
Digital thread delivers value, so what's stopping scale?
What aerospace and defense industry leaders say it takes to break through.
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Contents

Methodology

To understand how digital thread is being applied in practice, we surveyed Aerospace Industries Association (AIA) member organizations, primarily from US-based companies with annual revenues exceeding $100 million and at least three years of investment in digital thread initiatives. Insights were gathered through two sources:

1. A **digital survey** captured responses from 57 aerospace and defense (A&D) leaders across commercial and military aviation, space systems, unmanned platforms, and components and subsystems. Participants primarily held manager-, director -or C-suite-level roles, with functional backgrounds spanning executive leadership, engineering and quality assurance.
2. Eight in-depth **executive interviews** were conducted with AIA member companies, representing leading original equipment manufacturers (OEMs), primes and suppliers. These interviews brought survey findings to life through firsthand perspectives and real-world examples.

Introduction

A digital thread connects authoritative design, manufacturing and operational data across the end-to-end lifecycle, creating shared visibility and traceability across functions.

Demand in the aerospace and defense (A&D) industry remains strong, but delivering at speed and scale hinges on coordinated enterprise execution across complex product lifecycles and partner ecosystems. As requirements shift from documentation to demonstrable, end-to-end traceability in quality, certification and compliance, the pressure to execute reliably continues to grow. These demands are further amplified by advancements in digital and analytics capabilities and rapid AI innovation, reinforcing the imperative for digital thread.

> "Today in A&D, demand is not a problem – execution at scale is. That requires shifting the conversation from technology advancement to enterprise-level performance and sustained value delivery using these advancements.

Raman Ram
EY Americas Aerospace, Defense & Mobility Leader

Execution hinges on decisions across engineering, manufacturing, suppliers and sustainment, yet those decisions are often slowed or distorted by fragmented data, disconnected workflows and unclear ownership. The result is slower execution, greater risk, compromised program performance, and capital tied up in rework, buffers and manual coordination. A digital thread connects authoritative design, manufacturing and operational data across the end-to-end lifecycle, creating shared visibility and traceability across functions. This supports faster, better-informed decisions, greater change resilience, and the ability to scale delivery without proportionally increasing cost, risk or complexity.

While digital thread is not a new concept, many organizations continue to struggle to apply it across the enterprise beyond isolated use cases. Where has digital thread delivered measurable value? What differentiates leaders from laggards? And what does it take to scale results consistently?

Informed by an extensive survey and senior executive interviews, Ernst & Young LLP (EY US) and the Aerospace Industries Association (AIA) shed light on the state of digital thread in aerospace and defense. The research explores why scale remains elusive, what differentiates high performers, and what drives measurable, enterprise-level results.

> "Complexity is driving cost and schedule pressure across our programs, and digital thread is one of the most powerful tools we have to manage it. But digital thread enabling technology alone isn't the answer. Policy must do its part — clear mandates, aligned standards, enforceable contract language, and governance that makes digital thread a requirement, not an aspiration.

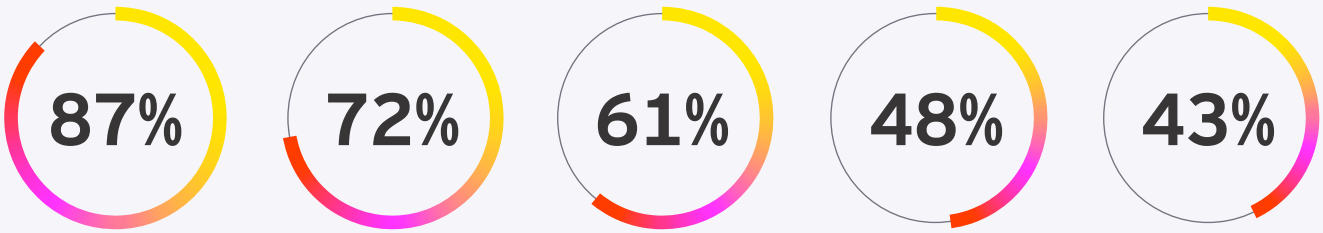
Timothy White, PhD
Vice President
Engineering & Technology, AIA

1 The case for digital thread

Enterprise impact is driven by execution across the value chain.

