiple on-premises IT solutions.

Companies even risk a loss of innovation when teams struggle to collaborate effectively. And in the worst-case scenario, talent flees as engineers and others grow frustrated with the friction in development.

To stay innovative, keep costs down and remain competitive, companies can't continue to rely on a traditional file-based approach to collaboration. The good news is, they don't need to.

MODERN DEVELOPMENT AND THE 3DEXPERIENCE PLATFORM

Developed by Dassault Systèmes, a global leader in software solutions for product development and digital transformation, the **3D**EXPERIENCE platform is a comprehensive solution that integrates design and collaboration tools into a unified environment. It supports multi-CAD environments and gives all teams easy accessibility. Plus, it supports the most recent development methodologies, such as simulation and model-based engineering.

Inclusive Support for Multi-CAD/Discipline Work

With product development spread across disciplines, departments and companies, it's rare that every team member uses the same software. Different roles and departments need different tools. Unfortunately, integrating data from multiple file types can be frustrating.

The **3D**EXPERIENCE platform removes the headaches of multi-CAD work by providing a collaborative development environment compatible with leading CAD tools. Now engineers developing that hypothetical transmission in CATIA can work seamlessly with parts developed in other CAD tools such as SOLIDWORKS, Solid Edge, Creo or NX. From the **3D**EXPERIENCE platform environment, the engineer can explore the shared 3D product definition and use the integrated PLM, simulation and manufacturing capabilities as necessary. They can also access **3D**EXPERIENCE capabilities like project tasks and product changes, on the cloud, without leaving their familar CAD environment; helping to be sure they can stay productive, and connected to the latest information.

With its ability to break down silos of operation, the **3D**EXPERIENCE platform benefits teams working with multiple CAD applications in several ways:

- Design contributors all work in a familiar environment.

- Collaboration is smooth.

- The risk of errors and rework is minimized.

- Development progresses faster.
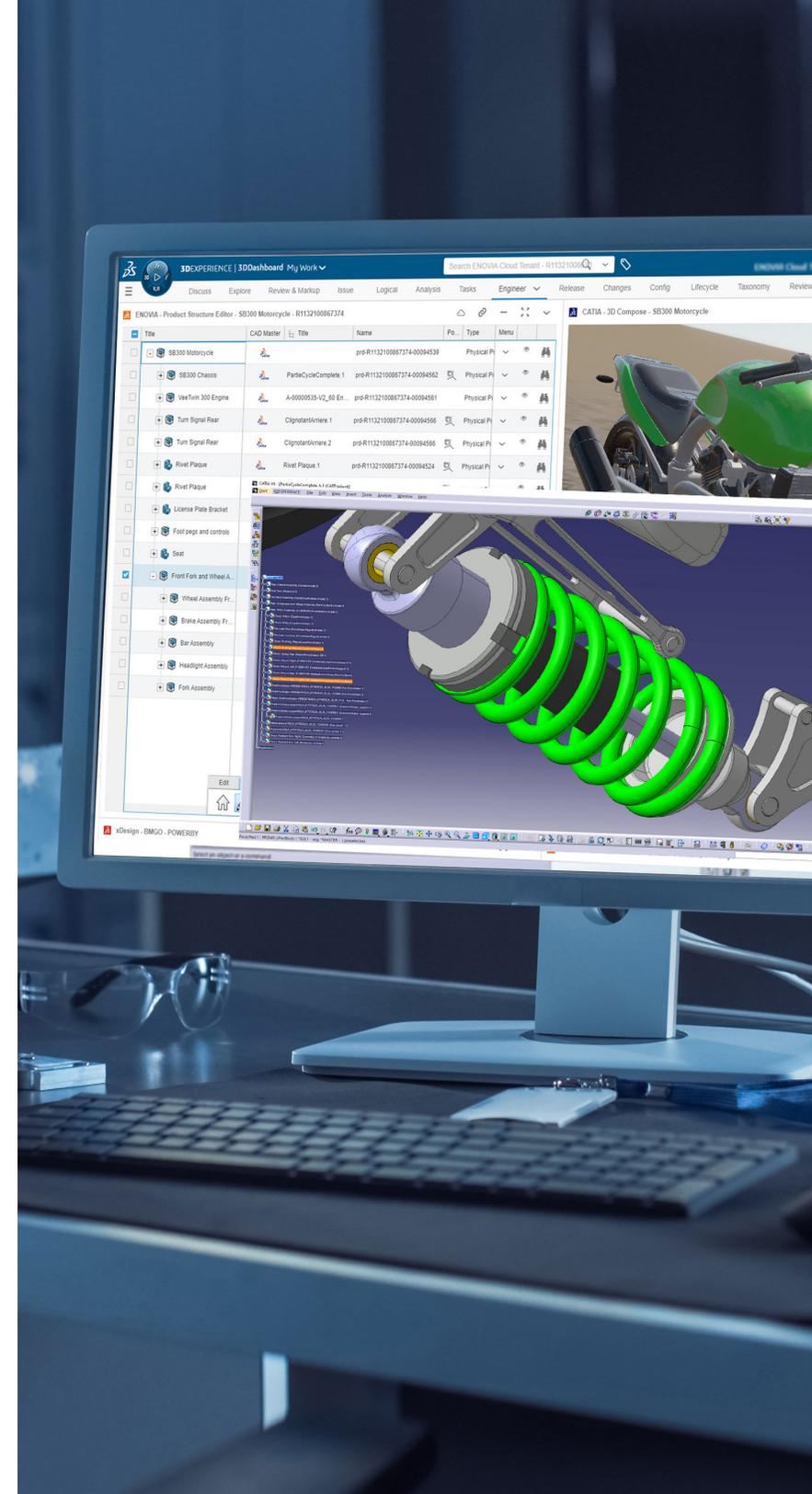
Access to Designs by Anyone from Anywhere

