



EXPERIENCE YOUR DESIGN

The What, Why and How of MODSIM for Developing
Better Products, Faster

INTRODUCTION

LEADERSHIP INSIGHT ON THE VALUE OF INTEGRATED MODELING AND SIMULATION

As manufacturers strive for efficiency throughout a product's lifecycle, a sweet spot can be found in its earliest development stages. Given the profound increase in the level of product complexity and the rapid rate at which it is accelerating, companies see digital transformation initiatives as that sweet spot.

*"A host of connected technologies is advancing rapidly, including more reliable and powerful networks, simulation, high performance computing, artificial intelligence, cognitive intelligence and augmented reality, among others. Taken together, these technologies can change manufacturing in profound ways,"*¹ observed digital transformation experts at Deloitte Consulting. Shane Eddy, Senior Vice President for operations at Pratt & Whitney, offered this widely-shared perspective: *"Digital is [enabling] us to create a step change in productivity, much like how the Geared Turbofan architecture has delivered a step change in performance for our commercial customers."*

Digital continuity, a critical component of digital transformation, offers significant advantages. By optimizing products in early development phases, analysis and validation-related costs occur up front, where costs tend to be far less. And this is the reason. Integrated modeling and simulation – also called MODSIM – allows designers and analysts to improve the design of new products well before physical prototyping begins.

Design and analytical engineers typically work in siloed teams using specialized solutions for simulation analysis. Designers share models and related files back and forth with analysts to validate a design. This disconnected approach hinders real-time collaboration. However, companies can eliminate this competitive disadvantage using MODSIM to improve productivity, accelerate innovation and improve product quality.

AUTHOR

Tony Velocci is former Editor-in-Chief of Aviation Week & Space Technology (AW&ST) magazine and Editorial Director, Aviation Week Group. At the end of 2012, he retired from The McGraw-Hill Companies, Aviation Week's parent company, and remains deeply engaged in the aerospace industry.



At Aviation Week, he received the distinguished McGraw-Hill Corporate Achievement Award for Editorial Excellence, and was named the Royal Aeronautical Society's Aerospace Journalist of the Year award in multiple categories (2006 and 2002).

Velocci led Aviation Week's coverage of the aerospace industry's massive consolidation, its rapid globalization, and the struggles of suppliers. In 1994, he developed Aviation Week's Top-Performing Companies study, a benchmarking tool used to measure operating performance. He also led or co-chaired various international forums on innovation and competitiveness, cross-border collaboration, and co-chaired annual aerospace executive summits on critical challenges facing the industry.



WHAT IS MODSIM?

Traditional Computer-aided Design (CAD) technology is used to model products and systems, while Finite Element Analysis (FEA) and other simulation tools evolved separately and are employed sequentially as discrete tasks to then validate the design. MODSIM, which is made possible using a common platform, represents a revolutionary approach to modeling and simulation bringing Dassault Systèmes CATIA® and SIMULIA® technologies together in a common environment with a single data model.

Seamless collaboration, one of the most distinguishing features of MODSIM, allows designers and analysts to work together. It ***eliminates*** laborious, time-consuming file sharing that routinely produces incomplete information and version control differences that can render a design suboptimal. Using MODSIM, geographically dispersed R&D teams and team members representing disparate functional responsibilities collaborate easily and quickly.

In Figure 1, the orange line shows the overall cost across the full lifecycle of a product using the traditional approach of modeling is followed by simulation. The dark blue line shows the overall cost is lower because it occurs earlier in product development using integrated modeling and simulation. This is a MODSIM advantage.

As designers and analysts refine a product’s final configuration, employing MODSIM provides all stakeholders with access to the same 3D modeling data and all associated files, with all users subject to the same automated rules. Working in this integrated collaborative environment, teams spend less time on repetitive, routine tasks and more time thinking “*out of the box*” to explore the art of the possible.

By performing analysis early, product designs are optimized and completed in much less time compared to the traditional siloed approach. This leap in productivity offers significant efficiency gains in near- and long-term product development costs.

