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# Transforming aerospace and defense with next-generation PLM

# Executive summary

Aerospace and defense (A&D) organizations are facing rising product complexity, longer program lifecycles, increasingly stringent regulatory requirements and globally distributed supply chains. In this environment, product lifecycle management (PLM) has become a strategic enabler evolving far beyond its origins in CAD and document management to serve as the digital backbone connecting requirements, engineering, manufacturing, certification and sustainment.

The industry is now entering a new phase of PLM transformation driven by cloud computing, AI and GenAI. Cloud native PLM platforms provide secure, scalable collaboration among OEMs, suppliers and government stakeholders while AI-augmented systems turn decades of engineering and operational data into actionable insights. Leading A&D organizations are using these capabilities to shorten development cycles, enhance traceability and compliance and enable more efficient, data-driven sustainment.

This whitepaper explores how PLM is reshaping the A&D landscape through digital threads, model-based processes and AI-enabled decision support. Drawing on industry research and real-world case studies, it highlights how organizations are streamlining configuration and change management, improving certification readiness and accelerating time to market within the boundaries of regulatory frameworks such as FAA requirements, AS9100 and military standards.

Across the sector, a clear shift is underway from siloed, document-centric workflows to integrated, intelligence-driven ecosystems that span the entire product lifecycle. Organizations that adapt to this transformation position PLM not only as a tool for managing complexity but as a competitive advantage that drives innovation, cost efficiency and mission success in the next generation of aerospace and defense programs.

# Industry challenges in A&D: The PLM perspective

**Why traditional PLM approaches break under this scale**

Traditional PLM systems were built for discrete manufacturing environments with relatively stable product structures and short lifecycle durations. In A&D, however:

- The product definition is constantly evolving
- Data volumes multiply over decades
- Global stakeholders require synchronized access
- Software and hardware lifecycles diverge
- Sustainment introduces billions of data points
- Configuration complexity increases exponentially

The result is a program environment too massive and dynamic for monolithic, document-centric PLM architectures. Without next-generation digital engineering foundations, A&D programs such as model-based systems engineering, digital threads, digital twins, modern data platforms and AI-assisted traceability face escalating risks, rework, cost overruns and schedule delays.
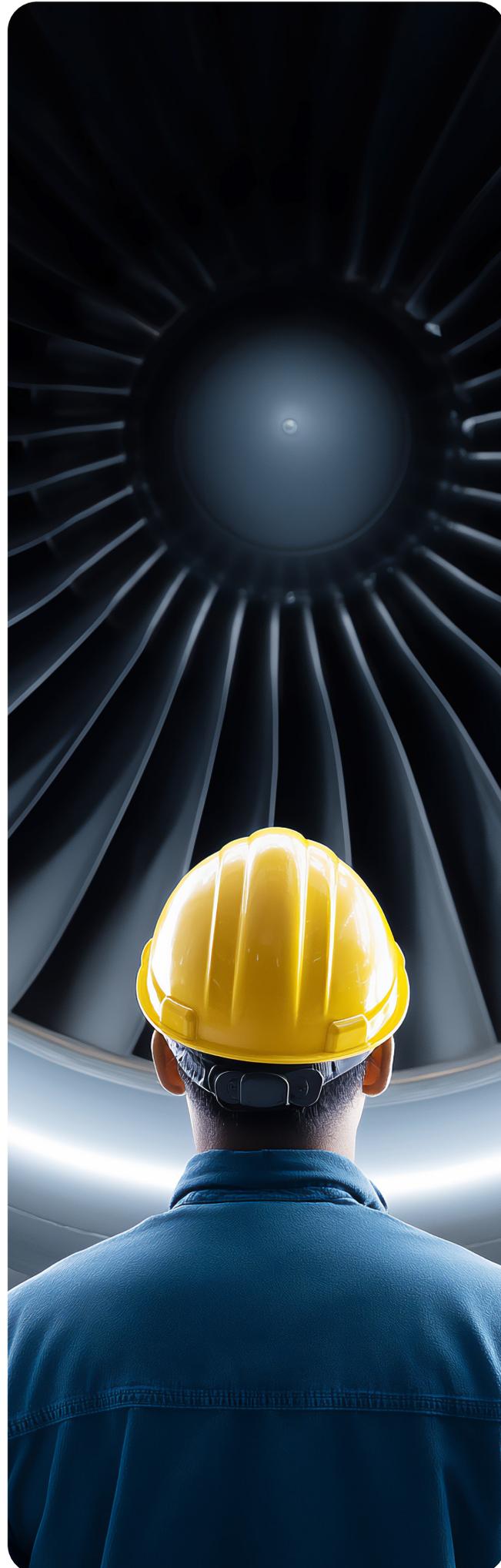
# Why A&D needs modern digital thread architecture

**Legacy ecosystems, fragmented tools and the challenge of digital continuity in A&D**

A&D organizations have accumulated decades of engineering tools, program-specific customizations and isolated data repositories. While each system served a valid purpose at a given point in time, the resulting landscape is now a highly fragmented digital ecosystem that constrains modernization efforts and undermines the promise of lifecycle-wide PLM.

**Multi-generation CAD and engineering tool diversity**

Most A&D manufacturers operate across multiple generations of CAD environments, reflecting product lines that have evolved over 20–40+ years. It is common to see the simultaneous use of:

- CATIA V4/V5/V6/3DEXPERIENCE
- Siemens NX
- PTC Creo
- Solidworks
- Specialized tools for wiring, composites, structures, systems modeling and manufacturing engineering

Each platform carries its own data models, versioning assumptions, geometric kernels and file structures. Engineering teams must maintain backward compatibility with legacy designs while advancing new programs using modern toolsets. This diversity leads to non-uniform engineering baselines, complex translation workflows and persistent loss of metadata as models move across CAD generations or tools.

