Getting started with PLM for aerospace and defense

Using a single source of product and process information to streamline certification

Executive summary

Aerospace and defense companies of all sizes implement product lifecycle management (PLM) systems to provide their diverse and widely dispersed enterprises with access to a single source of product and process information. Once a PLM system is in place, aerospace and defense companies can leverage this information to improve productivity, reduce lifecycle costs, facilitate global collaboration and provide the visibility needed for better business decision-making. This white paper identifies the best-practice capabilities that a PLM system should provide to facilitate these fundamental business needs.

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Introduction

The reason airplanes are the safest mode of transportation is because of the industry's strict regulations and rigorous certification standards.

For aerospace manufacturers, certification is everything, time is money and the product development challenges continue to escalate.

In addition to current regulations, aerospace and defense companies face additional demands for advancements including but not limited to aggressive sustainability targets and autonomous aircraft options – which require more integrated systems driven by software and electronics.

New technology like this is exponentially complex. It impacts all aspects of product development, including design, validation and testing. Instead of a few components and hundreds of interfaces, there are now thousands of components with tens of thousands of interfaces. So it's no surprise that today it costs more to certify an aircraft than it does to design it.

The reason for the dramatic cost increase is the huge number of intersections of systems and data in new products. Capturing and connecting all product-related information is recognized as a key enabler of business success. But even in today's digital age, most companies still struggle to utilize this information as a manageable asset from one business opportunity to another.

PLM enables companies to manage all of their product and process-related information in a single secure but accessible system that can be used by multiple applications and teams across an organization. With a PLM system in place, product information assets can be coordinated and synchronized, enabling companies to:
- Improve productivity and reduce cycle time
- Reduce development errors and costs
- Facilitate collaboration with anyone, anywhere
- Improve value chain orchestration
- Provide greater visibility so people can make better business decisions

To deliver these advantages, companies need a PLM system that is able to support their business-specific needs. At its foundation, this system must be able to provide best-practice solutions for:
- Secure data management
- Process enablement
- Bill-of-materials (BOM) management

Choosing the right PLM system provides companies with a solid foundation that can be easily expanded at their discretion into a full PLM platform.

Business challenges

Many aerospace and defense companies still use a traditional, linear, document-driven product development process. Product and process information is spread across multiple systems, databases and desktops. A wide variety of tools and software applications are used to create this information initially. Little or no connectivity is in place to tie these information assets together – it is still commonplace to develop mechanical, electrical, electronic and software systems independently, with different disciplines using different applications to create information in multiple formats.

The result is a lack of integration between domains that prevents aerospace and defense companies from reaching their certification goals. Because it is difficult to coordinate and synchronize the information that is used to define the aircraft and their related systems, assemblies, parts and components, reconciling a single change can be tedious. Product data isn't connected and it's not in the context for certification. Then multiply one change across millions of parts and hundreds of suppliers! To achieve certification faster you need more efficient and connected ways to track and easily access this level of product-, testing- and design-change data.

PLM provides a new more efficient product development approach that allows you weave together a digital thread of integrated data and processes across the product lifecycle. Seamless access to product requirements, designs, documents and 3D models enables all decision makers, stakeholders and lifecycle contributors – not just engineers – to make better decisions.

Best practice solutions

As the accompanying table indicates, a PLM system enables companies to address a variety of fundamental business needs.

Business needs addressed by a PLM system

| Fundamental business need	How a PLM system addresses these needs
Improve productivity and reduce cycle time	*Ensures that every participant in a lifecycle process has access to the current requirements, specifications and feedback in real time *Synchronizes product and process information across multiple organizations, linking an enterprise's silos and dramatically improving access to accurate and up-to-date data *Merges an enterprise's product and process information in a single highly accessible and secure source that eliminates time-consuming information searches while facilitating information re-use and better decision-making
Reduce lifecycle errors and costs	*Provides visibility into accurate, up-to-date information in a meaningful context, which reduces errors and lowers the cost of change *Enables enterprises to manage and reconcile multiple application systems more efficiently with a single, secure source of information *Eliminates the costly and error-prone process of manually duplicating information between different applications, reducing the need to redesign, rebuild and retest
Facilitate collaboration with anyone, anywhere	*Ensures that product teams and their members are working with the right version of the right product information in a meaningful context, seamlessly connected by a digital thread backbone *Enables dispersed teams, departments, suppliers and partners to seamlessly share diverse types of products and process information without regard to geographic, organizational or technical boundaries
Improve value chain orchestration	*Provides enterprises with a way to consistently manage processes that involve the participation of both internal users and external partners, as well as product and requirement changes that affect these participants *Enables companies to align the work of lifecycle participants and reduce errors caused by miscommunications *Ensures regulatory compliance with auditable traceability throughout development
Provide greater visibility into products and processes	*Enables enterprises to comprehensively manage their product and process data, including computer-aided design (CAD) data, parts information, documents, requirements, 2D and 3D data and other intellectual assets *Provides users throughout the enterprise with visibility into accurate, up-to-date information in context, where the impact and status of product changes, requirements changes and other decisions can be clearly understood by everyone

