DELMIA

3DEXPERIENCE®

MAXIMIZING THE BENEFITS OF AGILE MANUFACTURING IN AEROSPACE & DEFENSE

DASSAULT SYSTEMES

INTRODUCTION

Over the last few years, the Aerospace & Defense industry has been dealing with a multitude of extraordinary challenges. Amongst geopolitical events, climate-related disasters and public health crises, disruptions in general have been increasing in both frequency and magnitude.

Add on the pressures of higher standards for demand, customer service and delivery, and the outcome is clear – only companies and organizations with the ability to remain flexible and adapt to market demands and conditions have been able to brave the storms and re-emerge successfully.

For decades, low-cost supply and minimal inventory were the key principles of supply chain management. However, in an increasingly turbulent world, supply networks that are overly dependent on non-flexible, low-cost suppliers and minimal inventory levels can jeopardize business very quickly.

Manufacturers of today need to innovate, optimize and plan ahead by utilizing the right technologies: those that stand a chance to provide the most benefit.

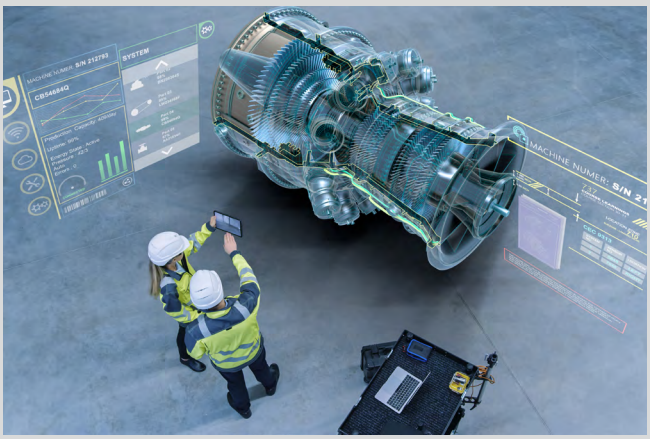
CHALLENGES IN THE INDUSTRY

Before determining the best solutions, let's take a closer look at the challenges that the aerospace and defense industry is currently facing. With many disruptions over the past few years, the need for flexibility in order to adequately manage the production environment, supply chain, and shop floor was pushed to the extreme.

Many OEM's and supply chains in the industry did not have that ability to avoid lay-offs, and a significant number of Tier 1 and Tier 2 suppliers had no choice but to release their workforce from factories and shop floors. However, now that the global situation is calmer and the demand for travel has increased, production is forced to ramp up.

Leading companies are planning to double or triple their production rate in the next few years, however, long-leading items in the Aerospace & Defense industry can take 2 to 3 years to be supplied. This sudden surge for demand has placed a huge pressure on the supply chain as a result, and led to multiple challenges, such as:

- **An unprecedented workforce skill gap**
- **New workplace safety improvements**
- **The need for production processes future-proofed for disruptions**
- **An increased need for flexibility in production capacity**
- **A major requirement for workforce automation**
- **The need for improved and resilient supply chains to support production ramp up**
- **An increase in requirements for digital transformation or digital acceleration strategies to improve factory floor activities with automation & robotics , data driven production environment**
- **Quick deployment smart factory with IIoT (Industrial Internet of Things) data to gain insight into manufacturing**



All these new challenges contribute to the difficulty and complexity of restarting production environments and returning to the standard of quality that production manufacturers were previously used to.

The aerospace and defense industry also has to deal with the enormity of complex products, assemblies and related production processes, including sustainability in manufacturing, cost, traceability, genealogy and ever-increasing statutory guidelines. Moreover, having large supply chains and varying operations across applications compounds the need to have flexibility and resilience in their businesses.

Industry challenges aside, manufacturers themselves also need to have a willingness to transform and innovate their supply chain and operations. Many are hesitant to make the change from paper to digital as their processes were built for long-term production plans. However, whether they are open to driving innovation in their operations could mean the difference between success and failure.

KEY CAPABILITIES NEEDED IN THE AEROSPACE & DEFENSE INDUSTRY

Now that we have assessed the challenges the Aerospace & Defense industry is currently facing, let's find out what functions and capabilities are needed in the solutions used to remediate these issues.