Digital thread is moving from concept to competitive necessity, as enterprise performance increasingly depends on connecting decisions and execution across the full value chain. Survey results show that while awareness of digital thread is widespread across A&D, realized benefits can vary with implementation maturity and adoption. Many organizations have begun implementing digital thread within individual functions, such as engineering, manufacturing, supply chain, quality and sustainment. And while early efforts demonstrate tangible gains, including improved quality, enhanced traceability and cost avoidance through reduced rework, these benefits often remain localized, limiting enterprise-wide impact.

Digital thread familiarity, implementation and results



Digital thread is already delivering real benefits, but enterprise impact continues to lag adoption.

ADOPTION IS AHEAD OF ENTERPRISE IMPACT

Respondents point to persistent data silos, legacy interoperability challenges and limited end-to-end supply chain integration as continuing barriers to progress. This lack of enterprise connectivity matters more than ever, as the same connected, authoritative data required to scale digital thread also forms the foundation for applying AI with confidence and impact.

From local optimization to enterprise orchestration

Current state	Future state
Isolated improvements	Enterprise impact
Stand-alone tools	Integrated workflows
Disconnected information	Single source of truth
Documented compliance	Proven traceability
Local accountability	Enterprise governance
Adoption activity	Measurable outcomes

Enterprise orchestration requires integrated workflows, a shared source of truth and enterprise-level governance.

Interview insight: value through targeted digitization

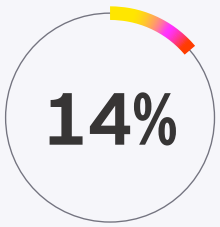
A precision A&D contract manufacturer described how digital thread value can be built incrementally by targeting high-friction operational work that connects data across the production lifecycle. Over the last decade, the organization digitized labor tracking, tooling management and certification review, linking execution data back to design intent and quality requirements. By reducing manual data entry and integrating these systems, it improved traceability and execution reliability. Rather than waiting for a full system overhaul, the company focused on connecting priority workflows into an early digital thread backbone, demonstrating that measurable digital thread value can be achieved through deliberate, lifecycle-aware digitization and integration choices.

2 The scale gap: from pilots to enterprise adoption

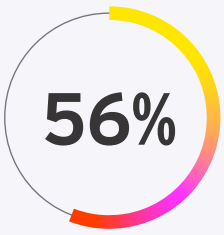
Enterprise impact is driven by converting pilot success into enterprise-level outcomes.

Most organizations have demonstrated digital thread value through pilots. The challenge is converting those pockets of progress into consistent, enterprise-wide impact. Survey results reveal a clear scale gap: digital thread implementation is common, but few organizations move beyond pilots even after several years. As organizations work to operationalize AI, this lack of enterprise integration becomes more consequential, constraining both the speed and quality of decisions and actions.

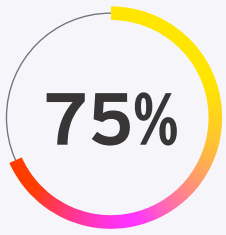
Pilot progress without enterprise impact



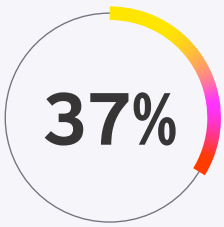
cite enterprise wide implementation.



indicate pilot or limited implementation stages.

