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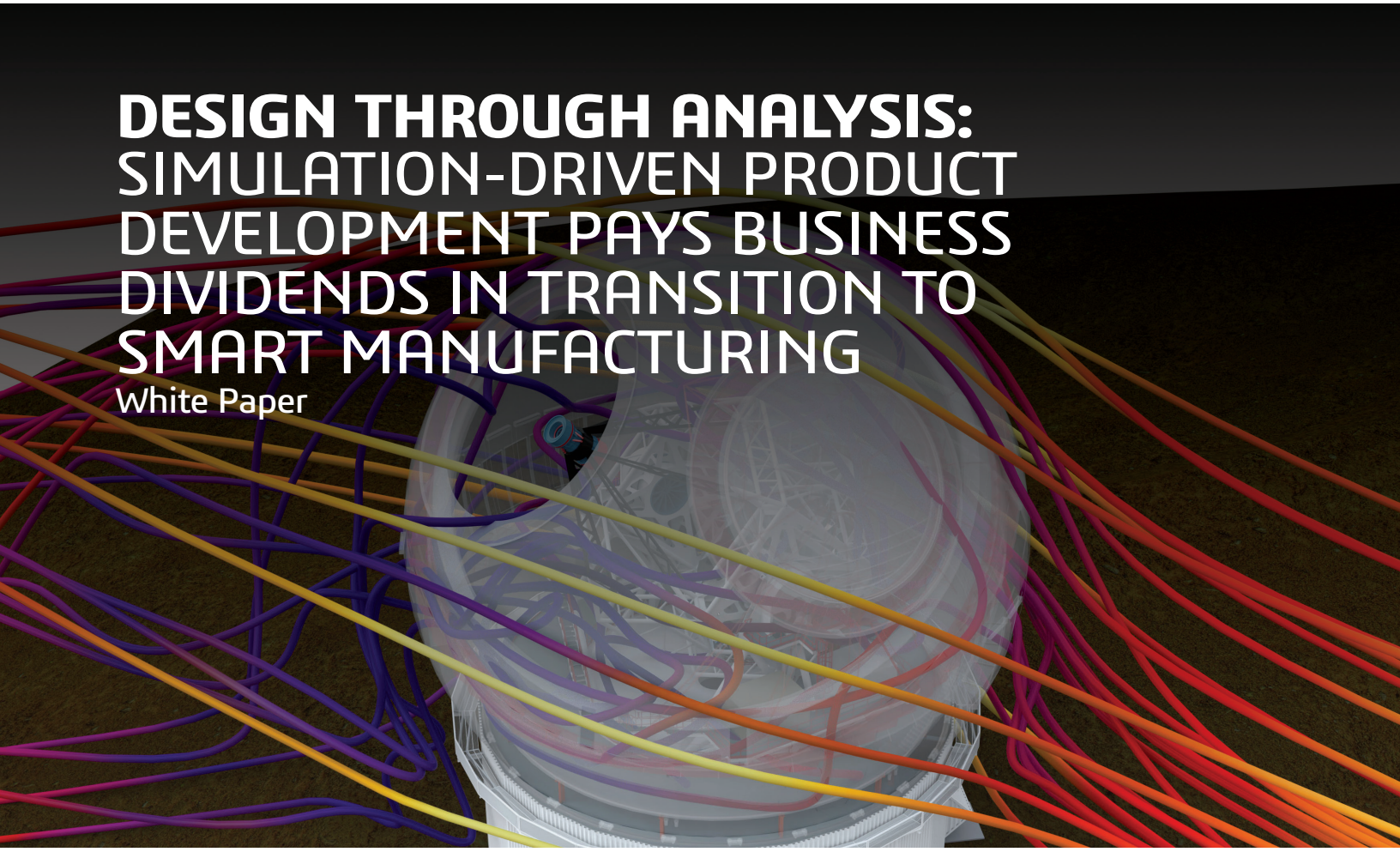
DESIGN THROUGH ANALYSIS: SIMULATION-DRIVEN PRODUCT DEVELOPMENT PAYS BUSINESS DIVIDENDS IN TRANSITION TO SMART MANUFACTURING

White Paper



OVERVIEW

Manufacturing companies in today's competitive global business climate face a seemingly insurmountable dichotomy: the need to develop, produce, and launch more innovative products of increasing complexity in less time and at lower cost while maintaining consistently high levels of quality. This challenge is driving the businesses towards an automated product development and smart manufacturing process, because traditional product development and manufacturing approaches are inadequate for handling increasingly complex products in less time and at lower cost without making trade-offs that negatively impact quality. Best-in-class manufacturers are embracing higher levels of innovation, automation, data exchange, and throughput in transitioning to smart manufacturing by leveraging integrated virtual prototyping and simulation technologies. Instead of engaging in repeated rounds of physical testing, manufacturers are leveraging simulation-driven product development because it provides a host of business benefits as part of the transition to smart manufacturing. What manufacturers need to secure these advantages and meet emerging business challenges are integrated, easy-to-use, and automated design simulation and analysis tools—tailored to meet the needs of specific functions—such as those developed by Dassault Systèmes SOLIDWORKS Corp.