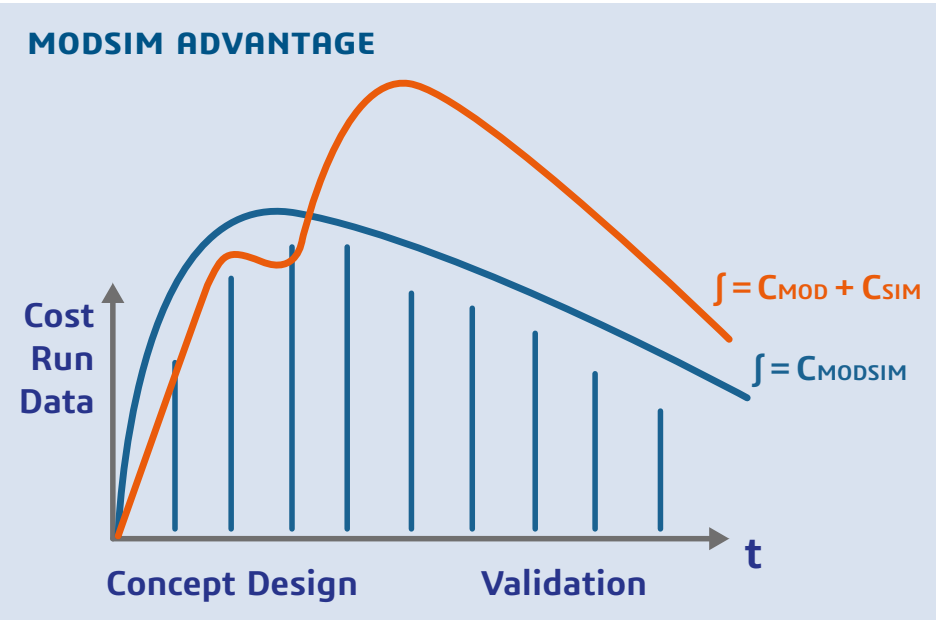
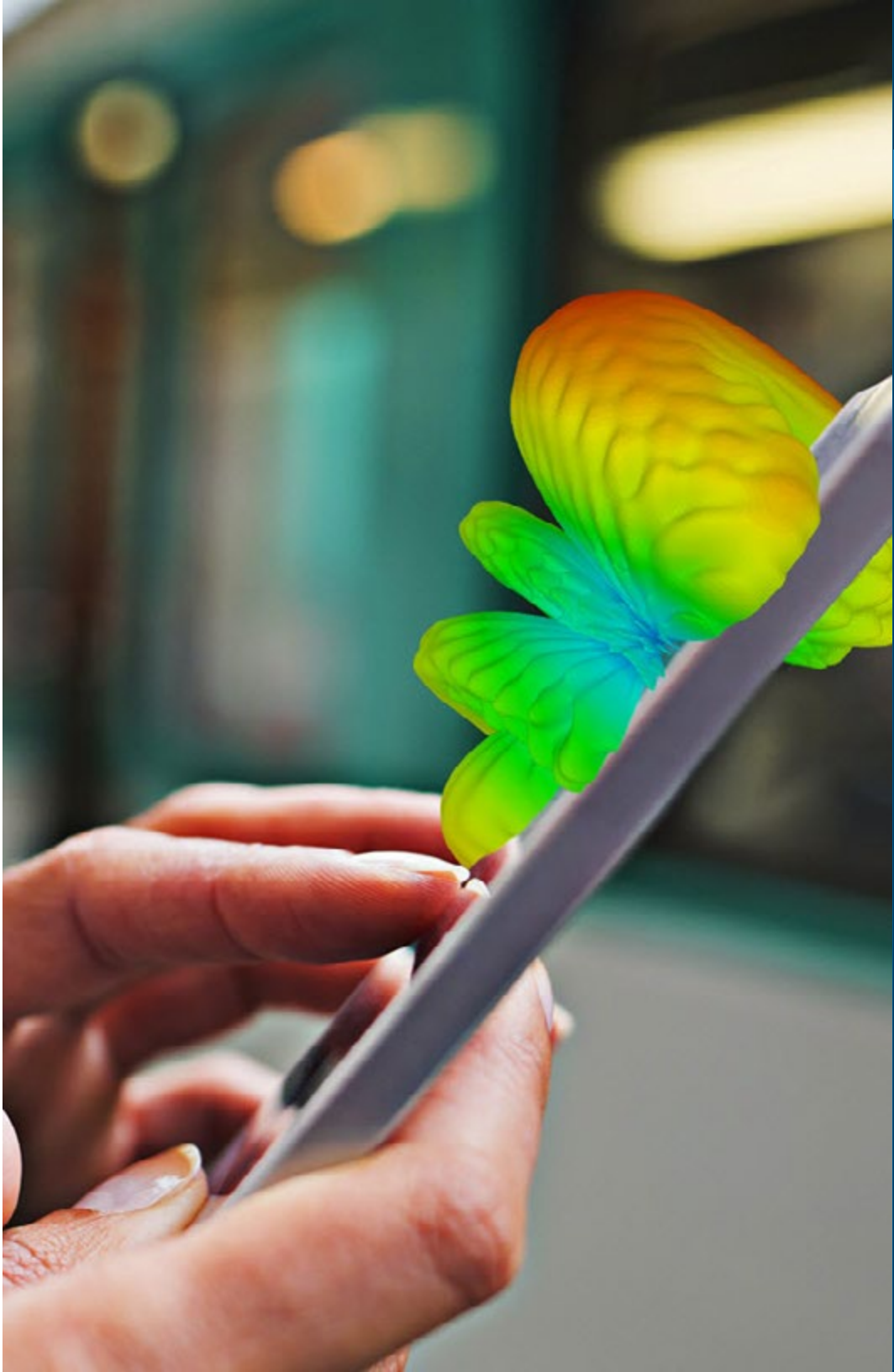