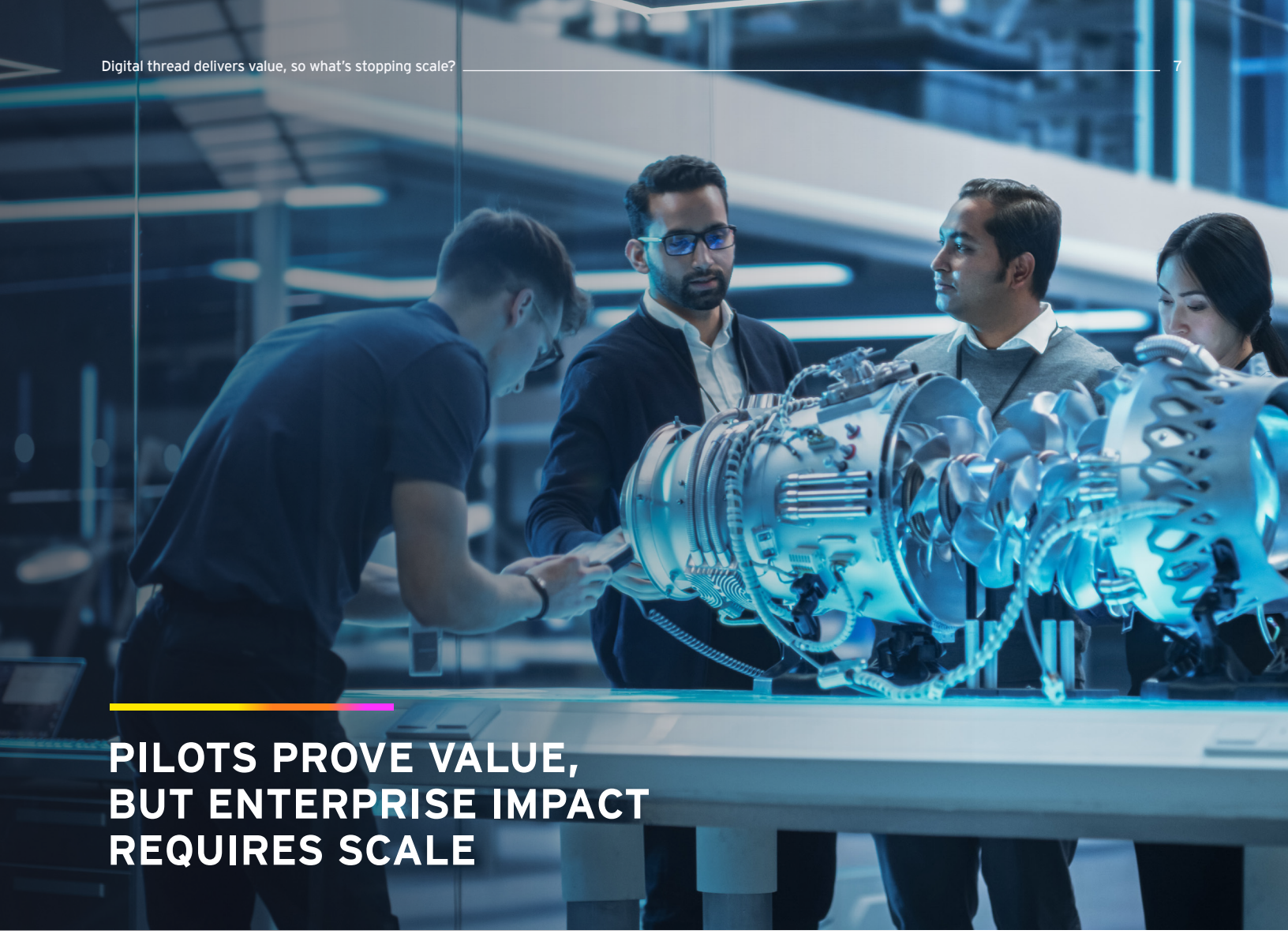


report three or more years of digital thread use.



rate adoption as early or developing.

Years of pilot activity have not translated into enterprise-scale digital thread adoption.

