DASSAULT SYSTEMES

DELMIA

CUSTOMER REFERENCES
VOLUME 2

TABLE OF CONTENTS

EMBRAER

"We used Dassault Systèmes solutions intensively to introduce new, best-in-class technologies, such as the fly-by-wire flight control system and a new interior design, and to deliver what we believed the market really expected."

Humberto Pereira, Vice President of Engineering and Technology, Embraer

Challenge:

As a leading commercial and executive jet manufacturer and the largest defense and security solutions company in Brazil, Embraer continues to evolve and achieve long-term success. The company seeks to anticipate customer needs on future programs and develop technologies for advanced production and manufacturing processes.

Solution:

Embraer adopted Dassault Systèmes' **3D**EXPERIENCE platform for design, data management, simulation and analysis, manufacturing and documentation as provided through the industry solution experience Co-Design to Target.

Benefits:

The **3D**EXPERIENCE platform provides engineering and manufacturing planning stakeholders with cross-site digital continuity and real-time access to accurate product and product-build information, thus accelerating development time and improving quality and design innovation.

Practically every major industrialized country has made aviation manufacturing a part of their strategic agenda, despite formidable barriers to entry. In addition to the huge capital investment, other requirements include a deep understanding of markets and the needs of customers, and the ability to manage a complex value chain. Successful aviation companies must pioneer and sustain the development of next-generation technologies and compete on the basis of both cost and quality, as well as maintain a highly skilled engineering and technical workforce and a global network of relationships vital to every facet of aerospace business.

Determined to fulfill its vision of an indigenous industry, the Brazilian government in the 1940s initiated the arduous process of building the infrastructure it would need, starting with the formation of a research and development institute. Eventually, Brazil began the process of transforming science and technology into product engineering and industrial capability. The result was the founding of Embraer in 1969, followed by its privatization in 1994. Brazil's intrepid initiative not only succeeded, but it proved to be a strategic inflection point in the evolution of aviation itself.

The civilian version of Embraer's EMB 110 played a pivotal role in establishing the modern regional air transportation industry worldwide, eventually all but displacing the incumbent dominant player. The company had a similar impact on yet another market segment – business aviation. Within 10 years after the company committed to the market, Embraer had the broadest product portfolio in the market that included some of the best-selling business jets of all time. The common denominator in Embraer's product success has been a level of innovation that has made it one of the most disruptive aerospace competitors in the last quarter century.

GLOBAL GOALS

As successful as the company has been in serving customers worldwide in multiple market segments, Embraer still faces challenges, such as how to become more global. In particular, Embraer must identify the best opportunities for partnerships that may spawn new technologies it could leverage across its product portfolio.

Embraer also strives to become even better at continuous product improvement and efficiently integrating higher performing suppliers into the production and product support system to meet its goal of delivering higher-value products to its customers. To help the company achieve this objective, Embraer partnered with Dassault Systèmes in 1997 and implemented CATIA® 3D modeling software for the development of the Super Tucano light-attack aircraft. "Since then, we have worked together constantly to find new ways of improving the process of creating, developing and manufacturing new products and serving our customers," said Humberto Pereira, vice president of Engineering and Technology at Embraer.

Most recently, Embraer implemented Dassault Systèmes' **3D**EXPERIENCE® platform for the development of the midsize Legacy 500 business jet and its smaller sibling, the midlight Legacy 450. "We chose the **3D**EXPERIENCE platform because we believed it would allow us to do a better job integrating people and ideas, starting at the conceptual stage of product design," he noted. "Another factor was our belief that it would help us create a better product, which is important strategically."

"We chose the 3DEXPERIENCE platform because we believed it would allow us to do a better job integrating people and ideas, starting at the conceptual stage of product design."

– Humberto Pereira, vice president of Engineering and Technology, Embraer

Indeed, no aerospace company has the luxury of being content with the status quo; customer expectations are continuously evolving, and so are the technologies. Paulo Pires, managing director of Embraer's Engineering and Technology Center in Melbourne, Florida, says Dassault Systèmes solutions are helping Embraer meet the challenge. For instance, the Legacy 500 was the first aircraft fully designed to reuse product engineering information through the different stages of development.

MEETING MARKET EXPECTATIONS

The business aviation market is ferociously competitive, and customers traditionally have high expectations in terms of technology, operating efficiency and the overall passenger experience. Market leadership requires continuous improvements in the design, the quality and the support of aircraft throughout its lifecycle – not to mention a thorough understanding of how to deliver the optimum customer experience. The introduction of new, more technologically sophisticated models typically stimulates market demand. Conversely, if an original equipment manufacturer (OEM) introduces a new model that fails to meet customer expectations, the experience can serve as an opening for an opportunistic rival.

In this pressure-cooker environment, even before the first customer took delivery of the new Legacy 500, third-party assessments had already concluded the aircraft set a new standard for excellence – but that was no surprise to Embraer. "We used Dassault Systèmes solutions intensively to introduce new, best-in-class technologies, such as the fly-by-wire flight control system and a new interior design, and to deliver what we believed the market really expected," Pereira said.

Chief Operating Officer Mauro Kern, who also is responsible for technology and engineering throughout the company, put it another way: "We focus on our customer to determine what's important to them. Can our airplanes be a differentiator? Can we de-commoditize them in a way that adds value?" The Legacy 500, noted Pereira, is a true example of all these things.

CROSS-POLLINATION OF DATA

About 4,000 members of Embraer's engineering, technical and product-support team uses Dassault Systèmes solutions, as do many shop floor, pre-design and customer-service-oriented employees. Adoption extends to Embraer's supply chain as well. From this widely distributed, widely used suite of software tools has come a variety of benefits, according to Pereira.