Essentially, a PLM system must be able to be used to manage product information and development processes in local, as well as global, environments. Companies make their own unique PLM decisions about the applications they deploy, as well as whether they want to enable their workflow-driven processes to span all or only selected aspects of their value chain. Regardless of what decisions are made, the selected PLM system must be able to provide best practice solutions for:

Secure data management, which enables the PLM system to address multiple end user needs and experiences. A PLM system should be able to be used to capture and manage all the information required to design, develop and produce today's products. Users across every stage of the product lifecycle need to be able to easily locate, understand and work with the information required to get their jobs done, including

parts, documents, requirements, electrical drawings, manufacturing instructions and other meaningful data. This access must respect the entitlements that protect the intellectual property (IP) rights and security needs of the enterprise. The PLM system should facilitate the digital documentation of targets and requirements that companies need to guarantee regulatory compliance and auditability.

Process enablement, which provides the PLM system with workflow and process capabilities needed to enable both internal product teams and external partners to participate in the product lifecycle. A PLM system should ensure that all processes are consistently managed through best-practice rules and conventions. A rules-based engine is especially valuable since it can be used to easily capture best practices and process information and allow consistent execution with appropriate participants and data.

BOM management, which enables the PLM system to manage product information from wherever it is created while allowing it to be used wherever it is needed. A PLM system should be able to be used to manage information across an entire product lifecycle and bridge the gap between the upstream stages of the lifecycle and its downstream phases, to offer data traceability from concept through production. The system also should enable participants in each stage to visualize and share information without requiring them to purchase or learn how to use special software. Just as importantly, the PLM system should provide total BOM visibility, which includes being able to see the bill-of-materials before and after changes are made, as well as from different points of view, including promoting understanding by nontechnical users by enabling them to visualize the product's parts in 3D.
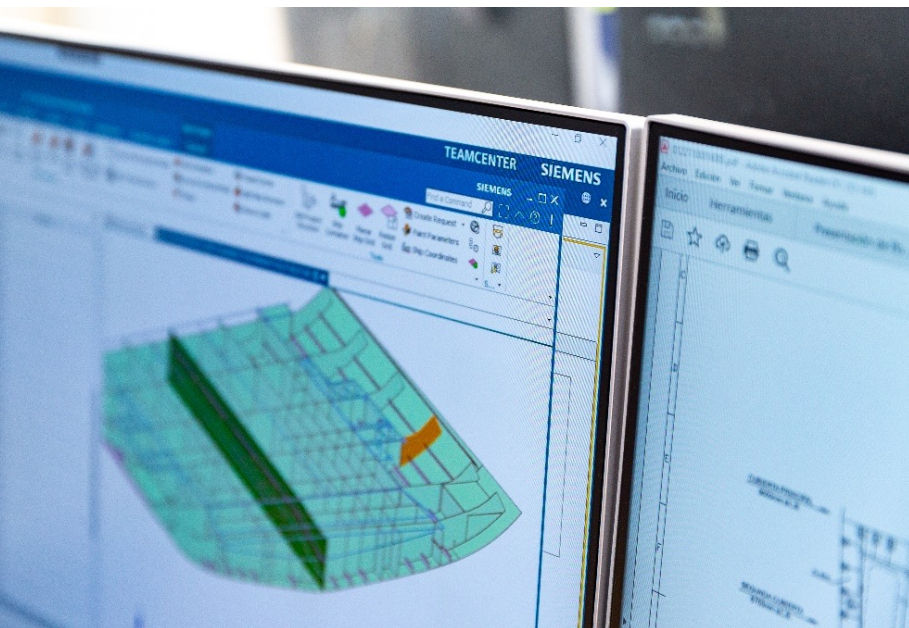
❙ Key capabilities

Although the general requirements discussed in the preceding section are helpful in conceptualizing the best practice solutions needed by a PLM system, the following table describes detailed capabilities required by these solutions.

A PLM system's key capabilities

Best-practice solution	Required capabilities
Secure data management	Provides the PLM system with key data management capabilities to capture, retain, communicate and validate up-to-date product information and ensure the right information is delivered to the right users in context. This single source of product and process information can manage and provide seamless access to all of an enterprise's related designs, parts, documents and require-ments. The PLM system also should be able to be used to facilitate: • Management of multiple CAD tools and formats • Authoring coordination (check-in, check-out) • Version and revision control Supports document management that provides product teams with appropriate templates, auto rendering and markup capabil-ities as well as support for desktop tools such as Microsoft Office. Provides search functionality that includes quick, detailed and graphical search capabilities for enabling widely dispersed and diverse users to access the PLM system's product and process information anytime anywhere. Delivers security and administrative functionality that protects the intellectual property rights of all lifecycle participants with: • Role management • Program-based security • Access privileges
Process enablement	Provides the PLM system with key process management capabil-ities to ensure that product and process information is delivered to the right person at the right time, including: Workflow capabilities that enable enterprises to establish, manage and execute automated and orchestrated work-flow-driven processes that reflect company-specific best practices. Facilitates change and revision management that enables enter-prises to implement best practices consistent with conventions such as the Institute of Configuration Management's CMII stan-dards for: • Change planning (what-if analysis) • Change incorporation (execution) • Change verification and communication A PLM system should also support other established processes, including phase-gate standards.