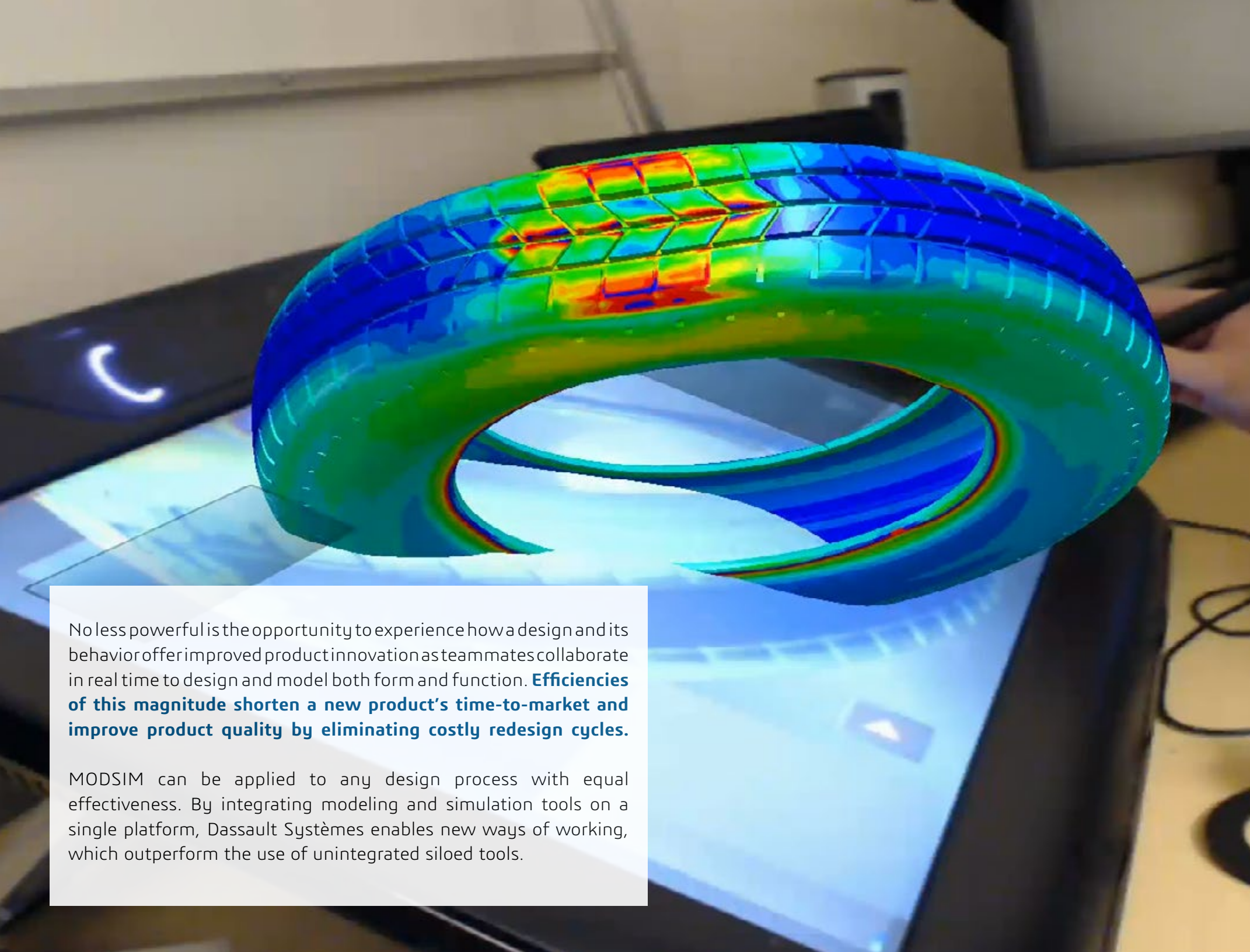