1 DIGITALIZATION:

Shop floor automation and digitalization is a concept that has been around for more than 20 years. Larger OEM's have been at the forefront of this movement, possessing the workforce and the budget to achieve this capability. While historically OEM's and supply chains have followed the trends of new programs to make drastic changes and remodel their facilities, smart manufacturers have used this recent period of global disruptions to invest in digitalization and remodel their processes with automation.

Previous remodeling efforts comprised of minor changes, including technology insertion, robotics, machine learning and integration, IIoT, etc., but startups are now in the position to adopt digitalization from the beginning and build a factory of the future, creating a new wave of manufacturers who will benefit the most from this technology.

2 REAL-TIME VISIBILITY:

Current communication systems used within the Aerospace & Defense industry are identified as a siloed and linear ecosystem. This needs to change before the supply chain can become a value network – one that provides full access to any required knowledge, know-how, skills and talents, as well as real-time social collaboration between individuals, groups or organizations. Not only will a singular, integrated platform improve the quality and speed of decision-making within an organization, but it will also increase the much-needed transparency between suppliers and OEM's.

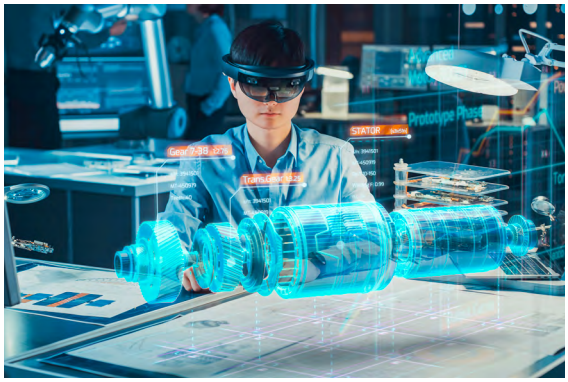
By utilizing control tower solutions, which provide the right information to the right disciplines in real-time, to integrate data across the entire supply chain, leadership teams can create real-time visibility and share vital, relevant information across the network. Companies can then better calibrate supply with forecast demand by comparing internal production capacity with real-time demand.

3 VALUE NETWORK AGILITY:

Reacting quickly to disruption requires a flexible ecosystem of suppliers and partners that can handle sudden shortfalls or even produce new products. That means setting up alternative manufacturing sites and assembly nodes and making the most of Industry Renaissance tools to optimize cost, improve quality, visibility, and accelerate reaction times.

4 VIRTUAL TWIN EXPERIENCE OR SMART FACTORY:

There is no greater opportunity for competitive advantage than delivering new products to the market faster than the competition. Customers are also demanding that manufacturers shorten product development cycles. Digital-to-physical manufacturing technologies, such as automation and the use of a virtual twin can dramatically speed up the design process, as well as the production and delivery of end-use products.



There is a growing utilization of virtual twins amongst manufacturers, with expanded use of IIoT sensors and devices in manufacturing plants. With IIoT data, the virtual twin will become more complete, more detailed, and even more valuable in increasing operational efficiency and speed up time-to-market. By combining the virtual world of production with the real world, manufacturers can more easily replicate and optimize design and manufacturing processes.

For example, Airbus has integrated digital mock-ups into production environments, giving assembly workers access to complete 3D models of the aircraft on the shop floor. This has reduced the time required to perform inspection from three weeks to just three days.

OPPORTUNITIES FOR IMPROVEMENT

The past few years have exposed an overreliance on manual processes & operations and a lack of visibility into supply chains, which ultimately affects organizational agility and production planning, particularly in the face of uncertain demand.

The hidden costs of single-source dependencies and poor flexibility in adapting to real-time disruptions have led to these inefficiencies. However, manufacturers can maintain supply chain resilience by being prepared for unexpected risk events, responding and recovering quickly to potential disruptions, and implementing several of these practices:

1. **Increasing operational flexibility with manufacturing automation**
2. **Ensuring employee upskilling and implementing safety**
3. **Lowering costs to stay viable in the business**
4. **Quick deployment of Digital Acceleration strategies to optimize the factory floor with IIoT, connected shop floor, AI/ML, flexible manufacturing layout, robotics, etc.**

Today, the industry will tolerate higher prices for certain goods, if it means faster delivery times and better alignment with customer demands. As a result, the change towards more flexibility, reliability, and visibility has already begun and multi-level sourcing will continue to accelerate tremendously.