## Heavily Customized, Aging PDM/PLM Foundations

In parallel, many organizations rely on PDM/PLM systems that were implemented decades ago and extensively customized for specific programs or customer requirements. Over time, these systems have diverged from their original vendor roadmaps, creating:

- Brittle custom code that is difficult to maintain
- Unique data structures for different product lines
- Program-specific workflows that resist standardization
- Limited scalability for new digital engineering practices such as MBSE or digital threads

As a result, modernization or migration efforts become risky, multi-year undertakings, leaving organizations trapped in outdated process models.

## Domain-specific tools without end-to-end integration

To support the expanding digital engineering landscape, A&D organizations have added specialized systems such as:

- Requirements management (e.g., DOORS, Jama)
- Application lifecycle management (ALM) for embedded software
- Simulation and analysis platforms for aerodynamic, structural, thermal and system behavior modeling
- MBSE tools for system architecture and behavioral models

While these systems deliver deep domain capabilities, they rarely integrate seamlessly with PLM or with each other. Their data often remains locked in proprietary formats or isolated repositories, limiting traceability across the full engineering lifecycle.

# Custom applications and point solutions fill the gaps-at a cost

To compensate for integration gaps, engineering and IT teams have created hundreds of custom scripts, middleware components, program-specific portals and point solutions. These tools often emerge as tactical fixes for immediate program needs but become long-term dependencies with hidden technical debt.

**Common challenges include:**

- Inconsistent logic across programs
- Unsupported code written by teams no longer in the organization
- Duplication of data validation and translation routines
- Increased cyber risk from unmanaged interfaces

Instead of enabling agility, these custom layers create fragility and impede enterprise-wide digital transformation.

# Enterprise systems remain loosely coupled to engineering

ERP, MES, quality management, supply chain systems and MRO platforms are mission-critical for delivering certified aircraft and supporting in-service fleets. Yet, in many organizations, their integration with engineering data remains limited and brittle.

**Typical issues include:**

- Manual re-entry of BOM data from engineering to manufacturing
- Discrepancies between engineering BOM (eBOM) and manufacturing BOM (mBOM)
- Delayed release processes due to mismatched revisions
- Incomplete digital threads connecting design changes to shop floor execution
- Quality deviations caused by outdated or inconsistent build instructions

These gaps undermine the promise of end-to-end digital continuity across the value chain.

# Consequences: Multiple versions of truth and broken lifecycle traceability

Because each system maintains its own partial view of the product definition, organizations operate with multiple, conflicting versions of truth. This fragmentation creates significant operational and compliance risks, including:

- Delays and rework during design to manufacturing transitions

- Inability to trace decisions across engineering, supply chain and program management

- Incomplete audit trails during regulatory, certification or customer reviews

- Process inefficiencies driven by system limitations rather than mission needs

- Difficulty scaling new digital capabilities such as digital twins, model-based engineering or AI-assisted engineering



The cumulative effect is a digital environment where no single system can confidently represent the authoritative product baseline.

# Impact on PLM as a lifecycle backbone

PLM is intended to function as the unifying digital backbone tying requirements, design, manufacturing and sustainment into a connected lifecycle. However, the legacy and integration challenges described above prevent PLM from fulfilling this role. Instead, organizations experience:



- Siloed engineering disciplines
- Fractured digital threads
- Inconsistent configuration control
- Inability to implement enterprise-wide governance
- Major gaps in cross-domain traceability

In short, the full value of PLM cannot be realized without modernizing the broader ecosystem around it.

# Program complexity and scale

Aerospace and Defense (A&D) programs represent some of the most expansive, intricate and long-lived engineering undertakings in the world. Major commercial aircraft programs can span 30–50 years from concept to retirement, while defense programs often extend well beyond that, some exceeding 70 years of operational life. Within this timeframe, systems undergo continuous evolution, modernization and operational adaptation. The cumulative effect is a program environment characterized by extreme scale, multi-domain complexity and a pace of change unmatched in most other industries.

# Long lifecycle programs spanning generations

Unlike consumer or industrial products, which typically have defined end-of-life cycles, A&D platforms endure across decades and evolve through multiple generational upgrades. A single aircraft type may support:

- Initial development and qualification
- Production across multiple blocks or tranches
- Service entry, sustainment and global fleet operations
- Mid-life upgrades and mission system modernizations
- Safety-driven redesigns and regulatory conformance updates
- Finally, decommissioning and retirement



These lifecycle stages overlap across different aircraft, fleets and customer types, creating a persistent need to manage historical configurations, current baselines and future design roadmaps within a unified digital ecosystem.

