Techno Vision 2026

Aerospace & Defense

Capgemini

Foreword

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Artificial Intelligence has moved from experimentation to transformation. Generative AI is becoming mainstream, agentic AI is emerging, and advances in quantum computing, digital twins, robotics, autonomous systems, biotechnology, and space technologies continue to redefine what is possible. Yet technology alone does not create value. The real challenge for organizations is understanding how these innovations can be combined, industrialized, and deployed responsibly to generate measurable business outcomes.

For more than sixteen years, TechnoVision has helped leaders navigate technology disruption by identifying the innovations that matter most and translating them into actionable business opportunities. While the pace of change continues to accelerate, one principle remains unchanged: successful transformation happens when technology, business ambition, and human ingenuity move together. Every industry follows its own path, and the maturity, impact, and adoption of these technologies vary significantly depending on operational realities, regulatory constraints, and strategic priorities.

I am, therefore, delighted to present TechnoVision 2026 for Aerospace & Defense. Developed by our global community of experts, this report explores the trends that will shape the future of our industry and illustrates them through practical use cases already delivering value across aerospace, space, and defense organizations worldwide. Our ambition is not simply to describe the future, but to demonstrate how it can be applied today. I encourage you to engage with our Aerospace & Defense experts to explore how these innovations can accelerate your own transformation journey.

The Aerospace & Defense industry stands at a pivotal moment. Civil aviation must simultaneously increase capacity, improve operational efficiency, enhance passenger experience, and meet ambitious sustainability objectives. Across the ecosystem, AI-enabled engineering, digital continuity, advanced manufacturing, and autonomous operations are transforming how aircraft are designed, built, operated, and maintained.

The space sector is evolving into a strategic layer of the global digital economy. Satellite constellations, Earth observation platforms, secure communications, positioning systems, and emerging in-orbit services are becoming critical infrastructures supporting governments, industries, and citizens alike. At the same time, sovereignty, resilience, and secure access to space-based capabilities have become strategic priorities for nations around the world.

Defense organizations are also adapting to a rapidly changing geopolitical environment. Modern military superiority increasingly depends on the ability to integrate data, software, autonomous systems, cyber capabilities, and human decision-making across multiple domains. The convergence of physical and digital systems is driving the transition toward software-defined capabilities, AI-assisted operations, and increasingly connected mission ecosystems.

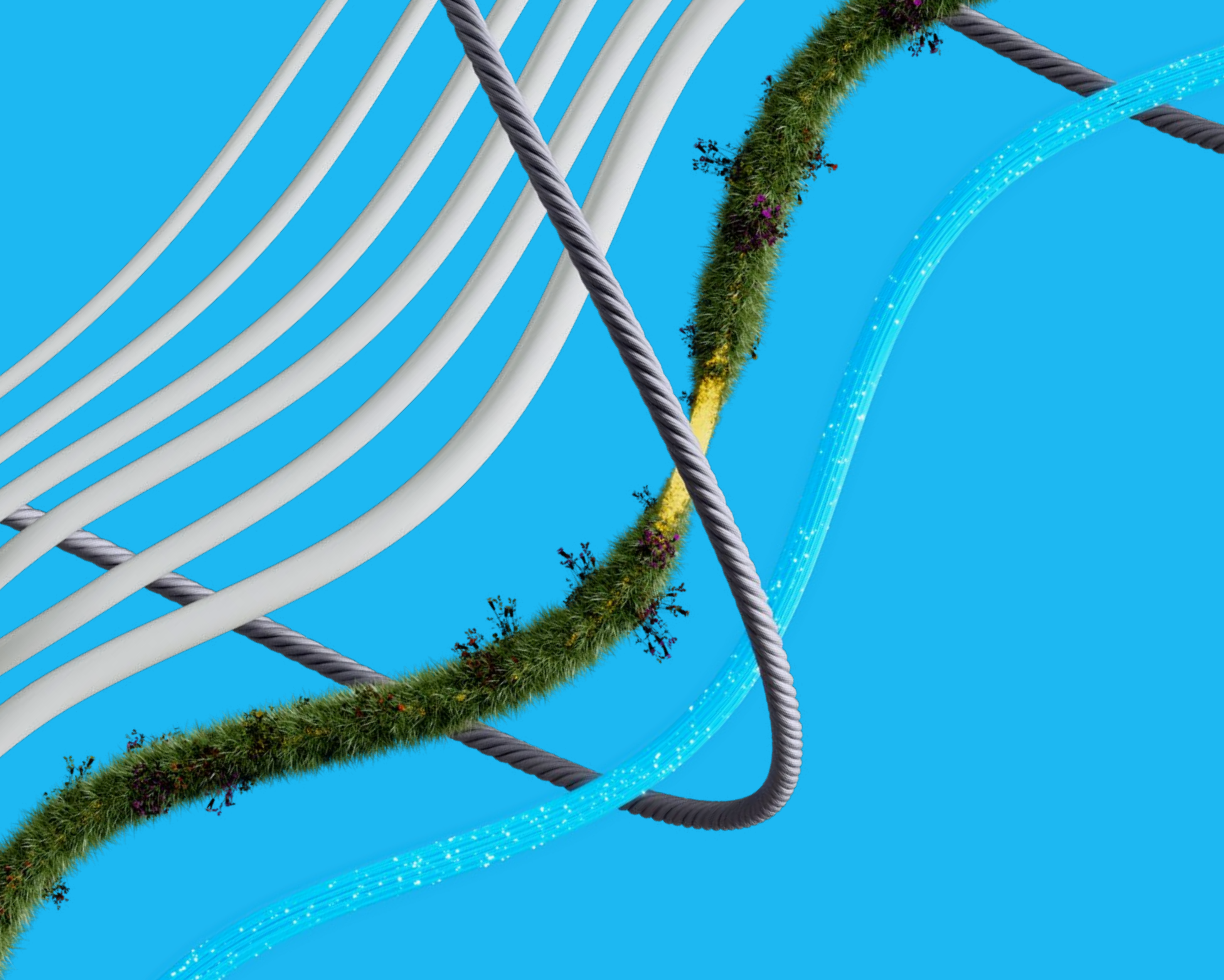
As you navigate through this report, you will discover how the nine TechnoVision 2026 containers interact to create new possibilities for Aerospace & Defense organizations. You will explore how intelligent experiences strengthen collaboration between humans and AI, how autonomous assets and connected ecosystems are creating a true Economy of Things, how invisible digital infrastructures enable resilience and scalability, and how trusted data foundations unlock entirely new forms of operational and business value. You will also see how digital twins, AI-powered engineering, advanced connectivity, and sovereign digital platforms are accelerating innovation throughout the aerospace, space, and defense value chains.

Yet technology progress alone is not enough. The most successful organizations will be those capable of balancing innovation with responsibility, performance with sustainability, automation with human oversight, and global collaboration with strategic sovereignty. This balance sits at the heart of TechnoVision 2026. Just like the theme of *The Sync Swing* in this year's report, leaders must continuously calibrate their decisions between what is technologically possible and what is operationally desirable, sustainable, secure, and trustworthy.

The future of Aerospace & Defense will not be defined by individual technologies, but by our ability to orchestrate them into intelligent, resilient, and trusted ecosystems that create value for businesses, governments, and society.

I hope you enjoy reading this report as much as we enjoyed creating it.

3, 2, 1… Ignition!



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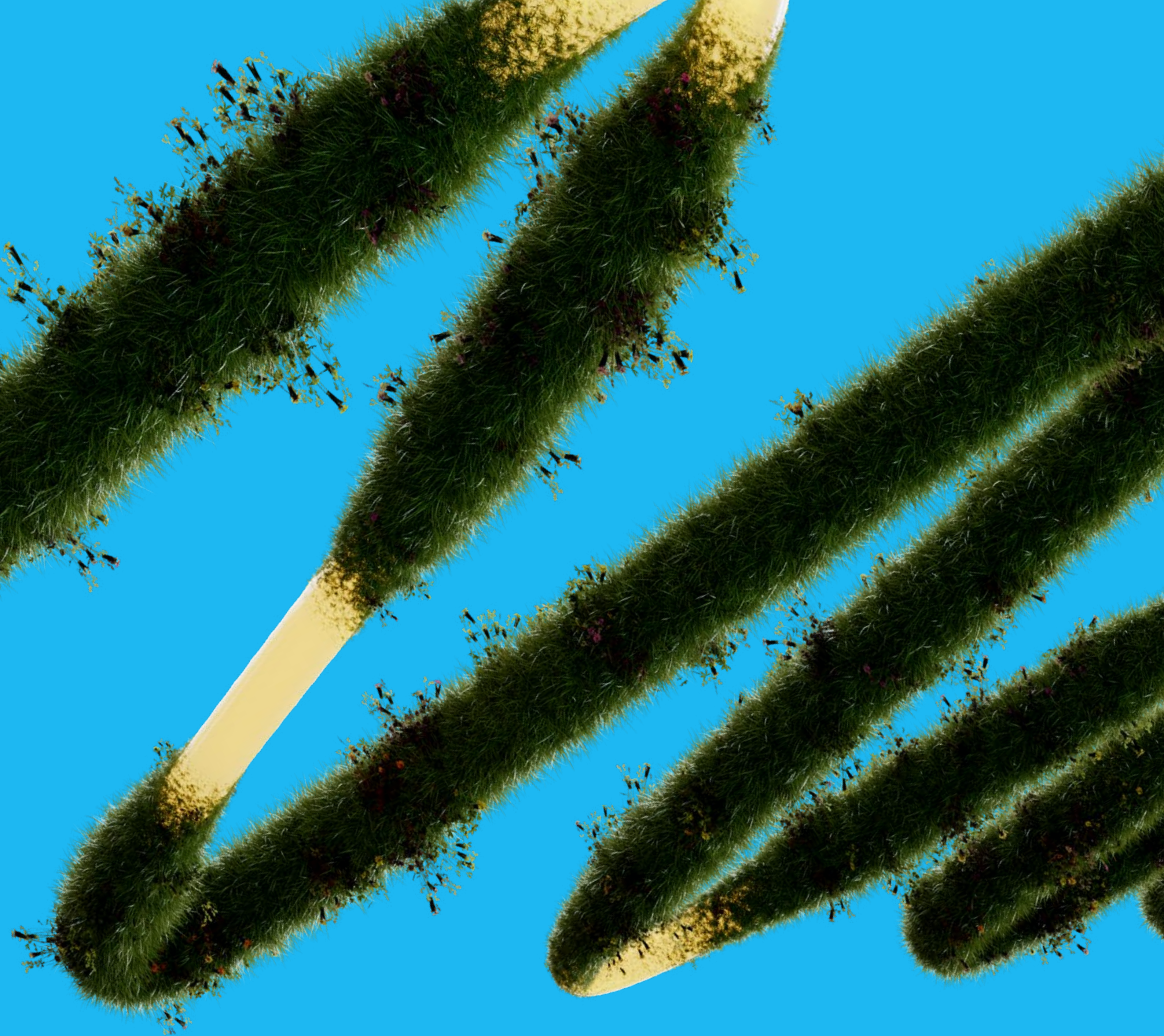


Introduction

Frédéric Combes
Global Aerospace & Defense Leader,
Capgemini

Aerospace & Defense is entering one of the most consequential decades in its history.

