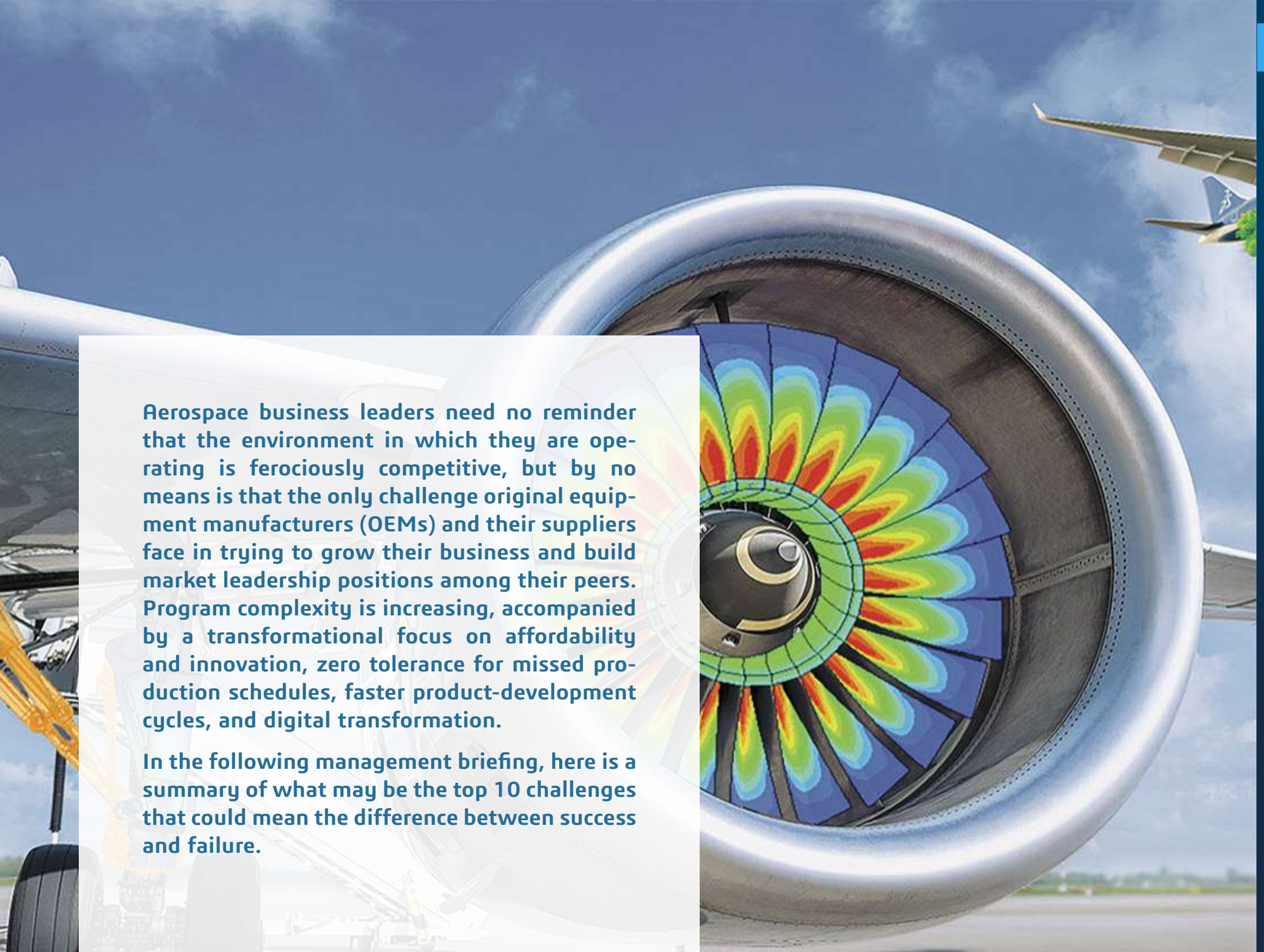
AEROSPACE
& DEFENSE

SUPPLIERS' CHALLENGING ROAD

Top Ten Challenges

DASSAULT SYSTEMES



Aerospace business leaders need no reminder that the environment in which they are operating is ferociously competitive, but by no means is that the only challenge original equipment manufacturers (OEMs) and their suppliers face in trying to grow their business and build market leadership positions among their peers. Program complexity is increasing, accompanied by a transformational focus on affordability and innovation, zero tolerance for missed production schedules, faster product-development cycles, and digital transformation.