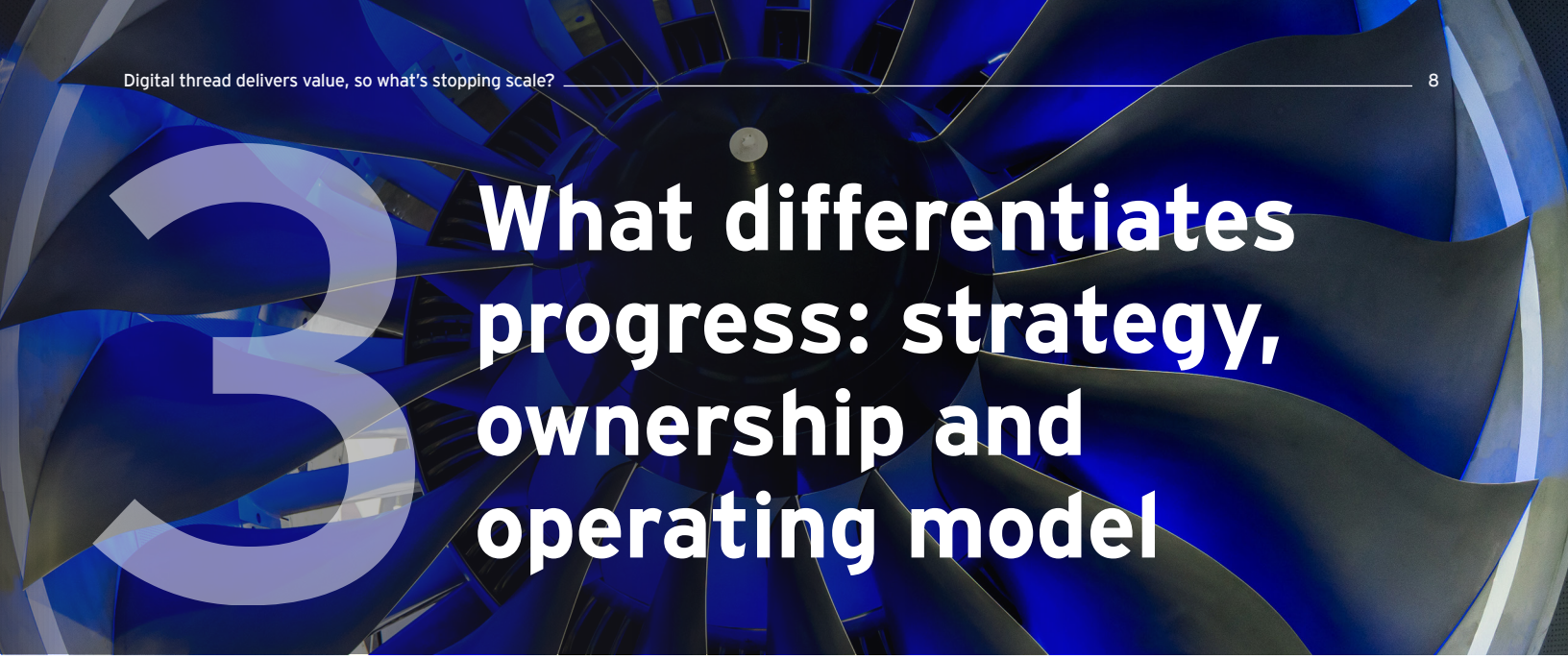


PILOTS PROVE VALUE, BUT ENTERPRISE IMPACT REQUIRES SCALE

Across interviews, a consistent pattern emerges: pilots that deliver measurable value typically have strong local ownership and a well-defined scope, often targeting specific manual or traceability bottlenecks. However, when organizations launch multiple initiatives without clear enterprise-level ownership, results fragment and enterprise-wide impact stalls. In the absence of defined accountability, progress is too often measured by tool deployment or time in market rather than end-to-end integration and measurable outcomes.

Interview insight: pockets of progress over time

A large A&D organization described digital thread not as a single program but as dozens of initiatives launched over several years, many delivering localized benefits while failing to connect into a cohesive enterprise digital thread. Leaders emphasized that enterprise digital thread value depends on stitching these efforts together across core systems, including product lifecycle management (PLM), enterprise resource planning (ERP), manufacturing execution systems (MES), and supply chain platforms, so data can flow continuously across engineering, manufacturing and sustainment. Without that integration, initiatives remain isolated. Moving from pockets of progress to enterprise execution required deliberate digital thread architecture, shared ownership and coordination across functions.