# Massive product structures that expand over time

A&D systems rarely remain static. As new mission needs emerge, regulatory requirements evolve and digital capabilities expand, the product structure grows to incorporate new systems, sensors, software elements and data streams. Over the decades, a platform's configuration has substantially deviated from its original certified baseline.
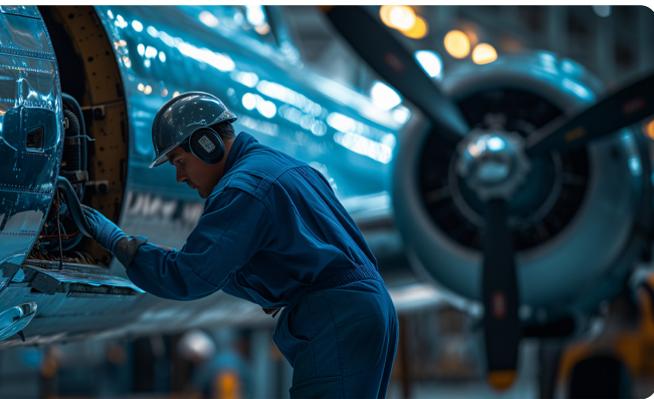


**This expansion includes:**

- Additional line replaceable units (LRUs)
- New avionics or mission systems
- Updated propulsion or environmental subsystems
- Embedded software revisions and cyber hardening updates
- Structural modifications driven by fatigue or safety findings

The result is an ever-increasing repository of design artifacts, requirements, models, tests and maintenance records, each of which must remain traceable across time.

# Interdependency across engineering disciplines

Modern aerospace systems integrate dozens of engineering disciplines, including mechanical design, electrical systems, avionics, flight controls, software engineering, cyber systems and increasingly, AI-enabled autonomy. These domains evolve at different rates and obey distinct regulatory constraints, yet must converge into a single certified configuration.

**Program complexity increases when:**

- Mechanical updates alter electrical routing
- Software changes affect flight characteristics or mission performance
- Subsystem upgrades require requalification of unrelated components
- Cybersecurity requirements introduce new testing cycles
- Regulatory changes cascade across multiple engineering domains

The scale of these interdependencies means every modification, no matter how small, can ripple across the entire system architecture.

# Global footprint of design, production and sustainment



**Most A&D programs span multiple continents, involving:**

- Distributed design centers
- International production lines
- Multi-tier supplier ecosystems
- MRO (maintenance, repair & overhaul) organizations worldwide
- Defense customers operating under classified or jurisdiction-specific constraints

This global footprint multiplies the complexity of data exchange, configuration control and program governance. Each stakeholder interacts with a portion of the product definition, yet all must align with a common digital reference.

# Sustainment-driven program scale

Sustainment activities, such as maintenance, repair, overhaul, parts replacement and modernization, can account for up to 70% of a platform's total lifecycle cost. These activities generate massive volumes of operational and maintenance data that must be integrated with baseline engineering definitions.

**Over decades, this adds layers of:**

- Field modifications
- Operator-specific configurations
- Environmental wear patterns
- Fleet performance data
- Software update histories

Sustainment inflates the scale of data that PLM systems must manage, while simultaneously introducing the need for high-fidelity digital twins and continuous lifecycle traceability.



# Regulatory and certification pressure across the entire lifecycle

Because A&D systems must meet stringent safety, mission and airworthiness requirements, every change, regardless of scale, must be:

- Documented
- Justifiable
- Traceable to requirements
- Verifiable and validated
- Audit-ready across decades

This regulatory environment magnifies the consequences of poor data control, fragmented systems or inconsistent configuration management. Non-compliance can lead to production stoppages, grounded fleets, fines or loss of certification.

# Current trends in PLM-cloud, AI and digital intelligence

**Integrated PLM–program management as a foundation for contractual performance**

To succeed under intense government oversight and performance-based contracting, A&D organizations require PLM capabilities that:

- Link engineering changes directly to Work Breakdown Structure (WBS) elements
- Provide real-time views of configuration maturity versus contractual milestones
- Support integrated cost schedule technical baselines
- Enable early detection of risk across engineering and program domains
- Generate audit-ready traceability for customer and regulatory agencies
- Offer a unified digital thread that connects requirements, design, manufacturing and program execution



This integrated approach allows program teams to anticipate how engineering decisions will affect obligations for delivery, compliance, technical performance and lifecycle cost long before deviations become program-critical issues.

# A lifecycle integrated modeling framework is essential-simulation and validation

To address these challenges, A&D organizations must treat simulation models, system architectures and digital twins as first-class PLM assets, governed and traceable across the entire lifecycle. This requires PLM platforms that support:



- Integrated model management across MBSE, simulation and CAD domains
- Linkage of models to requirements, test evidence and configurations
- Automated change propagation from design to model and vice versa
- Governance workflows that ensure model fidelity and repeatability
- Unified data structures to support digital threads and digital twins

Only with these capabilities can digital engineering become a reliable backbone for product development, rather than a collection of disconnected, domain-specific activities.

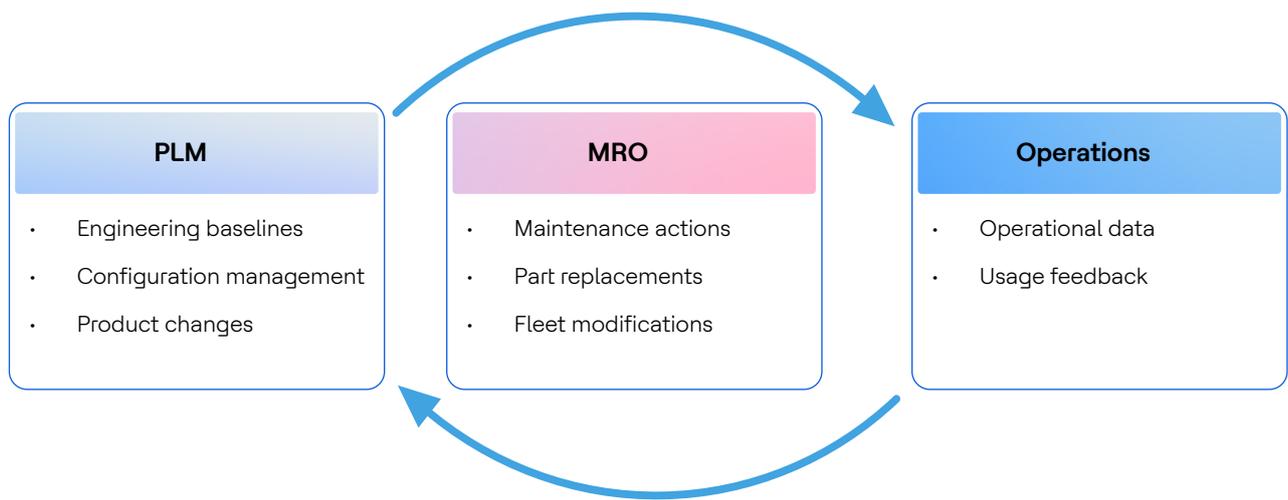# Integrated PLM–MRO digital continuity is now a strategic requirement

