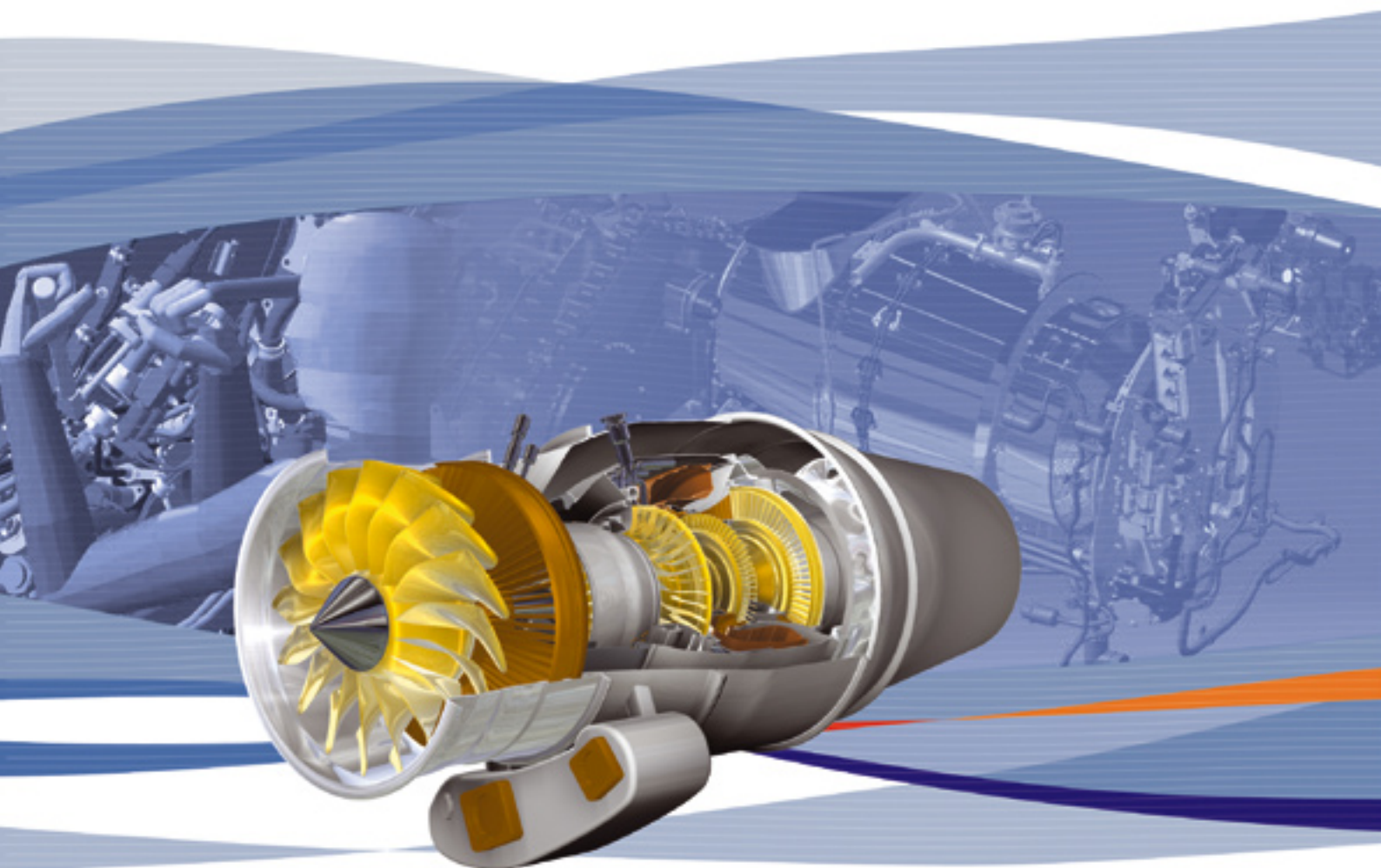


# Pratt & Whitney Canada

The Digital Engine takes off with PLM



# Company overview



## Pratt & Whitney Canada

A United Technologies Company

Pratt & Whitney Canada (P&WC), created 75 years ago, is among the world's leading designers and manufacturers of turbofans, turboprop and turboshaft engines for regional, business, utility and military aircraft as well as helicopters.

P&WC, a subsidiary of United Technologies Corporation, employs approximately 9,000 people worldwide. Based in Longueuil, Canada, the company's operations are also present in Australia, Brazil, China, Germany, Poland, Russia, Singapore, South Africa, the United Kingdom and the United States.