Timely access to up-to-date product design data resolves several issues inherent to the traditional approach. A remote mechanical designer doesn't risk wasting time using outdated files, an electronics engineer won't build incompatible components, and a manufacturer won't source the wrong equipment and materials.

With the **3D**EXPERIENCE platform, all stakeholders have access to current designs at any time and from anywhere. That means they can provide feedback on the design early in the development cycle, when changes are easier to make. Extended team members can optimize costs and catch errors effortlessly. Plus, engineers spend less time producing derivative 2D drawings, since stakeholders can conveniently explore and markup the 3D model.

The **3D**EXPERIENCE platform makes this collaboration possible partly because it's cloud-based, and stakeholders can interact with product data through a web browser. It requires no CAD expertise. Anyone can contribute.

It serves as a single source of truth, enabling collaboration between various departments, engineers and stakeholders throughout the supply chain for effective product delivery.
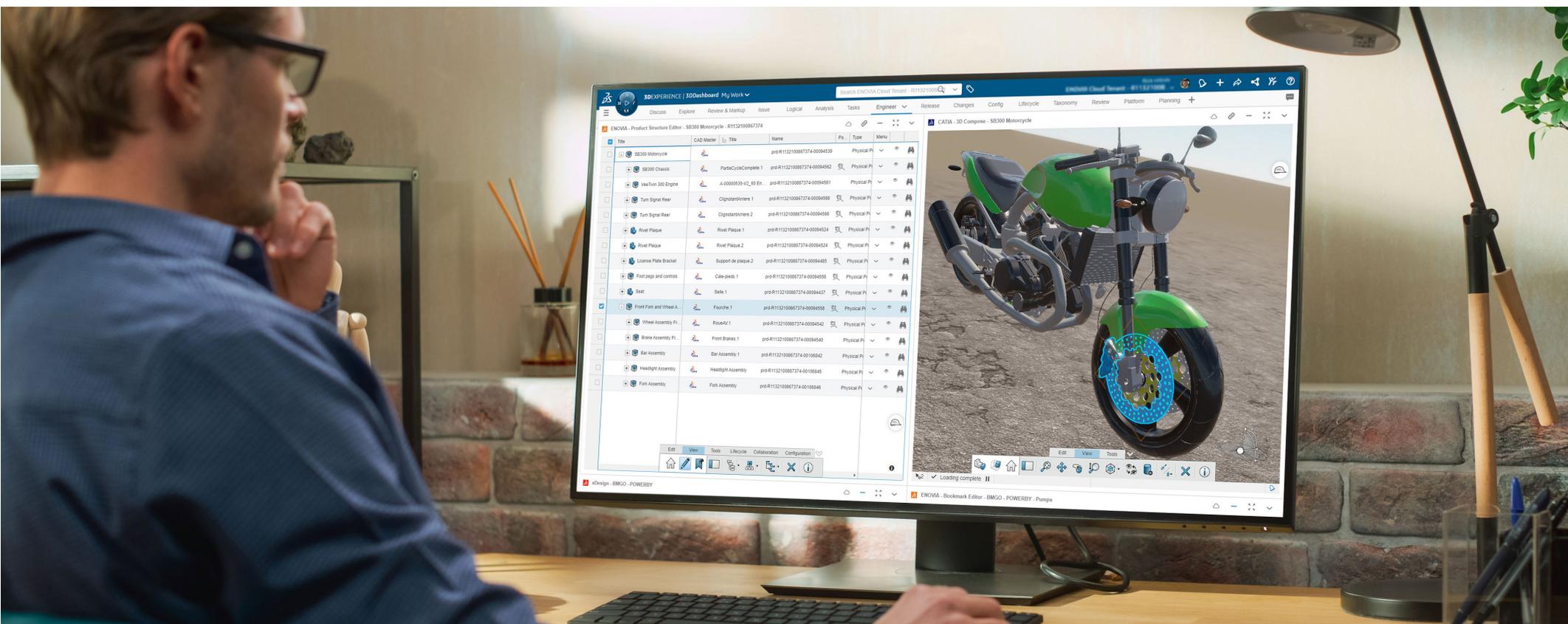
Employ Model-Based Systems Engineering