To support emerging mission and commercial needs—autonomy, hybrid propulsion, advanced sensors, predictive sustainment and digital twins—organizations must adopt a lifecycle integrated approach in which PLM functions as the authoritative backbone connecting design, manufacturing, sustainment and operations.

**A modern integrated ecosystem requires:**

- Bidirectional data flows between PLM, MRO and operational systems
- Unified configuration management across as-designed, as-built, as-maintained and as-flown states
- Digital twins synchronized with real usage patterns and maintenance histories
- Closed-loop feedback that continuously informs engineering decisions
- Predictive maintenance models that improve over time with operational data
- Traceability workflows that streamline audits and airworthiness reviews

Such integration transforms sustainment from a cost center into a strategic advantage, improving readiness, reducing total lifecycle cost and strengthening customer trust.

## Critical digital threads in aerospace & defense

| PLM | MRO | Operations |
|---|---|---|
| • Engineering baselines<br>• Configuration management<br>• Product changes | • Maintenance actions<br>• Part replacements<br>• Fleet modifications | • Operational data<br>• Usage feedback |

Field & usage data

**PLM–MRO–Operations integration loops**

# PLM as the enabler of cost-effective, accelerated and compliant delivery

When modernized and implemented at scale, PLM serves as the backbone that allows A&D organizations to meet the competing demands of:

- Cost reduction
- Accelerated development
- Compliance and certification rigor
- Operational readiness
- Continuous modernization

The industry does not need to choose between rigor and speed. With the right digital architecture, A&D companies can and must achieve both simultaneously.

**Combined regulatory alignment: DoD vs. FAA/EASA**

| Topic | DoD Focus | FAA/EASA Focus | PLM Role |
|---|---|---|---|
| **Digital Engineering** | Mandated (DoDI 5000.97) | Increasingly encouraged for certification efficiency | PLM is the digital thread platform |
| **Model Integration (MBSE, Simulation)** | Required to inform lifecycle decisions | Used for certification evidence and performance validation | PLM connects models to product baselines and requirements |
| **Cybersecurity** | CMMC, DFARS 7012, FedRAMP[3] | Less explicit but critical for OEM/Operator data | PLM enforces secure data governance |
| **Configuration Control** | Required for readiness and sustainment | Required for airworthiness | PLM is the authoritative configuration system |
| **Traceability** | Lifecycle, mission and contract traceability | Certification and safety traceability | PLM automates traceability across artifacts |
| **Auditability** | DCMA, GAO, service branch audits | FAA/EASA certification audits | PLM is the audit evidence repository |

# PLM as the regulatory enabler

Across both military and civil aviation environments, PLM enables:

- Digital authoritative source of truth (DoD mandated)
- Configuration control for airworthiness (FAA/EASA required)
- Full lifecycle traceability for certification, readiness and sustainment
- Secure, auditable digital thread meeting DFARS/CMMC/FedRAMP requirements
- Integration of MBSE, CAD, ALM and simulation for digital engineering adoption
- Compliance automation to reduce audit, certification and oversight risk

PLM is not just an engineering tool; it is the compliance platform for the A&D industry.
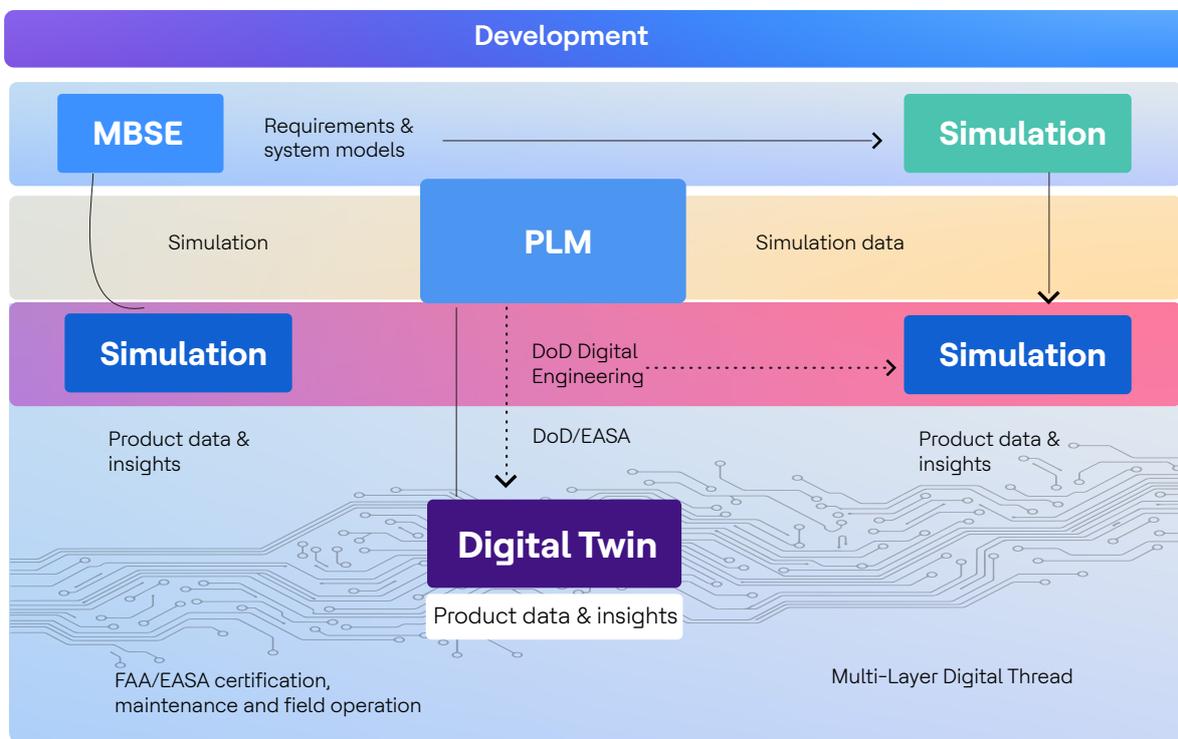
# The shift to cloud