Figure 1: Costs of modeling and simulation using the traditional approach vs MODSIM





No less powerful is the opportunity to experience how a design and its behavior offer improved product innovation as teammates collaborate in real time to design and model both form and function. **Efficiencies of this magnitude shorten a new product's time-to-market and improve product quality by eliminating costly redesign cycles.**

MODSIM can be applied to any design process with equal effectiveness. By integrating modeling and simulation tools on a single platform, Dassault Systèmes enables new ways of working, which outperform the use of unintegrated siloed tools.

WHY MODSIM?

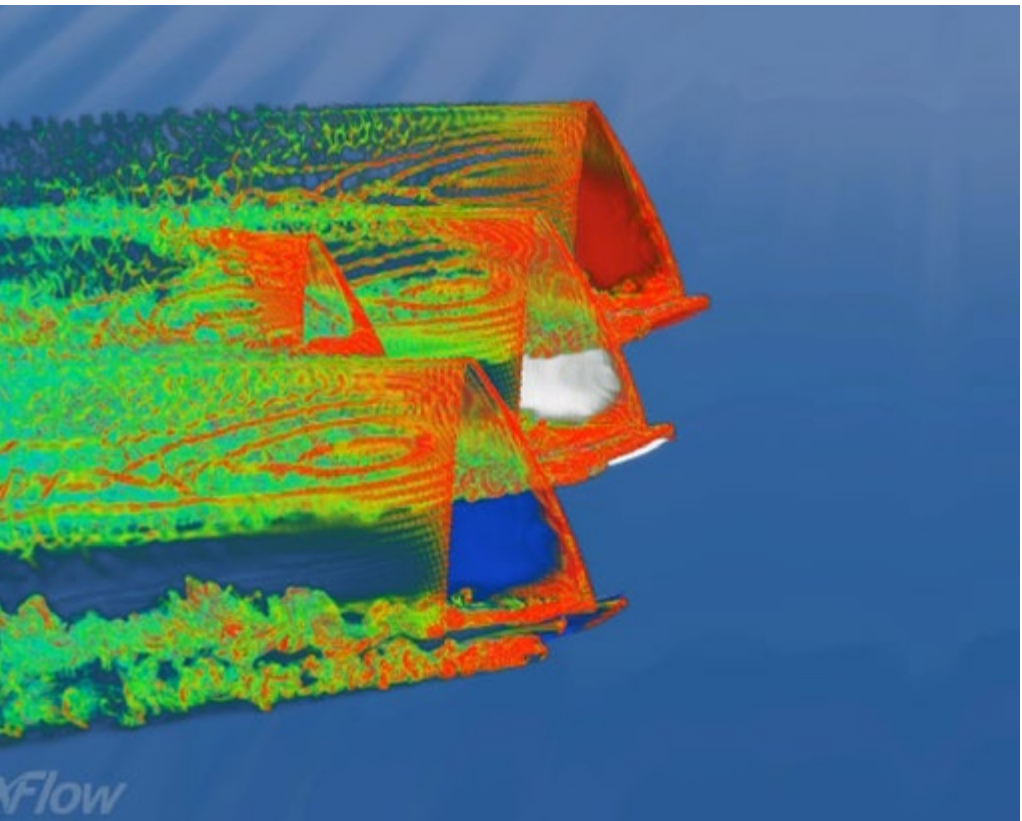
DESIGNING FOR VICTORY

In the high-technology sport of Olympic sailboat racing, competitors are always on the lookout for opportunities to optimize critical components. For masts, carbon fiber is the material of choice due to its light weight and stiffness, which can significantly improve the performance of the rig. For the vessel to operate at its best, both the sail and the mast must respond together when the boat is cutting through waves.