EMERGING TRENDS IN MANUFACTURING AND THE SUPPLY CHAIN

As mentioned earlier when addressing the challenges of the industry, many OEM's and suppliers in Aerospace & Defense tend to be hesitant when deciding to make major changes to their operations and shop floor environment.

Fortunately, technology adoption and deployment can happen step by step or evolve over time, and it is important to acknowledge that not all technological needs of robotics & automation, IIoT, AI/ML and connected manufacturing are necessary or should be changed all at once.

For that matter, DELMIA has a proven methodology of deploying a step-by-step digital transformation journey to prepare organizations who are ready to start their transformation journey.

CAPABILITIES OF DELMIA FOR THE AEROSPACE & DEFENSE INDUSTRY

The future of Aerospace & Defense manufacturing is reliant on the ability of organizations to modernize, optimize and automate asset insights, predictive maintenance and service, as well as smart manufacturing & operations, supply chain, and optimized production schedules across Health, Safety and Environment (HS&E).

With the Dassault Systèmes **3D**EXPERIENCE® platform, OEM's and supply chains are able to connect virtual and real worlds, seamlessly collaborate across the globe and integrate new technologies, products, and services. This will transform the innovation process by leveraging virtual environments through integrated Modeling & Simulation to solve real world challenges.

Our solutions include:

- **Virtual Twin Experiences to keep the production shop floor resilient and future-proof to disruptions**
- **Factory of the future technology that manufacturers can utilize today to prepare and anticipate supply chain capacity, support decision-making with analytics, model disruption and test potential responses with digital collaboration. Factory automation, predictive maintenance and operational excellence are some of the key aspects.**
- **Value Network agility with solutions for an emergency supply plan, Production Planning & Scheduling to enable greater efficiency, visibility, anticipation and agility and Workforce Resiliency Planning**
- **3DLEAN application for remote collaboration and lean operations management for business continuity**

The Virtual Twin Experience is key to incorporating sustainability into manufacturing. Virtual Twin Experiences enable modeling in the virtual world to perform optimization before realization in the physical world.

Optimizing the factory layout and performing "what-if" scenarios and factory flow simulations allow optimization of the factory layout for more efficient production, where there are also opportunities to arrange equipment in a manner that will reduce energy consumption of equipment, such as minimizing the distance motorized vehicles need to travel, as an example. Virtual Twin Experiences enable optimization through simulation to achieve:

REDUCED NEED FOR PHYSICAL MOCKUPS THROUGH ASSEMBLY LINE SIMULATIONS

Building the production system right the first time in a physical environment enables manufacturers to avoid the waste of physical prototypes. Leverage the power of simulation to virtually verify new production lines, manufacturability of new products and understand the performance gains based on factory layout changes.

PRODUCTION EFFICIENCY GAINS ENABLED BY SIMULATION OF MANUFACTURING SYSTEMS

Simulation helps reduce errors and waste, energy consumption, raw material consumption, water usage, and other costly manufacturing factors. The simulation of different scenarios allows manufacturers to achieve an efficient production system, and enables the virtual build of a physical production system to validate first time right quality, resulting in higher quality and durability.

SUSTAINABLE SUPPLIER NETWORK SETUP THROUGH SUPPLY CHAIN OPTIMIZATION

Sustainable sourcing provides visibility of a product's carbon footprint within the supply chain, considering the suppliers' emissions and transport (including distance and transportation mode). Subsequently, it enables the optimization of emissions and financial costs. Supply plan comparisons can be leveraged to achieve a sustainable sourcing strategy.

A CIRCULAR ECONOMY FACILITATED THROUGH SUPPLY CHAIN OPTIMIZATION

Being able to create new value chains and optimize the processing of material across company is one of the four main opportunities in the circular economy transition identified by the Ellen MacArthur Foundation.