For example, the **3D**EXPERIENCE platform, powered by ENOVIA®, has allowed Embraer to shorten the time it takes to shepherd new products through development, from conceptualization to manufacturing, due to improved communication between functional teams as well as the elimination of some documentation and intermediate steps. Prior to the adoption of the **3D**EXPERIENCE platform, software code containing work orders for making a part might have to be converted as many as three times – from 3D to 2D and back to 3D – by the time it reached a milling machine, Pereira explained. Not only were such steps time-consuming, but they also increased the risk of introducing mistakes into the production system.

In addition, Dassault Systèmes' DELMIA® application facilitates collaboration among shop floor employees and helps them better understand all of the steps involved in product assembly, increasing productivity." DELMIA has simplified the manufacturing process," Pereira declared.

Top image: To improve upon passenger experience, Embraer used Dassault Systèmes' CATIA 3D modeling application to help design the interior of Embraer's Legacy 500.

Bottom image: Cabin controls inside the Legacy 500

With the **3D**EXPERIENCE platform, Embraer's engineers also find they can cross-pollinate technology between civil and military aircraft platforms more effectively, another strategic benefit. Since the late 1990s, Embraer has had different types of aircraft in development and in production simultaneously at any given time. Throughout this period it has recognized that innovative technologies developed for a business jet, for example, can help create a more compelling value proposition for a family of commercial jet airliners or a military transport aircraft, or vice versa. The challenge, however, has always been what is the best way to implement such technology transfers?

Pereira says the **3D**EXPERIENCE platform allows Embraer to efficiently evolve technology from one aircraft to another, regardless of which market the model serves (agricultural, business aviation, civil or military) because of how information can be shared clearly and seamlessly. This is the case with the Legacy 500's state-of-the-art fly-by-wire flight control system – a technology that is unique in its class to the eight-passenger, 3,125-nautical-mile jet.

The system was based upon a previous generation technology applied to Embraer's first-generation commercial jets, which in turn, was based on the original electronic flight control system developed for the AMX fighter, in the 80s and evolved into the more sophisticated system that is now applied to the Legacy 500 and its smaller sibling, the Legacy 450, the KC-390 military transport aircraft and the E-Jets E2, the second generation of E-Jets. "By having a well-defined engineering center and technology roadmap, we've been able to evolve technology like this across business units," Pereira said.

BOLD INNOVATION

Embraer has always been a creative company that recognizes innovation as a competitive differentiator, according to COO Kern. From his perspective, the issue is how to innovate at a faster pace, since competitors essentially are trying to do the same. The data-driven, model-based architecture of the **3D**EXPERIENCE platform delivered by ENOVIA collaboration applications assists in this task, he said. "We are seeing more and more innovation."

Embraer is just one of many aerospace companies who face the challenge of how to bring new ideas and new technologies to market faster and with greater efficiency. "Our desire," Pereira said, "has always been to serve our customers as well as possible." Kern shares Pereira's sentiment, pointing out that delighting customers is one of Embraer's core values.

Reflecting on the industry in which Embraer has had such a profound impact, the company's collaboration with Dassault Systèmes and the benefits of using its solutions, Pereira said: "We are working in a more demanding and an increasingly complex environment, so we need to evolve fast because continuous improvement is necessary. Through the use of this tool, we have been improving our ability to develop new airplanes."

Focus on Embraer
Embraer is a global company headquartered in Brazil with businesses in commercial and executive aviation, defense & security. The company designs, develops, manufactures and markets aircraft and systems, providing customer support and services.

Since it was founded in 1969, Embraer has delivered more than 8,000 aircraft. About every 10 seconds an aircraft manufactured by Embraer takes off somewhere in the world, transporting over 145 million passengers a year.

Embraer is the leading manufacturer of commercial jets up to 130 seats. The company maintains industrial units, offices, service and parts distribution centers, among other activities, across the Americas, Africa, Asia and Europe.

Offering:
Production of tools and equipment, as well as consulting services and software solutions in automation and manufacturing for the automotive, aerospace, and offshore industries.

Revenue: US$ 6.4 billion (net 2015)

Employees: 19,000

Headquarters: São José dos Campos, Brazil

For more information: www.embraer.com

LOCOMACHS

*"The aerospace industry has a lot to gain by adopting an integrated and collaborative environment that facilitates the complex process of building an airplane. An environment like the **3D**EXPERIENCE platform can definitely facilitate this process."*

Peter Helgosson, Prodtex Director (M.Sc), Production Technology

Challenge:
As part of the LOCOMACHS research and development project led by key European players in the aircraft industry, Prodtex needed to improve the efficiency of the wingbox assembly process and the entire assembly line for an aircraft wing.

Solution:
The company chose the **3D**EXPERIENCE platform, including DELMIA for Digital Manufacturing, to virtually plan and simulate the wing fixture and assembly line.

Benefits:
Virtual simulation with DELMIA helped drastically reduce the time associated with the shimming process, improved the cost-efficiency of composite structural part assembly, and enhanced human safety, ergonomics, and feasibility.

MAKING MANUFACTURING EFFICIENCY IMPROVEMENTS TO MEET FUTURE TRAVEL DEMANDS

According to a recent Airbus study, air traffic will double within the next 15 years.[1] Increasing demands from airlines for more planes and growing competition from countries like China and India will consequently require European aircraft manufacturers to improve the efficiency of their manufacturing and assembly operations to meet these demands in a timely and cost effective manner. A collaborative research and development project called LOCOMACHS (LOw COst Manufacturing and Assembly of Composite and Hybrid Structures) involving 31 key European players in the aircraft industry was launched in 2012 to develop technologies that, if adopted, will allow manufacturers to accelerate, and more efficiently, produce and assemble composite structural parts. Among the objectives is to mitigate non-added value activities that include many shimming or dismantling operations that are time-consuming and generate recurring costs from composite production lines.