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SMART MANUFACTURING DRIVES 21ST CENTURY PRODUCT DEVELOPMENT

Product development and manufacturing methods have always been dynamic, evolving from the use of water and steam-powered industrialization more than a century ago to the heavy reliance on computer-driven technologies today. The current trend—often referred to as "Smart Manufacturing," the "Smart Factory," or "the 4th Industrial Revolution"—goes beyond the use of computer technology to complete separate functions more efficiently and involves greater levels of automation, integration, collaboration, and data-sharing among design, engineering, and manufacturing technologies and personnel—as well as other related functions—so that products are developed, validated, and produced concurrently instead of sequentially.

In the traditional design-to-manufacturing process, designers design products and create 3D CAD models and/or 2D drawings; engineers and analysts use those models and/or drawings to validate product performance and manufacturability through hand calculations, prototyping, physical testing, and/or virtual analysis; and manufacturing professionals use these modified, validated models and/or drawings to produce and assemble products through separate, serial, non-integrated processes. While this approach has succeeded in the past, growing market demands for product innovation, safety, reliability, smart features, improved quality, ergonomics, and aesthetics are gradually making the traditional, sequential approach to product development and manufacturing obsolete. To differentiate their products, manufacturers need to imbue increasingly complex products, such as those based on the internet of things (IoT), with all of these characteristics, which is directly at odds with the shorter development cycles, reduced development costs, higher product quality, and faster times to market that manufacturers need to remain competitive.

As product complexity increases, so does the likelihood that performance and manufacturing issues will blow schedules and budgets because problems of integration and performance are frequently not discovered until late in a sequential development process. The need to develop more complex products more quickly and cost effectively without hurting quality requires the use of virtual prototyping and simulation tools, which are customized to meet the needs of designers, engineers, and analysts in an integrated, collaborative, and concurrent approach. By deploying simulation tools at key junctures during development, greater design insight is achieved earlier in the product development process.

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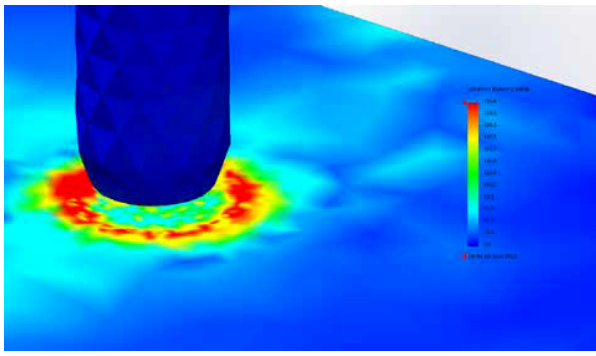


This is the driving force behind the transition to simulation-driven product development and smart manufacturing: validating more complex products earlier to avoid surprises, delays, and cost overruns; leveraging validated product designs earlier to support related concurrent functions, including visualization, testing, cost estimating, manufacturing planning, data management, quality control, documentation, packaging development, and marketing; and minimizing the volume of engineering change orders (ECOs), returns, field failures, and warranty claims.

In its 2017 study entitled "Virtual Prototyping vs. Traditional Product Development," the Aberdeen Group found that best-in-class manufacturing companies that leverage virtual prototyping technologies to support simulation-driven product development are outperforming their competititors in meeting product quality, launch, revenue, and cost targets while simultaneously reducing physical prototyping, and its attendant time and cost, by an average of 10 percent.

This paper explores the business challenges facing today's manufacturing companies and how integrated SOLIDWORKS® Simulation, SOLIDWORKS Simulation Professional, SOLIDWORKS Simulation Premium, and SIMULIA® Structural Simulation Engineer (SSE) virtual prototyping software solutions can help manufacturers transition to a concurrent, smart approach to product development and manufacturing.

MANUFACTURING BUSINESSES FACE A HOST OF NEW CHALLENGES

The maturation of computer-aided design, engineering, and manufacturing software technologies has become the great equalizer when it comes to product development and manufacturing. Anyone with a good idea can challenge the market status quo. Startups and new companies emerge from obscurity on a regular basis, introducing innovative products and new technologies that can completely disrupt or substantially cut into an existing manufacturer's business. The potential productivity gains of these technologies level the playing field between new and existing manufacturers, and create a host of new challenges for continued manufacturing business success.

Developing Innovative, Complex Products Faster

Today's competitive landscape compels manufacturers need to develop innovative, more complex products faster than ever in order to beat the competition to market. However, developing more complex products creates the need for more design iterations and rounds of physical prototyping to fully understand design behavior and validate product performance, both of which add time and cost when executed as part of a traditional, sequential product development and manufacturing approach.