In 2017, Dassault Systèmes and a team of sailing experts launched a two-year project to build a composite mast for a Finn-class racing vessel that would meet aggressive performance criteria. The team used MODSIM for its design definition and structural simulation. With numerous parameters the biggest

challenge was how to prioritize which to optimize. *“Finn Mast team members observed firsthand how the integration of modeling and simulation on the 3DEXPERIENCE® platform opened a new approach to developing a solution efficiently,”* according to Pierre Yves Mechin, Composites R&D Development Manager at Dassault Systèmes. Earlier attempts using siloed modeling and simulation software had fallen short.

The team concluded that the configuration of the material itself was the most crucial variable to mast stiffness. Five masts were constructed and a final mast will be delivered in the fall of 2020 in preparation for Olympic competition in 2021, with the promise of massive efficiency in choppy waters, Mechin said.



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— Pierre Yves Mechin, Composites R&D Development Manager,
Dassault Systèmes

IMPROVING THE TRAVEL EXPERIENCE

Standard & Poor's market analysts predict air travel will drop to 60 to 70 percent in 2020 year over year due to the global pandemic travel restrictions as airlines seek to restore public confidence.

Some airline carriers and airports looked to Dassault Systèmes for help. By simulating air circulation patterns inside certain jetliners, companies learned how to minimize the dispersal of contaminants, based on passenger cabin layouts. Original Equipment Manufacturers (OEMs) also used simulation analysis to improve safety by understanding the behavior of aircraft systems. Applying MODSIM can help OEMs improve the design of their cabin environment by allowing teams to experience the design to improve many factors including comfort, hygiene and safety.

Integrated modeling and simulation on the **3DEXPERIENCE** platform offer airlines, equipment suppliers and airports the tools to innovate. *"Out of the box"* thinking is possible when simulation is part of design whether it is optimizing cabin configurations or airport terminal procedures. More people may be drawn back to flying if offered enhanced safety at every step of their passenger experience.