LOCOMACHS, therefore, aims to create a new build philosophy that generates both cost and time savings in aircraft development, and reaps results for leveraging in other industries. Dassault Systèmes business partner Prodtex, one of the 31 companies participating in this research project, worked on two work packages. "The first work package is to design and build the fixture for a section of the wing (the demonstration wingbox)," said Peter Helgosson, Director, Production Technology at Prodtex. "Inside a wing, you have the spars or main structural members, a leading and trailing edge, and the ribs. The project involves individually moving aerospace parts in six degrees of freedom to install them. We designed and built two hexapod robots to automatically position the leading edge and a third hexapod to position the wingrib using a force feedback sensor against the other wingbox components. One of the difficulties here is that carbon fiber is not as easy to work with as metal here, because the thickness of the material varies. So when the rib is positioned, there are always slight adjustments to be made, which are usually done manually by two operators which is time-consuming and labor-intensive. Much of the time is spent shimming the gaps to correctly position the rib. We found that automating this activity reduced shimming by 50%, which was one of the targets of the LOCOMACHS project. If you multiply these savings by the number of ribs to be installed per wing, we would end up with an overall leaner manufacturing process," he said.

The second work package focused on what aircraft production lines should look like to satisfy increasing global air travel demands. This work package called on Prodtex's 3D modeling and assembly line expertise to create a full-scale virtual production line to assemble wings in a leaner, faster and more cost-effective manner. "We virtually modeled a full lean production line, or wing factory of the future if you will, that not only simulates the trajectory of a wing on the assembly floor, but also shows the different robots performing their assigned tasks. Here we integrated other technologies developed by our LOCOMACHS partners, as well as our own hexapods, to design the factory," Helgosson said.

"Virtual simulation with DELMIA enabled us to prove our build concept, verify the assembly path of the parts in the factory, and more efficiently balance the workload between stations, thereby reducing overall lead times."

— **Peter Helgosson, Director (M.Sc), Production Technology, Prodtex**

Magnus Engström, Technical Director of LOCOMACHS and Project Leader at Saab Aeronautics, explained the significance of this: "Modeling a virtual factory provides many benefits," he said. "Simulating the physical flow and work environment in which both robots and humans interact highlights details that are easy to miss in a static 2D drawing. For example, we can detect and correct accessibility and safety issues, improve ergonomics, and decide how materials should be handled," he said.

"In EU projects, it is important to demonstrate the potential of the developed technologies and how they can be implemented in products and production," Maria Weiland LOCOMACHS Project Coordinator, Saab Aerostructures said. "In LOCOMACHS, we chose to implement the most promising technologies in the virtual wing factory of the future to show the possibilities and efficiency of these technologies."

VIRTUAL SIMULATION CONFIRMS BEST DESIGN OPTION

Prodtex developed virtual demonstrators to prove the concepts put forth in these two work packages and used Dassault Systèmes **3D**EXPERIENCE platform including CATIA to design the hexapods for the wing's fixture system. DELMIA was used to simulate the assembly process of the wing and future assembly line. "Before building a physical demonstrator for each of these projects, we first virtually simulated the processes virtually using DELMIA," Helgosson said. "For example, we had the 3D model of the wing, but there were multiple ways of assembling it. Thus, we used the software to determine the best result. Based on this, we designed and simulated the hexapod robots to install the ribs in the wingbox. We tested various scenarios and any clashes or interferences were clearly displayed, which allowed us to correct our robot design accordingly before we built hexapod robots."

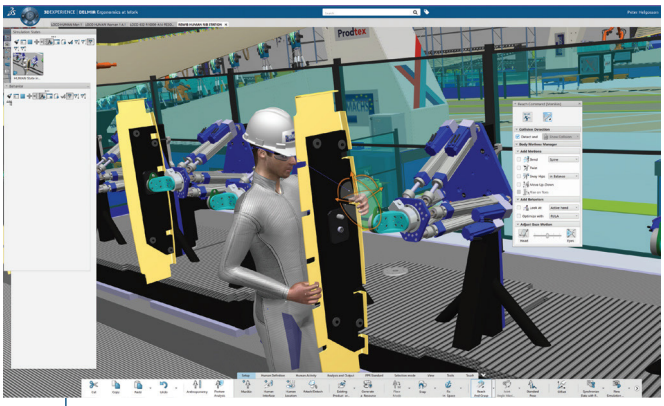
"For the second work package, through simulation, DELMIA helped us define the number of operators required to assemble the wingbox. It also allowed us to check our takt time and enabled us to foresee potential bottlenecks. In addition, in terms of operator's health and safety we used the ergonomics aspect of the software to help us design platforms to allow an operator to safely reach the work area."

There were many benefits to using DELMIA in these two work packages. "Virtual simulation enabled us to prove our build concept and verify the assembly path of the parts in the factory," Helgosson said. "In addition to access and reach of operators and equipment as well as ergonomics improvements, we were able to more efficiently balance the workload between stations and reduce overall lead times because there were fewer errors to correct. DELMIA can also produce virtual work instructions that are easier to understand than text-based documents, which cuts operator training and ensures information is live and updated," he said.

The LOCOMACHS project ended in the summer of 2016 and many of the participating companies have since continued perfecting certain technologies in preparation for new aircraft programs. "Manufacturers are looking ahead preparing for their new generations of planes," Helgosson said. "And maybe one day, if I'm lucky, I'll get a phone call from a company asking to use our new hexapods for their new wing assembly line. That would be rewarding."