Completing More Design Iterations while Minimizing Prototyping

Developing more sophisticated, complex products without completing more design and prototyping iterations raises the chances of discovering design performance and/or quality issues late in development or during production. Late-cycle issues can extend design and production cycles in unanticipated ways, blowing through schedules and budgets. The dichotomy here is that manufacturers need to conduct more design and physical prototyping iterations on complex products to eliminate the possibility of late-cycle problems but simply don't have the time to do them using a traditional approach and still shorten time to market.

Leveraging New Materials and Manufacturing Technologies

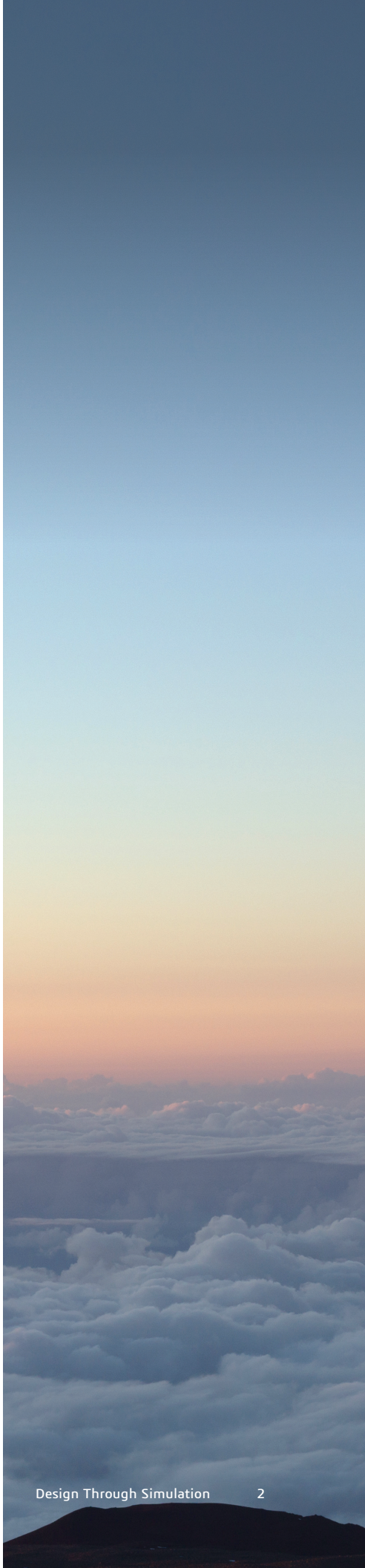
Many of today's innovative products are made from newly engineered materials or made using new manufacturing technologies, such as additive manufacturing. While many manufacturers are interested in leveraging new materials and production processes to create innovative products, doing so again increases design and prototyping iterations, which are obviously necessary when working with unfamiliar materials and techniques. Again, the dilemma is that product developers need more time to work with new materials and production techniques in a traditional sense—time that will lengthen time to market.

Minimizing Production Issues

Coming up with an innovative product concept is one thing. Manufacturing a complex product and selling it at a profit is something entirely different. New product concepts much be evaluated for manufacturability—what's the most efficient, cost-effective way to make it—in order to minimize the possibility of production issues. This process has traditionally required rounds of time-intensive physical prototyping (e.g., prototype molds, sample tooling, etc.), which extends development and production cycles, negatively impacting time to market.

Resolving Obstacles to Prototyping

As products become more complex, this greater complexity itself presents potential obstacles to effective, efficient physical prototyping. A more complex product concept may result in more extensive, time-consuming prototyping requirements. Product development personnel may not have experience working with the greater level of complexity or awareness of the multiple drivers affecting product performance. Furthermore, some new product designs are so complex that physical prototyping isn't feasible, yet the concepts still require safety and/or performance validation, creating a real obstacle to completing development.



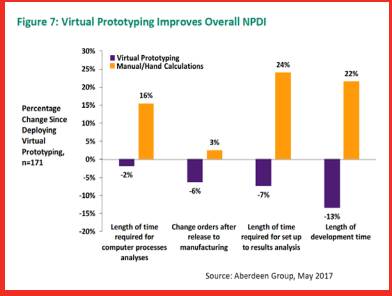
BEST-IN-CLASS COMPANIES RELY ON SIMULATION-DRIVEN PRODUCT DEVELOPMENT

According to a 2017 study by the Aberdeen Group entitled "Virtual Prototyping vs. Traditional Product Development," best-in-class manufacturing companies that leverage virtual prototyping technologies to support simulation-driven product development are outperforming their competititors in meeting product quality, launch, revenue, and cost targets, while simultaneously reducing physical prototyping by an average of 10 percent.

Increasing product complexity creates product development challenges in accurately predicting design behavior, which can negatively affect speed of development, cost, and quality. Product complexity and innovation are the top product development challenges that manufacturing organizations face, based on the responses of best-in-class companies in this study. Because time to market, innovation, and cost have a direct impact on product success and profitability, best-in-class manufacturers are meeting these challenges by embracing virtual prototyping and simulation-driven product development to analyze and verify design behavior as early as possible in the product development process.