To date, P&WC has produced over 55,000 engines for customers in more than 190 countries. It is estimated that every two seconds, an aircraft powered by a P&WC engine lands or takes off somewhere in the world. P&WC customers include: Agusta, Airbus, Bell Helicopters, Boeing, Cessna Aircraft Company, Dassault Aviation, Embraer, Eurocopter, Raytheon Aircraft and many more.

### Business challenges

- + Reduce time-to-market to maintain competitiveness
- + Manage seamless collaboration among an ever-growing number of partners worldwide
- + Empower innovation with a PLM solution that covers the entire engine development process

## Situation

Assembly design time: - 20%

In the aircraft industry, the development time of an engine is a critical success factor and represents a major constraint for aircraft manufacturers. "To be more proactive to customer demand, we have to reduce the development lifecycle of a brand new engine to less than three years. This will give us a competitive edge," said Mario Modafferi, director Engine Design, P&WC.

In order to manage the increasing sophistication of engines, P&WC has to integrate an ever-growing number of global strategic development partners. "We must enable customers, partners, suppliers and employees worldwide to collaborate while not wasting time in data transfer or management," said Sherrill Novosad, project manager Digital Enterprise program, P&WC.

P&WC also needed a Product Lifecycle Management (PLM) solution that covers the end-to-end engine development processes to empower innovation. "We cover so many disciplines, we want to ensure that our products reflect state-of-the-art technology in aerodynamics, structure, mechanical design, performance and control," said Mario Modafferi.



*"Our goal is to become an industry leader in designing engines using digital technology throughout the entire product lifecycle."*

Amal Girgis, CIO, P&WC

# Solution

“To enhance our end-to-end engine lifecycle, we have decided to implement a Dassault Systèmes and IBM PLM solution based on CATIA V5, ENOVIA VPM, ENOVIA Portal and DELMIA,” said Amal Girgis, CIO, P&WC.

## Large and successful CATIA V4 to V5 migration

P&WC, a long-time CATIA V4 customer, successfully migrated 700 users to CATIA V5 on Windows® since mid-2002. P&WC selected “power users” who worked with the migration project team to develop new work methods based on V5 functionalities. Once the methods were fully validated, training and deployment to the rest of the group started. In a very structured way, P&WC progressed through its Engineering and Manufacturing departments.

“We had two options in doing the migration,” said Nick Spathis, manager Engineering Systems, P&WC. “Either hire a company to convert all our data to V5 or migrate data on an ad hoc basis. We chose migration on demand. This helped lower the overall project costs and still allowed the migration to V5 to continue.”

## ENOVIA deployment for tight collaboration

With the upgrade completed in 2002, ENOVIA VPM became the central repository for P&WC’s product-related data. Data reviews are now simplified through easy access to the current versions of the product models.

In 2003, P&WC increased the use of ENOVIA VPM in line with the CATIA V5 rollout and implemented ENOVIA Portal for internal use. The next step will be to use the Portal to open secure access to product-related data to customers, partners and suppliers.



*“Today, approximately 700 users from engineering and manufacturing have successfully migrated to CATIA V5 and ENOVIA.”*

Nick Spathis, manager, Engineering Systems, P&WC



**Elimination of maintenance prototypes:  
- \$500 K / engine program**

# Results

## Increased design productivity

The intuitive and advanced functionalities of CATIA V5 enable designers to use new methods to be more productive:

- The ease-of-use and intuitiveness of CATIA V5 allow designers to **save about 20% of their time\*** during the assembly design phase.
- Parameterization and knowledgware capabilities in CATIA V5 permit the creation of a library of templates. "They are used by all designers to automate repetitive tasks, speed up development, and ensure consistency with company standards," said Sherrill Novosad.
- Other productivity-enhancing capabilities provide **millions of dollars** in productivity savings per year\*. These include: integration of in-house systems and Microsoft® Office tools within CATIA V5, ENOVIA VPM support of data sharing among applications, and P&WC-developed CATIA V4 functionalities now available as standard products in CATIA V5.



*"ENOVIA Portal enables us to create a secure environment for our partners and suppliers, as well as for the different departments of our company around the world."*

Sherrill Novosad, project manager Digital Enterprise program, P&WC

## Improved collaboration

The combination of CATIA V5 and ENOVIA offers P&WC a seamless environment for design creation and validation:

- ENOVIA Portal enables easy web access to product data. The development environment can be opened to customers and suppliers to reduce product development cycle time.
- ENOVIA VPM manages CATIA V5 data to ensure its integrity along the entire development process. Having product structures in CATIA V5 linked to ENOVIA VPM supports design in context. This improves overall design productivity and provides significant savings.
- ENOVIA DMU V5 gives P&WC the flexibility to share different degrees of digital mock-up information among its internal teams, suppliers, and customers. "V5 now allows us to extract the silhouette, get the skin and send to the customer a simple and light file that can be used for the design of the aircraft. This collaboration results in better products for our customers," says Nick Spathis.
- CATIA V5 assembly modeling, ENOVIA DMU design in context, digital mock-up, silhouettes and other features are estimated to **save P&WC over \$1 million per year.** \*

\*findings based on an independent study performed by CIMdata



**Clashes resolved in early design: 70%**

## Designed right the first time

IBM and Dassault Systèmes PLM solutions eliminate the need for a physical mock-up for interference analysis and maintenance simulation purposes, the cost of which represents approximately **\$500 k per engine program\***.

