

# Delivering Value to Pratt & Whitney Through Product Graphics Management

## Pratt & Whitney Develops Condition-Based Maintenance Solutions For Aircraft Engines

Delivering some of the world's most complex products, Pratt & Whitney has built an international reputation as a technology leader. The company not only drives innovation into their design process, but relies on technology suppliers such as Right Hemisphere to continuously innovate new processes that can strengthen their market leadership, shorten time to market, and reduce product lifecycle costs.

The Pratt & Whitney Advanced Programs Office is applying Right Hemisphere's Product Graphics Management software as it develops next-generation maintenance support solutions and transforms the servicing of aircraft engines. By leveraging their 3D CAD data assets, they can lower support costs while delivering more intuitive, graphical directions to on-ground service crews. Taking advantage of a lightweight yet graphically accurate format allows the use of wireless communications and mobile laptop platforms. Both new and retrofit aircraft engines can be more efficiently diagnosed thereby streamlining maintenance.

The use of Product Graphics Management software yields several benefits for Pratt & Whitney:

- ▶ Differentiates Pratt & Whitney engines with a unique high-value-add maintenance support offering
- ▶ Lowers total cost of ownership by increasing engine up time
- ▶ Shortens on-ground maintenance and service times through condition-based maintenance and highly graphical, visually accurate, interactive procedures
- ▶ Enables continuous improvement and accelerates tailoring of maintenance content by leveraging ever-changing 3D CAD data and supporting easy content annotation and revision
- ▶ Shortens time to market for new and modified engine designs by speeding maintenance content creation and allowing support solutions to be developed concurrently with final product designs
- ▶ Provides a platform for managing and sharing 3D engine graphics with other functional areas such as the System Engineering and Validation Group



Images courtesy of Pratt & Whitney

*"The ability to deliver wireless, fault-code-driven 3D-directed maintenance at the point of work is a significant advance for our industry. Product Graphics Management software is a key component of our Knowledge Management Architecture and is making condition-based maintenance a reality."*

**David Loda,  
Manager, Network Centric  
Systems Architecture**

## Scope of Product Graphics Management at Pratt & Whitney

Like any business in a highly competitive industry, the Advanced Programs Office at Pratt & Whitney constantly looks for ways to help their customers reduce total cost of ownership. For a complex product like an aircraft engine, any reduction in cost has to be carefully balanced with increased service effectiveness and adherence to very strict, constantly evolving best practices.

The team identified two transformations that would aid their efforts to lower total cost of ownership. First, service teams needed a way to tailor maintenance procedures for each engine. Compared to predefined preventative maintenance procedures-typically based on worst-case needs instead of the actual condition of the engines-condition-based maintenance would allow on-ground service crews to specifically diagnose each engine and perform only the work required. Second, a move away from text-intensive maintenance procedure documentation to more interactive, visual content would shorten the time required for maintenance crews to carry out the required procedures.

Pratt & Whitney chose Product Graphics Management software from Right Hemisphere as the key enabler for both transformations.

## Previous Operation Constraints

Today, service crews rely on an extensive library of service manuals to carry out all engine service and maintenance procedures. A steady stream of service bulletins provides updates, but tracking changes manually is time consuming and not always effective. Other challenges exist because the service information is not integrated with the onboard diagnostic systems or with the parts ordering systems. Crews spend a lot of time isolating and diagnosing problems, having to decipher text messages from the diagnostic systems, manually searching through service manuals and bulletins for appropriate fixes, and then looking up and ordering replacement parts. Further, preventative maintenance is sometimes carried out needlessly or sooner than necessary for a particular engine.

## Optimized Processes using Product Graphics Management

The Advanced Programs Office chose Right Hemisphere Software to demonstrate onboard hosting of 3D visualization data, integrated with the engine or other subsystem, using its Onboard Internet Microserver™ architecture. In this way, training and supporting technical information can be co-located onboard and driven by the engine or other aircraft subsystem's controller, and is displayed in an easily understood, computer game-like 3D format using any web browser-enabled wireless device. This network centric embedded intelligence approach will enable both higher quality of maintenance work performed and reduces time for task completion because all of the information required is hosted onboard. Wireless connectivity through the Microserver's two-way network centric communications architecture ensures automated updates and synchronization. This solution is the world's first fault code driven, onboard 3D maintenance solution, and will revolutionize the way line maintenance is done in the industry.