Across every segment of our industry, the forces of transformation are accelerating. Civil aviation must simultaneously increase production, modernize fleets, improve passenger experience, and advance toward ambitious sustainability targets. Defense organizations are adapting to a rapidly evolving geopolitical landscape, where operational advantage increasingly depends on the ability to connect systems, integrate data, and make decisions at unprecedented speed in a secure environment. Meanwhile, space has evolved from a specialized sector into a strategic pillar of the digital economy, enabling connectivity, intelligence, security, and resilience on a global scale.

At the same time, Aerospace & Defense organizations face a familiar but increasingly urgent set of challenges. Supply chains remain fragile. Talent shortages continue to constrain growth. Production ramp-ups are testing industrial capacity. Certification, security, and regulatory requirements are becoming more demanding. And the need to balance innovation, sovereignty, sustainability, and operational performance has never been greater.

Artificial Intelligence is rapidly moving from experimentation to industrialization. Digital twins are becoming the foundation for smarter engineering, manufacturing, operations, and maintenance. Autonomous systems are reshaping how we design, build, and operate products and missions. Advanced connectivity is enabling real-time collaboration across platforms, organizations, and domains. And new developments in quantum computing, robotics, materials science, biotechnology, and photonics continue to expand what is possible. Yet technology alone is not the story. The real opportunity lies in how these innovations converge to create intelligent, resilient, and trusted ecosystems capable of delivering measurable business and mission outcomes.

This is the context for TechnoVision 2026 for Aerospace & Defense.

More than a technology report, TechnoVision provides a framework for understanding how innovation is reshaping the future of our industry. It helps leaders move beyond isolated trends to see the broader connections that are driving change across engineering, manufacturing, operations, supply chains, customer experiences, defense missions, and space ecosystems. The central message of this year's report is clear: competitive advantage will no longer be defined by individual technologies or standalone systems, but by the ability to orchestrate people, data, software, infrastructure, and intelligent machines into connected and adaptive ecosystems.

This year's theme, *The Sync Swing*, reflects the balance every organization must achieve. Leaders must continuously calibrate between innovation and execution, autonomy and oversight, performance and sustainability, global collaboration and strategic sovereignty. Success will belong to organizations that can move quickly while maintaining trust, security, resilience, and human accountability.

To help navigate this landscape, TechnoVision 2026 is organized around nine interconnected containers. Eight explore where technological innovation is emerging—from human experiences, collaboration, data, applications, infrastructure, physical systems, and biological innovation to intelligent process automation. The ninth, Balance by Design, focuses on how organizations can apply these innovations responsibly, sustainably, and effectively. Together, these perspectives provide a structured yet dynamic view of the forces reshaping Aerospace & Defense.

Throughout the report, our global community of Aerospace & Defense experts illustrates these trends through practical industry use cases drawn from civil aeronautics, defense, and space. These examples demonstrate that many of the technologies shaping the future are already creating value today. We conclude with dedicated perspectives on each of these sectors, examining how innovation will influence their evolution over the coming decade.

The Aerospace & Defense industry has never faced greater challenges—or greater opportunities. As technology continues to redefine the boundaries of what is possible, the winners will be those who can connect innovation to industrial performance, mission effectiveness, and sustainable growth.

We hope this report provides both inspiration and practical guidance as you navigate the next chapter of transformation.

Welcome to TechnoVision 2026 for Aerospace & Defense. The future is not waiting. It is already taking shape around us.

Overview of TechnoVision: Aerospace & Defense

TechnoVision is more than just a collection of technology trends. It's a **framework**, a way to make sense of innovation as it moves, swings, converges, and transforms. At its heart are containers: structured lenses through which we observe and categorize the changing technology landscape. Each container represents a distinct perspective, helping us explore how technologies impact everything from user experiences to organizational design, infrastructure to intelligence— and now, even biology and the physical world.

Think of the containers as nine harmonized instruments in an orchestra. Individually, they offer sharp insights. Together, they create a coherent view of technology's role in shaping business and society.

Nine Containers, One Frame

Until now, TechnoVision grouped its trends into seven containers. For 2026, we expand that to nine, adding two new perspectives that reflect the growing complexity—and convergence—of digital, physical, and biological innovation.

Eight of these containers represent the **what** of technology: the areas where innovation manifests:

- **You Experience**: Trends in user interaction, personalization, and immersive engagement
- **We Collaborate**: The future of teamwork, co-creation, and human-agent collaboration
- **Thriving on Data**: Data mastery, AI-powered business, and knowledge as an asset
- **Process on the Fly**: Flowing, agile, intelligent automation of work and operations
- **Applications Unleashed**: The modernization, liberation, and reinvention of applications
- **Invisible Infostructure**: Intelligent, resilient, and often unseen infrastructure
- **Physical Matters (new)**: Smart products, robotics, edge devices, and sentient materials
- **Nature's Code (new)**: Biotech, organic systems, and nature-inspired innovation

The ninth container, **Balance by Design**, is different. It focuses on the **how**: a set of five design principles (and their often more easily spotted antiprinciples) that help organizations apply these trends effectively, ethically, and sustainably.

Together, these nine containers offer a dynamic, yet structured way to explore technology's impact across domains, weave together compelling stories, and translate trends into action.

New Containers

TechnoVision evolves as the world evolves.

The introduction of the **Physical Matters** container acknowledges that digital is no longer confined to screens or software. From autonomous vehicles to sensor-rich environments, physical things are becoming intelligent participants in business ecosystems.

With **Nature's Code**, we are building an era where Biotechnology (BT) stands shoulder to shoulder with Information Technology (IT) and Operational Technology (OT). Innovation is now inspired as much by biology as by code and systems are being built to regenerate, adapt, and even self-heal.

We have added these containers not to stretch the model, but to complete it as the pendulums swing between disciplines, building bridges between technology, biology, and the physical world.

A Framework in Motion

The TechnoVision 2026 visual (on your left) represents a framework in motion—a living structure where technology, business, and human experience converge.

At its foundation lie the **enabling technologies**: Invisible Infostructure, Thriving on Data, and Process on the Fly. These are the engines of digital transformation— ensuring that whatever sits above them can operate, scale, and adapt.

On top of that base, three **interconnected domains**—Applications Unleashed, Physical Matters, and Nature's Code—show how software, engineered products, and biological innovation merge. Together, they form the new heart of technology-powered transformation, bridging IT, OT, and BT.

Above them rise the **human-centric layers**—We Collaborate and You Experience—the places where all technology eventually becomes tangible, meaningful, and personal.

Finally, Balance by Design forms the **overarching dome**—a reminder that innovation without balance and design is chaos, and that true transformation only happens when design, ethics, and purpose align.

Together, these nine containers form a **harmonized ecosystem**—from invisible enablers to visible impact. It's how TechnoVision 2026 transforms complexity into clarity, and motion into meaning.

The Trend Format: Crisp, Actionable, Synchronized

Each TechnoVision trend is designed to be:

- **Crisp**: A short summary, easy to digest but rich in insight
- **Actionable**: Clear real-world use cases and practical examples
- **Synchronized**: Aligned with the broader pendulum dynamics, and with other trends across containers

Each trend is structured into three simple sections:

- **What**: A clear description of the trend
- **Impact**: The transformational potential and business relevance
- **Use**: Best practices and real-world applications

And because we believe in the power of human connection, each trend includes an **Expert in Residence** you can always reach out to for more.

A Framework with a Twist

As always, **TechnoVision remains playful**. You'll find references to music, cinema, literature, and pop culture sprinkled throughout. Not just to lighten the tone, but to spark recognition and memory. These Easter eggs (some well-hidden) aren't gimmicks; they are part of what makes the trends sticky, shareable, and, dare we say, fun.

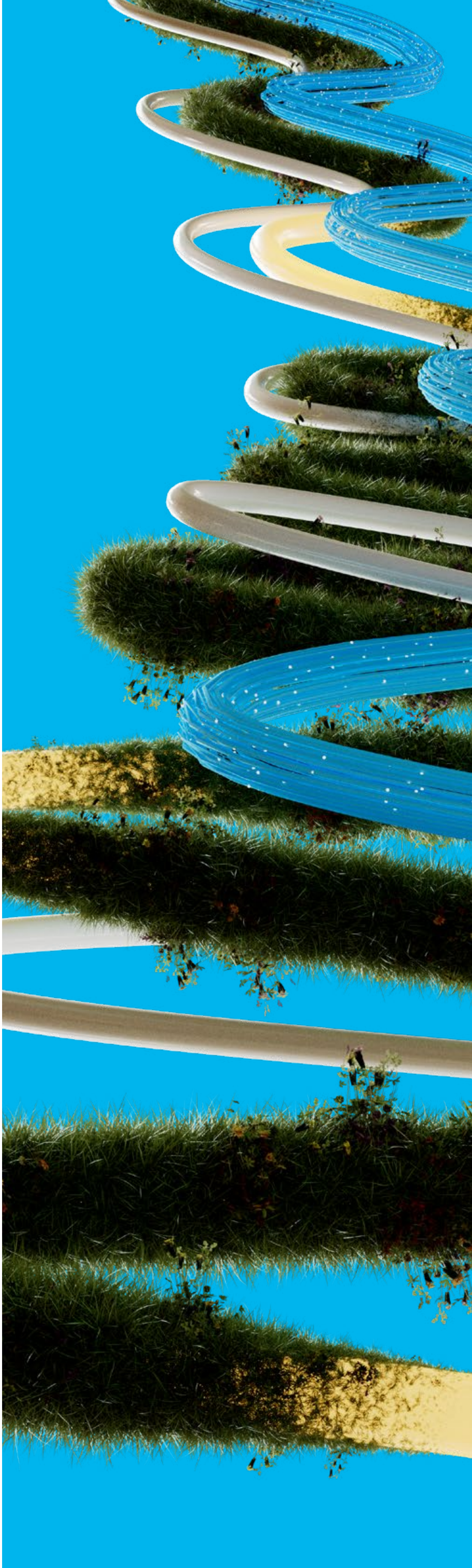
What's Inside, and What's Next?