Roughly 67 percent of the best-in-class manufacturers that participated in this study rely on simulation tools for design validation and verification of functions ranging from proof of concept, multiple design iteration support, and troubleshooting to automating repetitive analyses, predicting future process defects, and optimizing designs. By utilizing virtual prototyping as part of simulation-driven product development, best-in-class manufacturers have reduced the amount of time required to analyze product behvior, slashed the number of engineering change orders (ECOs) needed, and cut overall development time by an average of 13 percent.

VIEW THE FULL REPORT



Reducing Product Development Costs

In addition to developing more complex products faster, manufacturers are facing competititive pressures to reduce product development costs: either to increase profits or in response to customer and market demands for lower prices. Developing innovative products generally costs more in the traditional, sequential product development process because more testing and prototyping are required to iron out the kinks along the way. Again, manufacturers need to develop more innovative products for continued success while at the same time reducing product development costs, which seems impossible using a traditional product development and manufacturing approach.

Developing Complex Products in Less Time

Time is money, and the longer it takes to develop a product, the higher the product development costs will be. To accelerate time to market and reduce development costs, product development organizations need to find ways to shorten design cycles without sacrificing quality and/or innovation. This is especially challenging when developing complex products under the existing product development paradigm because the development of complex products typically adds time-related costs to the process.

Minimizing Physical Prototyping

Physical prototyping and testing can add substantial direct and time-related costs to the development of a product. This is particularly true in the development of complex products, because the time and cost of prototyping and testing—how many rounds of prototyping are required and what's the overall cost—cannot be accurately anticipated. Manufacturers face competitive pressures to reduce prototyping costs—for example, one major automobile manufacturer plans to leverage virtual prototyping and simulation tools to eliminate prototypes completely by 2020—but still needs a means for validating innovative/complex concepts withou sacrificing product safety or quality.

Cutting the Number of Engineering Change Orders

Late-cycle design changes that are necessitated by the issuance of engineering change orders (ECOs) add costs to the product development and manufacturing process. ECOs are generally issued to resolve product performance and/or manufacturability problems that aren't discovered until a product is in production or already in the field. ECOs also require additional rework or retrofits for resolution, adding additional direct and time-related costs. This is why reducing the volume of engineering change orders, or eliminating them completely, is a critical success factor for today's manufacturers.

Decreasing Returns, Field Failures, and Warranty Claims

Although product innovation and complexity are increasingly important for success in today's competitive manufacturing environment, quality continues to outpace all other product characteristics for securing and maintaining brand loyalty among customers. Perhaps the worst thing that a manufacturer can do from a cost standpoint is to release an innovative product that is beset with quality issues that result in a high volume of returns, field failures, and warranty claims, as one major smartphone manufacturer learned in recent years. To remain competitive, manufacturers need to maintain high levels of quality, not only to avoid the direct costs or returns, field failures, and warranty claims, but also to steer clear of lasting damage to the reputation of the manufacturer's brand.

Facilitating Internal and External Collaboration

Another challenge facing today's manufacturers is finding ways to facilitate internal and external collaboration among product development and manufacturing technologies and personnel to achieve the heightened innovation, automation, data-sharing, and throughput that are the hallmarks of simulation-driven product development and smart manufacturing. Designers, engineers, analysts and manufacturing specialists need to be able to collaborate more effectively—not only among themselves but also with partners, suppliers, and customers—to secure the productivity gains required to develop more innovative/complex products faster and at lower cost without compromising quality.

Speaking a Single Product Development Language

One of the barriers to achieving greater, more-effective collaboration is the fact that designers, engineers, analysts, and manufacturing personnel frequently use different non-integrated design data and simulation platforms, which cannot communicate with each other efficiently. In essence, these skilled, talented professionals speak different product data and simulation languages because they are using separate single-point solutions instead of an integrated, automated system. To collaborate successfully—both internally and externally—product development and manufacturing personnel need to be able to communicate in a single, integrated design language and system.

Collaboration vs. Confrontation

Interactions between designers, engineers, analysts, and manufacturing professionals in a traditional, sequential product development process have tended to be confrontational instead of collaborative. This is because the members of the team work separately in sequence using different systems, which prevents the consensus and buy-in necessary for collaboration to work. Instead of having somebody down the line changing earlier design work without discussing and deliberating why the change needs to be made, a single, integrated system—with everyone involved speaking the same design language and working concurrently—can transform disruptive confrontation into constructive collaboration.

Interactions between designers, engineers, analysts and manufacturing professionals...have tended to be more confrontational instead of collaborative.

Leveraging Integrated Tools

Another impediment to more effective collaboration within traditional product development approaches is that product development personnel often don't have access to integrated simulation and virtual prototyping capabilities that are designed to meet their specific needs while also facilitating communication and collaboration. Many designers don't have CAD-integrated simulation tools for evaluating their conceptual designs. Engineers and system-level designers usually can't access CAD-integrated analysis capabilities for verifying system level/assembly designs and manufacturability. Analysts may have access to some virtual prototyping capabilitiies, but often do not have the robust, CAD-integrated tools required to solve complex physics problems.

