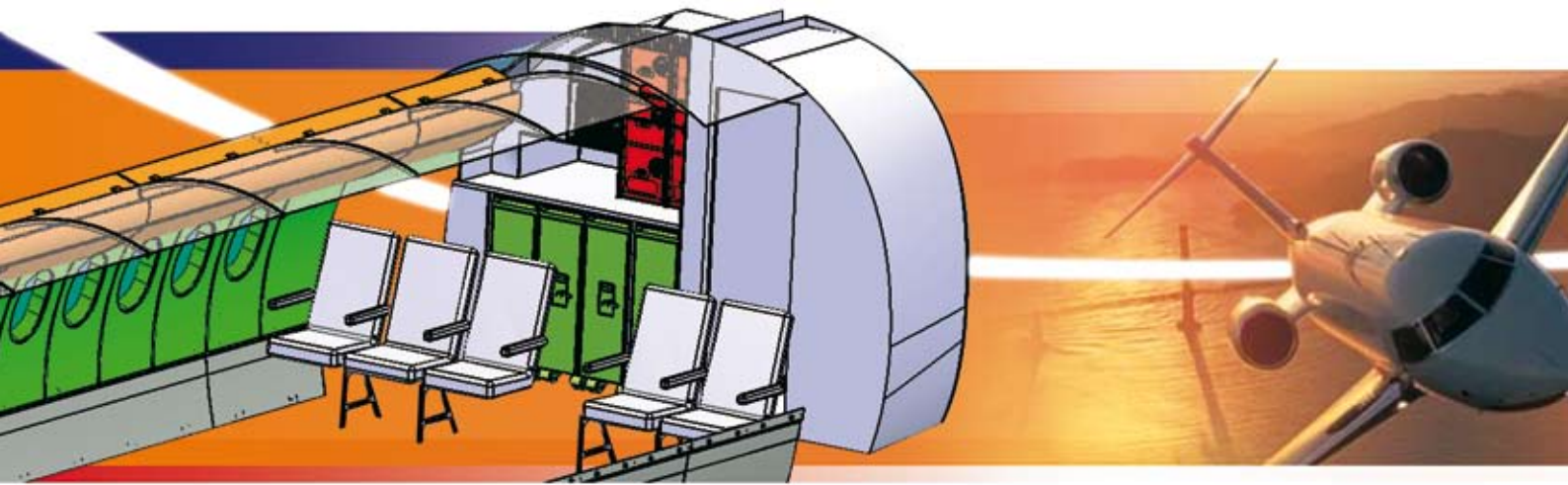


# Bombardier Aerospace

Driving collaborative innovation across the extended enterprise with V5 PLM





## Bombardier Aerospace PLM Objectives

- **Increase market share by meeting customer needs and expectations**
- **Leverage 3D product information to respond to changing business drivers**
- **Reduce cycle time and costs by integrating global development resources**
- **Maximize efficiencies and optimize processes across the product lifecycle**



“V5 PLM helps us flow information throughout the entire value stream, enabling a higher level of concurrency that helps us bring new products to market faster.”