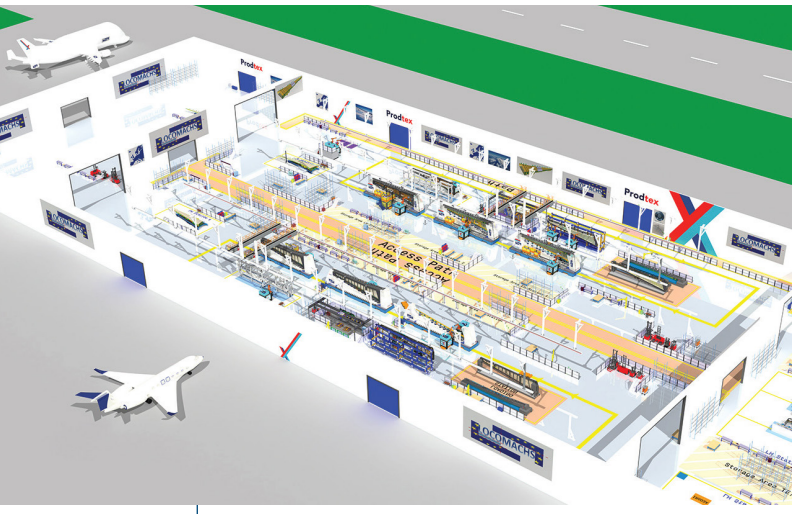
COLLABORATION, THE PATH TO EFFICIENCY

Peter Helgosson believes the aerospace industry still has some progress to make when it comes to collaboration. "Real-time collaboration is not yet culturally the norm," he said. "Project stakeholders work more in silos than together in parallel, which causes delays and reworks. We've really stretched an engineer's lead time. They can't go any faster because we have individual people doing their jobs, and passing it over to the next person who needs to review the work, provide feedback, and make corrections. This all takes time. If, however, everyone accessed the same trusted data on the same platform and made decisions together, the potential for savings would be huge."



Different **3D**EXPERIENCE applications were used to simulate the future wing production line (for example, Ergonomics at Work application was used to study operators workstations layout, reach studies, and ergonomics). Robot and equipment simulation was used to demonstrate the assembly processes of the wing structure and equipment.

"For example, there were 70 work packages in the LOCOMACHS project, which translated into 70 different technologies being tested by the 31 participating companies," Helgosson said. "One project may involve two companies, whereas another one comprises several companies working on a particular technology, such as a new drilling process or a new measurement system. If one party is designing a fixture to hold the wing and another is designing a new type of drilling technology, then they obviously need to collaborate at one point or another, right? In addition, to having a powerful simulation solution like DELMIA to rapidly try out new designs to see if they work before committing to the final build. The aerospace industry has a lot to gain by adopting an integrated and collaborative environment that facilitates the complex process of building an airplane. An environment like the **3D**EXPERIENCE platform can definitely facilitate this process," he concluded.



Wing of the future production lines simulated using the **3D**EXPERIENCE platform. Applications used: Process Planning, Manufacturing Definition, Plant Layout Design, Robot Simulation, and Equipment Simulation.

Focus on Prodtex
To deliver high-end solutions, development and sales of software and production equipment to the manufacturing industry. The focus is to rationalize our customers processes and methodologies. We deliver accompanying consultancy in management and engineering technology internationally in the automotive, aircraft, and offshore industries.

Offering:
Production of tools and equipment, as well as consulting services and software solutions in automation and manufacturing for the automotive, aerospace, and offshore industries.

Employees: 20 (approximate)

Revenue: approximately 2.5m €

Headquarters: Gothenburg, Sweden (and Bristol, UK)

For more information: www.prodtex.com

WATCH THIS VIDEO TO DISCOVER MORE

1. Global Market Forecast, Mapping Demand 2016-2035

AIRBUS HELICOPTERS

AIRBUS HELICOPTERS:
On the Road to Manufacturing Excellence

Airbus Helicopters, a division of Airbus Group, provides the most efficient civil and military helicopter solutions worldwide. To stay ahead of the competition, Airbus Helicopters launched a DELMIA Apriso Manufacturing Operation Management project to address Primary Components Machining, Sub-System Assembly and Final Assembly Lines.

WATCH THIS VIDEO TO DISCOVER MORE

"Digitalization is a key element for our future strategy. We have in our company the top of the technology for our customer, but now we have to give the top of the technology also for our employees. We want to ease the life of our blue-collar worker in the workshop, we want to ease circulation of the information, we want to ease the management of the interface."

Christian Cornille,
Executive Vice President, Industry, Airbus Helicopters

ALSTOM TRANSPORT

ALSTOM TRANSPORT WORKS WITH DASSAULT SYSTÈMES

To Improve Industrial Operations Performance

Alstom Transport was looking to provide greater visibility, synchronization and control across their manufacturing shop floor processes that run global operations. A highly versatile Manufacturing Operations Management (MOM) from Dassault Systèmes was implemented that leveraged DELMIA Apriso products to accommodate a wide range of manufacturing operations management tasks. This provided real time up-to-date data, throughout the organization, on daily activities and modifications and the status of each task.

WATCH THIS VIDEO TO DISCOVER MORE

"Atomes has been working in Belfort since May 2013 and good improvement for the benefit of our customer has been deployed. Among all of them we are able to have consistent data at shop floor level. We have also close monitoring of activity, and in particular we have the real information to react quickly."

Vincent Lecat,
Site Managing Director, Belfort, Alstom Transport

AUTOLIV

AUTOLIV

Deploying their Lean Manufacturing Solution

DELMIA Apriso is being implemented to help Autoliv standardize their operations and logistics systems. By using this solution, their supervisors and plant management can all use it to monitor production progress status. Standardization also enables Autoliv to have one process, one system, and one data source. Additionally, by deploying the Lean Manufacturing Solution, Autoliv can achieve the following:

- Support continuous process improvement across operations
- Provide high availability of shop floor execution tasks
- Improve flexibility across shop floor operations, including facilitation of better mobile device integration

"ACE is the business transformation program which brings Autoliv to the next level of performance. It's a business-driven program to harmonize processes to bring everything to the same master data into one ERP and one MES system. So, in short, one process, one system, one data."

Jan-Henning Krumme,
ACE Program Director, Autoliv

WATCH THIS VIDEO TO DISCOVER MORE

ARMOR

"Without DELMIA, we would never have been able to absorb the current load and maintain our customer service level, while maintaining the same number of material and human resources."

Tony Connradt, ARMOR Digital Manufacturing Systems Manager

Goal:
Implement a planning and scheduling solution that allows Armor's production team to control customer lead-times, reduce product waste and avoid shop floor stock-outs, while maximizing equipment uptime.