Historically, PLM systems were deployed on-prem, requiring complex infrastructure installations and significant capital investment. These environments demanded extensive IT governance and stringent security management, creating several limitations:

- Global collaboration challenges: High latency, complex access controls and limited connectivity restricted seamless international engineering collaboration.

- Scaling constraints: Capacity expansion required long planning cycles and hardware procurement, slowing business agility.

- Disruptive technology refreshes: Upgrades often involved system downtime, heavy testing cycles and operational disruptions.

- Supplier integration barriers: Firewalls and access restrictions reduced the ease of connecting external partners and suppliers.



Cloud-based PLM platforms are fundamentally reshaping this landscape. Leading providers now deliver:



- Elastic scalability: Infrastructure automatically adjusts to support large user loads, complex engineering models and growing data volumes without the traditional bottlenecks of on-prem capacity planning.

- Global accessibility: Users can securely access PLM capabilities from anywhere with consistent performance, simplified identity management and built-in disaster recovery.

- Continuous innovation: Cloud services roll out new capabilities, AI-driven functions, advanced analytics, updated compliance templates, without disruptive upgrade cycles.

- Integrated ecosystems: Modern cloud PLM solutions connect natively to simulation tools, supply chain visibility platforms, analytics engines and other SaaS applications through APIs and middleware.

- Flexible cost models: Consumption-based pricing aligns technology cost with business usage, reducing dependence on large capital expenditures.

Aerospace and defense organizations, particularly defense contractors, historically approached cloud deployment with caution due to security and intellectual property concerns. This perspective is rapidly changing as the cloud ecosystem matures:

- Hyperscale cloud platforms such as AWS, Microsoft Azure and Google Cloud now deliver security architectures that exceed the protection levels of most on-prem environments.

- Compliance with US government frameworks such as FedRAMP and NIST SP 800-171 enables secure handling of controlled unclassified information (CUI).

- Private and hybrid cloud models offer flexible deployment paths, balancing security needs with modernization goals.

- Containerized and microservices-based architectures allow organizations to retain sensitive datasets on-prem while leveraging cloud compute and applications for non-sensitive workloads.

For example, Boeing has begun migrating applications from on-prem data centers to AWS to modernize engineering and manufacturing processes. This shift illustrates that even long-standing aerospace organizations with strict security requirements are adopting cloud-based architectures to strengthen agility, resilience and innovation[1].

# AI and GenAI in PLM

AI is transforming product lifecycle management (PLM) from a static system of record into a dynamic, predictive system of intelligence. This shift represents one of the most consequential advances in PLM value creation in decades.



**Traditional PLM value proposition**

PLM historically focused on control, structure and compliance, providing organizations with the ability to:

- Centralize engineering and product data

- Enforce governance and configuration rules

- Maintain traceability throughout the lifecycle

- Support compliance and audit readiness

These capabilities established PLM as a foundational backbone, but one primarily optimized for documentation and process control.

# AI enhanced PLM value proposition

AI amplifies the core strengths of PLM and adds entirely new dimensions of operational and engineering intelligence:

- Predict design issues before manufacturing begins

- Recommend optimal design configurations based on performance, cost, manufacturability and compliance

- Identify process risks and bottlenecks across engineering, production and supply chain

- Accelerate certification activities with automated documentation checks and digital evidence generation

- Enable predictive maintenance and sustainment, using product history and real-time sensor data

With AI, PLM shifts from documenting decisions to informing and automating them.



# AI for design optimization

AI can evaluate thousands of design variants in minutes, optimizing for weight, structural integrity, cost, manufacturability and regulatory constraints. A noteworthy example is Northrop Grumman, which achieved a 25% reduction in propulsion system weight by combining PLM-connected data with AI-driven, iterative design exploration.

**AI for manufacturing intelligence**

When integrated with PLM and manufacturing execution systems (MES), AI enables:

- Intelligent recommendations for process parameters

- Early identification of quality risks

- Optimization of production sequences

- Closed-loop feedback between engineering and manufacturing

Companies such as iBase t, through its Solumina AI portfolio, are advancing domain-specific generative AI models trained on aerospace manufacturing data rather than general internet sources. This ensures accuracy, relevance and contextual understanding tailored to high criticality A&D production environments[2].