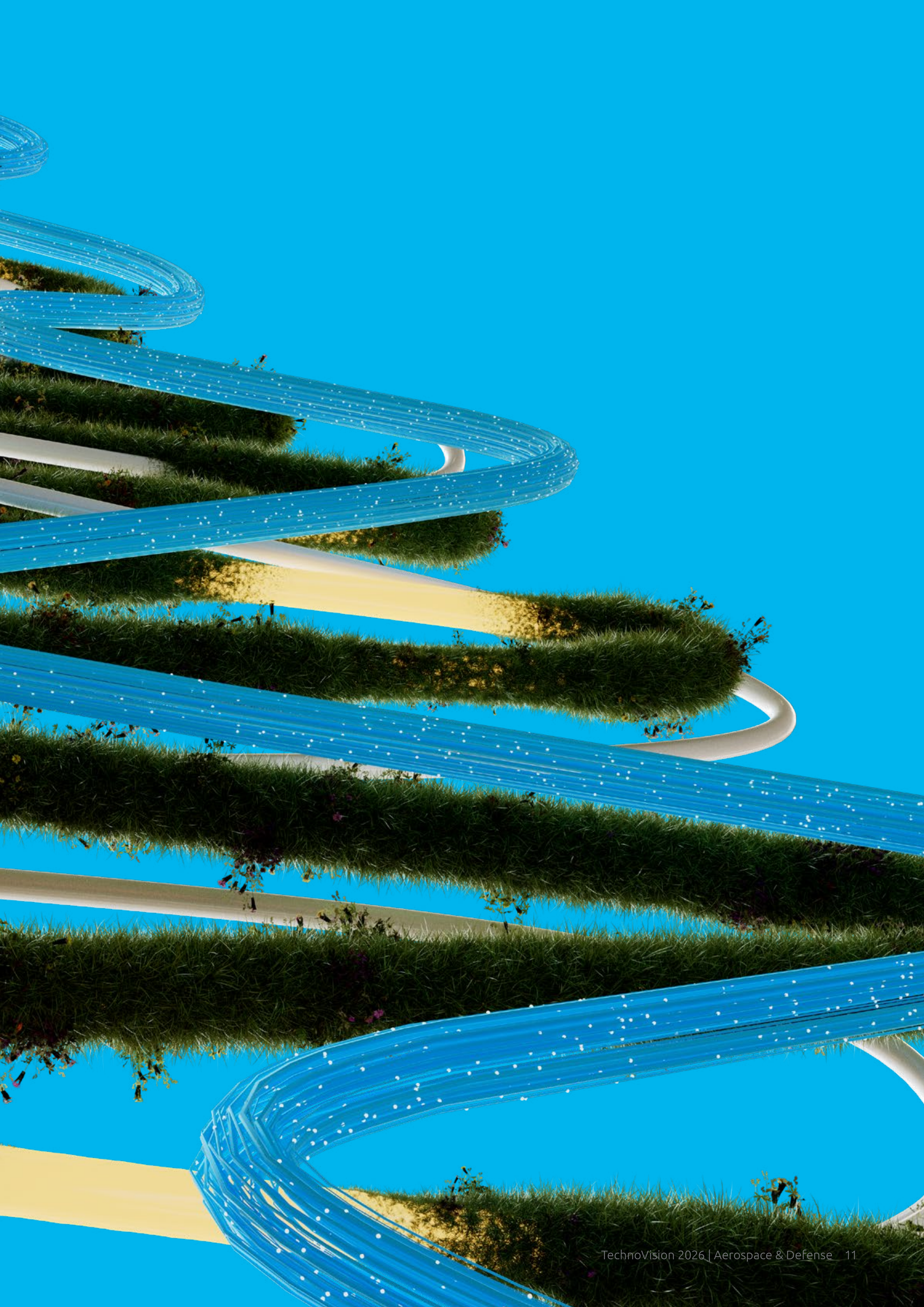
With nine containers, 37 synchronized trends, and a unifying theme, *The Sync Swing,* TechnoVision Aerospace & Defense 2026 sets the stage for bold, balanced, and creative transformation. It invites you to explore not just isolated innovations, but the deeper rhythms and counterforces at play in technology, business, and society —in a search for value from their joint resonance.

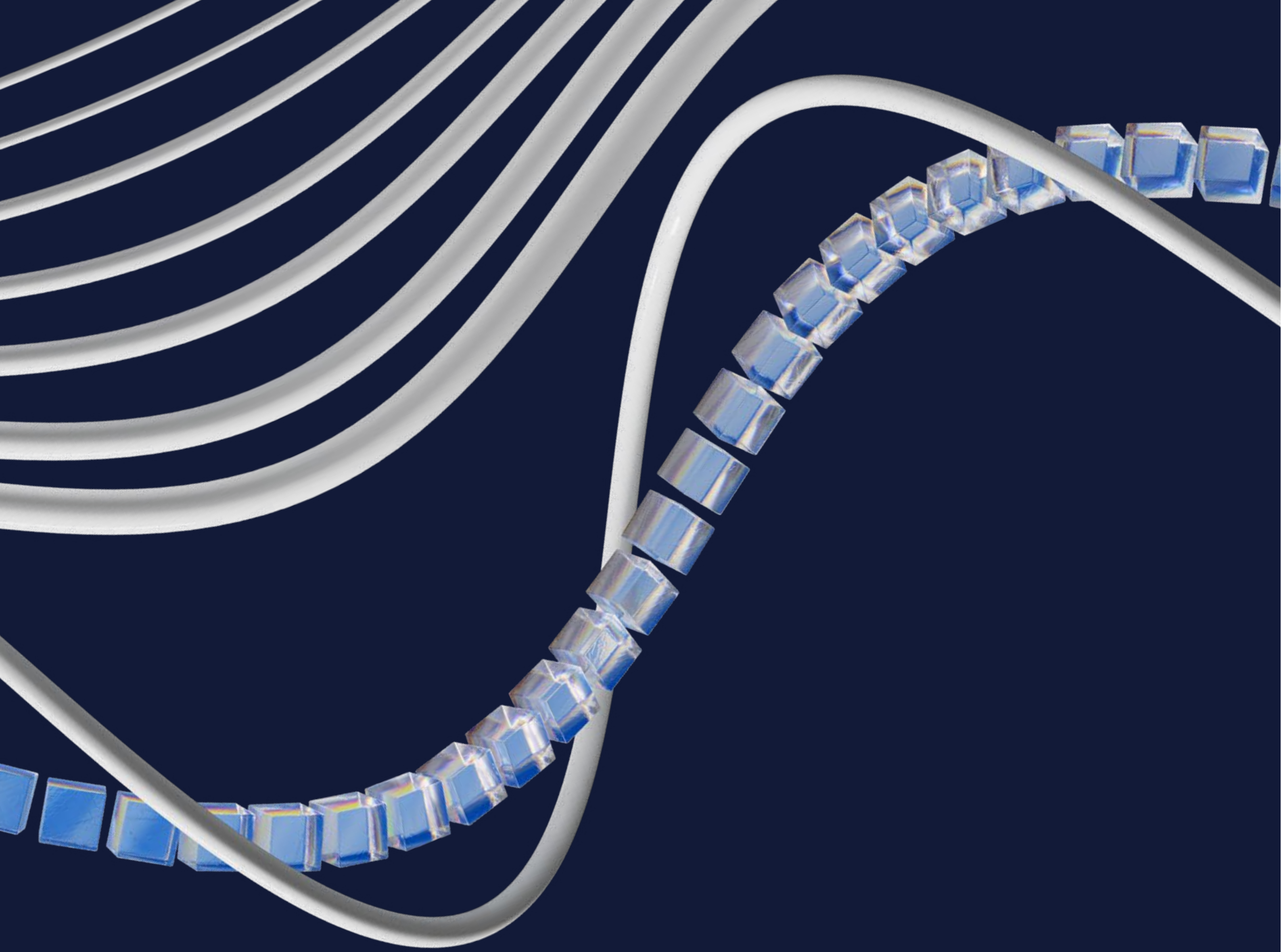
Use it to shape roadmaps, inspire workshops, build strategies, or simply rethink what's possible.

And keep an eye out: our **industry playbooks, TechnoVision cards** and other assets offer even more ways to bring the framework to life across portfolios, programs, and projects.

So, whether you're orchestrating a technology-powered transformation, designing the next smart product, or wondering how AI and fungi might someday work together: this is your go-to toolkit.







01 You Experience

Carolina Sanchez Hernandez

When AI agents look, sound, and act like us, interaction feels as natural as human-to-human.

Face to Interface

What

Face to Interface is the natural evolution of human interactions with machines, moving from analog dials to multiple screens and displays, and to the latest, AI-augmented interfaces. Today, the key concept is multimodal convergence, combining natural language processing, speech recognition, computer vision, gesture recognition, eye-tracking into interactions that work with underlying complex systems. The closer these interactions are to human-like experiences, the more likely users will adopt and use them to make sense of complex data, operations or technology.

In Aerospace & Defense, the rapid adoption of new interfaces comes from the need to deal with heavy workload, time pressure and vast amounts of information that users receive simultaneously. We are now seeing voices, videos, holograms, avatars and embodied robots function as interfaces in multiple business operations and customer solutions. There are chatbots to interrogate digital twins for aircraft maintenance, avatars to help customer services and humans to navigate an airport etc.

AI is everywhere and represents significant technological progress. Fostering adoption of these new technologies is key as it helps people interact more naturally, bringing balance for businesses and individuals. Enabled by multi-modal interfaces, chatbots and agents can work with us, assisting us via new interactions. No longer are we bound by the keyboard and mouse, clicking for results. It's a whole new world.

Impact

In the short term, the focus is on making technology accessible and bringing value to users' everyday jobs by democratizing the use of data, information and systems. In the long term, interfaces and technology will continue to evolve, leading to more advanced and dynamic interactions with voice, gestures, sounds, haptic and avatars; this will lower the barrier to tech adoption, transforming operations and services. However, it's crucial to put humans at the center of this digital landscape, with increasingly natural interfaces. Technology should adapt to users, not the other way around. The goal is to ensure interactions are frictionless, safe and seamless.