Solution:
DELMIA Supply Chain Planning & Operations

Benefits:
Reduced human intervention, faster planning, sustainably high customer service levels throughout periods of increased loads, efficiency gains, reduced product and process waste, and improved responsiveness.

ARMOR is the world's leading manufacturer of thermal transfer ribbons, which are widely used to print variable information related to traceability. Common applications include parcel shipping labels, foodstuff use-by dates and garment label washing instructions.

ARMOR, THE WORLD LEADER IN THERMAL TRANSFER RIBBONS

Armor was founded in 1922 and today is the world leader in Thermal Transfer ribbons. The ARMOR Group has strong annual growth, 1,800 employees and revenues of €245 million (2016). The Group's head office is located in Nantes, France. It has production facilities located in Brazil, Mexico, USA, Canada, South Africa, Singapore, China and India, and a main manufacturing plant on the edge of Nantes.

OPTIMIZING MANUFACTURING PERFORMANCE AT ARMOR'S MAIN PLANT IN NANTES

DELMIA Ortems has helped the Group optimize operational performance and control production flows in the 600-person Nantes plant, a facility that produces more than 60,000 rolls per day, 7 days a week and 365 days a year. The project was a complex one because of the interdependence of the plant's three main manufacturing shops—ink grinding, spool coating and roll cutting—which needed to be synchronized to avoid overproduction while still meeting delivery lead-times.

INCREASED FLEXIBILITY FOR THE GRINDING SHOP WHEN PRODUCING RAW MATERIAL FOR THE COATING SHOP

In the coating shop, ink tanks are made available to the coating machines based on consumption. Each coating batch can consume several tanks, and a single tank can serve several coating batches. Prior to implementing DELMIA, volumes were constantly growing (+7%/year), which meant planning for this workshop was difficult—equipment was often underutilized and that impacted the rest of the production chain.

There were other constraints: the coating shop encompasses a large number of machines, the grinding processes are disparate and complex, the actual ink consumption can vary +/- 10% from the theoretical consumption, and some inks have a maximum lifetime of 24 hours, so coordination with coating becomes vital.

DELMIA adds flexibility to the coating shop by making it possible to regularly validate the load/capacity matching, avoid stock-outs and overproductions, reduce waste, and reschedule production orders daily, based on variances and new needs.

> "We wanted a production planning and scheduling solution that could help us control customer lead-times, reduce product waste and avoid stock-outs on the shop floor, while maximizing equipment uptime. DELMIA was selected because it was the tool that best met the challenges and issues we wanted to resolve."
>
> — Tony Connradt,
> ARMOR Digital Manufacturing Systems Manager

The coating shop is synchronized with the grinding shop and the runs are coordinated between grinding and coating.

The coating shop supplies all of the Group's Thermal Transfer manufacturing plants and drives the grinding needs. Production runs typically last at least a week but the team needs to avoid changeovers over the weekend, so effective production planning and synchronization is critical.

By coordinating runs between grinding and coating, DELMIA makes it possible to avoid ink stock-outs and overproductions, and to optimize the management of color runs and the associated changeover times. It also makes it possible for the planning team to accurately predict an operator's resource requirements versus the forecast load.

THE CUTTING AND PACKAGING SHOPS:
Constraints and Challenges

The cutting shop was the first manufacturing shop to implement DELMIA. There are diverse constraints in this shop, including:

- The materials database is extensive, with more than 10,000 SKUs
- Most of the machinery is automated and constantly updated with variable range times, and changeover times that are longer on robotized cutters
- Product/machine compatibility is more or less flexible, so planning needs to account for the availability of machines which are limited in scope and whose demand varies over time
- The machine setup and changeover time can be as much as the production time for small quantities
- Shipping lead-times are short; next-day on stock and D+3 on made-to-order

Coordinating the sequences of WOs (Working Orders) on each cutter to optimize machine utilization, while meeting customer delivery dates, is essential. Weekend scheduling is also complex because only automated equipment is used. The products' compatibility with the machinery (both in cutting and in packaging) must be controlled while also adapting the product mix, since the weekend packaging capacity is limited for certain types of products.

DELMIA makes it possible to manage the scheduling for cutting and packaging shops with an alert system and to control the load through regular simulations. Schedulers can now plan the weekend in a few minutes, a task that previously took several hours.

The Benefits Provided by the Solution

"Today we manage and plan all of our manufacturing shops in a semi-automated fashion using DELMIA," said Connradt. "The system lets us re-compute the schedule every day so we can dedicate the scheduling teams to real value-added tasks, while giving the schedulers flexibility in certain choices or certain situations, such as with test WOs or rush WOs which are injected into the daily schedule."

According to Connradt, the benefits are seen at several levels.

First, the planning requires less human involvement: "Today, manual scheduling readjustments account for just 15% of the calculated schedule whereas, originally, everything was done manually." The schedulers also save time for weekend planning: "Before, weekend planning required 2 to 3 hours, whereas now it only takes the schedulers 30 minutes."

High customer service levels are maintained, even during major load periods, with the same level of resources: "Without DELMIA, we would never have been able to absorb the current load and maintain our customer service level, while maintaining the same number of material and human resources."

Productivity gains have also been recorded: "By finely scheduling the production runs, we have increased productivity, both in terms of production time and changeover time. We are able to limit the risks of product outage for downstream steps in the process while avoiding overproduction, which reduces product and process waste."

Improved responsiveness: "We have continuous insight into our advance/backlog status and can respond accordingly on a daily basis. The utilization of our manufacturing assets is more efficient, and the value added of administrative tasks is maximized. DELMIA is an excellent addition to our ERP and MES. The combination of the three lets us push automations and eliminate paper documents and double entries, which makes it possible to maximize both the utilization of our manufacturing assets and the value added of administrative tasks."

A POSITIVE RESULT

For Tony Connradt, the impact has been significant: "Every day, DELMIA lets us control customer lead-time and even improve it, while helping us better manage machine utilization. We've seen a reduction in customer lead-time from ten to three business days and a 50% reduction in product stock-outs in the manufacturing shops."