In the following management briefing, here is a summary of what may be the top 10 challenges that could mean the difference between success and failure.

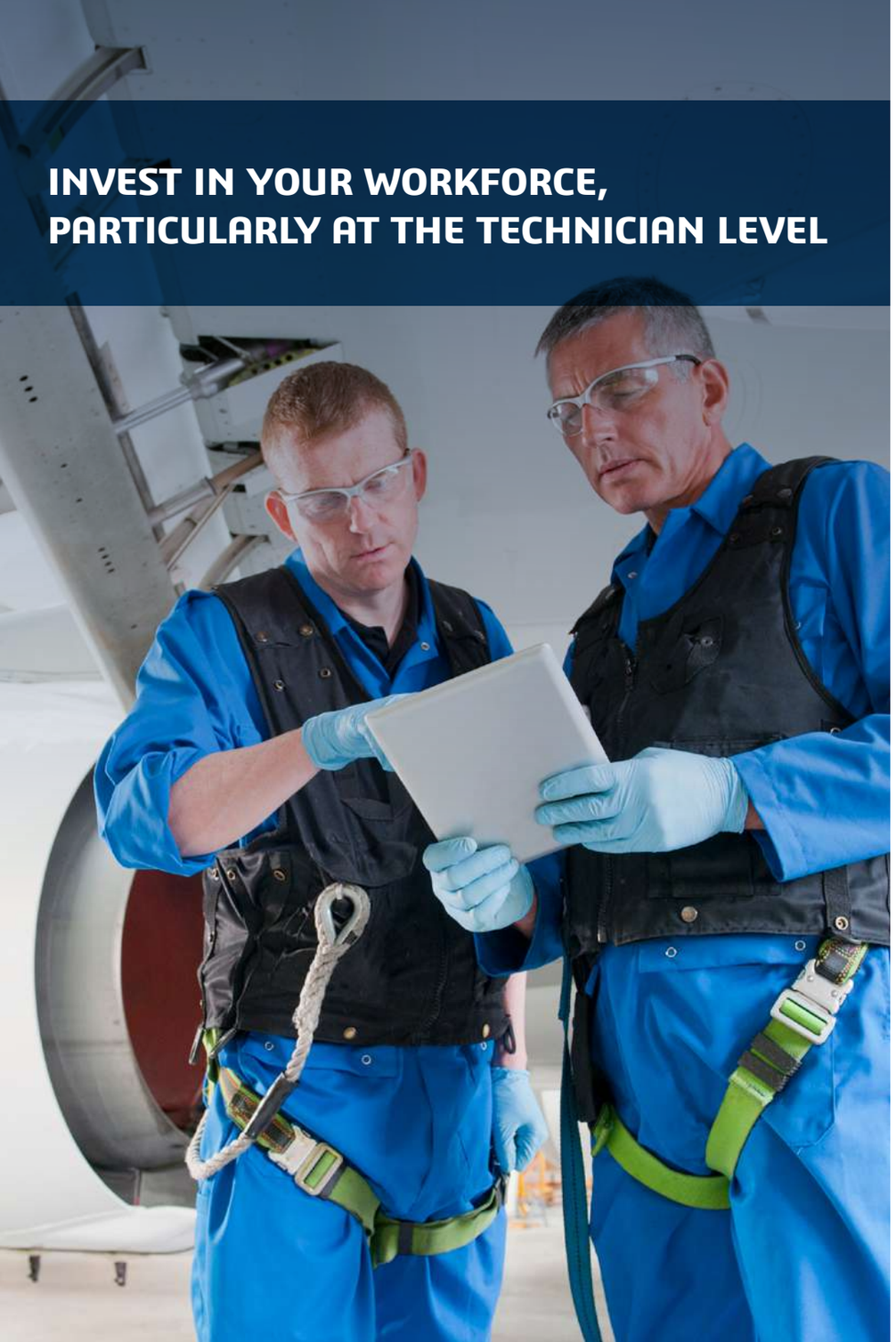
EMPHASIZE BOTH PRODUCT AND PROCESS INNOVATION FOR DIFFERENTIATION

There are no strategies for growing a business in the long term that are not driven by innovation. The challenges for companies are how to create and sustain a culture of innovation, and how a company uses innovation to renew its core in a world where any enterprise that's not constantly reinventing itself over time is slowly – if not imperceptibly – becoming irrelevant.