Even when team members have access to the most up-to-date multi-CAD data, other problems still hinder collaboration. This could be as simple as available 2D data being hard for non-experts to understand. Or as complex as maintaining clear traceability of changes from one model to all related models.

A model-centric approach to development quickly resolves these issues. Model-based definition (MBD) is the practice of adding product information directly to the 3D model, including geometric dimensioning and tolerancing (GD&T) information, material specifications and other design details. Traditionally, creating the 2D engineering drawings requires extra effort from engineers, yet the information is often challenging to interpret. When engineers embed data directly in the model, teams eliminate the extra work, making product details much easier to understand.

Model-based systems engineering (MBSE), which is similar to MBD, uses the model as a central artifact throughout the product lifecycle, but with a more comprehensive approach. The MBSE model represents requirements, functions and logical architectures. MBSE ensures that changes made to one model appear in related models. Then, developers can trace requirements to specific design decisions and implementation details.

MBSE helps create a virtual twin of a product. A virtual twin represents an object or system throughout its entire lifecycle. It continuously integrates data from sensors, Internet of Things devices, simulation software and more.

Using MBSE with the **3D**EXPERIENCE platform leads to several advantages:

- **Awareness:** Design structures are fully visible throughout the product lifecycle.

- **Reliability:** Product data is always up to date.

- **Scalability:** Models are expandable with full configuration support.

- **Agility:** Engineers are more nimble and can innovate quickly.

- **Cost-effectiveness:** Cross-functional teams are more efficient and legacy investments in design tools are preserved.
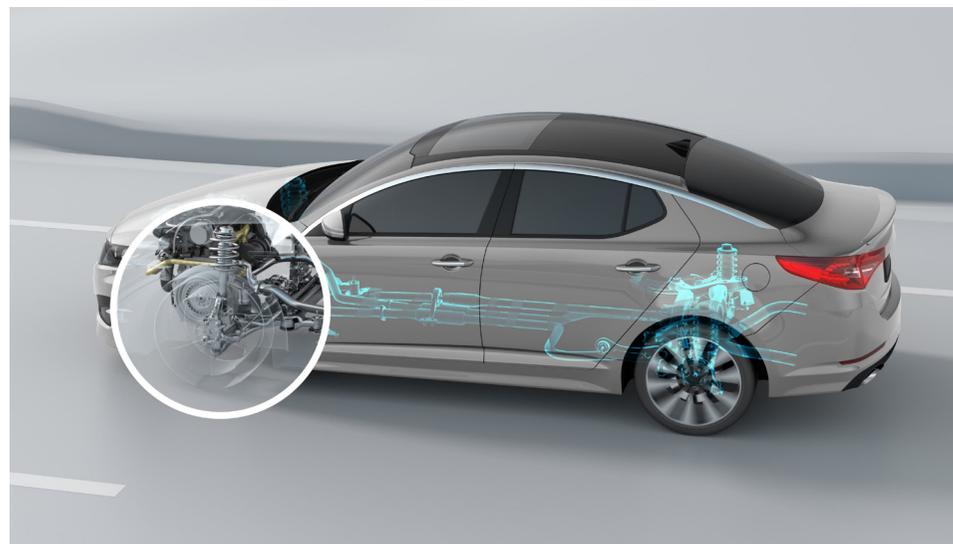
CONCLUSIONS