Sharing Simulation and Engineering Expertise

Without integrated virtual prototyping and simulation tools that can communicate effectively in a single product design language, design, analysis, and engineering expertise cannot be easily shared with other members of the team. This stifles both effective collaboration and professional development among team members. Each distinct role offers important insights that can increase the expertise of everyone involved. Designers can learn from analysts, engineers, and manufacturing specialists, and vice versa for every member of the product development and manufacturing team.

Supporting an Increasingly Mobile Workforce

Another significant challenge to developing more complex products faster and at less cost is the mobile and transient nature of the product development workforce. Professionals are not spending their entire careers with a single company, which was commonplace just a few decades ago, and need to remain interested, challenged, and fulfilled to refrain from seeking other opportunities. More skilled, talented product development professionals are also working remotely. In responding to these trends, manufacturers need to supply the integrated tools that enable valued staff to continue to be motivated instead of frustrated in the face of demands for greater automation, data sharing, and throughput.

Challenging Talent to Maximize Retention

Product development professionals tend to be creative, analytical, and skilled problem solvers who need to be continually challenged to remain interested in and fulfilled by what they are doing. They need to feel that they are a part of something that's bigger than themselves and that they are making signicant contributions. One of the ways to ensure that talented designers, engineers, and analysts remain committed and focused—instead of looking for new challenges—is to provide them with the integrated virtual prototyping and simulation tools that they need to solve problems and express their creativity, analytical talents, and engineering skills.

Providing Remote Access to Simulation Tools

In today's fast-paced, information-rich world, product development professionals don't always have the time or inclination to work from a single office or location. As the workforce becomes increasingly mobile, manufacturers need to provide designers, engineers, and analysts with flexible, integrated virtual prototyping and simulation tools that can be used remotely or in an automated fashion. The ability to work on projects securely and remotely in the cloud; batch-process simulation runs during off-hours, overnight, or over the weekend; or share product design and simulation information via smartphones or tablets will increase individual productivity and contribute to the faster times to market that are vitally important for manufacturing companies.

"SOLIDWORK Simulation Premium software provides accurate results and produces solutions much faster than... the software that we used in the past."

— Fernando Díaz , Engineering Manager

Integrating Simulation Data into Product Development Processes

Integrating simulation data into a manufacturer's product development process is a basic requirement for transitioning to simulation-driven product development and smart manufacturing. This is because simulation solutions have tended to be one-size-fits-all, single-point solutions that are not completely integrated from a data standpoint with the primary product design or CAD platform used to develop and manufacture products. To develop more innovative/complex products faster and at lower cost without compromising quality, manufacturers need to completely integrate simulation data into a concurrent product development process.

Overcoming Data Compatibility Issues

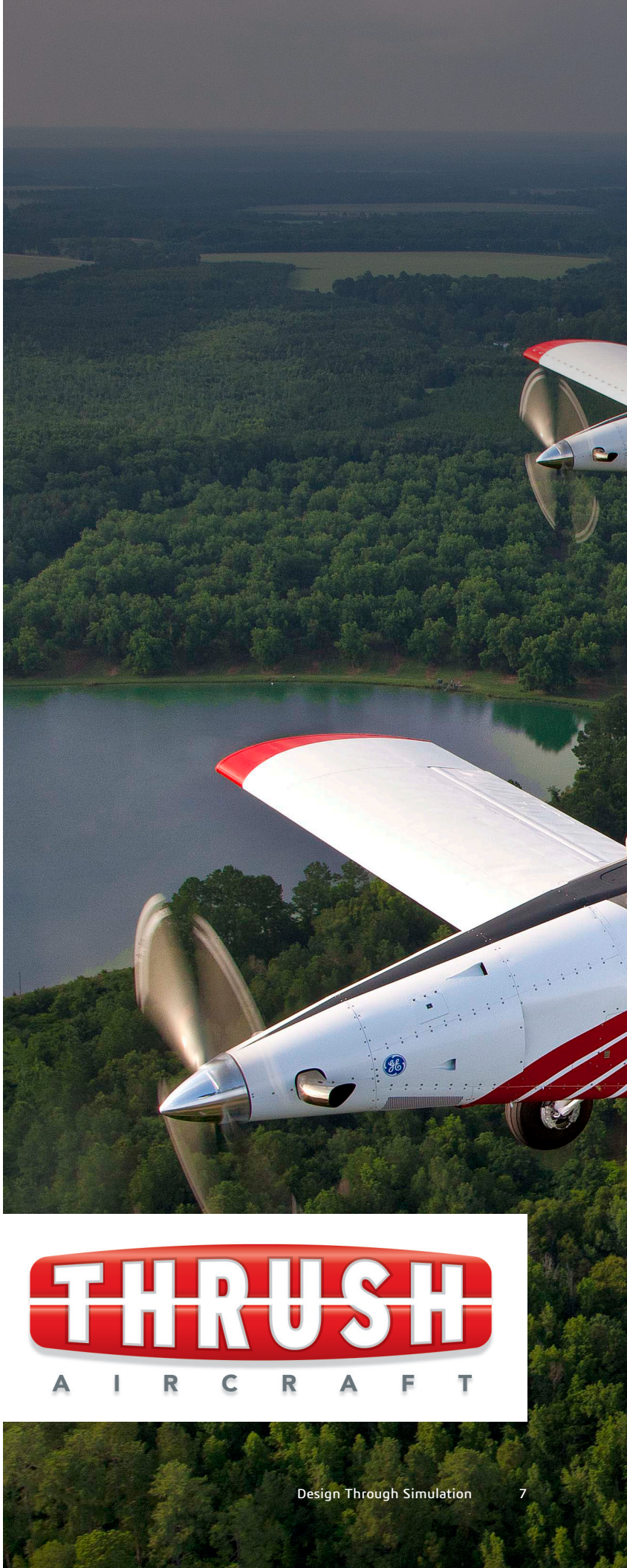
While many product development professionals use file conversion or transfer protocols to import product design data into simulation packages, and sometimes export modifications based on simulation results back into the primary product design CAD system, this approach adds time and limits collaboration. To truly overcome data compatibility issues, product development professionals need access to simulation tools that are completely integrated with the primary product design CAD system, not just to eliminate the time wasted in importing and exporting data between systems, but to establish the single product design language that fuels collaboration and innovation.