What often makes solutions to these challenges so elusive is that innovative cultures are paradoxical. For example, a willingness to experiment requires rigorous discipline. Collaboration must be balanced with individual accountability, and tolerance for failure requires an intolerance for incompetence. Google is an example. It is known to have a very employee-friendly culture, but it also has a rigorous performance management system that moves people into new roles if they are not excelling in their existing ones.

Moreover, the imperatives for building and sustaining a culture of continuous innovation are just as applicable to the multitude of small aerospace enterprises as they are for large original equipment manufacturers (OEMs). **On a playing field where customization counts, small scale and narrow scope can be turned into decisive advantages.** Consider TECT Aerospace, an aerospace machining company that one might expect to seek innovation advantage around hardware. Instead, the company markets its successes with services-oriented, knowledge-based innovations and vertically integrated structures that do not require large scale.

INVEST IN YOUR WORKFORCE, PARTICULARLY AT THE TECHNICIAN LEVEL



The aerospace industry has a jobs crisis. Not the one that observers have been predicting over the past two decades of a failure to produce scientists and engineers in sufficient numbers or a tsunami of retirements. Rather, what seems to be a less noticed and even more troublesome problem is unfolding – job-ready skills, or a lack of thereof, on the factory floor.

Numerous jobs across aerospace are coming online that job seekers aren't equipped to fill – well-paid positions for high school graduates with enough math and computer training to work as technicians to run machinery. For every job in manufacturing that requires a master's degree, two jobs require a four-year degree and seven require a one-year certificate or a two-year degree for technicians, according to Keith Campbell, author of Manufacturing Workforce Development Playbook.

Memo to suppliers: **Establish your own apprentice and training programs, while investing in joint programs with vocational schools** which need far more support and guidance from business to train and educate. That's what Space Exploration Technologies and some other aerospace companies are doing in association with Utah-based Davis Technical Institute, which offers a hands-on composites materials technology program that's uniquely aligned with the industry's needs. SpaceX has hired many of Davis Tech's students upon completion of the program, and some aerospace companies have hired students before they finish. A similar program is offered by the Wichita State University Tech Workforce Education Division. They offer training for business and industry to develop the technical workforce in the region. The college also grants college credit and awards associate of applied science degree.

HARNESS THE INDUSTRIAL INTERNET OF THINGS WITH THE POWER OF CONNECTIONS

Aerospace, like most other industry sectors, is undergoing a massive collective shift towards seamless integration of the digital and physical worlds, with the goal of digitally interconnecting all of the information essential to a product's lifecycle – from conceptual design to product support – and establishing digital continuity across the enterprise. Digital continuity creates a consistent source of data from connected systems that your teams can access and leverage across the product lifecycle. However, the **3DEXPERIENCE®** platform gives you the power of connections. When implemented, **the platform allows your organization to make data instantly and securely accessible to anyone who needs it, at any location and on any device.**

Despite its well-deserved reputation for being at the cutting edge of technology innovation, the aerospace industry is playing catch-up in embracing Industry 4.0 and its associated technologies more broadly, even though these technologies have proven to deliver a great deal of value in other sectors, such as automotive.

Nonetheless, many aerospace OEMs are in advanced stages of implementing IIOT, and they're expecting their suppliers to follow their lead. Think of IIOT as an ecosystem involving all participants who are interconnected and derive tangible benefits from working together, advises top Airbus manufacturing executives. For its part, The Boeing Co., calls its IIOT digitalization strategy its "second-century enabler", which will secure its foothold as a global industry champion.

IMPROVE TIME TO MARKET TO MEET CUSTOMER DEMAND

Depending on a company's focus, it may pursue different opportunities within the manufacturing value chain – the series and sequence of activities through which an organization transforms inputs and raw materials into outputs, and ultimately sells, delivers and continues to support those outputs for customers.

But there is no greater opportunity for competitive advantage than delivering new products to market faster than rivals. More to the point, customers are demanding that manufacturers shorten product-development cycles.

Digital-to-physical manufacturing technologies, such as automation and the use of the 3DEXPERIENCE twin can dramatically speed up the design process, as well as the production and delivery of end-use products.