# Critical digital threads in A&D

Industry research consistently identifies seven foundational digital threads that enable lifecycle continuity and mission-critical performance across aerospace and defense programs. These threads ensure that engineering, manufacturing, supply chain and sustainment activities operate from a single source of truth.

### 1. Integrated program planning and execution

A systems-based approach that unifies cost, schedule, risk and technical performance into a thoroughly planned and budgeted management framework. This thread provides holistic visibility into program health and supports informed decision-making across engineering, finance and operations.

### 2. Requirements for the delivery thread

Provides end-to-end traceability from customer and regulatory requirements through design, analysis, manufacturing and test. This ensures that every requirement is satisfied, validated and supported with auditable evidence critical for defense certification and compliance.

### 3. Verification management thread

Synchronizes requirements, design artifacts, simulations, analyses and physical test results. By automating traceability and evidence collection, this thread accelerates certification cycles and supports rapid iteration in both virtual and physical environments.

### 4. Supplier collaboration and management thread

Manages data flows, deliverables, source selection, quality results and compliance across multi-tier supplier ecosystems. This thread ensures consistent governance, visibility and accountability from initial bid through delivery and sustainment.

### 5. Configuration and change management thread

Maintains authoritative product configuration from as designed through as built, as tested, as delivered and as maintained states. It provides full traceability of every change, its rationale and its downstream impacts, ensuring the integrity of safety-critical systems throughout the lifecycle.

### 6. Service and sustainment thread

Supports lifecycle maintenance and field operations through configuration-driven service information, spare parts management and bidirectional integration with engineering. This enables predictive sustainment, reduces downtime and supports faster return to service decisions.

### 7. Model-based systems engineering (MBSE) thread

Integrates system architecture models with domain-specific models (mechanical, electrical, software) to maintain consistency across disciplines. This thread enables systems-level analysis, rapid trade studies and cross-functional design alignment.

## Critical digital threads in aerospace & defense

| | | |
|---|---|---|
| Integrated program planning & execution | Requirements-to-Delivery | Verification management |
| Supplier collaboration & management | Configuration & change management | Service & sustainment |
| | | Model-Based Systems Engineering |

# Strategic Benefits of PLM

- Reduced cycle time - PLM streamlines engineering and manufacturing workflows, enabling faster design iterations and reducing the time required for change approvals. By integrating requirements, configurations and simulations, organizations can cut cycle times by 20%–30%, accelerating the delivery of mission-critical systems.

- Cost efficiency - Through improved data reuse, reduced rework and optimized supplier collaboration, PLM lowers program costs. Fixed-price contracts benefit from predictable execution, while lifecycle cost savings are realized through efficient sustainment and upgrade management.

- Improved quality - PLM embeds compliance and certification requirements directly into processes, ensuring quality is built in rather than inspected later. Traceability across requirements, BOMs and configurations reduces errors and enhances audit readiness, thereby increasing the reliability of aircraft and defense systems.

- Enhanced collaboration - Global supply chains and multi-disciplinary teams require secure, role-based collaboration. PLM provides a unified platform for OEMs, contractors and suppliers to share data safely, fostering transparency and alignment across continents and organizations.

- Lifecycle value - A&D platforms often remain in service for decades. PLM ensures digital continuity across design, production, certification and sustainment, enabling predictive maintenance, modernization and upgrades. This maximizes lifecycle value and extends mission readiness well beyond initial deployment.

**Case study comparison table:**

| Dimensions | Case study A: Legacy OEM | Case study B: Defense contractor | Case study C: Emerging space firm |
|---|---|---|---|
| Business context | Large-scale aircraft programs, long lifecycle | Complex defense systems, compliance-heavy | Agile satellite and launch systems, rapid iteration |
| PLM Drivers | Reduce engineering rework, manage multi-tier suppliers | Ensure ITAR compliance, secure collaboration | Speed-to-market, modular design reuse |
| Solution Approach | Enterprise PLM migration, BOM harmonization | Secure PLM backbone, integrated change management | Cloud native PLM, lightweight CAD integration |
| Key Challenges | Legacy data migration, Global supplier alignment | Regulatory audits, siloed engineering teams | Scaling processes without bureaucracy |
| Benefits Realized | 20% reduction in the engineering change cycle time | Improved compliance traceability, faster approvals | 30% faster design-to-launch cycle |
| Strategic Impact | Strengthened Supplier Collaboration | Enhanced defense readiness and program assurance | Competitive edge in the commercial space race |

It visually maps the full lifecycle from Concept → Sustainment, with vertical threads for Requirements, BOM, Configuration, Change Management, Compliance and Simulation that weave through each stage.

# Implementation Roadmap

**Phase 1: Assessment – Benchmark current processes.**

The journey begins with a comprehensive assessment of existing workflows, systems and data structures. Benchmarking against industry best practices highlights gaps in traceability, compliance and collaboration. This phase establishes the baseline for transformation and aligns executives.

**Phase 2: Digital thread setup – Integrate requirements, CAD, BOM.**

Next, organizations establish the digital thread by connecting requirements, CAD models and Bills of Materials (BOMs). This integration ensures end-to-end traceability across engineering disciplines, laying the foundation for configuration control and change management.

**Phase 3: Supplier integration – Secure portals.**

With the digital backbone in place, the focus shifts to supplier collaboration. Secure portals enable controlled data exchange across global supply chains, balancing openness with ITAR and cybersecurity compliance. This phase reduces delays and strengthens supplier alignment.