Communicating Simulation Results Effectively

Another barrier to developing more innovative, complex products faster and at lower cost is the inability to effectively communicate simulation results to other members of the product development team and related departments. How are key players in the product development process going to know what simulation results mean if they don't have a compatible package for viewing and understanding those results, or can't view them remotely on a smartphone or tablet? With a compatible simulation system that supports flexible results-sharing, manufacturers can better leverage simulation-driven design to meet product launch and cost targets.

Customizing Simulation Tools to Meet Specific User Needs

Perhaps the biggest obstacle to developing more innovative, complex products faster and at lower cost is the lack of CAD-integrated virtual prototyping and simulation tools that are designed and packaged to meet the needs of specific roles within the product development team. A designer typically doesn't need the robust, multi-physics nonlinear analysis capabilities required by an analyst to evaluate design concepts. Similarly, the needs of an engineer for verifying system-level/assembly performance and/or manufacturability differ substantially from those of designers and analysts. Simulation is not a one-size-fits-all proposition, and manufacturers that provide simulation solutions tailored to the needs of specific roles will realize the greatest benefit.



... A CASE IN POINT

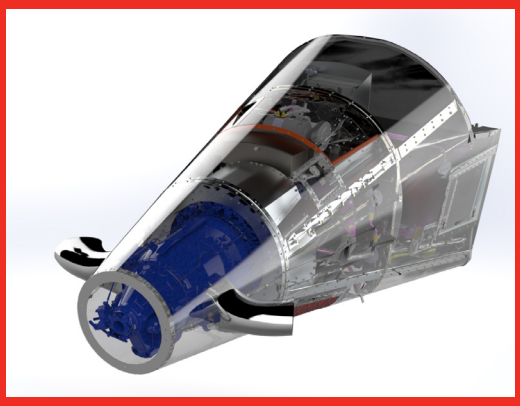
Thrush Aircraft, Inc. designs and manufactures specialized aerial application aircraft, which are used for agriculture, forestry, border surveillance, and fire-fighting functions worldwide. Founded in 2003, Thrush is well-known for building the most durable aircraft in the aerial application industry, which pilots and operators agree are the best flying planes for these purposes. Today, there are more than 2,100 Thrush aircraft operating in 80 countries.

The company's recent success may not have occurred had the company not pursued a more aggressive product development effort. Although Thrush's predecessor, the Ayres Corporation, went out of business, visionary businessman Payne Hughes bought the assets of the defunct Ayres Corporation in 2003, and the greatest turnaround in agricultural aviation began.

Thrush decided to standardize on the SOLIDWORKS 3D product development system, implementing SOLIDWORKS Premium design and analysis software. As the company has grown, Thrush has implemented additional SOLIDWORKS solutions, including SOLIDWORKS Simulation Professional analysis software. According to Lead Design Engineer Fernando Alvarado, revamping the company's product development platform played an important role in the company's turnaround.

"The move to SOLIDWORKS is really helping us bring our product development operation to the next level by enabling us to automate our design and manufacturing processes as much as possible," Alvarado stresses. "We're designing new products that raise the bar on innovation in our industry. Whether we're using SOLIDWORKS Premium software to model innovative concepts, SOLIDWORKS Simulation Professional software to conduct assembly analyses that reduce our testing costs, or SOLIDWORKS PDM (product data management) Professional software to automate development and manufacturing workflows, SOLIDWORKS is helping maintain our upward trajectory."