Focus on Armor
Leader in Thermal Transfer ribbon printing technologies

Products: Thermal Transfer Ribbons

Personnel: 1,800

Headquarters: Nantes, France

For more information: www.armor-group.com

NOVARES

"Our objective is to be close to our clients and their manufacturing plants and guarantee them the best performance, by staying as close as possible to demand and therefore by minimizing our inventories with the implementation of Lean Manufacturing principles. The implementation of DELMIA Ortems fits perfectly in this context."

Frédéric Marcotte, Novares Supply Chain Director

Goal:

- Be able to produce realistic and executable delivery schedules for Novares automotive manufacturer clients and offer a 360° bird's eye view of projects.
- Have a scheduled, long-term and reliable outlook in order to chart the requirements through the entire supply chain starting from Novares suppliers.
- Have a comprehensive tool that can centralize and share information, accommodating an international context with different work cultures and methods, which is one of the key project features.

Solution:

Novares, an automotive supplier specializing in plastic injection, has equipped 18 manufacturing plants around the world with DELMIA Supply Chain Planning & Operations.

Benefits:

- Improved performance: a group-wide customer service level of 98.5%, and 90% for suppliers
- Realistic and executable production plans that improve plant productivity
- Reduced inventory levels and obsolescence, and elimination of exceptional shipments
- Organizational benefits: teamwork has developed, communication is better structured and decision-taking has improved with better accountability, better control and improved anticipation

Novares is a supplier of comprehensive solutions that meet the needs of the automotive industry around the world. Using advanced plastic injection technology, Novares designs high-tech products to be embedded into vehicles of today and tomorrow that are easier to use and more ergonomic and affordable. Its expertise covers the design, manufacturing and assembly of components and the integration of advanced systems. Always designed to provide more value for automotive manufacturers, its solutions are equipped with complex mechanisms that use kinematics, mechatronics and multiple functionalities.

The Novares group designs, develops and manufactures injected plastic parts that meet vehicles' autonomy and connectivity needs. The group's business operations cover the engine, interior and exterior car body ranges, and include complex systems and mechanisms. Novares is positioned as a world leader in automotive equipment, supplying manufacturers like Peugeot-Citroën, Dongfeng, Renault-Nissan-Dacia, Ford, Fiat Chrysler, Toyota, General Motors, Jaguar Land Rover, BMW, SAIC and Volkswagen as well as suppliers like Yanfeng Johnson Controls, Faurecia, IAC, Continental and Visteon. In 2016, the Novares group, whose head office is located in France, posted adjusted revenues of €1.2 billion.

Novares operates in 21 countries and has 42 manufacturing plants around the world, 7 expertise centers, 5 technical centers and 17 customer service centers. The group's revenue has increased 58% over the past 5 years and more than 200 million parts were produced in 2016.

SEVEN PRODUCT LINES FOR VERY DIFFERENT PROCESSES

80,000 metric tons of injected plastic are produced every year. The 7 major product families are:

1. Engine Components (water, oil and air treatment, acoustic and aerodynamic management and tanks)
2. Bezels and Clusters (radio and climate control assemblies, instrument clusters)
3. Air Vents and Decoration Trim (all types of air vents, lighted or not, decorated parts and small mechanisms like cup holders)
4. Interior and Car Body Trim (trunk trim, dashboard components, roof consoles and wheel-arch flarings, acoustic and aerodynamic parts as well as black parts)
5. Handles (interior, exterior and fuel doors)
6. Exterior Paint and Surfaces (painted and decorated parts, black parts, roof bars)
7. E-Powertrain Components (electric and cooling system)

Depending on these product lines, the processes are very different.

THE DELMIA PRODUCTION PLANNING & SCHEDULING SOLUTION AS A RESPONSE TO NOVARES MANUFACTURING CONSTRAINTS

Novares operates in a dynamic, competitive and constantly changing automotive market: increasingly broad diversity, more SKUs, more segmentation and more complex flows. "Our agility, responsiveness, customer service and ability to push the performance of our components and systems beyond market requirements and customer demands are critical in our business and for our group's growth. Our goal is to make our plants more responsive to the actual demands of our customers by better managing production and using Lean Manufacturing principles to minimize inventories. The implementation of DELMIA fits perfectly in this context," said Frédéric Marcotte.

From the manufacturing point of view: "Master Production Scheduling is an essential link with, in particular, the levelling of customer demand and the management of our capacities for improved forward certainty. We also have to take into account the complexity related to the diversity of our products and their processes. Each product requires a specific process. The plants must integrate all of these products and processes into a heterogeneous manufacturing environment that is also able to quickly adapt to new customer requirements."

KEY OBJECTIVES OF IMPLEMENTING DELMIA PRODUCTION PLANNING & SCHEDULING

According to Marcotte, the team identified six key objectives for the new solution:

- **Be able to produce realistic and executable schedules** because they are developed based on production constraints: "We use different standard solutions. Thus we needed a tool to increase the reliability of our schedules."
- **Establish a longer scheduling horizon with more reliable lead-times:** "Go from a horizon of a few days to a few weeks in order to extend this degree of reliability to the entire supply chain, and in particular, to our suppliers by reviewing and refining material and component supplies (less inventory, fewer stock-outs and fewer exceptional shipments)."
- **Save time through automated, single-loop computation:** "We wanted computation to be completely automated to avoid the tedious and unsynchronized steps and to save time for the people involved in planning." The time freed up is used to assign resources to analyze the medium-term capacity plan.
- **Obtain a bird's eye view of the schedule** with the ability to simulate and recalibrate the working orders in case of contingencies: "Make the right decisions."
- **Be able to optimize changeover time** by taking constraints into account.
- **Have a complete tool that can be used to centralize and share information** with the necessary KPIs, flags and alerts to produce the schedule: "A single tool and a single source of information shared by everyone."