**Phase 4: Sustainment linkage – Feed operational data back into design.**

PLM extends beyond production into sustainment and modernization. By linking operational data such as maintenance records and performance analytics back into design, organizations enable predictive maintenance, upgrades and lifecycle optimization.

**Phase 5: Continuous improvement – Iterative upgrades.**

Finally, PLM becomes a living system, continuously refined through iterative upgrades. Lessons learned from sustainment, supplier feedback and compliance audits feed into ongoing improvements, ensuring the PLM ecosystem evolves with technology and mission needs.

## Implementation roadmap

**1** — **Digital twin**

Assessment, benchmark current processes

**2** — **Digital thread setup**

Integrate requirements, CAD and BOM

**3** — **Supplier integration**

Secure portals

**4** — **Sustainment linkage**

Feed operational data back into design

**5** — **Continuous improvement**

Iterative upgrades
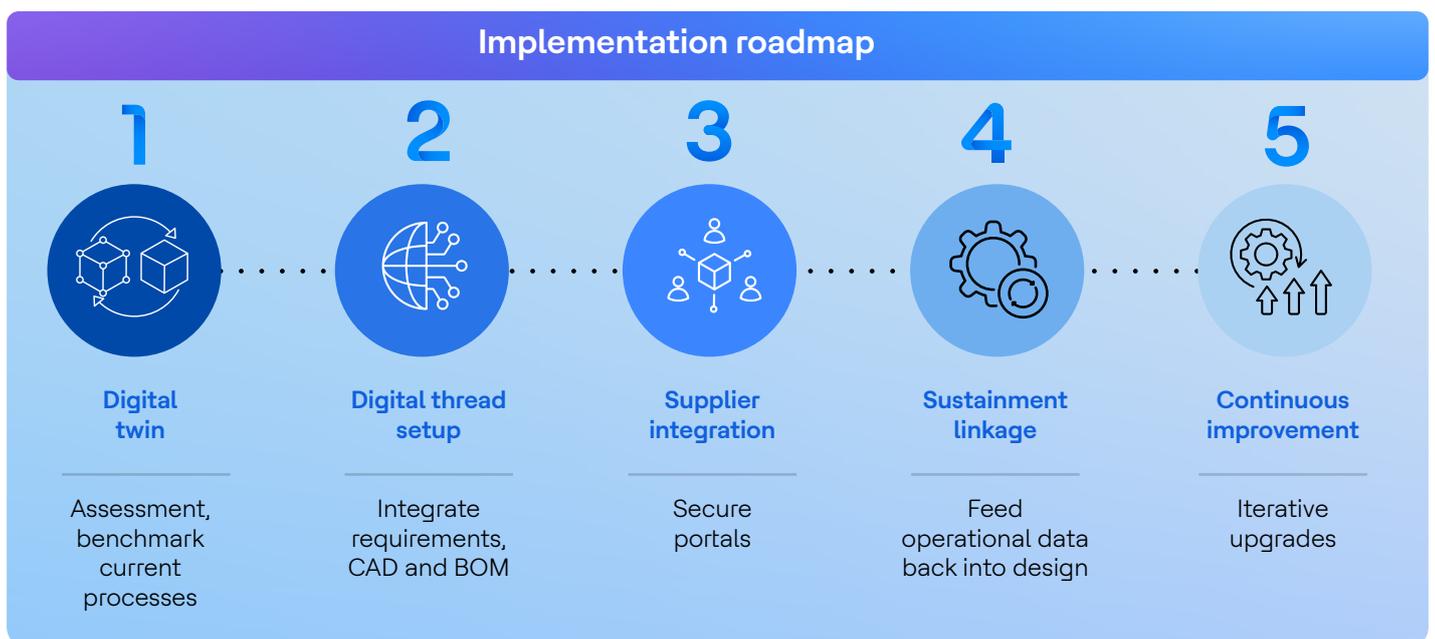
The gradient blue design moves from dark to light, symbolizing progression and maturity.

# How HCLTech can help

HCLTech brings deep aerospace and defense expertise together with comprehensive PLM transformation capabilities spanning strategy, implementation, integration and operations. Our A&D practice works within stringent export control and security frameworks, supporting OEMs, Tier-1 suppliers and defense agencies across aircraft, engines, space systems and defense platforms.

We specialize in designing and deploying digital threads that unify requirements, engineering (including MBSE/MBE), manufacturing, supply chain and MRO into a traceable, authoritative product definition. Our teams have extensive experience with all major PLM platforms, integrating them seamlessly with ERP, MES and downstream enterprise systems. This includes delivery of large-scale digital backbone programs that consolidate dozens of legacy systems into a coherent, lifecycle-driven product ecosystem.

To help organizations modernize legacy PLM environments, HCLTech offers cloud-ready, SaaS based PLM modernization services, including xLMate, our AI-driven platform hosted on hyperscale cloud. xLMate accelerates deployment, migration and lifecycle management of PLM applications, while optimizing performance, scalability and total cost of ownership. These services are supported by standardized cloud reference architectures and engineering-grade DevOps pipelines built for high-performance, graphics-intensive workloads.

AI and GenAI are integrated directly into PLM and engineering processes through HCLTech's platforms and accelerators. These capabilities enhance productivity in customization, validation, test automation, analytics and everyday engineering tasks. For A&D organizations, this enables mission-critical use cases, including intelligent requirements and change analysis, automated metadata enrichment, technical publication assistance and predictive insights across the product lifecycle.

Time to value is further accelerated through reusable digital thread patterns, prebuilt integration templates, migration toolkits, digital manufacturing frameworks and PLM SaaS accelerators. Our strategic alliances with major PLM vendors, combined with a strong co-innovation ecosystem, position HCLTech as a preferred partner for aerospace and defense organizations seeking to evolve PLM into a secure, cloud-ready, AI-enabled enterprise backbone.