Airbus has integrated digital mock-ups into production environments, giving assembly workers access to complete 3D models of aircraft in production. This has reduced the time required to inspect from three weeks to just three days. In automotive, Ford estimates that its use of rapid prototyping during vehicle design saves weeks, with additively manufactured prototypes taking hours to fabricate rather than four to six weeks taken by typical machine tooling operations, bringing motor vehicles to market faster.

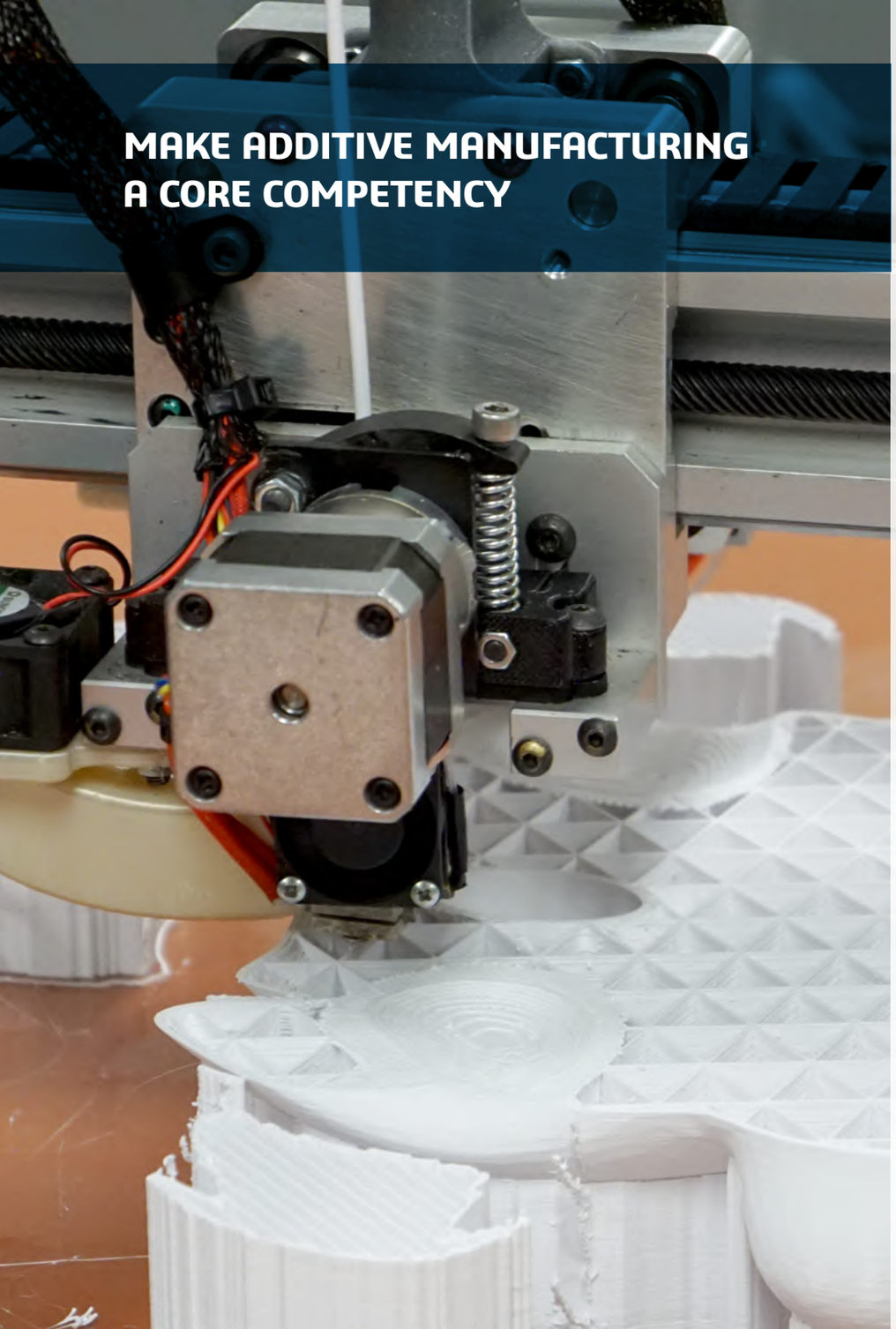
The aerospace industry can learn from other industries.