François Caza, Vice President and Chief Engineer, Bombardier Aerospace

## Company Overview

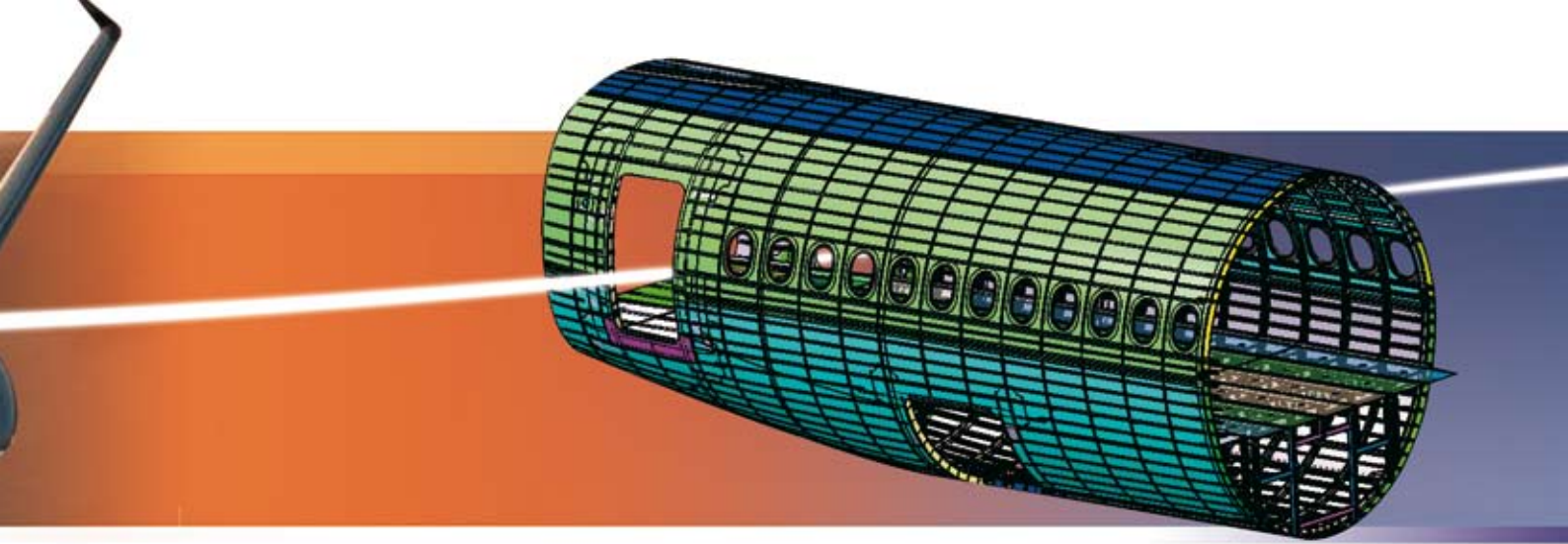
Bombardier Aerospace is the third largest civil aircraft manufacturer in the world and a leading supplier of business, regional and amphibious aircraft, with fiscal year 2005 aerospace revenues totaling US\$8.1 billion. Bombardier Regional Aircraft leads the 50, 70, and 90-passenger regional carrier market. Bombardier Business Aircraft offers five models of narrow-body aircraft under the Learjet brand, and four models of wide-body business jets under the Challenger and Global Express brands. Like the company's technology vision, Bombardier Aerospace's values and business priorities are seamlessly connected:

- Create a safe and rewarding workplace.  
V5 PLM provides tools that enhance employee skills and increase effectiveness
- Provide an amazing customer experience.  
V5 PLM provides the means to develop innovative aircraft at a faster pace
- Eliminate waste in every possible way.  
V5 PLM provides a single source of accurate and relevant product definition data.

## Business Challenges

A company with a history of innovation, Bombardier Aerospace has put itself at the forefront of aerospace product development by completing 16 major new and derivative aircraft programs in the last 16 years. Today, a faster rate of change in the airline and business jet markets and more intense competition means that the company must develop innovative aircraft at an even faster pace. Rapid market shifts often require that aircraft designs be quickly repurposed from one program or application to another.

Bombardier Aerospace has assembled a global product development network that includes internal teams and global development partners. Providing these teams with the right data and tools to collaborate not only with upstream disciplines like design and product planning, but also with downstream stakeholders including manufacturing, sales and marketing, and after-sale services, represents an enormous challenge.



Changes need to ripple across the extended enterprise in real time so that everyone is working with most current and accurate information. Engineers need to understand the reasons for and the impact of changes in order to perform cost-benefit analyses and drive right-first-time innovation. Engineers need to be able to re-use parts and assemblies from other aircraft programs to jump-start projects, reducing cycle times and cost. Downstream processes such as manufacturing and after-sales require access to detailed design information so they can quickly analyze the impact of design changes on shop floor automation and design, as well as scheduling and allocation of global resources

## Solution

Bombardier Aerospace selected Dassault Systèmes Version 5 Product Lifecycle Management (DS V5 PLM) Solutions and the IBM PLM Solutions team to help address the challenges of integrating their global engineering organization. “We needed a PLM system and implementation partners that had already proven their ability to address the challenges involved in developing large aircraft throughout the entire development lifecycle, as well as a partner with the resources to support us during and beyond the implementation process,” said Tim Ambridge, Director, PLM Business Processes, Bombardier Aerospace. “CATIA V4 had helped us lead the aircraft industry in innovation over the past two decades, so selecting V5 PLM was an easy decision. By teaming with Dassault Systèmes and IBM PLM Solutions, we ensure that we are implementing an efficient and cost-effective PLM system.”

### **CATIA V5 aids move from document-centric to data-centric system**

Bombardier Aerospace uses CATIA V5 as the centerpiece of new product definition methods in which the 3D model becomes the central source of all product information. CATIA V5 3D models completely define the product and its lifecycle requirements, providing far more information than paper-based engineering drawings, which will no longer be used in future aircraft designs. The 3D models can be repurposed effortlessly across the value chain to generate whatever deliverables may be required, while providing instantaneous updates on product, process or resource changes.