Two Right Hemisphere applications provide foundational functionality for the maintenance solution. Right Hemisphere Deep Server™ software allows the team to transform existing CAD data into lightweight 3D models optimized for efficient use in a wireless Internet-based environment. With 3D data that can be delivered onboard or planeside, and a 3D graphical user interface, a mechanic with a secure login can get instant access to relevant information at the point of work. The new service solution ties into the onboard diagnostic systems, other onboard systems, and on-ground centralized maintenance management systems. Crews no longer need to rely on cryptic text-only status information. Instead, using an off-the-shelf PDA, laptop, or tablet PC, mechanics are visually directed to areas that need attention and provided with up-to-date visually oriented repair instructions. The new platforms simplify data collections during routine engine checks, and report status back wirelessly to maintenance control.

Pratt & Whitney also uses Right Hemisphere Deep Creator™ software to author high-quality, interactive, 3D maintenance procedures for the new solution. Starting with existing CAD data and using Deep Creator authoring tools to adjust graphics shortens the content creation process. Annotations and notes can be injected directly into visuals, and animation added for stepping through complex procedures or illustrating parts in motion. The resulting content allows maintenance crews to identify and carry out any required procedures more quickly.



*Images courtesy of Pratt & Whitney*

## Applying Product Graphics Management Throughout Pratt & Whitney

Another Pratt & Whitney organization, the System Engineering and Validation Group, is finding numerous ways to achieve their business goals by applying Right Hemisphere software. This group performs engine design validation for more than 50 new engines per year.

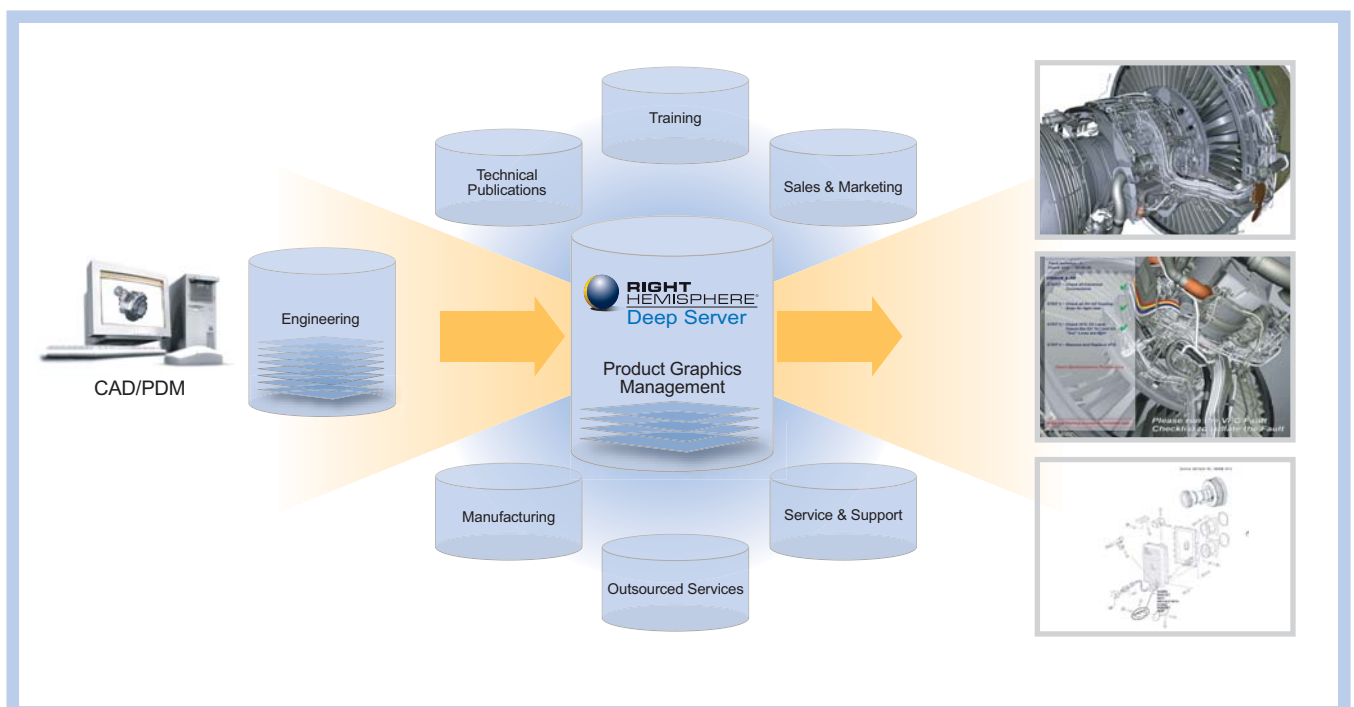
For each design, the team tests for the resolution of outstanding design issues, and carries out an in-depth analysis of engine performance and resistance to stress. The instrumentation and prototypes required for the extensive testing can be time consuming and costly to build for each iteration of an engine design. By applying Right Hemisphere software, the team has developed engine test setups and scenarios in virtual reality. Many of the engine evaluation operations can be performed earlier, concurrently with design, resulting in less engine rework and higher-quality designs. By reducing cycle time, shortening the duration of tests, and simplifying test instrumentation layout, the engine validation team expects to realize several time and cost reductions:

- ▶ Engine build cycle time reduced by 5%
- ▶ Engine mount time reduced by 6%
- ▶ Time in test stand shortened by several hours


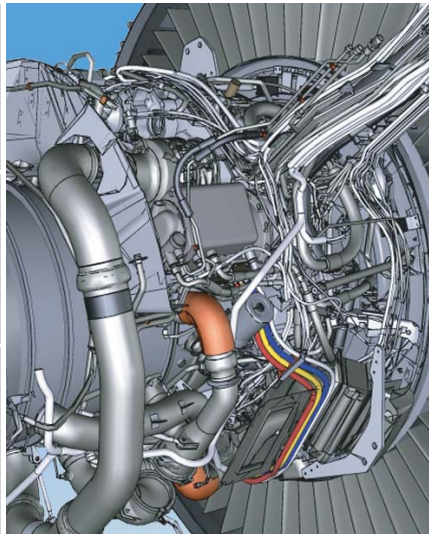
Outside of Pratt & Whitney's engineering organizations, graphics development represents a significant recurring support cost. With literally thousands of graphics produced per year, reducing graphics development time and increasing graphics reuse translates into significant cost reductions and shortened time to market. Graphics that can be centrally managed and shared throughout the entire company also introduce opportunities for increasing revenues from content-dependent offerings such as training and documentation.

Pratt & Whitney groups such as Training, Design for Maintainability, and Technical Publications have identified areas where Product Graphics Management will yield benefits:

- ▶ Developing and managing graphical content for technical publications.
- ▶ Replacing traditional classroom instruction with media-rich computer-based training.
- ▶ Improving training effectiveness by introducing increased realism and interactivity into course content.
- ▶ Shortening development time for virtual-reality (VR) environments used to test designs for maintainability; enabling VR development earlier in the design phase.
- ▶ Improving the quality, efficiency, and thoroughness of engineering analysis when designing for maintainability



*Images courtesy of Pratt & Whitney*

 <p><b>Pratt &amp; Whitney</b> A United Technologies Company</p>	<p><i>Established a new standard for condition-based engine maintenance and service, introducing wireless communications to deliver onboard and planeside visually interactive maintenance instructions to ground crews.</i></p>	
<p><b>Business Challenge</b></p>	<ul style="list-style-type: none"> <li>▶ Reduce time to service aircraft engines</li> <li>▶ Ensure execution of best practice service procedures</li> <li>▶ Differentiate product based on support offerings</li> </ul>	
<p><b>Solution</b></p>	<ul style="list-style-type: none"> <li>▶ Translated CAD data into optimized engine model to host onboard aircraft</li> <li>▶ Authored interactive 3D service procedures</li> <li>▶ Integrated 3D graphical model to aircrafts onboard diagnostics system</li> </ul>	
<p><b>Results</b></p>	<ul style="list-style-type: none"> <li>▶ Demonstrated ability to rapidly diagnose repairs and access service procedures</li> <li>▶ Demonstrated ability to lower service and maintenance costs</li> <li>▶ Key component of Global Product Management strategy</li> </ul>	

*Images courtesy of Pratt & Whitney*

## Right Hemisphere

Right Hemisphere® is the leading provider of Product Graphics Management software. Product Graphics Management is a new category of enterprise software that integrates, automates, and manages 2D and 3D product graphics across the extended enterprise. Five of the top six automotive OEMs, nine of the top ten U.S. aerospace and defense contractors, and hundreds more customers use Right Hemisphere software to streamline publishing of technical publications, interactive training, marketing communications, engineering collaboration documents, and more. Right Hemisphere accelerates time to market for new products and product support offerings, increases revenue and competitive advantage, and reduces product lifecycle costs.

Learn more about Right Hemisphere at [www.righthemisphere.com](http://www.righthemisphere.com)



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