## MPM Accelerate

- Templatized Solution
- Manufacturing Process Planning, Validation and MES integration, which is easy to adopt and make customer-specific changes

**Value:**

50% to 70% time saving in adopting TC Manufacturing by using this solution

## Active Tester

- HCLTech solution built for PLM (Windchill, Teamcenter, 3DExperience applications) with prebuilt 2000+ OOTB test cases enabling Closed Test Automation Framework

**Value:**

60% to 70% reduction in test automation efforts. Ready to use with 200+ Step Definitions and 550+ Windchill OOTB test scenarios

## xLMCloud

- Faster and secure migration of PLM and CAx applications to the cloud, enabling flexible and scalable infrastructure
- Among the top 10 GSI solutions on AWS

**Value:**

Reduces TCO and CAPEX for new PLM implementations

## ModEx-MBSE connectors

- Model-Based Systems Engineering adoption and model exchange framework enabling end-to-end connectivity of system models with requirements and downstream artifacts

**Value:**

Model-based approach adoption for connected product design for improved quality and end-to-end traceability

## DTwinX

- Digital Twin Solution for the energy and utility sector
- Closed-loop Digital Twin Solution from As-designed to As-operational twins
- Scalable and extendable to other industrial sectors
- Listed on Azure Marketplace and MS App Source

**Value:**

Asset agnostic solution for Predictive maintenance, Performance improvement and RUL

## Qualitz

- Closed Loop Quality Management and Change Management App built on ThingWorx for enabling a unified dashboard view for NC, CAPA and Customer Experience

**Value:**

Faster downstream user adoption. Easily extensible to new data sources and 3rd party systems

## TechPax

- Integrated TechDoc Lifecycle Solution for ATA / S1000D on PTC Product Portfolio
- Provide accurate service information to prevent failure to deliver the right parts and service information in critical situations

**Value:**

Integrates seamlessly with PLM/SLM for complete product workflows, BOM transformation and parts management (leverage the digital thread)
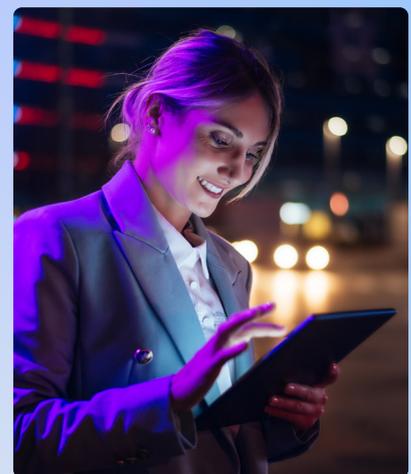
Asset agnostic solution for Predictive maintenance, Performance improvement and RUL

## XLM.AI

- Integrates AI and GenAI into ALM and PLM and systems to boost productivity, collaboration and decision-making across the product and software lifecycle

**Value:**

**40%** faster time-to-market through automation. **50%** higher productivity with reduced manual tasks



To know more about HCLTech PLM solutions, please visit

https://www.hcltech.com/product-lifecycle-management-plm

# Conclusion

Aerospace and defense organizations are entering a pivotal moment in the evolution of product lifecycle management. As programs grow more complex and regulatory expectations intensify, traditional document-centric PLM approaches can no longer support the speed, rigor and collaboration required across modern global value chains. Cloud native platforms and AI-enabled intelligence now offer a path forward, transforming PLM into a connected, data-driven ecosystem that spans requirements through sustainment.

The evidence is clear: leading organizations that adopt cloud, digital threads and AI augmented workflows are realizing measurable gains in development velocity, traceability, certification readiness and lifecycle performance. These advancements are enabling A&D enterprises to manage complexity more effectively while improving mission assurance and cost efficiency.

To unlock this value, organizations must approach PLM modernization as a strategic, multi-year transformation. Success hinges on executive commitment, strong governance, supplier collaboration and deliberate investment in workforce capability. By embracing integrated, model-based and intelligence-driven practices, A&D organizations can elevate PLM from a necessary operational system to a source of competitive advantage.

Those that act decisively will be best positioned to deliver next-generation aerospace and defense programs faster, with higher quality and greater confidence, thereby strengthening their ability to innovate, reduce lifecycle costs and achieve mission success in an increasingly demanding global environment.

The path to next-generation PLM is ambitious but achievable. Organizations that act now will be best positioned to deliver on mission-critical demands, enhance program performance and remain competitive in an increasingly digital and AI-driven aerospace and defense landscape.

# Authors

**Giriprasad Gurramkonda** (Giri) brings over 23 years of experience in PLM/PDM consulting and pre-sales, with deep expertise in business requirements development, pre-alignment workshops, solution architecture and system design. Giri is leading the architecture, design and development of product structuring and configuration strategies for a wide range of customers. His experience includes shaping PLM roadmaps, enabling scalable solutions and driving cross-functional alignment across Design, Manufacturing, Supply and Enterprise systems.

**Giriprasad Gurramkonda**

**Anshul Sharma**, an A&D Industry Principal at HCLTech, is responsible for sales enablement and thought leadership initiatives. He has over 17 years of A&D experience, primarily in business research, presales and client account planning and supporting large-scale digital transformations and go-to-market initiatives for A&D companies.

**Anshul Sharma**

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3 FedRAMP enables agencies to leverage cutting-edge cloud technologies with a focus on the security and protection of federal information (PDF)

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