3 What differentiates progress: strategy, ownership and operating model

Enterprise impact is driven by leadership discipline.

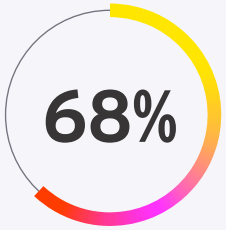
Technology rarely limits digital thread; the real constraint is the absence of clear enterprise-level direction. Survey results show that while executive leadership broadly champions digital transformation, commitment and direction weaken when attention narrows to digital thread specifically. This gap does not prevent activity; it prevents direction toward enterprise outcomes. The result is a great deal of effort but limited enterprise impact.

These findings suggest that digital thread has broad conceptual support but often lacks the enterprise-wide ownership, governance and operating-model integration required to scale. Interviews help explain what differentiates organizations that break through.

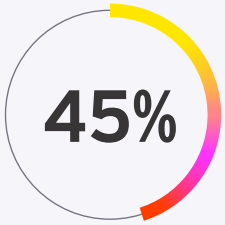
Leaders who translate early progress into broader impact apply a small set of repeatable patterns:

- Funding aligned to value streams.
- Roadmaps that drive end-to-end integration.
- Governance that spans functions.
- Accountability for enterprise-level outcomes.

Digital transformation support outpaces digital thread



note leadership support for digital transformation.



cite clear strategic vision for digital thread.

Broad executive support for transformation does not translate into scale without clear ownership and direction for digital thread.

EXECUTIVE SUPPORT WITHOUT OWNERSHIP DOESN'T SCALE

Clarifying leadership roles across three dimensions

People

Assign clear enterprise ownership

Empower teams to redesign workflows

Process

Prioritize work around value streams

Sequence initiatives based on end-to-end impact

Product and data

Define authoritative sources of truth

Resolve cross-functional integration decisions centrally

Clear ownership across people, process and data turns fragmented digital thread efforts into enterprise execution.

Interview insight: ownership must sit with the business

A leader working across major A&D OEMs and suppliers noted that digital thread initiatives sustain momentum when business or product line owners sponsor end-to-end lifecycle outcomes, with information technology (IT) enabling implementation and operations. When digital thread efforts originate solely within IT, they are often treated as cost-center projects and struggle to connect workflows across engineering, manufacturing and sustainment. Clear business sponsorship, explicit digital thread objectives and staged delivery milestones were cited as critical to sustaining return on investment (ROI) and scaling digital thread beyond localized wins.

4 Adoption at scale: capability, not just training

Enterprise impact is driven by embedding new ways of working.

Digital thread adoption is often constrained less by training gaps than by whether underlying ways of working evolve. Survey results suggest that while talent constraints factor into adoption, they do not on their own determine scale. Foundational capabilities exist, but advanced, enterprise-ready depth is less common, and vendor solutions are frequently viewed as only somewhat effective. In practice, scale follows when leaders institutionalize new ways of working, embedding clear ownership, decision rights and outcome-based execution into end-to-end workflows.

Digital thread skill levels and vendor effectiveness

52%
rate digital thread skills as moderate

40%
report vendor solutions as limited.

54%
cite cultural shift as a primary challenge.

Digital thread does not stall because of tools or training. It stalls when organizations cannot redesign workflows, integrate data and operationalize new ways of working at the enterprise level.

DIGITAL THREAD STALLS AT EXECUTION, NOT TRAINING

Interviews reinforce this picture. Where digital thread is implemented effectively, teams report reduced manual effort and simpler, more reliable workflows. Where it stalls, adoption is constrained not by tools or training but by the inability to redesign processes, apply enterprise-level outcome measures, and overcome cultural and trust-related barriers.

Leadership plays a decisive role in resolving these constraints. Those organizations that succeed pair skills development with clear ownership, permission to redesign workflows and expectations tied to enterprise outcomes. Those that scale digital thread typically rely on continuous-improvement or digital-enterprise teams to act as the connective tissue across functions—coordinating change, enforcing roadmap discipline and translating strategy into execution.