MAIN BENEFITS RECORDED USING DELMIA PRODUCTION PLANNING & SCHEDULING

- **Better visualization**
  The tool is highly visual, which facilitates decision-making. "Compared to what we had, there is no doubt that our decision-making is faster and more efficient."
- **Time saving on producing the schedules and improved anticipation**
  Save time on managing short-term scheduling and thus leaves more time for medium-term scheduling.
- **Management of alternative resources**
  It can be used to manage alternative machines: "an injection mold can be mounted on several pieces of equipment and the ability to integrate these constraints directly in the system makes us more efficient."
- **A single, benchmark system for everyone**
  A unique system replaces several tools.
- **Configurable flags and alerts**
  Reliable, real-time flags and alerts while the schedule is being developed.
- **A response to contingencies and constraints**
  The ability to level the workload and to work with more anticipation makes it possible to limit the frequent emergencies and unpredictables in automotive production.

"The tool meets all of our needs and our operating constraints."

— Frédéric Marcotte,
Novares Supply Chain Director

DELMIA PRODUCTION PLANNING & SCHEDULING SOLUTION ROLLED OUT IN 18 PLANTS AROUND THE WORLD IN A LITTLE MORE THAN ONE YEAR

Project Timing, Scope and Deployment Methodology

After a proof of concept was completed in late 2014, the decision was made to deploy DELMIA Production Planning & Scheduling across 18 plants within a relatively short timeframe. The core model was built in Q1 2015 and the rollout ran in parallel every month starting April 2015. "The scope is relatively global and covers the plants in China, India, Europe and Mexico. In this international context, the maturity, cultures and organizations are very different and this is one of the key features in project implementation," stated Frédéric Marcotte.

The methodology was implemented jointly with the DELMIA team "whose efficiency and effectiveness had already been proven at other clients." The starting point was a pre-audit conducted 4 weeks before kick-off to confirm that the plant was ready for deployment. Each plant did not have the same degrees of maturity and process control. The goal was to validate the prerequisites, that the bills of materials and manufacturing ranges were up-to-date, and the inventories were reliable. "If deviations are noted, action plans with relatively short timelines are implemented."

"We continue to evolve. In the automotive industry, the market changes very quickly. We are in an organic growth phase with the implementation of new plants in Morocco, Slovakia, Romania and China. The DELMIA solutions will be part of the DNA of each of the plants that we are going to deploy."

— Frédéric Marcotte,
Novares Supply Chain Director

After kick-off, the deployment was completed over 5 to 6 weeks, with the last steps performed on site: user training, integration testing, go-live and support. "A classic IT system rollout plan. The purely IT aspects (software installation, configuration of interfaces with SAP, tests) are managed jointly by our IT teams and the DELMIA team. Important things to keep in mind are overall we have the ability to start a plant every 5 to 6 weeks. Consequently, the rollout is fast and efficient."

TODAY, THE BENEFITS SPEAK FOR THEMSELVES

Benefits in Terms of Improved Performance

Marcotte reports that the Group has seen performance improvements in several important areas:

- **The customer service level** is 98.5% group-wide: "We have plants that weren't at 100% before the tool was installed, which is a real bonus", noted Frédéric Marcotte. Regarding the supplier service level, it is more than 90%. "We issue much more reliable delivery schedules and lead times with fewer changes, which lets us level out our demand at suppliers and consequently reduce inventory levels both at suppliers and in our plants."
- **Plant productivity is improved:** "The fact that production plans are realistic and executable lets us minimize unforeseen changeovers. This occurs in any industry. If we don't plan ahead, we suffer the consequences. We have seen real savings in this area across all plants that have deployed the solution."
- **Reduced inventories:** The average inventory levels are 8 days: "This includes materials, semi-finished components and finished goods. In some cases, this represents 30 to 40% less inventory and thus substantial savings." The risks of obsolescence have been reduced since the plants produce as close as possible to customer demand. Finally, exceptional shipments (plant/customers or suppliers/plant) have mostly been eliminated.

ORGANIZATIONAL BENEFITS

According to Marcotte, the Group has seen benefits/performance improvements in a number of areas:

- **Enhanced teamwork:** "At the same time that DELMIA was being implemented, the production planners who previously were part of the production teams were transferred to the logistics department."
- **Structured communication:** "We only have one source of information and it is shared."
- **Improved decision-making,** which requires less effort and is faster: "Across all plants, a 30-minute maximum daily meeting is sufficient between logistics and production. Things are clear; we do not rehash decisions and the day proceeds naturally and calmly."
- **Improved accountability:** "All scheduling depends on a single role, where responsibilities were shared previously."

Products
A range of solutions that cover seven product lines comprised of 19 product segments with more than 36,000 part SKUs. Positioned in the engine compartment and interior and exterior car body parts market, Novares serves more than 15 major brands daily, has more than 70 automotive clients and its parts are present on more than 400 vehicle models.

Head Office: Clamart, France

Founded: 1955

Personnel: 10,000 employees in 21 countries

For more information: www.novaresteam.com

ULYSSE NARDIN

"Ulysse Nardin has coupled the DELMIA Ortems solution to its Solvaxis ERP and launched a Lean Manufacturing project. We can now optimally control our just-in-time production, reduce run times and balance the loads across the different shops, while minimizing bottlenecks and in-process inventory."

Lucas Humair, Ulysse Nardin Industrial Director

Goal:

Ulysse Nardin wanted to optimize the way it manages the flow of its production of watch components, mainly the ébauches, gears and regulating organs, moving from unit production to mass runs of several thousand items.

Solution:

The company selected DELMIA Supply Chain Planning & Operations.

Benefits:

- Financial savings (reduce scheduling time, in-process inventory, just-in-time production and run times)
- Strategic gains (improve Supply Chain service level reliability and anticipate and eliminate bottlenecks)
- Organizational gains (fine-level control of multiple trades and shops, anticipate subcontractor information via precise communication of volumes and lead-times)

Founded in Locle, Switzerland, in 1846, and a subsidiary of the Kering group since 2014, Ulysse Nardin is a watch manufacturer that produces 'Haute Horlogerie' Swiss watches. The factory is based in La Chaux-de-Fonds and unites 40 trades to produce the components and movements of its different collections.