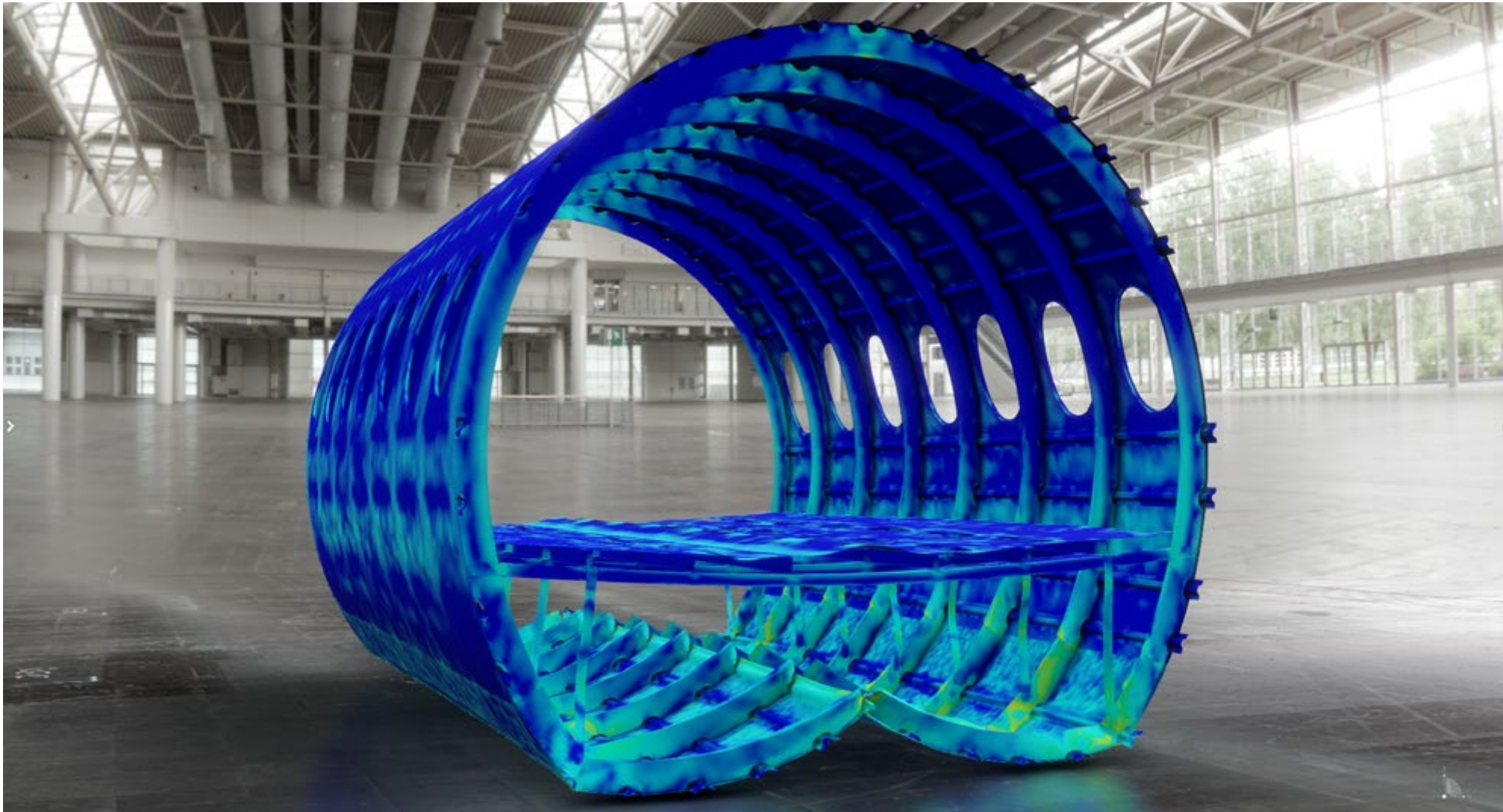


HOW MODSIM HAPPENS

One respected supplier of high-tech electronics systems has embraced the concept of the digital thread and have begun to look at how its designers and analysts engage in modeling and simulation. Today teams collaborate by handing data files back and forth. They work as if they are walled off from one another.

“The current method we’re using to perform modeling and simulation is extremely inefficient,” according to one of the company’s design engineers who wished to share his