Clash and fitting simulation allows detection of collisions and gaps early in the design process, saving hundreds of hours of design time on each program. "Clash detection occurs even before the first engine is built. **70% of interferences\*** are now resolved at the early design stage. It saves us money and time on each project," said Mario Modafferi.

Virtual prototyping enables P&WC to verify accessibility and maintainability of aircraft engines. P&WC can now virtually optimize and validate engine removal using a human manikin, demonstrate the engine extraction, estimate maintenance time more accurately, and obtain the acceptance from the aircraft manufacturer.

## Streamlined NC Manufacturing

The P&WC manufacturing department benefits from the entire PLM suite, including CATIA V5 for NC tool path definition, ENOVIA for change management, and DELMIA IGRIP for robotic and NC manufacturing process simulation.

The seamless integration of the CATIA V5 engineering and DELMIA manufacturing environments ensures associativity by saving and managing the links between the 3D product model and the manufacturing processes required to produce it. Programming is **up to 10 times faster** and machining time can be improved by **up to 35%\***.

"Sometimes we have to iterate our design and change it. With CATIA V5, we make significant improvements since we can revise our process planning for a new part very quickly - a lot faster than in the past," said Andrew Cion, director Manufacturing Engineering Development, P&WC.

- Other manufacturing benefits include:
  - .13% reduction in jigs and fixtures design costs\*
  - .10% decrease in the value of scrap\*
  - .nearly a 10% reduction in rework costs\*

\*findings based on an independent study performed by CIMdata



*"With IBM and Dassault Systèmes PLM solutions, we can now perform advanced virtual maintenance simulations. We no longer need physical prototypes."*

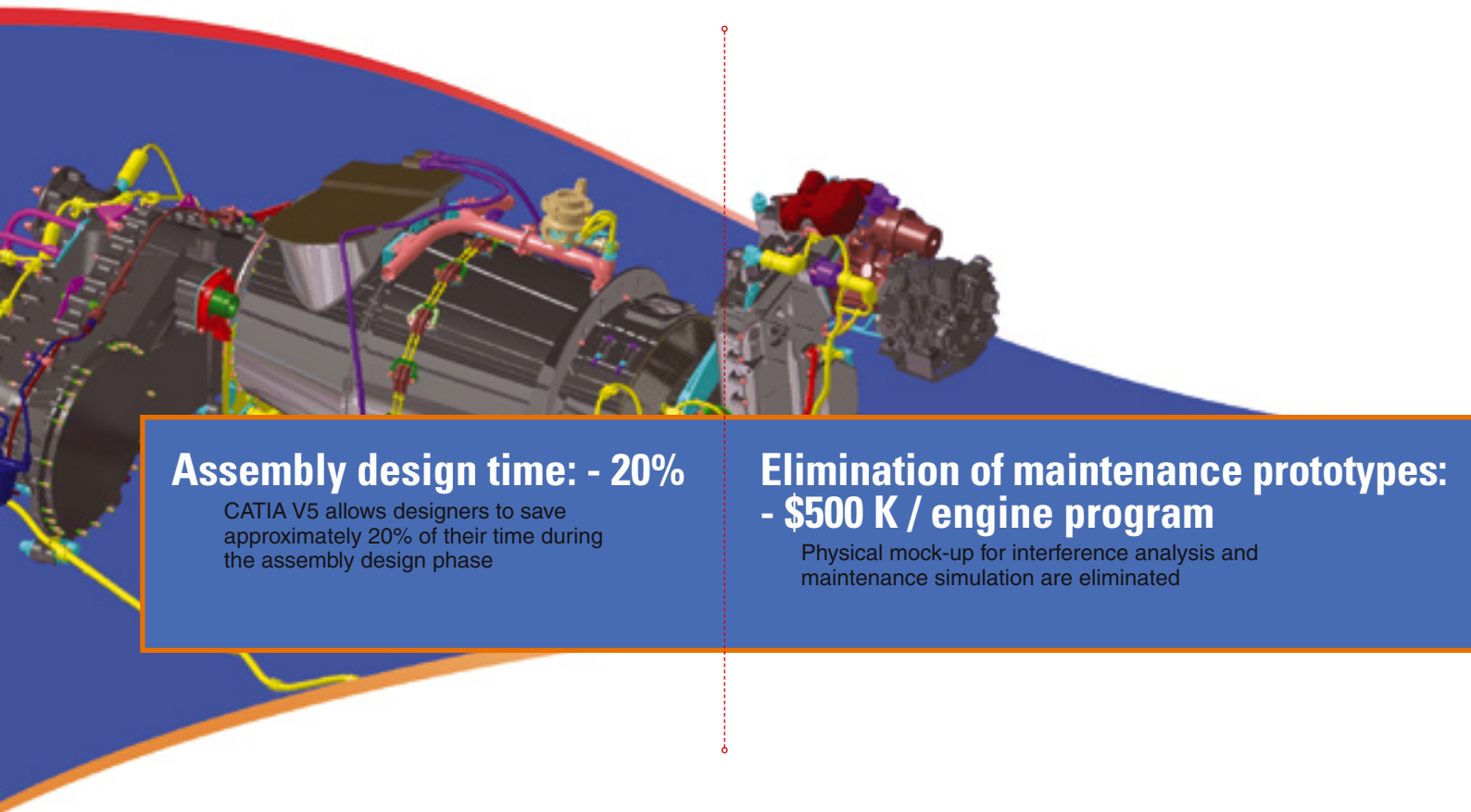
**Mario Modafferi, director Engine Design, P&WC**