One of the biggest challenges this trend faces is building trust. Creating trust in AI interactions is essential, especially in safety-critical environments such as Aerospace & Defense. Overcoming these challenges involves proving that the system's responses are correct, accurate, and communicating to the user information, in the right way, at the right time and allowing for meaningful human oversight. Embedded assurance and governance are key factors for building trust and adoption.

Use case

Advances in this trend are happening at a rapid pace. In A&D, this translates into AI avatars and holograms at airports to help travelers—AR in pilot helmets to command autonomous agents, voice activated systems being able to scan the environment and recall contextual information, computer vision interfaces offering timely recommendations for actions in turnaround processes. There's also AI agents reminding crew members of task updates, suggesting rescheduling, and surfacing relevant instructions; or agentic systems assisting machine speed decision making. It's all happening quickly, changing the face of the standard toolkit. However, all these actions should always include humans at the core, implemented securely, safely and ethically.

René Schlepphorst

Spatial computing, digital twins, and real-time 3D are syncing up to transform industries with immersive, sustainable, and intelligent experiences.

You're Something Spatial

What

The evolution of spatial technologies in the Aerospace & Defense domain continues to be driven by the need to fundamentally modernize data access, decision-making, and operational readiness. While early applications primarily focused on virtual training, the scope of use has expanded significantly.

Today, spatial computing, digital twins, large vision models, and real-time 3D are converging into integrated systems that not only visualize situations but also actively analyze and anticipate them. These systems enable use cases such as damage assessment, autonomous reconnaissance, and simulation-based operational planning.

Geopolitical developments have further accelerated this transformation. Modern conflicts have demonstrated that data-driven and AI-enabled capabilities are critical for achieving operational superiority. Technologies such as AR-assisted support systems and AI-based target recognition are no longer experimental but increasingly operationally relevant.

A key development is the growing convergence of spatial systems with agent-based AI. As a result, systems are evolving from reactive visualization tools into predictive, context-aware assistance systems that prepare and actively support decision-making.

Impact

Spatial computing is evolving from static VR/AR applications into dynamic, adaptive systems that capture physical environments in real time and overlay digital information contextually.

This evolution is transforming Aerospace & Defense operations across three key dimensions:

- Predictive operations: Digital twins no longer represent individual assets but entire operational scenarios. They integrate factors such as adversary behavior, environmental conditions, and logistical dependencies, enabling forward-looking decision-making.
- Autonomous reconnaissance: Advances in large vision models enable reliable detection of even unknown or camouflaged objects. In combination with unmanned systems, this significantly reduces risks to personnel and accelerates intelligence gathering.
- Networked command and control: Shared virtual environments, from digital situational awareness displays to immersive "war rooms", enable synchronized collaboration across organizations and nations. Decisions can be made faster and tested immediately.

With the integration of agentic AI, the focus shifts further: systems no longer just support decisions but anticipate courses of action and prioritize them. This marks a transition from reactive to increasingly predictive operational models.

At the same time, this evolution is not without challenges. Issues such as latency, interoperability, and cybersecurity define scalability. In addition, ethical considerations, particularly in the context of autonomous decision-making, are gaining importance. The initial phase of technological hype is giving way to a stage where tangible operational value becomes the primary focus.

In the long term, a landscape is emerging in which continuous simulation, real-time data, and adaptive systems are tightly integrated. The decisive competitive advantage lies in the ability to interpret information faster and translate it into action.

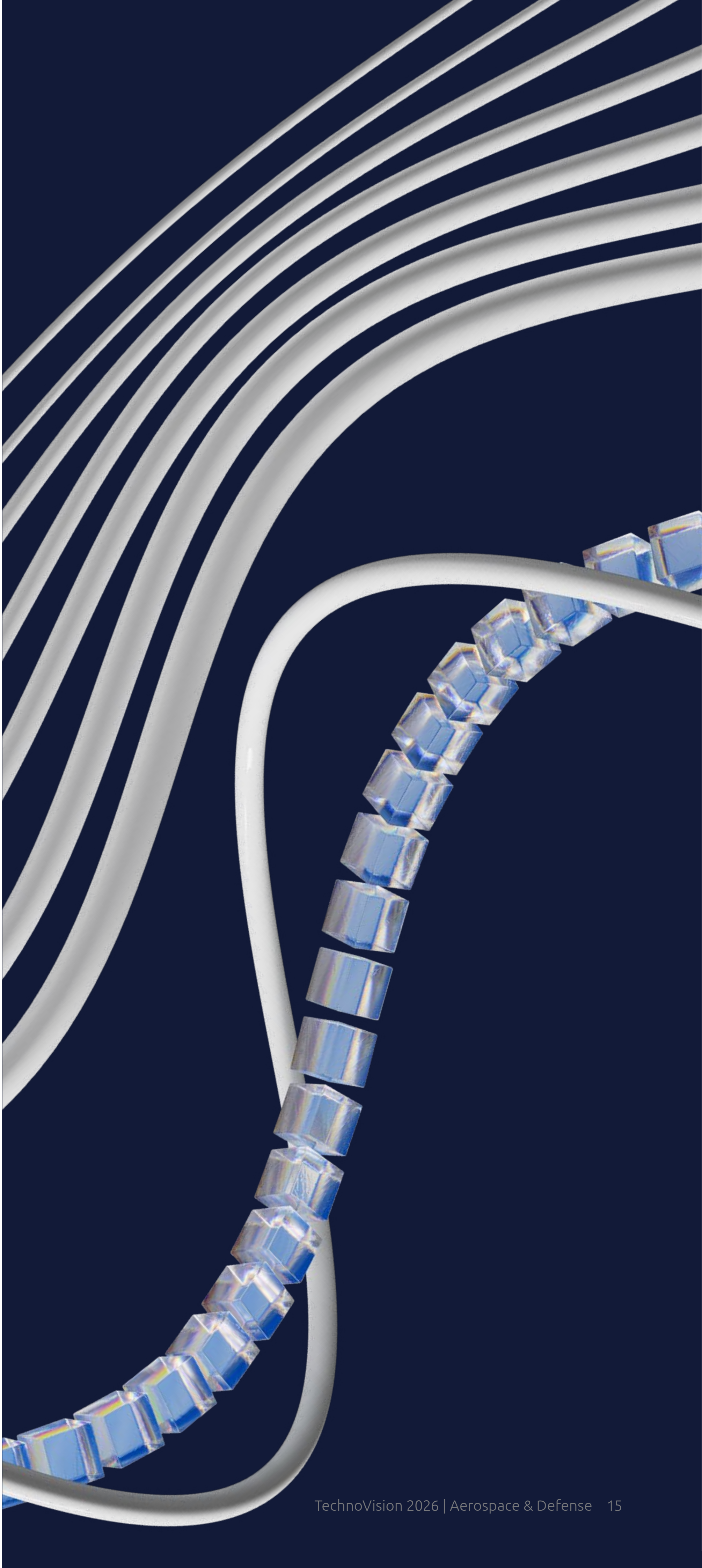
Use case

A practical example is predictive operational logistics. Supply routes and material depots are vulnerable under adversarial pressure (e.g., drone attacks).

As a solution, a digital twin of the entire supply chain (transport vehicles, storage facilities, routes) continuously simulates current conditions and potential disruptions. AI agents use real-time situational data (weather, adversary movements) to predict supply bottlenecks or risks of convoy attacks. Based on these insights, the system generates proactive recommendations, for example rerouting supply paths or scheduling predictive maintenance for heavily stressed vehicles.

This shift, from immersive visualization to predictive, AI-driven operations across interconnected systems, is made tangible through the Capgemini SDD demonstrator.

As an end-to-end system, it showcases, across six use cases, the interplay of multi-domain data fusion, edge autonomy, resilient connectivity, digital twins, simulation, and DevSecOps-based fleet operations on an open, modular platform. Development, testing, and training start reproducibly in virtual environments and are seamlessly transferred to real-world systems. This results in real-time situational awareness, increased operational effectiveness through edge autonomy, and AI-supported decision-making with a human-in-the-loop, forming the foundation for the transition from reactive to predictive operational models.



Pierre-André Vandelle

Digital twins, virtual representations of real-world entities and processes, deliver better mastery of real-world challenges, with less strain on resources and energy.

Internet of Twins

What

The *Internet of Twins* is recognized as a significant game changer and a powerful facilitator of decision-making processes at all levels of an enterprise. By leveraging digital twin technology, Internet of Things capabilities and agentic AI, organizations gain a continuously updated understanding of current situations, dynamically evaluate complex scenarios, and receive real-time, actionable guidance. This is especially critical in uncertain environments where key decisions must be data-driven, adaptive and aligned with rapidly evolving constraints to maintain competitive positioning.