firsthand experiences. Team members sometimes must travel to other locations just to “get on the same page” he said.





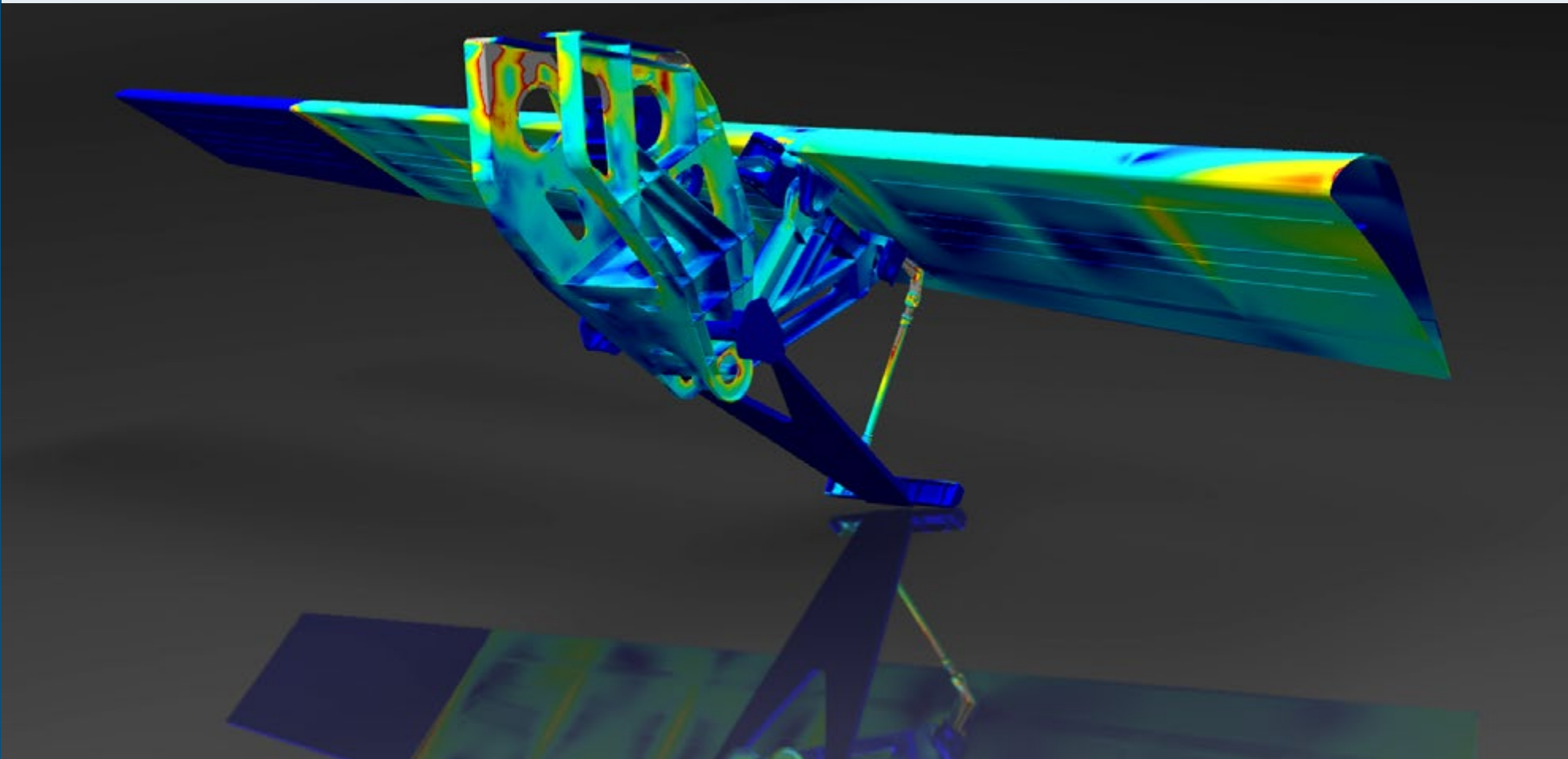
A structural analysis engineer who holds a fellowship at the same organization observed: *"In the absence of an integrated modeling and simulation tool, we're forced to develop workarounds, which are very time consuming."* Designers and analysts are continuing to perform their modeling and simulation duties, of course, but it takes a lot longer, added the structural analyst.