For Ulysse Nardin, watchmaker since 1846, true technical mastery implies perfecting its timepieces in the purest meaning of the term. To guarantee excellence, the watchmaker designs and manufactures most of its movements in-house. It is one of the rare 'Haute Horlogerie' watchmakers to produce its own balance springs[1] and escapements[2]. The factory is based in La Chaux-de-Fonds and unites 40 trades to produce the components and movements of its different collections.

A COMPREHENSIVE SUITE OF PLANNING AND SCHEDULING SOLUTIONS TO OPTIMIZE PRODUCTION FLOWS

To manage the flow of its production of watch components, which ranges from unit production up to mass runs of several thousand items, the factory selected DELMIA. DELMIA software is designed to meet the challenge and specific requirements of manufacturing operations.

A LEAN MANUFACTURING PROJECT

Lucas Humair, Ulysse Nardin's Industrial Director stated: "Ulysse Nardin has coupled the DELMIA solution to its Solvaxis ERP and launched a Lean Manufacturing project. We can now optimally control our just-in-time production, reduce run times and balance the loads across the different shops, while minimizing bottlenecks and in-process inventory."

The DELMIA solution was implemented and fine-tuned by, and under, the responsibility of the Head of Movements Supply Chain in charge of defining the model best suited to the needs of the factory in cooperation with DELMIA specialists.

"DELMIA is a tool that is indispensable to our organization. The different teams in Ulysse Nardin are completely satisfied by their daily use of the solution."

— Stefano Marzo,
Head of Movements Supply Chain, Ulysse Nardin

MAIN BENEFITS RECORDED

- Financial gains: the scheduling is easier and faster to implement, which means the team can focus on value-added tasks (reduced scheduling time by 25%, reduced in-process inventory, just-in-time production, reduced run times)
- Strategic gains: improved, more reliable Supply Chain service level, anticipate and eliminate bottlenecks
- Organizational gains: fine-level control of multiple trades and shops, anticipate subcontractor information via precise communication of volumes and lead times

A POSITIVE RESULT: FLEXIBLE SOLUTION ACCOMMODATING MULTIPLE TRADES AND SHOPS

For Stefano Marzo, Head of Movements Supply Chain:

"The different teams in Ulysse Nardin are completely satisfied by their daily use of the solution. It offers a detailed two-month view of the load while remaining flexible in case of need, taking into account the many trades and shops to manage and any production contingencies. DELMIA is a tool that is indispensable to our organization. We plan to deploy it in other planning units of our departments, for example the movements assembly process."

[1] Balance springs: very fine springs considered as the soul of the mechanical watch

[2] Escapement: mechanisms that count the oscillations of the balance of a watch

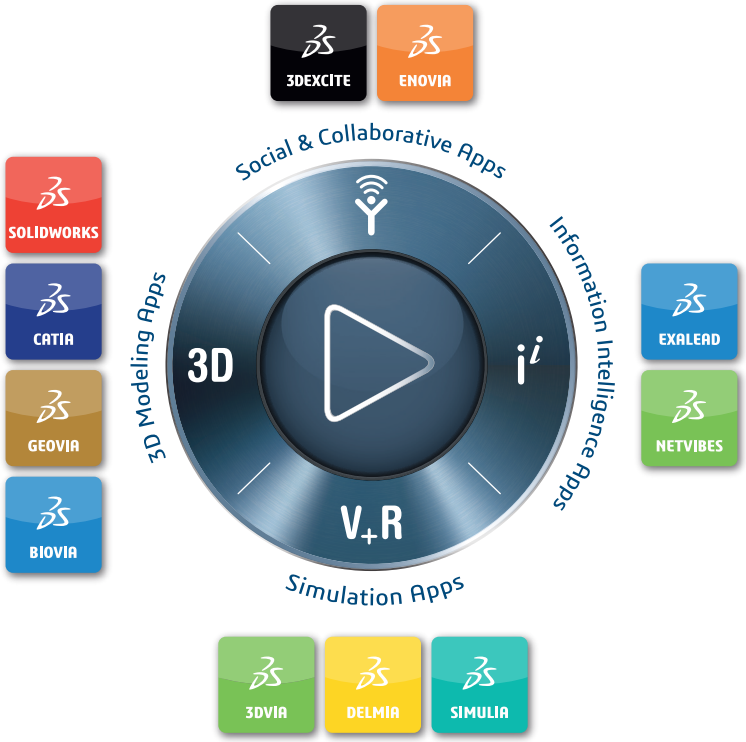
Products: 'Haute Horlogerie' watchmaking

Revenue: US$ 6.4 billion (net 2015)

Head Office: le Locle (Switzerland)

Workforce: 300 employees

For more information: www.ulysse-nardin.com



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

Dassault Systèmes, the **3D**EXPERIENCE® Company, provides business and people with virtual universes to imagine sustainable innovations. Its world-leading solutions transform the way products are designed, produced, and supported. Dassault Systèmes' collaborative solutions foster social innovation, expanding possibilities for the virtual world to improve the real world. The group brings value to over 220,000 customers of all sizes in all industries in more than 140 countries. For more information, visit **www.3ds.com**.

Europe/Middle East/Africa
Dassault Systèmes
10, rue Marcel Dassault
CS 40501
78946 Vélizy-Villacoublay Cedex
France

Asia-Pacific
Dassault Systèmes K.K.
ThinkPark Tower
2-1-1 Osaki, Shinagawa-ku,
Tokyo 141-6020
Japan

Americas
Dassault Systèmes
175 Wyman Street
Waltham, Massachusetts
02451-1223
USA

DASSAULT SYSTEMES | The **3D**EXPERIENCE® Company