Using SOLIDWORKS simulation-driven product development solutions, Thrush has cut its design cycles in half, grown its product development throughput by a factor of 12, increased aircraft sales from 4 to 54 annually, and improved design accuracy and quality dramatically.



HOW SOLIDWORKS SIMULATION-DRIVEN PRODUCT DEVELOPMENT EASES THE TRANSITION TO SMART MANUFACTURING

Manufacturers can overcome the numerous challenges they face to develop more complex products faster and at lower cost by embracing a concurrent, simulation-driven approach to product development using fully CAD-integrated simulation solutions from Dassault Systèmes SOLIDWORKS Corp. Because SOLIDWORKS simulation software tools are fully integrated with the SOLIDWORKS 3D CAD product design system, and are packaged to meet the specific needs of designers, engineers, and analysts, these solutions can help manufacturers develop more innovative and complex products faster and at lower cost without compromising quality. SOLIDWORKS-powered simulation-driven product development will put manufacturers firmly on the road to smart manufacturing.

Accelerate Time to Market for Complex Products

Accelerating time to market for increasingly complex products is the key critical success factor for today's manufacturers. With SOLIDWORKS simulation solutions, manufacturers can completely eliminate or dramatically reduce their product development organization's reliance on time-intensive and costly physical prototyping iterations by leveraging virtual prototyping and simulation technologies and a concurrent approach to product development. By adopting SOLIDWORKS simulation-driven product development, product developers can save substantial amounts of time and money while ensuring quality by working smarter instead of harder.

Shorten and Improve Conceptual Design Processes

By utilizing SOLIDWORKS Simulation software during initial conceptual design, designers can quickly evaluate multiple design concepts while they design, focusing on design performance as well as form and function. With increased attention on design aesthetics and greater understanding of design performance, designers can achieve the innovations that are so prized in today's market, while simultaneously contributing to greater design fidelilty earlier in the product development process. CAD-integrated SOLIDWORKS Simulation software will enable designers to help avoid the late-cycle design surprises that result in ECOs, missed deadlines, and unnecessary costs.

"The move to SOLIDWORKS is really helping us bring our product development to the next level..."

— Fernando Alvarado, Lead Design Engineer

Facilitate System Level/Assembly Design

With SOLIDWORKS Simulation Professional software, engineers and chief designers can more quickly and easily "productize" design concepts by ensuring that the products based on these designs are safe, perform as intended, and are manufacturable, minimizing the number of ECOs. Engineers can use CAD-integrated SOLIDWORKS Simulation Professional software to boost throughput—increasing the number of system-level and large-assembly design concepts that are "productized" in the same amount of time—by gaining the insights and knowledge regarding design performance and manufacturability from software that used to require extended rounds of lengthy, expensive physical prototyping.

Solve Difficult Physics Problems

Anaylsts can tap the power of SOLIDWORKS Simulation Premium and SIMULIA Structural Simulation Engineer (SSE) advanced analysis software to tackle and resolve a greater number of complex physics problems earlier in the product development process. These powerful simulation tools will allow analysts to prototype practically any physical scenario while at the same time improving collaboration with designers and engineers early in product develoment through the use of fully integrated tools. With simulation capabilities already applied during conceptual and system-level/assembly design, analysts can focus their problems on the more difficult problems, maximizing utilization of engineering resources while speeding time to market.

Slash Product Development Costs while Introducing Innovations

With SOLIDWORKS CAD-integrated simulation solutions deployed during conceptual design, system-level/assembly design, and pre-production, manufacturers can slash product development costs by minimizing or eliminating physical prototyping requirements. Using SOLIDWORKS simulation tools to conduct virtual prototyping, product developers can do what would take days or weeks in the past in minutes or hours, all while gaining greater insight into cost-saving opportunities earlier in the process. This will minimize the frequency of late-cycle performance and/or manufacturability surprises that result in ECOs and rework, as well as returns, field failures, warranty claims, and their attendant costs.

Retaining Product Development Talent

By providing access to role-targeted SOLIDWORKS simulation solutions, manufacturers can keep talented designers, engineers, and analysts invested, motivated, and excited to confront the product development challenges associated with creating more innovative/complex products through the use of more efficient, compatible simulation tools. Designers and engineers will grow professionally, adding simulation expertise to their skill set, and analysts will be able to work more flexibly and efficiently with SIMULIA SSE software, which operates on the cloud-based 3DEXPERIENCE® platform. Analysts will be able to batch-process multiple complex simulations in the cloud during down time, allowing them to work smarter. Improved SOLIDWORKS simulation agility and flexibility will enable all product developers to work smarter, instead of harder, which will contribute to the retention of valued design and engineering talent.