OPERATIONAL SUSTAINABILITY TRANSFORMATION BY ENGAGING THE RIGHT PEOPLE

Connecting shop floor execution data with DELMIA 3DLean provides a visual status of the resources at a glance. The data gains valuable meaning by involving people on the shop floor and evaluating operational KPIs together. DELMIA 3Dlean enables teams to do this collaboration in a digital way, by adding comments, defining issues, and assigning personal actions for follow-up. This helps specifically in the sustainability transition as well!

KEY BENEFITS OF A SUPPLY CHAIN TRANSFORMATION

Aerospace & Defense companies need to do away with point solutions and integrate an end-to-end solution. By doing so, they will be able to experience enterprise planning with a holistic planning solution that's able to optimize long-, intermediate- and short-term horizons across the entire supply chain. Here are some of the key benefits to keep in mind when researching a transformation for your supply chain:

AGILITY IN PRODUCTION:

Increase the level of control over production planning to create fully optimized master production schedules. At the core of the solution is an optimizer that holds over 100 optimization world records and a stellar track record in helping organizations meet their business goals.

RESPONSIVENESS OF SUPPLY:

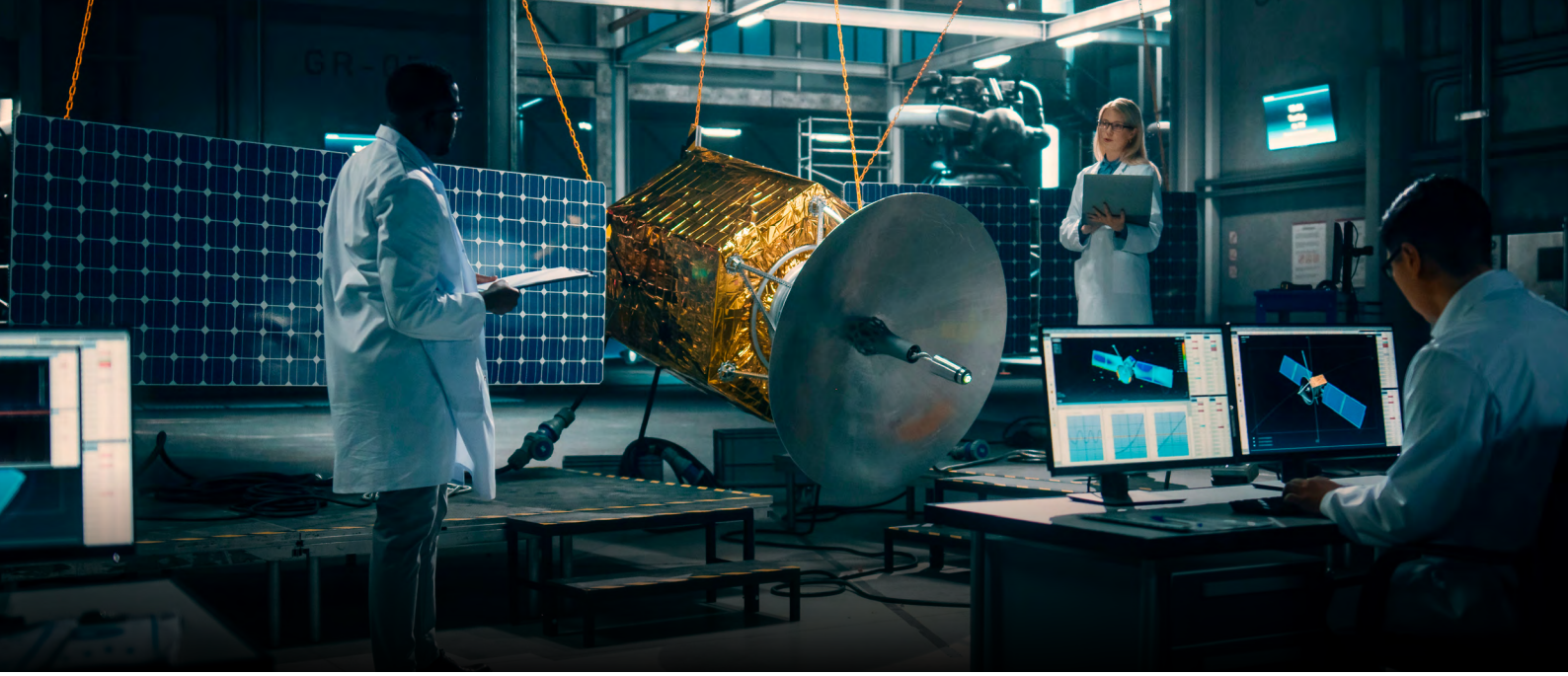
Close the gap between what should be produced and what can be produced. The solution also lets customer take it one step further – to move from capacity to capability by seamlessly integrating supply plan with operational plan.