“V5 PLM is a critical component of our PLM Enterprise Architecture and will provide our entire organization with a single source of information that will speed decision-making and reduce errors,” said Tony Boisvert, Business Transformation and Systems Director, Engineering and PLM, Bombardier Aerospace.



“V5 PLM solutions help us optimize the product lifecycle by creating a comprehensive digital product definition that we can repurpose throughout the value chain.”

Verner Baird, Business Transformation and Systems, Vice President Engineering and Supply Chain and ERP, Bombardier Aerospace





“At Bombardier Aerospace, we pride ourselves in our ability to quickly launch more innovative products into the marketplace. V5 PLM helps us to maintain that lead by putting us at the forefront of the movement to develop an integrated product development process.”

Tony Boisvert, Business Transformation and Systems Director, Engineering and PLM, Bombardier Aerospace.

### ENOVIA VPLM extends power of CATIA V5 to globally dispersed teams

ENOVIA VPLM extends the power of CATIA V5, allowing globally dispersed teams to collaborate anytime and anywhere, knowing that each contributor can easily access up-to-date product information. The ability to quickly evaluate designs within the context of a part, a large assembly, or an entire product portfolio improves decision making and promotes reuse across product lines and variants. With ENOVIA VPLM change management, downstream users in manufacturing, aftermarket, and other business-critical areas have the information they need to be more productive and avoid errors and rework.

“ENOVIA VPLM provides the right data at the right time in the right format to the right people,” said Colin Campbell, Manager PLM Business Processes, Bombardier Aerospace.

### DELMIA optimizes manufacturing processes

Bombardier Aerospace’s integrated product development teams use DELMIA to improve the efficiency of global manufacturing operations. It allows them to reduce downstream errors, training and documentation costs by creating digital models of factories and evaluating many different designs and operating scenarios before committing to construction and equipment expenditures. Digital 3D modeling helps Bombardier Aerospace increase operational productivity, evaluate precisely what resources are required to meet diverse production scenarios, and optimize utilization of factory space and personnel.

“DELMIA virtual manufacturing helps us to transfer learning sooner and more completely to the low-numbered aircraft units (the first aircraft off the assembly line) in any new program,” said Tony Curry, Process and Tools Manager for New Aircraft Programs, Bombardier Aerospace.

## Results

The implementation of V5 PLM is proceeding on a program-by-program basis at Bombardier Aerospace. Many of the early V5 PLM successes have come in the test integration department. With testing occurring in parallel to the development of the aircraft, the department has served as a laboratory for innovative design and manufacturing methods and, because it needs to respond efficiently to continuous change, as a microcosm for the entire organization.



### **Test Integration Group: time savings**

As an example, the test integration group was able to rescale a wind tunnel model in two hours to accommodate an internal motor used to simulate engine flows. Using the old document-centric approach, it would have taken up to 40 hours to rescale the design – freeing up almost a week of man hours.

In another case, test engineers using CATIA V5 developed the first parameterized iteration consisting of a part in two days then, on the third day, created 200 different configurations. This work would previously have taken eight days to complete.

### **Regional aircraft design: time savings**

Bombardier Regional Aircraft engineers recently used a CATIA V5 model to perform buoyancy calculations on the wing of a new regional jetliner. It previously would have taken 80 hours to perform the calculations using a spreadsheet based on engineering drawings. The CATIA V5 3D model provided the volume and density information for each component of the wing, making it possible to perform the calculations in only four hours, freeing up two more weeks.

### **Business jets: time savings**

ENOVIA VPLM is being used by the Bombardier Completion Center Montreal (BCCM) to manage design information used to provide luxurious custom interiors for Global Express business jets for customers. The interior for each jet is designed from scratch, and includes many one-of-a-kind components such as handcrafted cabinetry, custom upholstery, chairs with fold-out tables, etc. ENOVIA reduces by 80% the time required by BCCM engineering and manufacturing personnel to locate data, while ensuring that everyone is working with the most current and most accurate information.

### **Manufacturing: cost savings**

Bombardier Aerospace engineers used DELMIA software to simulate the manufacturing operations for a proposed new production facility. They used the digital 3D model to evaluate the best way to get parts to workstations, determine what production rate could be achieved with various resources, and determine what manpower was needed where and how much. The simulations made it possible to reduce the size of the factory by 50% compared to previous standards, providing potential savings estimated at US\$9 million. Engineers also improved the productivity of the factory by using the virtual model to identify potential bottlenecks, then redesigning the factory to eliminate them.