Interview insight: adoption follows value-stream outcomes, not vanity metrics

A senior engineering leader at a large A&D prime emphasized that digital thread adoption is often overstated when measured by tool usage rather than by continuous data flow across the value stream. They cautioned that mandated adoption and activity-based metrics frequently mask persistent breaks between engineering, manufacturing and supply chain workflows. In contrast, adoption accelerates when digital thread delivers measurable improvements in lead time, quality and decision confidence across end-to-end workflows, and when incentives and organizational structures are aligned to those outcomes rather than functional silos.

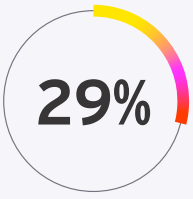
5 Data readiness: unlocking digital thread and AI at scale

Enterprise impact is driven by data readiness that allows AI to move beyond experimentation

Data readiness remains a critical gating factor for digital thread adoption. Survey and interview findings suggest the constraint is less about tool availability and more about organizations' ability to standardize, govern and share trusted data across the enterprise and extended ecosystem. While interviewees pointed to pockets of system integration, these efforts have not consistently translated into enterprise-wide data that is accessible, governed and reusable at scale.

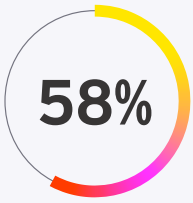
Data as the enabler and the roadblock

Only

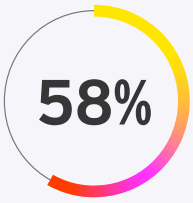


say enterprise data is standardized and accessible.

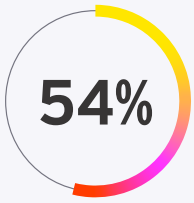
Primary constraints



report data silos.



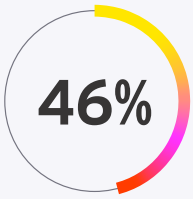
note legacy interoperability challenges.



cite weak data governance.

Data sharing limits

cite intellectual property (IP) risk.



indicate cybersecurity and governance concerns.

Digital thread and AI scale only as far as enterprise data readiness allows. Without standardized, governed and shareable data, integration stalls and value remain constrained despite continued investment.

PROGRESS BREAKS DOWN AT DATA NOT TECHNOLOGY

To move from integration to scale, organizations need authoritative data sources grounded in full lifecycle context and interoperable across engineering, manufacturing and supply chain. Interviews suggest leaders make progress by clearly defining enterprise sources of truth for critical product and process objects, standardizing definitions and identifiers, and resolving ownership and integration decisions at the enterprise level rather than locally. Integration priorities are increasingly aligned to value streams and workflow events, enabling data to move with the work and support end-to-end traceability.

Interview insight: data protectionism is a governance problem, not just a systems problem

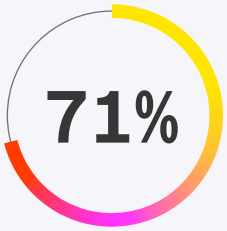
Leaders at a large A&D OEM described persistent data protectionism that prevented digital thread continuity, with teams reluctant to share reliability and execution data due to concerns about how it could be interpreted or used. This fragmentation weakened lifecycle traceability and slowed decision-making. After establishing digital thread governance that clarified authoritative sources, standardized definitions and enforced least-privilege access, data sharing improved significantly. The organization noted that greater transparency, including near real-time collaboration with customers, is possible only when data trust, control and accountability are explicitly managed.

AI IS THE VALUE MULTIPLIER, NOT THE STARTING POINT

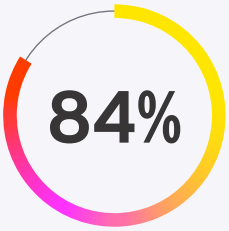
This foundation also determines whether AI can move beyond experiments. A mature digital thread provides the structured, contextual data required for advanced analytics and AI to operate consistently across functions and partners. This is particularly evident in supply-chain scenarios, where interviews indicate that AI-driven forecasting and risk mitigation are constrained by cross-company data readiness.