**A PLM system's key capabilities** *(continued)*

Best-practice solution	Required capabilities
Bill-of-materials management	Provides the PLM system with the visibility necessary for managing and presenting BOM information from wherever it is created to wherever it is needed. Key capabilities include: BOM management that enables enterprises to accurately represent and efficiently manage a complete BOM in all of its lifecycle stages. The PLM system also needs to facilitate: • Complete, multi-domain BOM that can include mechanical, electronic/electrical, software and simulation parts, components and assemblies • Integrated configuration management (change management) • Alignment and synchronization of all sources of BOM data as well as all lifecycle phases, including the as-designed, as-planned, as-built and as-maintained states • Open applications and systems integration
Visualization and digital mockup	Enables lifecycle participants to share and visualize on-demand representations of the product and its underlying assemblies and parts in a secure portable format without the need for a CAD authoring tool. The PLM system also needs to provide: • Digital mockup capabilities that significantly reduce the need for costly physical prototyping • The JT™ data format support, the common 3D language for PLM visualization

▎Conclusion

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comprehensive software, hardware and services. Take control of your product information and processes with PLM today, then grow to meet your needs tomorrow. We can help you achieve your strategic business goals.

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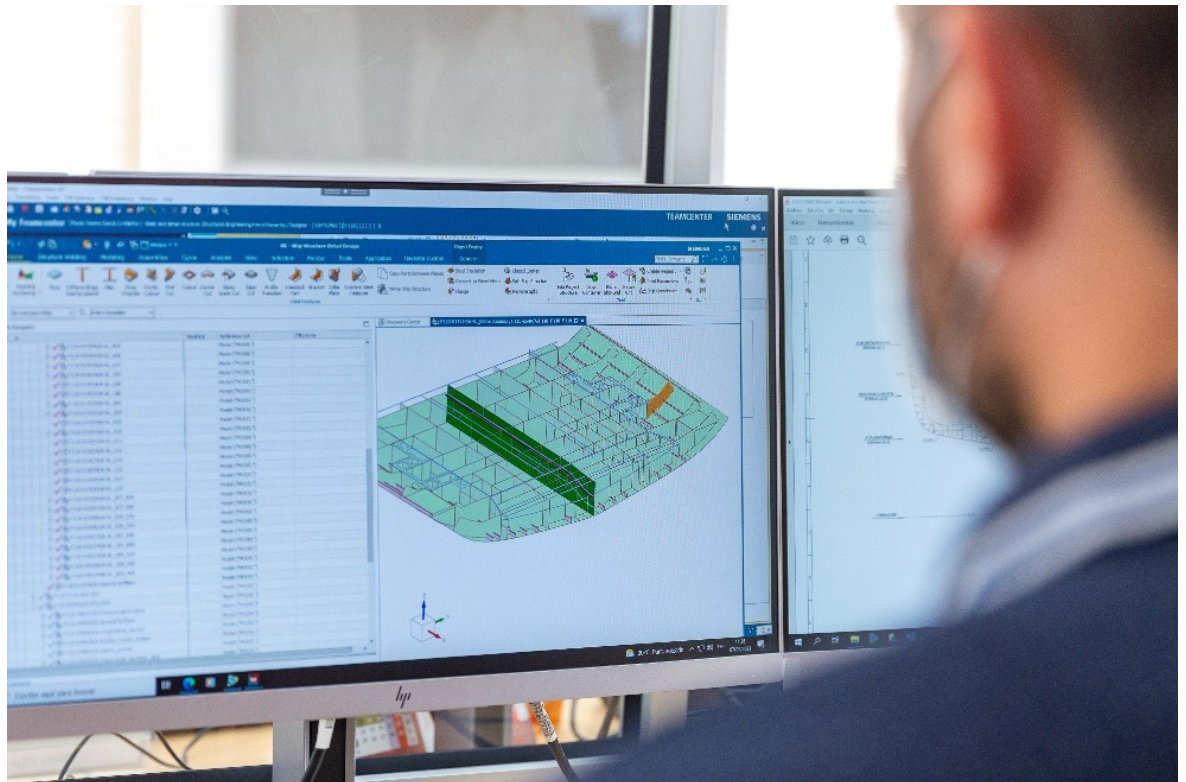
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Americas: 1 800 498 5351

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Asia-Pacific: 001 800 03061910

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