DEEP COMPREHENSION OF DEMAND:

Anticipate demand through advanced statistical forecasting, collaborate more effectively with internal sales teams and external customers, and explore demand scenarios to increase sales.

DELIVERING ON PROMISE AND END PRODUCT TO CUSTOMER EXPECTATIONS:

Gain immediate insight into exactly what can and should be promised to customers and deliver on that promise every time. Order Promising allows to see the implications of accepting an order and helps determine whether you have the materials and capacity needed to fulfill the order.



CASE STUDIES/VALUE & BENEFIT

A wide range of Aerospace & Defense companies are currently using the **3D**EXPERIENCE platform to transform industry challenges into business opportunities, from established players such as NASA, Dassault Aviation, Airbus, Boeing and Embraer to disruptive startups such as Interstellar Lab, Joby Aviation, Ascendance Flight Technologies and Vertical Aerospace.

To give a clear understanding and evidence of the true value and benefits of using an integrated planning and optimization platform, here is a detailed case study from Hexcel.

Founded in 1948, Hexcel is an advanced composites manufacturer based in North America. They currently have 23 manufacturing sites globally with over 4,800 employees. Finding a common solution for the vast disparity of teams and products was a tremendous challenge for their organization. Here is a list of key capabilities that Hexcel required in a solution:

- **Access to necessary functions which perform cohesively from one integrated platform**
- **Full visibility of active production runs and past progress**
- **Easily generate analytical reports of production data to develop meaningful optimizations for future runs**
- **Quickly and accurately review production for quality improvements and investigate claims**
- **Compare real-time data of production across sites to apply best practices**
- **Convert to paperless production data records from the shop floor**

By partnering with DELMIA, Hexcel was able to leverage several solutions within the **3D**EXPERIENCE platform to achieve their business goals. One such tool was DELMIA Apriso, which provided a digital portal for operators to access all work instructions, safety documentation, etc. and to record manufacturing process information.

DELMIA Apriso also allowed Hexcel to track the raw material used to build a finished product in order to provide genealogy. The common environment also enabled Hexcel to handle non-conformances enterprise-wide with built-in integrations and workflow management, as well as to keep records for instruction and recording steps completed as part of their preventative and corrective maintenance activities. As a result, these are some of the values and benefits that Hexcel has achieved with DELMIA solutions:

- **Capture of "tribal knowledge"**
  - Consistent operations; repeatability
- **Insights through process data**
  - Optimized processes resulting in cost & time savings
  - Significant reduction in scrap
- **Avoidance of creating bad materials**
  - Identification of wrong raw materials
  - Containment of non-conforming materials
- **Significant improvements in production runs due to optimized scheduling**

With the solutions DELMIA provided on the **3D**EXPERIENCE platform and Hexcel's drive to achieve digital transformation, they were able to understand and experience how to do more, with less people, in a shorter time frame. This has given them an advantage over competitors who have not implemented the same technology and solutions, and are now falling short in the industry.

KEY TAKEAWAYS

Aerospace & Defense manufacturing operations are complex and today's hyper connected, fast-evolving markets only add to the challenge. To keep up with a global economy in an advanced digital age, manufacturers must have the visibility and control to satisfy customers who are demanding more sustainable products and services on time, every time.