Taken together, the findings reinforce a clear message: while leaders see AI as central to digital thread's future value, data readiness remains the practical limiter. Interviews further emphasize that meaningful digital thread value can be achieved without AI, establishing the conditions for AI to be applied safely and at scale. When introduced too early, AI often increases rework and undermines confidence; when applied on top of trusted, governed data, it accelerates impact.

Looking ahead with digital thread



expect future value to come from predictive analytics and AI.



rate AI and machine learning as important to value realization.

AI represents the next horizon of digital thread value, but only for organizations that get the fundamentals right. Without a mature digital thread, AI remains aspirational rather than transformative.

6 From proof points to ecosystem value

Enterprise impact is driven by digital thread use cases that deliver measurable ROI.

Our conclusions about digital thread are grounded not only in survey data and interviews but also in observations of repeatable execution patterns observed across AIA member companies. When implemented with clear ownership and measured through workflow outcomes, digital thread delivers practical value by connecting work across functions and the entire supply chain, reducing manual effort and improving decision speed.

AIA member companies described several examples:

- One organization replaced spreadsheet-based reconciliation with automated data integration to establish a more consistent source of truth, improving decision confidence and reducing manual effort. When paired with analytics and AI-enabled insights, it further improved speed and decision quality.
- A midsize A&D manufacturer targeted high-friction operational pain points, including manual time entry and certification reviews. By implementing labor tracking and optical character recognition (OCR), the company optimized tooling and inventory spend by approximately $8 million, demonstrating ROI through waste reduction rather than added overhead.

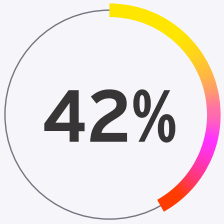
These examples reflect a broader pattern: the highest-value digital thread use cases are those that improve execution and visibility across the product lifecycle. Across the survey and interviews, organizations consistently point to a small set of operational metrics that most directly translate to financial impact:

- Quality improvement (including reductions in material review board actions and quality holds)
- Cycle-time and lead-time reduction
- Improved first-pass yield

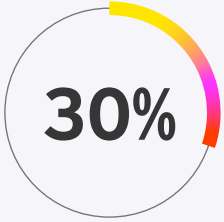
These metrics drive measurable value by reducing scrap, rework and inspection efforts while increasing throughput and execution reliability.

END-TO-END VISIBILITY OUTRANKS OPTIMIZATION

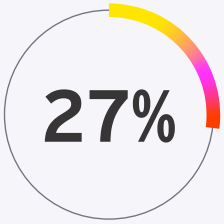
Highest-ROI digital thread use cases



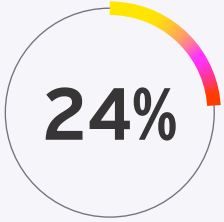
indicate end-to-end lifecycle traceability.



report digital twin enablement.



cite real time supply chain visibility.



identify manufacturing optimization.

Digital thread ROI is highest where integration is deepest. End-to-end, cross-functional use cases consistently outperform localized optimizations.

The survey also reinforces an important point about scale: the highest-value use cases are inherently cross-functional. "Easy" pilots that avoid cross-functional integration tend to deliver localized improvements by design, but they rarely translate into enterprise performance gains. In contrast, initiatives that span functions surface integration requirements earlier, creating the conditions needed for scalable impact.

Taken together, the findings point to a repeatable formula for scale: digital thread compounds value when organizations connect initiatives across value streams, measure success through workflow outcomes, and establish governed, reusable enterprise data. This same foundation also positions AI to move from localized experimentation to repeatable advantage, particularly as integration extends to suppliers and customers.