Grow Product Development Team Professionalism

Implementing SOLIDWORKS CAD-integrated simulation tools will help manufacturers achieve time to market, cost, and innovation objectives while simultaneously building the professionalism and effectiveness of the product development team. With everyone on the same SOLIDWORKS platform and speaking the same simulation/virtual prototyping language, they will be able to confer and collaborate in a more constructive and professional manner. Because SOLIDWORKS simulation tools are designed for role-specific needs, designers and engineers won't be overwhelmed, nor will analysts be underwhelmed. The expertise, efficiency, and effectiveness of the entire product development team will continue to grow and develop.

... A CASE IN POINT

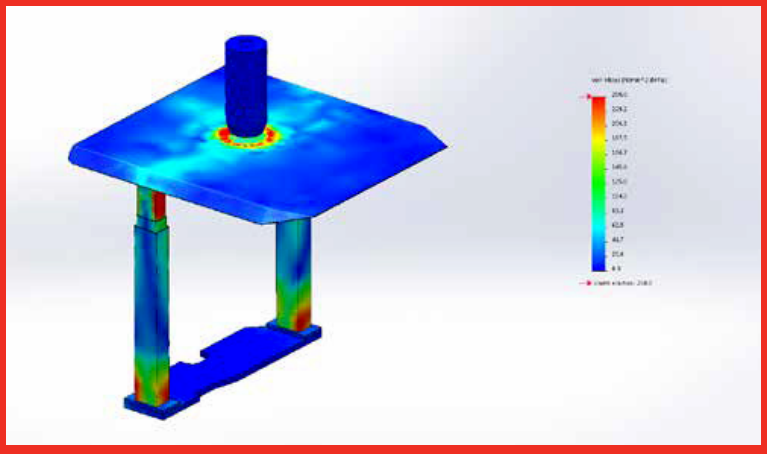
Resemin is a top international manufacturer of underground drilling machinery and related equipment, producing some of the leading mining equipment brands in the world. Founded in 1989, the company has grown into an international leader by focusing on quality, safety, reliability and strict adherence to international standards under its ISO 9001:2000 certification.

According to Engineering Manager Fernando Díaz, producing 3D design geometry more quickly and easily to drive finite element analysis (FEA) studies, which help reduce development time and prototyping requirements while enabling the company to meet ISO 3449:2005 falling-object protective structures (FOPS) performance criteria, became critically important for the manufacturer's competitiveness.

Although Resemin engineers initially used ANSYS® software to conduct FEA studies on SOLIDWORKS models, they saw the potential for realizing greater productivity gains by leveraging integrated SOLIDWORKS Simulation Premium software, which Resemin migrated to in 2011, to conduct the complex nonlinear analyses that are required to comply with the FOPS standard. With SOLIDWORKS Simulation Premium software, Resemin not only can conduct the complex nonlinear contact with plasticity analyses required to validate that its designs will protect operators from falling rocks, it also can perform these studies more quickly, resulting in a 70 percent reduction in prototyping.

"SOLIDWORKS Simulation Premium software provides accurate results and produces solutions much faster than the ANSYS FEA software that we used in the past," Díaz explains. "A nonlinear contact with plasticity analysis used to take two days to solve with ANSYS. With SOLIDWORKS Simulation Premium software, we're solving the same type of problem in a couple hours. This saves a lot of time in validating our designs prior to prototyping."

Using SOLIDWORKS simulation-driven product development solutions, Resemin has cut its machine delivery times in half, increased throughput from two to 60 machines annually, shortened analysis run times from two days to two hours, and reduced prototyping by 70 percent.



GAIN A COMPETITIVE MANUFACTURING EDGE WITH SOLIDWORKS SIMULATION-DRIVEN PRODUCT DEVELOPMENT

As product development and manufacturing organizations transition to smart manufacturing approaches to meet today's competitive and product complexity challenges, they'll need to leverage computer technology in more automated, integrated, and collaborative ways. Design, engineering, analysis, and manufacturing personnel will need to both share and work with the same product design data in a concurrent, integrated fashion instead of following traditional sequential approaches based on single-point, incompatible solutions. They'll need to leverage fast, cost-effective simulations for virtual prototyping instead of time-intensive rounds of physical prototyping to develop more innovative/complex products in less time and at lower cost without sacrificing quality. In short, they'll need to work smarter and more collaboratively instead of harder and separately, requiring them to utillize the same product design data platform and speak the same design language.

The solution to facilitating the transition to a concurrent, simulation-driven product development and smart manufacturing process is to utilize SOLIDWORKS integrated simulation and virtual prototyping technologies. Specifically designed to meet the distinct needs of designers, engineers, and analysts during conceptual design, system-level design, and pre-production, SOLIDWORKS Simulation solutions will help manufacturers consistently meet product launch, cost, and innovation targets while improving the professionalism, cohesiveness, and effectiveness of the entire product development and manufacturing team.

To learn more about how SOLIDWORKS Simulation software can improve your product development and production processes—and power your transition to smart manufacturing through simulation-driven product development—visit www.solidworks.com or call 1-800-693-9000 or 1-781-810-5011.

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