Design Engineers, Product Engineers, Manufacturing Engineers and other professionals each bring unique perspectives to product development. Working together, they can find and address issues more efficiently and create higher quality, more competitive products.

The 3DEXPERIENCE platform reduces friction in collaboration by centralizing data on the cloud, where team members can universally access it and provide input. Furthermore, it enables a virtual twin representation of products so teams can combine virtual- and real-world data to deliver innovation continuously. These benefits ensure that teams make the right design decisions, development costs stay within budget, and products reach the market on schedule.

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As EVUM Motors works fast to establish itself in the highly competitive EV industry and scales up production, it needed a technology platform to support its growing operations and accelerate its time to market. The team – many of which were involved in the initial project at TU Munich – were already familiar with the design application CATIA as they had used it at university, so it was a natural decision to opt for the **3D**EXPERIENCE® platform on cloud.

"CATIA seems to be the easiest and most effective design solution," Šoltés said. "It was one of the main tools taught at university, so we already had the advantage that we knew how to use the tool and we wanted to extend that functionality with the **3D**EXPERIENCE platform."

A cloud implementation was an ideal fit for EVUM Motors' business needs on many levels. Not only does the **3D**EXPERIENCE platform on cloud give it the agility and flexibility to scale up and down its computing resources in line with its business needs, it also is a future-proof solution that can adapt and grow with the business as it enters new markets and delivers on its philosophy "Engineered in Germany – reinvented everywhere."

> "There is a short window of time for entry into electromobility, which is receiving large and strong funding from the state. You have to be quick with a reliable, full developed product on the market. The **3D**EXPERIENCE platform on cloud helps us to quickly exchange the data and information required for accelerated development.

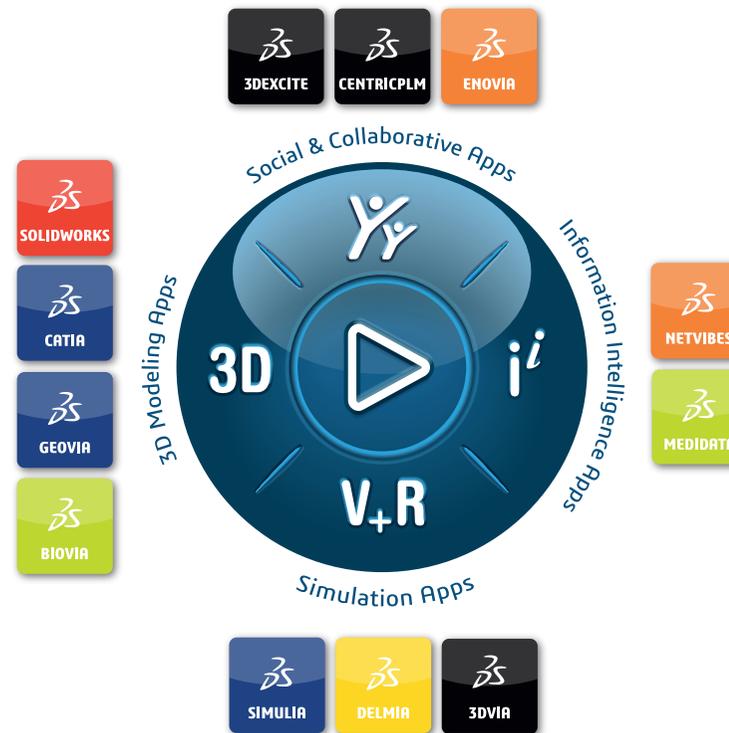**Martin Šoltés, Co-Founder and Managing Director, EVUM Motors**

EVUM MOTORS

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To get more information about how you can improve engineering and manufacturing collaboration.

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

Dassault Systèmes, the **3D**EXPERIENCE 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 **3D**EXPERIENCE 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**.

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