The DELMIA factory of the future will enable you to:

1 **ACHIEVE SUSTAINABLE INNOVATION AND EXCELLENCE:**

Reduce risk, improve and predict operational performance by combining the power of virtual and real worlds where people and machines come together to transform manufacturing operations.

2 **CREATE VALUE NETWORKS:**

Transform supply chains into value networks by removing barriers between business partners to deliver sustainable innovation to consumers.

3 **EMPOWER THE WORKFORCE OF THE FUTURE:**

Reveal the workforce talents of today to enable the workforce of tomorrow with readily accessible knowledge and know-how.

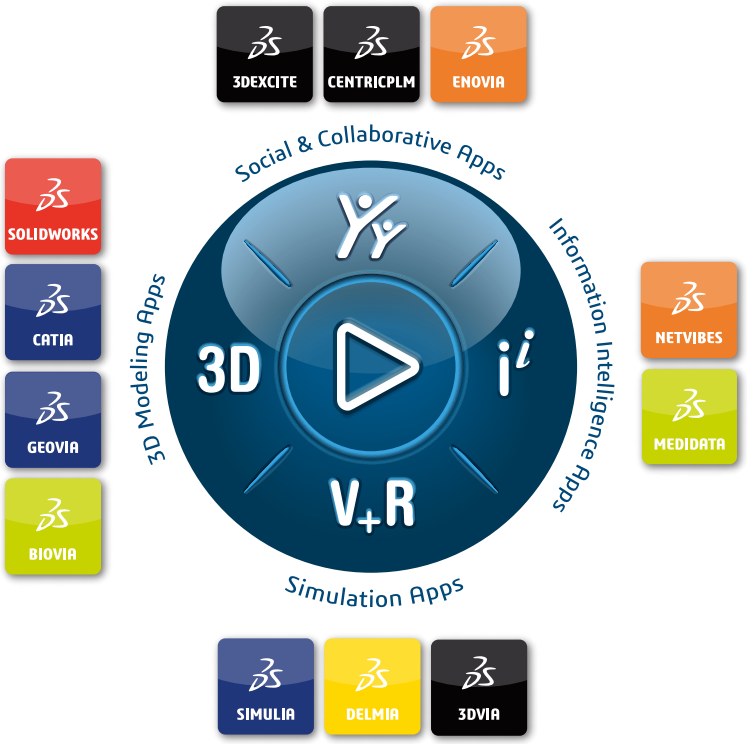
HOW TO GET STARTED

With the high cost of disruption caused by the global pandemic fresh in their minds, business leaders know that they need the improved business agility and resilience that digital transformation enables – and they need it now.

But, with transformation failure rates that approach 80% across all industries, they also need a better way to plan and manage these sophisticated, multi-faceted projects – one that lowers the risks and raises the likelihood of success.

Dassault Systèmes has developed its Value Engagement model specifically to deliver success on high-risk, must-succeed digital business transformation projects by leveraging our proven consulting practices and services portfolio. Unlike other consultants, who focus primarily on what software to buy, our experienced transformation experts will partner with you to determine what you need most to make your business more agile, resilient and sustainable, and how best to achieve it.

The **3D**EXPERIENCE platform Dassault Systèmes provides a broad scope of solutions that help companies innovate from product ideation through planning and manufacturing. Using the **3D**EXPERIENCE platform, organizations can unify the critical parts of their business using digital tools and models. This platform is where supply chain and production virtual twins can work together to help organizations achieve their goals. For more information on the Virtual Twin Experience for operational excellence, read the eBook here.



Our **3D**EXPERIENCE® platform powers our brand applications, serving 11 industries, and provides a rich portfolio of industry solution experiences.

Dassault Systèmes, the **3DEXPERIENCE** Company, is a catalyst for human progress. We provide business and people with collaborative virtual environments to imagine sustainable innovations. By creating 'virtual experience twins' of the real world with our **3DEXPERIENCE** platform and applications, our customers push the boundaries of innovation, learning and production.

Dassault Systèmes' 20,000 employees are bringing value to more than 270,000 customers of all sizes, in all industries, in more than 140 countries. For more information, visit **www.3ds.com**.

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