He estimates the time could be cut in half when designing and validating the configuration of many components. As a result, quality improves and innovation thrives since team members have access to a product's current progress at any time. *"An integrated modeling and simulation tool would quickly identify whether we're on track to deliver a product that the customer expects. If changes are required in the design, they could be made in the moment – not hours, days or weeks later."*

MODSIM offers the means to improve collaboration and increase efficiency in the early stages of product development. *“There’s no need to wait,”* the structural analyst asserted. *“This is the future of engineering.”*

Lockheed Martin’s Advanced Development Programs (ADP) – more popularly known as Skunk Works – is one of the world’s most successful R&D enterprises, where small empowered teams have been creating powerful solutions to some of the most technologically demanding problems imaginable.

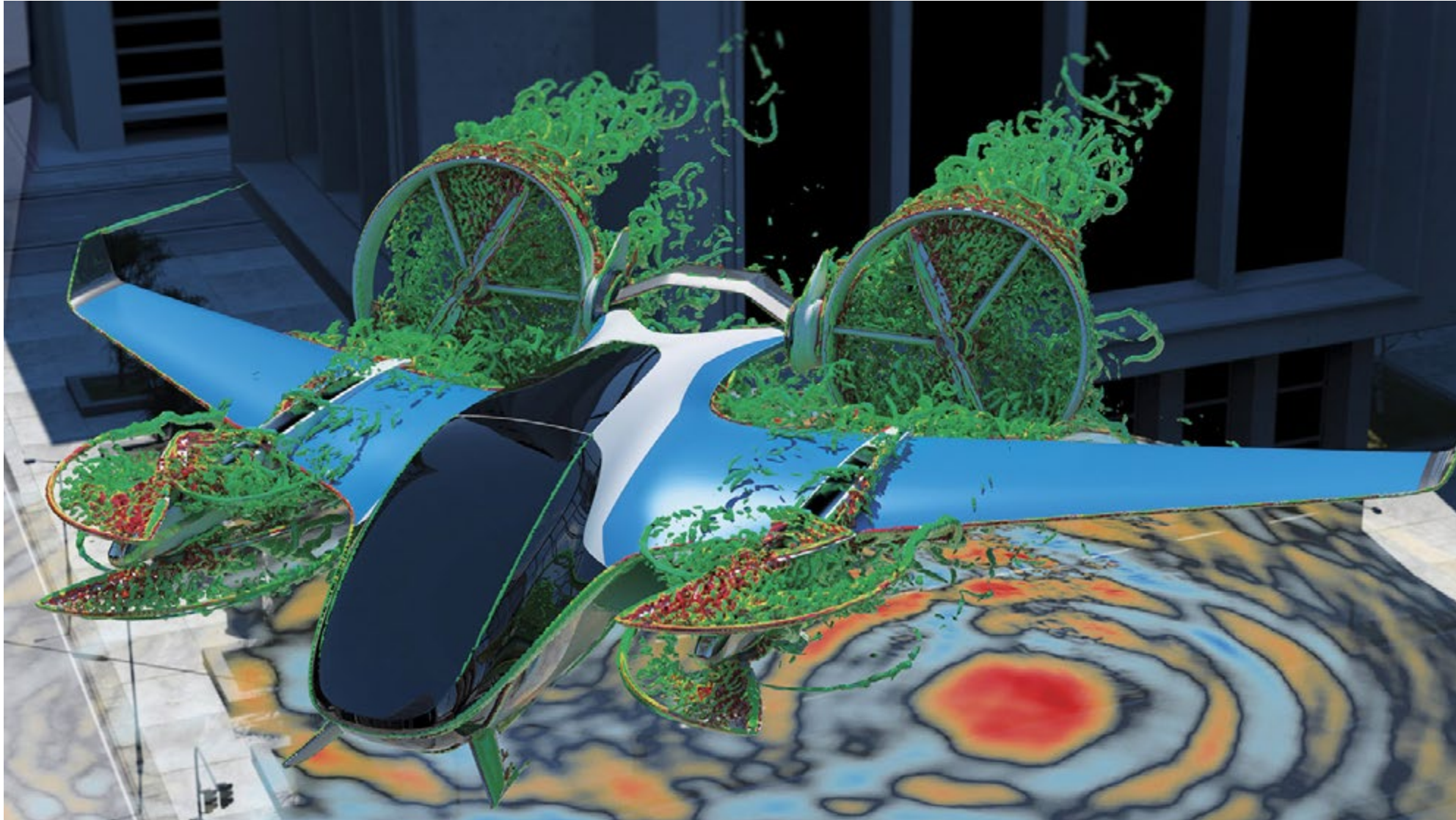
The organization employs the Dassault Systèmes **3DEXPERIENCE** platform to deliver, on schedule, the quality of products that customers expect, according to Renee Pasman, Director of Integrated Systems. *“Since starting our digital-thread initiative, we have learned that by giving our workforce the latest tools, we’ve been able to strengthen our collaboration among ourselves and our suppliers, bring data in sooner, make better decisions, and see the impact of those decisions and use that to guide us,”* Pasman said.



More recently, Skunk Works has started focusing on combining its product design activity with its Model-Based Systems Engineering (MBSE) infrastructure to better understand how changes in requirements impact design and vice versa.

"We've had simulation capabilities for a very long time, but by having those capabilities on the [3DEXPERIENCE] platform we can

pull [simulation] very far forward into the product lifecycle and use virtual builds to learn what we're going to do before we start doing it – to a level we couldn't achieve before," Pasman said. It also has enabled engineers to influence a product's design on the fly – again with an unprecedented level of certainty. *"We've been able to increase efficiency and create a more affordable solution."*



MODSIM IN PERSPECTIVE

MODSIM is a natural outgrowth of the digital continuity of the **3DEXPERIENCE** platform. The ability to make changes efficiently, the opportunity to update a design quickly and the capacity to trace the history of decision-making are all benefits of working on the platform. These values directly address issues caused by working in silos including questionable data integrity, use of outdated information and unintegrated tools that impede innovation.

All manufacturers will eventually embrace MODSIM or a comparable approach including the home and lifestyle and life science industries. No matter what your industry, achieving the productivity gains and improving quality supports the move toward integrated modeling and simulation. *“MODSIM represents the future of engineering, because it will become pervasive across industry,”* said Byron Pipes, Executive Director of the Indiana Manufacturing Institute at Purdue University. *“This is transformational.”*

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¹ Industry 4.0 and manufacturing ecosystems: https://www2.deloitte.com/content/dam/insights/us/articles/manufacturing-ecosystems-exploring-world-connected-enterprises/DUP_2898_Industry4.0ManufacturingEcosystems.pdf



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