BECOME A NIMBLE ENTERPRISE THAT CAN ADAPT RAPIDLY TO MARKET CONDITIONS

Many of today's aerospace suppliers, handicapped by inefficient legacy technology and siloed processes, aren't set up to manage the complexities of modern markets, shifting customer expectations and unprecedented technological change. Equally disconcerting is that some operations executives and supply chains lack the strategic visibility to deliver the tailored experiences that customers increasingly demand.

With an estimated $14 trillion in cost disruption across the value chain over the next decade, according to Accenture, organizations can ill-afford to miss any opportunity to rapidly adapt to changing market conditions or customer demands. **Many successful manufacturers are discovering the key to becoming an agile enterprise is integrating information technology (IT) and operations technology (OT)**, whether it's in the production of a physical product or some other facet of running their business.

Consider Tru Simulation, which utilizes the latest generation in 3D digital design tools within a data storage architecture to increase efficiency of its global workforce. Many of the company's engineering teams require access to technical data from customer locations around the world. Without an effective Cloud-based architecture, Tru Simulation would struggle to provide a workable solution that maintains accuracy, accessibility and fidelity with legacy design tools, according to David B. Smith, vice president and general manager, Business Aviation.



MAKE ADDITIVE MANUFACTURING A CORE COMPETENCY

As aerospace suppliers of all sizes decide how and where to invest in new technologies, and as they identify which technologies will create the most benefit for their organizations, additive manufacturing (AM) should be at or near the top of the list. Traditional manufacturing probably will never go away, but any supplier that doesn't have a core competency is 3D printing, as the process also is known, could find itself at a serious competitive disadvantage.

An increasing number of suppliers are using AM to develop complex components one layer at a time, providing a creative canvass for imaginative engineers. It allows production of parts with complex geometries with fewer tools and permits multiple parts of an assembly to be made in one integrated space. Of course, it's not just the machinery of 3D printing that allows the process to produce many parts more efficiently and, in some cases, parts that otherwise would be unattainable; no less important is the design software, such as Dassault Systèmes' Function-Driven Generative Design, which also can be used with more traditional processes such as milling, casting and forging. It allows a designer to capture all of a part's functional specifications, like geometrical and analysis inputs.

3D printing dramatically reduces production time, from design to prototyping to finished product. Moreover, since parts can be made at the site of assembly just in time, AM also can help manage inventories. AM also reduces a company's carbon footprint by reducing both the amount of raw materials used in manufacturing and the number of subsequent operations.

Lockheed Martin uses additive manufacturing to produce an enormous titanium dome meant to serve as caps for satellite fuel tanks. The company was able to slash its cost and shrink its delivery timeline from two years to just three months.