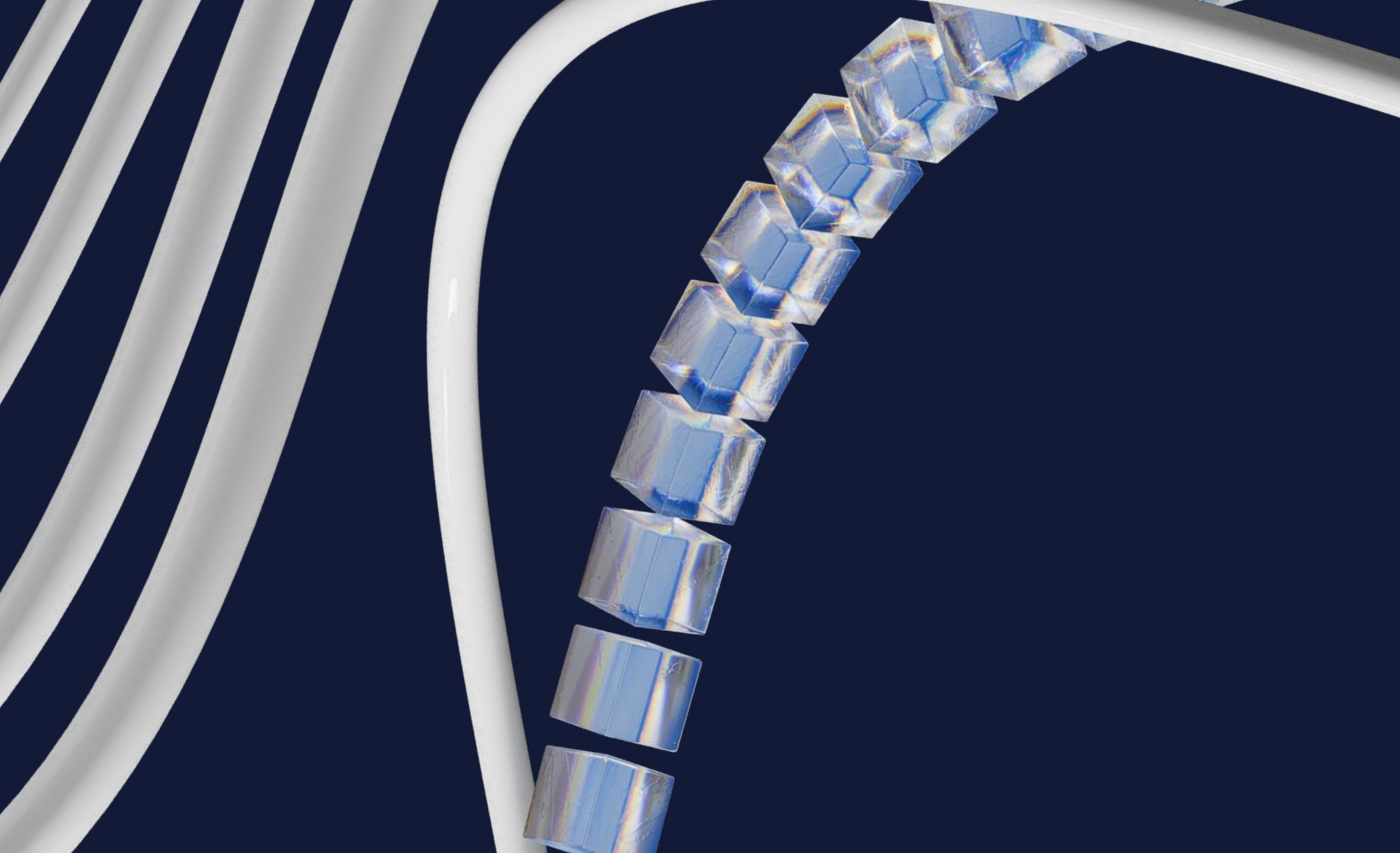
For example, digital twins help anticipate market changes and ensure early design of next-generation products meets top-level requirements more efficiently, particularly in defense where reacting to fast changing operations matters a lot. In Aerospace, digital twins enable tighter integration of engineering and manufacturing through advanced simulations enriched with real-time field data. This integration allows for more efficient production planning from the design stage, accelerating the manufacturing of complex systems such as an aircraft. Additionally, advancements such as optimization and agentic AI transform digital twins into adaptive systems capable of managing complexity, autonomously detecting deviations and delivering high-value insights for decision-makers. Engineers designing via 2D or 3D modelling can leverage agentic AI to continuously assess real-time conformity of designs, significantly reducing the delay between defect introduction and late detection across the lifecycle.

Furthermore, the integration of cloud platforms and secure data analytics enhanced by AI-driven orchestration strengthens collaboration among stakeholders. It also enables a comprehensive, continuously synchronized model-based approach to decision-making from the earliest stages of product development.

In recent years, digital twins have evolved from static simulation tools into dynamic, service-based and AI-powered environments. They are no longer only used to reproduce behaviors of complex systems through real data reinjection but act as continuously learning systems able to secure architecture and design decisions by combining models, simulations and live data. Digital twin as a Service, increasingly powered by agentic AI, is emerging as a new standard for scalable and flexible adoption across Aerospace & Defense.

Impact

The current trend emphasizes the need for continuous interplay between the operating model, skills, leadership and digital enablers, increasingly driven by AI and agentic capabilities. This approach is no longer limited to adopting tools or infrastructures; it requires enabling augmented, more collaborative processes where human expertise and intelligent agents work seamlessly across functions. It also implies equipping teams with the skills to operate in a data-and-AI-driven environment and to leverage the right digital solutions supporting complex and evolving engineering ecosystems. It is crucial to adopt a dual-level approach. Firstly, delivering tangible operational value through targeted use cases addressing key pain points. Secondly, simultaneously building a long-term transformation strategy reshaping organizational practices through the integration of people, processes, digital platforms and AI agents. This dual-level approach ensures that investments are focused on where



they deliver maximum impact. Furthermore, these technologies are instrumental in attracting and retaining talent by offering dynamic, digital and AI-augmented work environments aligned with new engineering expectations. This shift is becoming critical, as the ability to attract and develop top talent directly supports competitive advantage and operational excellence.

Digital twins must be further systematically integrated into development strategies to secure complex systems architecture, design, manufacturing and operations. Many transformation programs over the last decade have not sufficiently addressed how integration, verification and validation can be optimized, despite representing up to 60% of engineering lead time in some contexts. Enhanced with AI and agentic orchestration, digital twins become a core capability to autonomously support validation activities, anticipate integration issues and pre-secure design decisions. They should therefore be considered as a key enabler to shift left verification, reduce late-stage defects and significantly improve overall engineering performance.

Use case

Capgemini implemented a digital twin for A&D OEM with the objective of optimizing lead time and development cost. The solution relied on an AI-augmented approach:

- Co-development: The product and its industrial system, including operations and services, are modelled within a virtual environment and continuously refined through iterative simulations until optimal performance is achieved.
- AI-driven orchestration: Agentic AI enables cross-disciplinary orchestration, automating interactions between engineering domains, accelerating trade-off analysis and supporting decision-making across the lifecycle.
- Analytics, execution and services: Real-time data collection continuously synchronizes the physical asset with its digital twin, enabling improved products, manufacturing and services through predictive insights and proactive interventions.
- Market qualification: Digital twins simulate company environments, emerging technologies and evolving parameters to anticipate future constraints and define target performance levels.
- Innovation factory accelerator: Advanced modelling of technology integration enables early assessment of future product performance while evaluating the readiness of the organization and supply chain to support disruptive innovations.

Observed results are manyfold. Industrial digital twin use cases are structured, scaled, and embedded into engineering practices; prioritization is aligned with strategic product program roadmaps and value-driven decision criteria. There is direct reduction of Recurring Costs (RC) and Non-Recurring Costs (NRC) at factory level; there is also a significant contribution to development lead time reduction through earlier validation and anticipation.

Florian Bemm

Interfaces that better understand human intent, context, and behavior, enabling more effective human-machine teaming in complex operational environments.

Knowing Me, Knowing U(X)

What

Human-machine understanding is entering a new phase. As AI and agentic systems mature, interaction is moving beyond reactive interfaces towards a more grounded understanding of human intent, behavior, and operational context. In Aerospace & Defense, this is not just about improving interfaces. It is about changing how humans and intelligent systems actually work together in complex environments.

In practice, interaction in these environments is already moving beyond screens and dashboards. The question is less about how information is displayed and more on how it reaches the operator, how much of it is filtered, and how quickly it can be acted on. Human-machine teaming therefore starts to take very different forms of input and output than today. Operators increasingly engage through voice, radio, or short contextual exchanges, while systems return interpreted insights rather than unprocessed data. UX shifts from interface design to shaping interaction under operational conditions.

This reflects a shift from personalization to synchronization. Systems are no longer just tools that are used when needed. They become part of the communication and decision loop. The distinction between tool and teammate does not disappear, but it becomes less clear as systems actively contribute to how situations are understood and how responses are shaped.

In multi-domain, software-defined environments, this shift becomes critical. Operations are more distributed, more time-critical, and driven by large volumes of sensor data. AI-enabled systems move beyond aggregation towards helping operators manage complexity by prioritizing signals, interpreting context, and supporting faster responses while keeping human judgment central.

A key aspect is the increasing role of systems that operate persistently within the environment. Instead of being continuously controlled, they observe, analyze, and act over longer periods, interacting with humans only when needed. Interaction becomes more event-driven. Humans engage selectively, rather than continuously, and systems increasingly influence how reality is perceived, prioritized, and communicated.

What makes this shift more relevant now is that it is technically feasible. AI can be deployed closer to the operational edge, which is critical in environments shaped by latency, bandwidth, and resilience constraints. Combined with modular, software-defined architectures, this enables human-machine teaming to move beyond support towards a more synchronized way of operating.

Impact

The impact of this shift becomes most visible in how decisions are made and executed. Intelligent systems move beyond supporting decisions towards actively shaping them. They influence what is seen as relevant, how options are framed, and when attention is required. UX in this context is less about usability and more about how human judgment and machine contribution work together under pressure.

Interaction also changes fundamentally. Instead of monitoring constant streams of data, operators increasingly rely on concise, contextual signals. UX shifts from optimizing screen interactions to managing interruption, confidence, and control. The key question becomes whether operators understand why a system communicates, how reliable the output is, and what action is required.

This introduces a more demanding model of oversight. As systems interpret environments and act over extended periods, accountability extends beyond individual decisions to the supervision of ongoing system behavior. The challenge is not how much autonomy is possible, but how its boundaries are defined and maintained in practice.

Adoption is less constrained by regulation than by trust, controllability, and operational reliability. Systems must perform under real-world conditions such as degraded connectivity, limited bandwidth, and contested environments, while remaining transparent enough for operators to question and override them. What matters is whether humans retain meaningful control without slowing down operations.

Integration remains a significant challenge. These capabilities must fit into fragmented data environments, legacy platforms, and mission-critical workflows. Persistent systems also introduce practical constraints, including training, maintenance, and power requirements. Human-machine teaming does not remove complexity. It redistributes it.