## **V5 PLM Key Benefits**

**- 62%**  
Time to develop multiple iterations of existing designs reduced from eight to three days

**- 95%**  
Engineering calculation time reduced from 80 to four hours

**- 80%**  
Time to locate design information reduced by 80%

**- 50%**  
Size of new manufacturing plant reduced by 50%



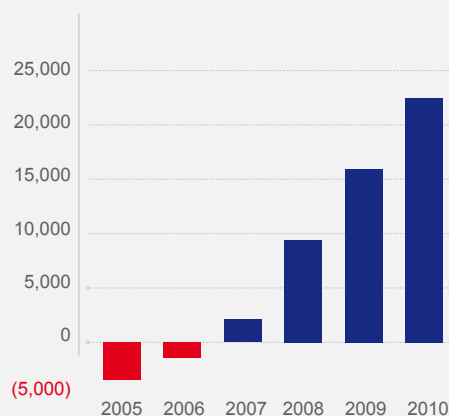
## Independent ROI study

CIMdata performed an independent Return on Investment (ROI) study on Bombardier Aerospace's implementation of the V5 PLM solution. The study was based on interviews with Bombardier Aerospace personnel, data about the benefits of the PLM solution, and the cost of its deployment (software, hardware, training, maintenance, ramp-up and administration). CIMdata's ROI model calculated the overall ROI for a six-year period.

Bombardier Aerospace's ROI is impressive with a short payback period and a high internal rate of return:

- pay back period is 2.1 years
- net present value of benefit over six years is US\$21.7 million
- internal rate of return is 108.0%

Cumulative Discounted Cash Flows - k\$



CIMdata is a leading and independent worldwide consultancy specialized in PLM strategy

**CIMdata**



**Additional benefits achieved with V5 PLM\***

Benefit area	Reduced by
Overall product design time	10%
Engineering changes costs	50%
In-production error correction costs	19%
NC programming time and costs	30%
Transfer of BOMs into manufacturing systems labor costs	50%



“Our success depends upon continuing to innovate faster than our competitors. V5 PLM solutions play a critical role in increasing our competitive advantage by enabling us to integrate our extended enterprise, optimize the performance of our products, and rapidly implement change.”

Tim Ambridge, Director, PLM Business Processes, Bombardier Aerospace.

**Future**

Up to now, Bombardier Aerospace has focused its V5 PLM implementation on a few key demonstration programs and departments. The goal for the future is to extend the benefits of V5 PLM system-by-system, program-by-program, throughout the extended enterprise. Bombardier Aerospace intends to integrate all of its global design teams, global design and manufacturing partners, suppliers, and the full gamut of after-sales activities with V5 PLM solutions.

\*Findings based on Return on Investment study performed by CIMdata

**V5 PLM for the Aerospace industry**

**With more than 20 years of experience developing solutions for the aerospace industry, Dassault Systèmes has a legacy of innovation and success in one of PLM’s most pioneering markets.**

Developed in close collaboration with leading aerospace OEMs and suppliers, the V5 PLM aerospace offering combines Dassault Systèmes’s V5 PLM portfolio of CATIA, DELMIA,

ENOVIA, and SIMULIA, with specialized aerospace best practices or work methodologies called DS PLM Practices. Leveraging the same digital manufacturing tools widely used in the automotive and shipbuilding industries, DS V5 PLM aerospace solutions allow manufacturers to significantly reduce time-to-market and costs, while advancing innovation and product quality.

As a world leader in 3D and Product Lifecycle Management (PLM) solutions, the Dassault Systèmes group brings value to more than 90,000 customers in 80 countries. A pioneer in the 3D software market since 1981, Dassault Systèmes develops and markets PLM application software and services that support industrial processes and provide a 3D vision of the entire life cycle of products from conception to retirement

Dassault Systèmes develops and markets PLM application software and services that support industrial processes and provide a 3D vision of the entire lifecycle of products from conception to maintenance.

The Dassault Systèmes V5 PLM offering consists of CATIA V5 for designing the virtual product, DELMIA for virtual production, ENOVIA for global collaborative lifecycle management (including ENOVIA VPLM, ENOVIA SmarTeam, and ENOVIA MatrixOne), and SIMULIA for virtual testing.

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Images courtesy of Bombardier Aerospace

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