MODEL-BASED ENTERPRISE: THE KEY TO IMPROVED COMPETITIVENESS

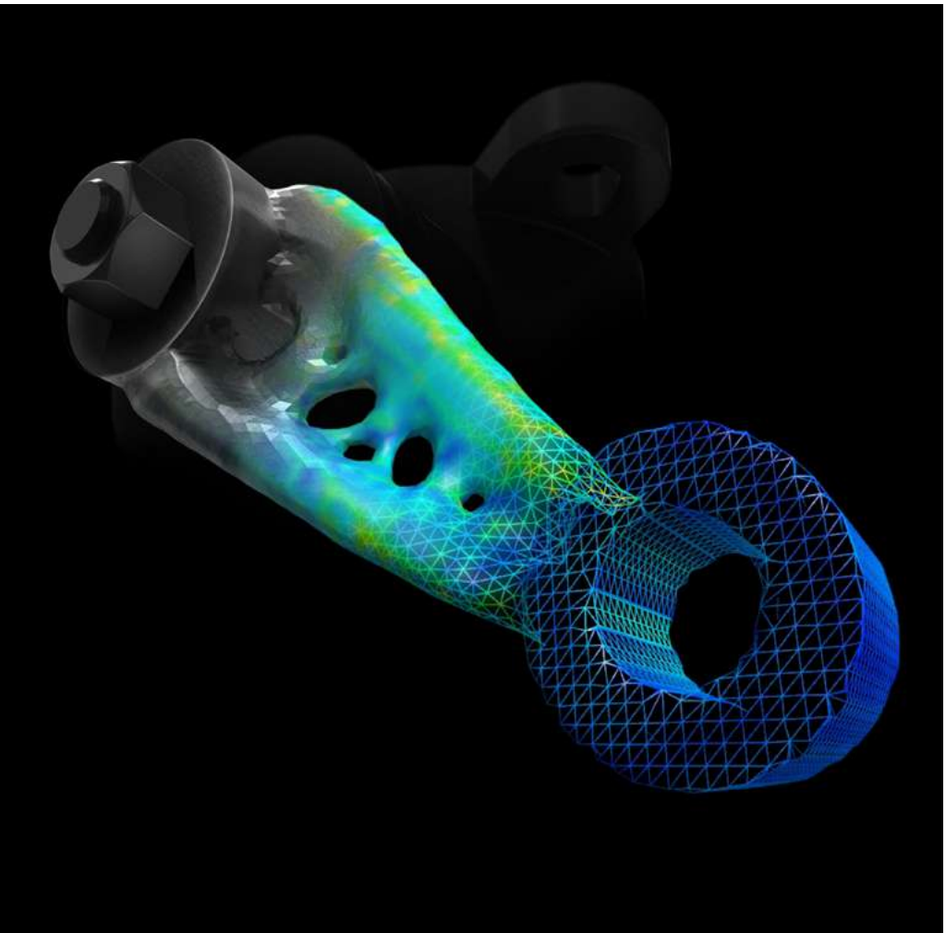
As aerospace systems and subsystems become more integrated and their systems more interconnected, decisions that can determine whether a new-product cycle can be successful are often made long before production gets underway or a contract is even won. Many companies continue to employ older methods of working, with functional teams operating in silos, inhibiting the sharing of critical information, and relying on inefficient paper-based systems ill-suited to customer demands and the growing complexity of products.

Both conditions are responsible for a large percentage of the scrap, rework, bloated bills of material and wasted time stemming from some combination of inaccurate engineering documents, outdated information, human misinterpretation of data, lack of transparency, or inadequate collaboration. An increasing number of companies are embracing or giving credence to an approach called model-based enterprise, which includes model-based systems engineering. MBE is built around a core set of annotated product models that replace traditional 2D design drawings. In this environment, a 3D computer-aided model of the product is created and used throughout the product's development.

As Bell Helicopter discovered in its phased approach to implementing a model-based enterprise with the help of ENOVIA, a scalable lifecycle management solution from Dassault Systèmes, the company improved its agility and its overall efficiency. **MBE reduced the number of touch-labor hours required to engineer and build aircraft and made quality assurance easier**. In another example of the power of digital technologies, Boeing credits model-based systems engineering with helping the company "break the cost curve" in preparing its winning bid for the T-X aircraft-development program.

AGGRESSIVELY MANAGE RISK MITIGATION, INCLUDING AVOIDING COUNTERFEIT PARTS

Delivering highly engineered systems on spec and on time at the price and quality they were promised historically has been one of the biggest challenges facing aerospace business leaders, and it still is. No longer is it about what end-use customers are willing to pay. Rather, it's about how much performance at what cost and at what business risk.



The previous ability of customers to tolerate price drift is over. Companies need to deliver more capability at lower cost. They also must become adept at combining cost-reduction strategies with innovative-ready derivatives of next-generation products. Defense contractors, in particular, can create more value and manage risk more effectively by becoming more "risk intelligent". Some recommended practices include:

Budgets and schedules need to contain and be certified as "risk tolerant", meaning they should have enough contingency time to mitigate financial, operational, funding and human resources risks. Top executives set the tone, design, direction and key performance indicators, but risk management should permeate all layers of the organization. Implement a common risk framework that's consistent with the organization's risk objectives and strategies. Own the risk at the unit and/or department level, with business units and functions using the framework to decide which opportunities to pursue and which potential risks to avoid, rather than unilaterally "betting the farm". **Provide management and governing bodies with improved transparency into the organization's risk management practices.** Last but not least, don't underestimate the power of modern 3D design and engineering software, such as Dassault Systèmes' SIMULIA solutions, to validate structural components and help deliver efficiencies throughout the product's lifecycle.

Finally, suppliers should take steps to eliminate the risk of introducing counterfeit parts and materials. Processes should be in place to raise awareness and identify actions to help avoid or report potential counterfeits.