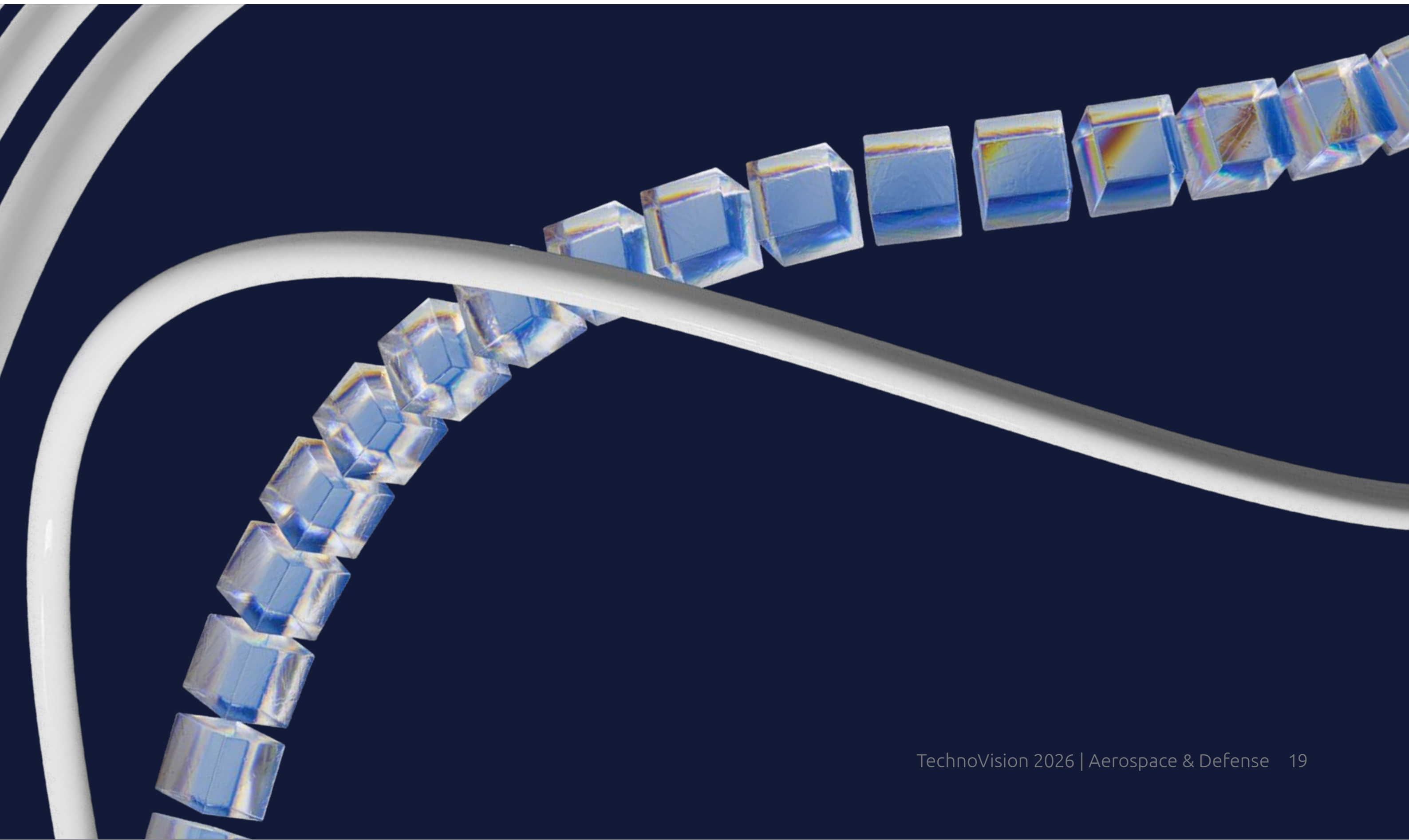
This shift also changes required skills. Operators move from using systems to supervising them. This requires capabilities in interpreting outputs, intervening when needed, and maintaining situational awareness despite filtered information. At the same time, organizations must avoid over-dependence and preserve the ability to operate under degraded conditions.

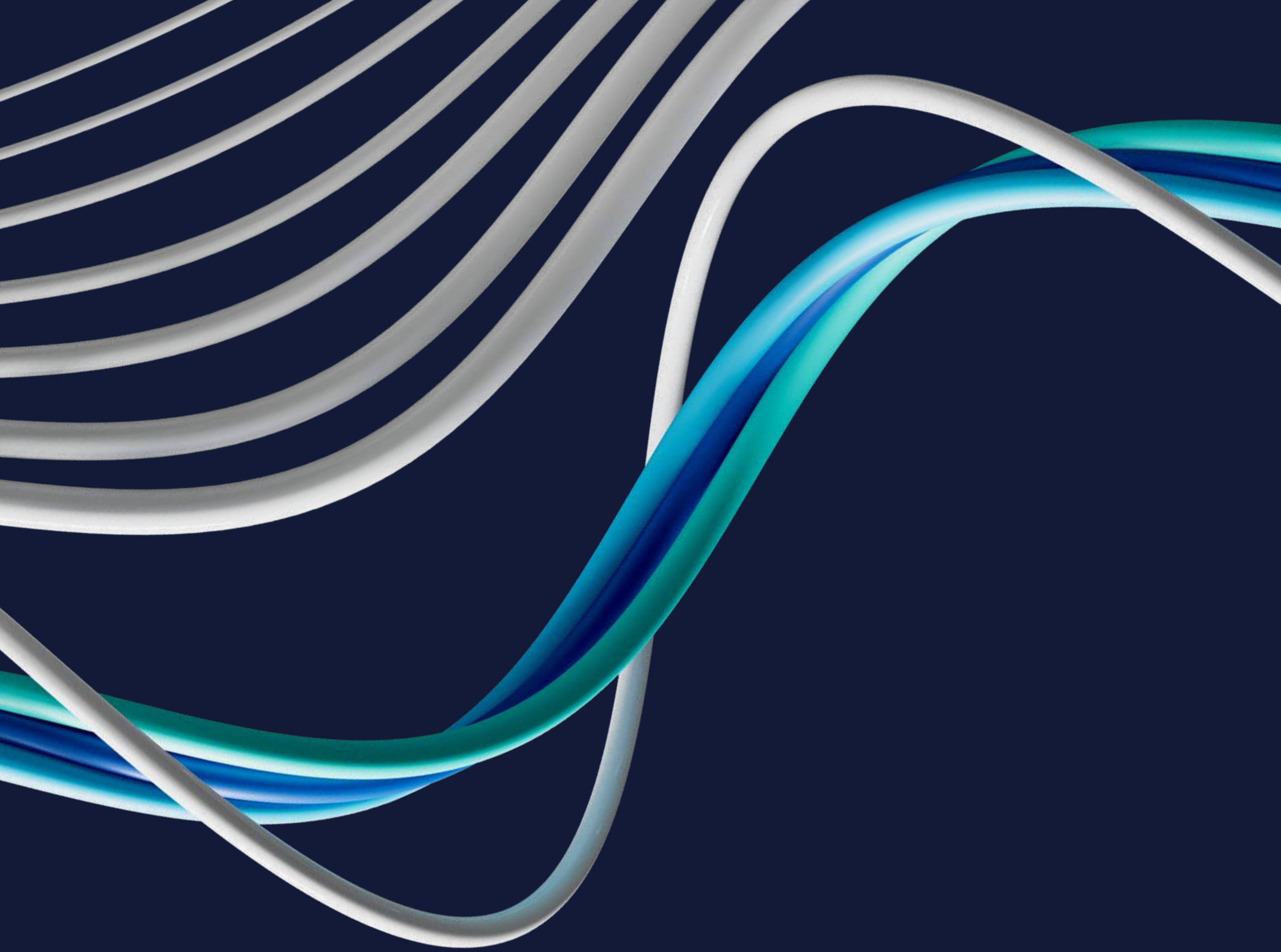
Finally, the ethical challenge becomes more operational. As systems shape how reality is presented and acted upon, risks emerge around reduced situational awareness, blurred responsibility, and unchallenged machine interpretation. Maintaining human authority therefore requires governance to be embedded in how these systems are designed and used from the outset.

Use case

Practical examples already show how human-machine teaming is evolving beyond traditional support models.

In the US Air Force's Decision Advantage Sprint (DASH), AI-supported battle management was used to help operators deal with complex and time-critical situations. Instead of simply providing more data, systems were used to prioritize information and structure decision flows. This made it possible to respond faster while keeping human authority over critical decisions intact.





02

We Collaborate

Lucy Mason

A shift towards dynamic, context-aware authentication, where individuals and systems reclaim control over identity amidst rising threats from AI-driven social engineering.

My Identity, My Business

What

Identity refers to characteristics, both real and imagined, which together distinguish between people and groups. Identities are deeply held, valued, and multilayered. Individuals hold overlapping identities: personal, professional, biometric, religious, ethnic, and national. Groups maintain their own identities ("brands") as well as distinctive cultures and values. Nation-states share an identity, rooted in tradition, history and language.

Because identity is so embedded, it is one of the most powerful drivers of human behavior, and consequently, geopolitical conflict. When people's personal or group identities are threatened, they will go to extreme lengths to defend themselves and their in-group. Harnessing identity politics is effective in mobilizing people to take action. Identity-based conflicts are the most intractable and can last generations.

National identity is one of the most significant factors in current geopolitical conflicts, from the US to China, Russia's attempt to annex Ukraine, and the rise of the BRICs. In early 2026, Greenlanders' response to the US President suggesting the US could take over Greenland was strongly driven by a perceived threat to national identity and autonomy.

Businesses are not exempt from identity politics: we are seeing technologies and corporations weaponized through a national security and defense "lens". Technology innovation is no longer driven by governments, but by industry: the technology edge in critical capabilities like AI and data now lies with large and small private companies – not the Aerospace & Defense companies long-used to operating alongside governments.

These technology-led businesses are not neutral. While multinational corporations often maintain political impartiality and respect for government decision-making, some companies seek to express their own values and impose them on governments; while some governments are explicitly seeking to leverage private companies for political, strategic, and military advantage, including demanding "sovereignty" (i.e. control). Businesses cannot pretend that hard-edged geopolitics have nothing to do with them. For a start, in a conflict situation businesses are now soft targets.

Impact

Most businesses haven't yet thought about what this will mean for them. Business leaders are unused to operating in highly politically charged environments. They will need well thought-through and communicated policies on what they are and are not prepared to do – where their "red lines" are as a business.

At the same time, organizations must recognize that their employees bring their own identities to work. A disconnect between corporate actions and workforce values can lead to talent attrition, reduced engagement, and a loss of the diversity of thought that drives innovation. Trust will depend on consistency, transparency, and authenticity. Keeping employees on board means living and breathing those expressed values at every level.

Furthermore, businesses must take a more sophisticated approach to partnerships and supply chains, going far beyond ESG policies. In an era of geopolitical tension, decisions about who to work with, what technologies to adopt, and how to manage data are strategic choices.

Businesses will need to undertake conflict planning, not only through business continuity planning and cybersecurity, but deciding where and how they will take action in support of military goals, and what actions they are prepared to take, including how they might respond to government pressure to provide capabilities, or to deny them to others. For example, Elon Musk denied Russian forces access to his Starlink satellite-based services, giving Ukraine an advantage. Denying access to AI models might prove to be a decisive factor in future conflicts.

Identity is a strategic factor shaping global power, corporate behavior, and risk. For businesses, understanding and navigating identity is not optional. It is, increasingly, central to survival and success.