Interview insight: scalable impact follows multiyear roadmaps and ecosystem collaboration

Leaders working across A&D OEMs, suppliers and government partners emphasized that scalable digital thread implementations rely on multiyear roadmaps that incrementally connect design, manufacturing, certification and sustainment data. Aligning digital thread capability releases to program and acquisition cycles helped organizations maintain continuity and avoid fragmentation. The greatest value emerged when the digital thread extended beyond a single enterprise, enabling secure data sharing and traceability across OEMs, suppliers and customers in support of verification and certification workflows.

7 Executive call to action: Five focused leadership decisions

Digital thread has proven value. The next step is scaling that value consistently across the enterprise and ecosystem. The following five leadership decisions define whether digital thread becomes an enterprise capability or remains a set of disconnected efforts.

1. **Assign a single enterprise owner for outcomes**
   Appoint one accountable leader with enterprise scope and decision rights across engineering, manufacturing, supply chain and IT. Place ownership where end-to-end outcomes can be driven, often in a digital enterprise, continuous improvement or product-centric organization (not IT alone). Ensure this role has authority to set priorities, resolve trade-offs and hold functions accountable to shared outcomes.

2. **Fund digital thread by value stream, not by technology solutions**
   Allocate investment around value streams (for example, design-to-manufacture and order-to-delivery), not by individual tools or functions. This aligns funding to end-to-end outcomes and forces cross-functional integration decisions early.

3. **Replace adoption metrics with workflow and productivity metrics**
   Shift measurement from usage to outcomes. Track workflow performance indicators such as lead time, wait time, first-pass yield and automated verification rates. Use these metrics to guide sequencing decisions, prioritize integration work and demonstrate enterprise impact.

4. **Standardize the data backbone before scaling AI**
   Treat data standardization and governance as prerequisites. Define authoritative sources for critical objects, integration standards and a consistent semantic layer so data can be reused across functions and partners. Use this foundation to scale AI safely, with consistent inputs, clear lineage and controlled risk.

5. **Start with the hard, cross-functional use cases**
   Prioritize use cases that require integration across functions and the supply chain, because they catalyze enterprise connectivity rather than avoiding it. Focus areas like lifecycle traceability, automated verification and supply chain visibility tend to deliver strong returns and expose integration requirements early, when they can still be addressed deliberately.

Bottom line

Leaders who scale digital thread treat it as an enterprise capability, with clear ownership, value-stream funding, outcome-based measurement and a governed data foundation. This is what turns isolated proof points into repeatable enterprise performance and prepares the organization to apply analytics and AI with confidence.

Setting the context: Scaling digital thread in A&D

As digital thread initiatives expand to support certification, sustainment and cross-organizational workflows, scaling impact increasingly depends on interoperability requirements shaped beyond the enterprise.

Digital thread and digital twins are rapidly transitioning from conceptual tools to mandated infrastructure across A&D, setting new expectations for traceability, quality and compliance. While civil aviation is progressing more slowly, it is moving in the same direction, with increasing pressure to adopt end-to-end digital integration. Critically, policy and regulation — not technology — are increasingly cited by industry stakeholders as emerging limiting factors: in the absence of aligned mandates, standards and governance frameworks, digital transformation efforts often struggle to scale beyond enterprise boundaries, particularly at the supply chain level. As a result, AIA is closely watching how evolving regulatory expectations around certification, data exchange, lifecycle traceability and cross-organizational interoperability may influence the pace and consistency of digital adoption across the broader ecosystem.

Across interviews and industry engagement, several areas of policy focus have been discussed as potential enablers of ecosystem-level interoperability:

- Integration of digital thread into Federal Aviation Administration (FAA) certification pathways through phased pilot programs, allowing regulators and manufacturers to validate digital lifecycle data in parallel with traditional documentation models
- Greater clarity around data rights and intellectual property governance, with the goal of enabling secure collaboration and trusted data exchange across OEMs and supplier networks
- Expanded support mechanisms for small- and medium-sized suppliers to reduce barriers to participation in digitally integrated value chains beyond prime contractor environments
- Improved international alignment on lifecycle data standards, particularly between the US and EU, to minimize fragmentation in certification or interoperability expectations

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