SUSTAIN A HEALTHY LEVEL OF COMPANY-FUNDED R&D INVESTMENT

The evidence supporting the notion that strategic-minded aerospace companies – those that invest substantial amounts of their own money in R&D as a percentage of revenue and that focus on growing their businesses far into the future – outperform short-term thinkers is overwhelming. A report in 2017 from the McKinsey Global Institute examined 615 large and midsize companies over the years 2001 to 2014, and found that "long-term firms," as McKinsey defines them, had significantly higher revenue growth and profit than "short-termers." Their market value grew faster, and they fared better during the financial crisis, too.

Starting in the late 1990s Raytheon Co., invested more than $300 million in the design, development and in-house production of gallium nitride, a semiconductor technology. **That long-range strategy positioned the company to eventually gain a decisive competitive advantage over its peers in radar systems.**

Many small suppliers have achieved similar success through healthy levels of R&D investment. One such company is Liquid Measurement Systems Inc., which specializes in the design and production of proprietary sensors and electronics for fixed and rotary-wing aircraft. It also pioneered the use of carbon-composite fuel probes as an alternative to ones made of aluminum and stainless steel.

These are just two examples of the benefits of a long-term commitment to R&D investment, based on aligning projects with strategic and market priorities and understanding the driving needs of a company's most desirable customers.

There are lessons to be learned from industry leaders like Raytheon, who recognize the value of betting long and have the courage to invest in their own future instead of focusing primarily on maximizing near-term shareholder value creation at the expense of longer-term, more impactful business strategies.

START PREPARING NOW FOR A POST-DIGITAL WORLD

With an increasing number of aerospace suppliers digitalizing their organization or planning to do so – albeit at a slower pace than companies in some other sectors – digital over time will become the price of admission for doing business, versus a source of competitive advantage.

In the post-digital world that lies just over the horizon, how will suppliers differentiate themselves among peers? Answer: applying digital in powerful new ways to meet the demands of customers in both civil and government markets. **The power of cloud and artificial intelligence will continue to advance.** When combined with technologies such as distributed ledger, extended reality and quantum computing, they will reshape not only the business landscape, but also relationships with customer and ecosystem partners.

TRU Simulation and Training, a Textron company, is extending and strengthening its program management tools and processes to include cloud software solutions that include design, customer relationship management and enterprise resource management tools. The organization is using them to strengthen its estimating methodologies and its ability to manage complex budgets and schedules. The biggest advantage TRU Simulation and Training has seen, however, is in the trust and accuracy of data; it's never suspect. Such trust is crucial for timely risk management decisions, communications and overall program management.

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Tony Velocci is a former Editor in Chief of Aviation Week & Space Technology, retiring in 2012. With 30-plus years of experience in aerospace and defense, Tony continues to serve the industry as a writer, speaker and member of the Board of Directors of the National Aeronautic Association and a member of the Industry Advisory Board of Embry-Riddle Aeronautical University.

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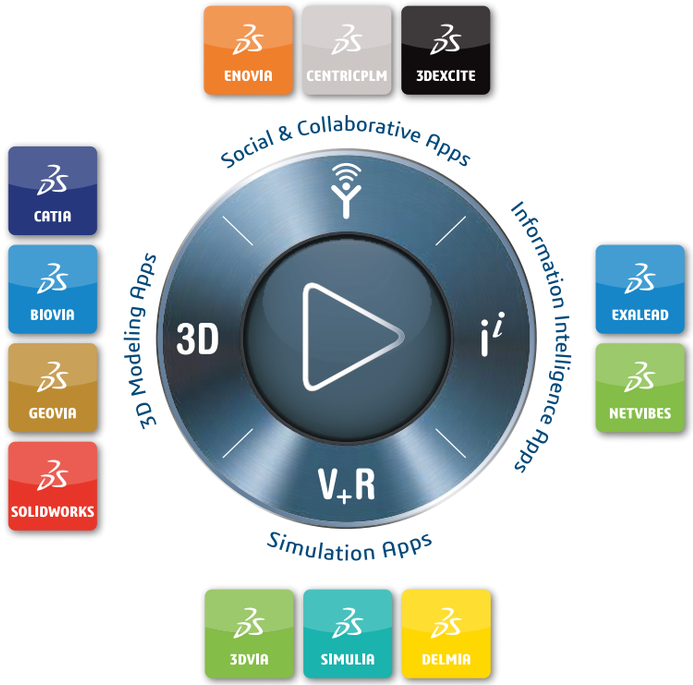

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