Use case

Corporate diversity, equality and inclusion (DEI) policies have come under pressure from politicized debates over “wokeness”, driven by US President Donald Trump. In 2025, Boeing scaled back its workplace diversity initiatives, dismantled its DEI department, and removed references to diversity. Rolls-Royce withdrew formal support for its internal diversity networks, including its LGBTQ+ group, replacing them with a company-wide “employee voice network”. Such changes signal to employees and customers what the company values are, and how they may shift under political pressure, perhaps for pragmatic reasons, but have ramifications for people feeling welcomed and valued.

Michael Mifsud

The rise of AI agents that collaborate, adapt and coordinate in real-time, forming intelligent agentic systems operating with seamless autonomy and collective intelligence.

Autonomous Agent Alliance

What

The Aerospace & Defense sector is approaching a fundamental inflection point: the transition from digitally enabled operations to fully agent-driven enterprises. This is not an incremental evolution of existing AI capabilities, but a systemic shift in how work is executed, decisions are made and value is created.

At the core of this shift is the emergence of the Agentic Enterprise: an organizational model where intelligent AI agents interpret intent, orchestrate workflows and execute tasks across complex, fragmented systems. Instead of humans acting as the integration layer between siloed applications, agents operate as digital co-workers, coordinating end-to-end processes with increasing autonomy and contextual awareness.

This transformation is underpinned by a new enterprise stack. Traditional systems of record and enterprise applications are now augmented with an intelligence layer leveraging foundation and industry-specialized AI models, an orchestration layer that coordinates work across agents and systems, a context/semantic layer that translates data into actionable business context, an interaction layer where humans and AI agents collaborate, and a control plane that governs identity, policy, safety and cost at scale. Together, these layers redefine the architecture of the enterprise, shifting from application-centric design to outcome-centric execution.

In A&D, this shift is particularly significant. The convergence of AI with engineering, manufacturing and operations is creating an "intelligent industry" where digital and physical systems operate as a coherent, adaptive whole.

This is no longer a future vision. Rapid advances in AI capability, accessibility and cost are moving agents from experimentation to autonomous execution at scale. And this is not a technology shift alone. It represents a full business model reset, from application-centric task-based work to outcome-centric execution, from human effort to human oversight, and from static planning cycles to real-time adaptive operations.

The question is no longer if this will reshape the enterprise, but how quickly organizations can define and control their role within it.

Impact

The implications of the Agentic Enterprise for A&D are profound, reshaping not only technology architectures, but also operating models, workforce dynamics and economics.

1. Coordination to orchestration: Today's programs rely heavily on manual coordination across engineering, supply chain, manufacturing and support functions, often creating significant overhead, delays and integration complexity. In the agentic model, this coordination burden is absorbed by AI agents, enabling seamless execution across domains and dramatically reducing "integration debt".

2. Human time to AI time: Decision-making operates at a fundamentally different speed. AI agents continuously sense, interpret and act on real-time data, compressing decision cycles from weeks or months to minutes. For Aerospace & Defense organizations, this has direct implications for operational readiness, supply chain responsiveness and program delivery timelines, enabling faster and more adaptive responses to changing mission and capability requirements.

3. Applications to outcomes: Value shifts. Traditional enterprise models optimize around systems and processes; the agentic model optimizes around results. This reframes performance metrics toward outcome-based measures such as cycle time, cost per outcome and operational effectiveness, fundamentally changing how productivity is defined and managed.
4. Data fragmentation to semantic coherence: The introduction of a semantic layer (the enterprise “Rosetta Stone”) enables both humans and agents to interact with data through business meaning rather than technical structures, creating a unified and continuously updated view of the enterprise. This is particularly critical in Aerospace & Defense, where fragmented data across engineering, maintenance and operations has historically limited end-to-end visibility and driven inefficiencies.
5. Hierarchy to dynamic networks: The organizational model itself evolves. Hierarchical, static structures give way to dynamic networks of humans and agents working in continuous feedback loops. Humans increasingly shift from execution to oversight, focusing on intent-setting, validation and strategic decision-making, while agents handle the orchestration and execution of complex workflows.

For A&D organizations, these changes directly address long-standing challenges: accelerating production cycles, improving asset availability, reducing rework and enabling more agile responses to evolving threats and demand signals.

Use case

Consider a mission-critical A&D operation requiring a real-time operational readiness assessment across a fleet.

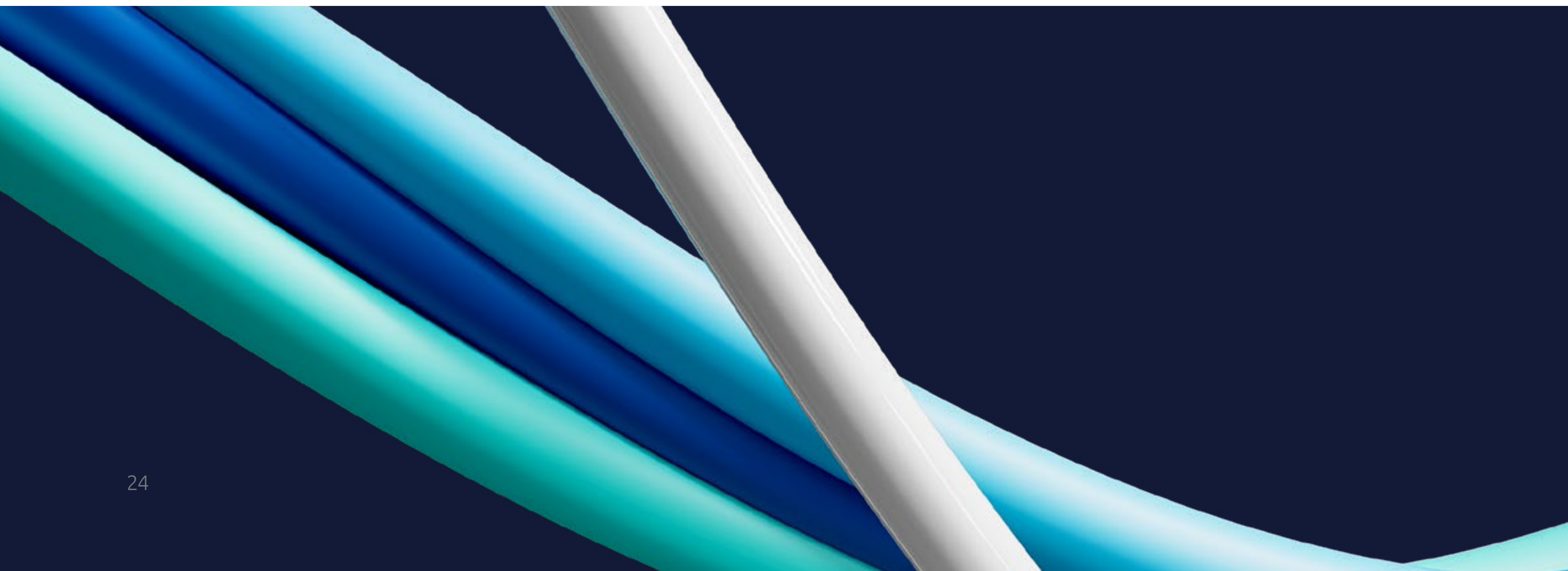
In a traditional enterprise, this would involve manual coordination across engineering systems, maintenance records, supply chain data and operational reporting. Teams would spend days or weeks reconciling fragmented information, validating assumptions and producing a consolidated view, often by the time insights are already outdated.

In the Agentic Enterprise, the same outcome is achieved through orchestration.

A leader sets the intent: assess readiness, identify risks and recommend actions. This triggers a network of AI agents operating across the enterprise. One agent retrieves and analyses maintenance data and engineering records; another reconciles supply chain availability and logistics constraints; a third integrates operational metrics and mission readiness indicators. A supervisory agent applies governance, policy and validation rules, ensuring outputs are compliant, auditable and aligned to mission objectives.

Within minutes, the organization receives a fully integrated, real-time assessment, highlighting readiness gaps, forecasting risks and proposing optimized courses of action. Instead of constructing the analysis, human operators focus on validating insights, making decisions and managing exceptions.

This pattern extends across the A&D value chain. Engineering becomes a continuous, AI-enabled lifecycle with reduced rework and faster validation cycles. Manufacturing shifts to adaptive, agent-driven production planning with real-time optimization. Through-life support evolves into predictive, outcome-based models, where maintenance and logistics are orchestrated dynamically based on live asset data.



Mike Dwyer

The new workplace has extended beyond just human-to-technology interaction; it's a dynamic synergy between physical and digital AI, humans, intelligent systems, and inter-agent communication.

Synergy²

What

The future of Aerospace & Defense lies in rapid, robust, and accurate innovation—driven by engineers, empowered by AI. Everything we see today in the A&D ecosystem has been powered by human creativity. Engineers continue to push boundaries, solving increasingly complex problems across A&D products and services. However, the vastness of the challenge demands augmentation.

In Aerospace: reducing weight, fuel efficiency, faster build times, lower costs, understanding lifecycle usage, and extracting insights from massive datasets—all require this mix of digital AI, physical AI, and humans. In Defense, the demands are the same: innovate twice as fast, be 10 times more creative and agile.

The AI revolution could enable us to do more with less at twice the speed and ten times the complexity.

This shift is reinforced by a *Generate–Validate–Orchestrate–Execute* model, where AI systems generate solutions, validation systems ensure correctness and safety, and orchestration layers integrate outcomes across workflows and stakeholders before AI robotic systems manufacture, assemble and test physical components and systems.

Today, the synergy between human ingenuity and machine intelligence is exponential. This synergy now extends across both physical and digital worlds, bringing together back-office operations, engineering, manufacturing, and a new generation of digitally skilled workers operating AI-driven robotics and cobotics (collaborative robotics).

With the rise of generative AI and hybrid methodologies grounded in trusted physics-based models, we can now explore more design variants, accelerate mission performance, and enhance both engineering and manufacturing processes, while simultaneously ensuring orchestration across systems to ensure these innovations are usable at scale.