**NC Programming: up to 10 times faster**

# Challenges met

CATIA V5, ENOVIA VPM, ENOVIA Portal, and DELMIA have helped P&WC to meet and surpass its business challenges. The PLM solutions have streamlined P&WC's end-to-end engine design process across all phases of product development and given the company a competitive edge.

"I believe that P&WC's design process is the best in the world. Our reputation depends on the reliability of our products. We are very proud of the number of P&WC engines flying out there and of the number of engine contracts we have won," said Amal Girgis.



## Assembly design time: - 20%

CATIA V5 allows designers to save approximately 20% of their time during the assembly design phase

## Elimination of maintenance prototypes: - \$500 K / engine program

Physical mock-up for interference analysis and maintenance simulation are eliminated

# Future

P&WC's analytical engineering community will benefit from Dassault Systèmes' V5 architecture. Hundreds of analysis applications could be replaced by or integrated with IBM and Dassault Systèmes' PLM solutions, thereby integrating the analysis process with product geometry. "Analysis is like our 4th dimension here at P&WC and the ROI expected is enormous," said Mario Modafferi.

ENOVIA V5 offers P&WC opportunities for its extended enterprise. ENOVIA 3d com will enhance collaboration with partners and the supply chain. P&WC is investigating ENOVIA LCA as a tool to enhance its digital engineering processes.

P&WC is also evaluating additional DELMIA Digital Manufacturing capabilities, including integrated process planning for NC manufacturing (methodology and tools needed to bridge information flow from design to production) and the use of manikins to train maintenance workers (human modeling technologies).

## Return on Investment

### An independent ROI study

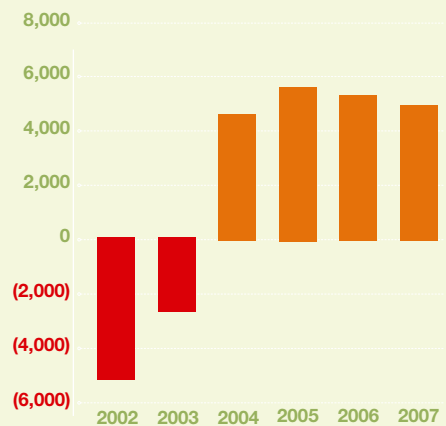
CIMdata performed an independent Return On Investment (ROI) study on P&WC's implementation of IBM and Dassault Systèmes PLM solutions. The study was based on P&WC data on the benefits of PLM versus the cost of implementation (software, hardware, training, maintenance and administration).

### Findings

CIMdata took a conservative approach when measuring P&WC ROI. The study findings show excellent ROI for a large PLM deployment in the first phase of implementation.

- Payback period is **three years**
- Net Present Value of Investment (over six years) **is superior to \$12 million**
- Internal rate of return is **54%**

Discounted Cash Flows - \$k



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

Nov 2003 - **CIMdata**

## Clashes resolved in early design: 70%

Majority of interferences are now resolved at the early design stage

## NC Programming: up to 10 times faster

Seamless V5 integration between engineering and manufacturing environments dramatically shortens programming time

## Conclusion

"Dassault Systèmes and IBM have a unique PLM vision and strategy that impressed the people involved in the project," said Amal Girgis. "Their PLM solutions represent a key element in our Digital Enterprise vision. We plan to be together for a long time!"





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