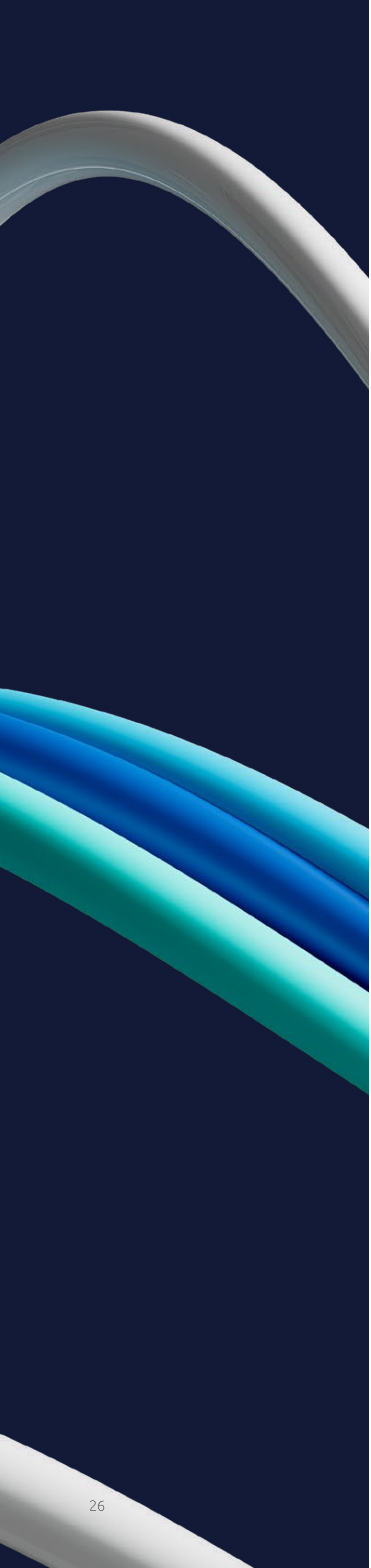
At the heart of AI adoption in A&D lies a cultural shift—learning to trust augmented technologies. In this industry, we rightly begin with a "zero trust" mindset. It's a cautious approach, and a necessary one.

Existing employees may feel threatened, fearing that automation or AI is replacing their roles. But the reality is that their jobs are evolving—not disappearing. The goal is to shift their focus from repetitive tasks to more meaningful, problem-solving work that adds real value to the organization. Their roles can become more dynamic, productive, and even more fulfilling.

Impact

In the short term, we're seeing a wave of proof-of-value pilots across A&D. Teams are experimenting with generative platforms and agentic systems in focused, limited use cases—measuring their impact on daily workflows, speed, and productivity. A key impact dimension is the ability to generate solutions faster while ensuring significantly higher levels of accuracy and robustness, as system complexity increases.

In an industry where every hour counts, the goal is clear: maximize time spent on high-value tasks like engineering, manufacturing, and creative problem-solving, while minimizing time lost to admin and information retrieval. Early successes—like using metahumans for training—are helping organizations recognize the value of these technologies. As confidence grows, the conversation is shifting from experimentation to scaling.



There is also an increased emphasis on early lifecycle investment, where more time spent in initial design and simulation stages leads to better downstream outcomes in performance, cost, and reliability.

Long term, this transformation has the potential to redefine the A&D workforce experience. By integrating leading-edge tools into meaningful missions, making the industry more attractive to new talent. The future workforce will be AI-native. They are conscious of impact—environment, security, and organizational values. So, there must be innovation-driven environments, advanced AI tools comparable to consumer experiences. Leadership must manage change responsibly. Otherwise, we become a legacy business.

Moreover, AI will play a critical role in tackling complex challenges like sustainability and net zero. Whether it's reducing CO_2 emissions, improving ethical sourcing, or minimizing waste, AI enables multi-dimensional decision-making across design, manufacturing, and supply chains. Ultimately, this journey is about empowering people, helping them understand their roles, making better decisions, and contributing meaningfully to the mission.

Finally, the question of security and trust needs to be central. And because it is the Aerospace & Defense sector, so does the question of validation. AI outputs must be explainable, auditable, and verifiable. Data must be secure across digital systems, physical systems, and human interaction layers. Security must extend across the entire ecosystem, including partners and collaborators and last but definitely not least, systems must remain secure without restricting innovation and creativity.

Use case

A compelling example of how AI is transforming research and engineering is the Augmented Co Scientist—a Capgemini solution that combines generative AI, conversational interfaces, and reasoning capabilities to support structured problem-solving. It helps users perform the right tasks and run the right models, but do it in a way that the users can see and influence the work-steps and remember the workflow for future use. It augments the users instead of replacing them.

This approach directly addresses key challenges in R&D environments. Researchers typically spend over 20% of their time finding and manipulating data, limiting their focus on high-value scientific work. At the same time, standard large language models fall short of scientific requirements—they are not knowledge models, not scientists, and not inherently rigorous. The Co Scientist bridges this gap by combining AI capabilities with structured workflows and domain-relevant models.

The solution provides easy-to-use access to data, models and tools. It's a one-stop shop to data and insight. This agent-based architecture helps in harnessing existing assets (data sources, tools, models etc.) – keeping source systems untouched.

Patrice Duboé

When intelligent assets, autonomous agents and physical systems become economic actors, entirely new value networks emerge.

Economy of Things

What

The *Economy of Things* represents the convergence of Physical AI, robotics, intelligent agents, industrial IoT, digital twins, edge computing, advanced connectivity, and decentralized trust technologies into a single economic ecosystem. In this emerging model, machines are no longer passive assets that simply generate data. They become active participants capable of sensing, reasoning, deciding, collaborating, and transacting with other systems while remaining aligned with human objectives.

Connected products, manufacturing equipment, autonomous vehicles, drones, satellites, software agents, and humanoid robots increasingly operate as components of intelligent networks. These systems continuously exchange information, negotiate resources, coordinate actions, and optimize outcomes in real time. As AI evolves from predictive capabilities toward autonomous decision-making, physical and digital assets become capable of acting on behalf of organizations, creating a new generation of machine-to-machine and agent-to-agent interactions.

The result is a shift from isolated assets and linear value chains to adaptive ecosystems where intelligence is distributed across devices, infrastructures, and digital platforms. Achieving this vision requires trusted data foundations, resilient connectivity, interoperable standards, cybersecurity-by-design, and human oversight mechanisms embedded at every level.

Impact

The *Economy of Things* transforms how organizations operate by enabling autonomous coordination across complex ecosystems of people, machines, and intelligent agents.

In Aerospace & Defense, fleets of aircraft, satellites, drones, manufacturing systems, and logistics assets can collaborate dynamically, continuously optimizing performance, availability, mission readiness, and resource utilization. Decisions that once required centralized coordination can increasingly be made at the edge, closer to where events occur and where data is generated.

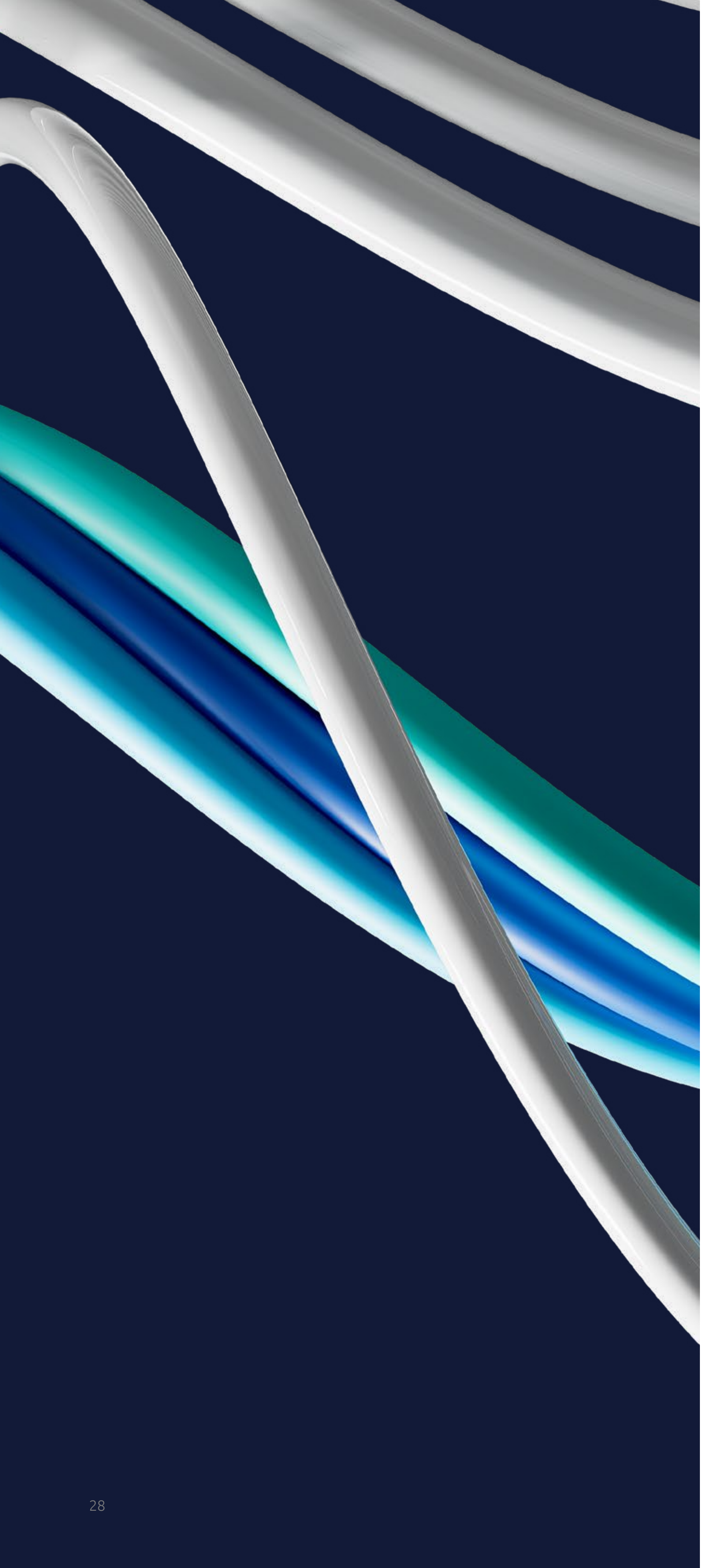
This shift allows enterprises to move beyond automation toward autonomous operations. Supply chains become adaptive, industrial assets become self-optimizing, maintenance becomes predictive and eventually prescriptive, and mission-critical systems become capable of reacting to changing situations in near real time.

At the same time, new challenges emerge. As intelligent agents gain greater autonomy, organizations must balance efficiency with accountability, performance with transparency, and innovation with resilience. Trust becomes the defining factor. Secure identities, explainable AI, robust governance, digital sovereignty, and human-in-the-loop controls will be essential to ensure that autonomous systems remain safe, trustworthy, and aligned with organizational and societal objectives.

Ultimately, the *Economy of Things* represents a transition from connected assets to connected decision-making, creating entirely new business models based on outcomes, services, and autonomous value creation.

Use case

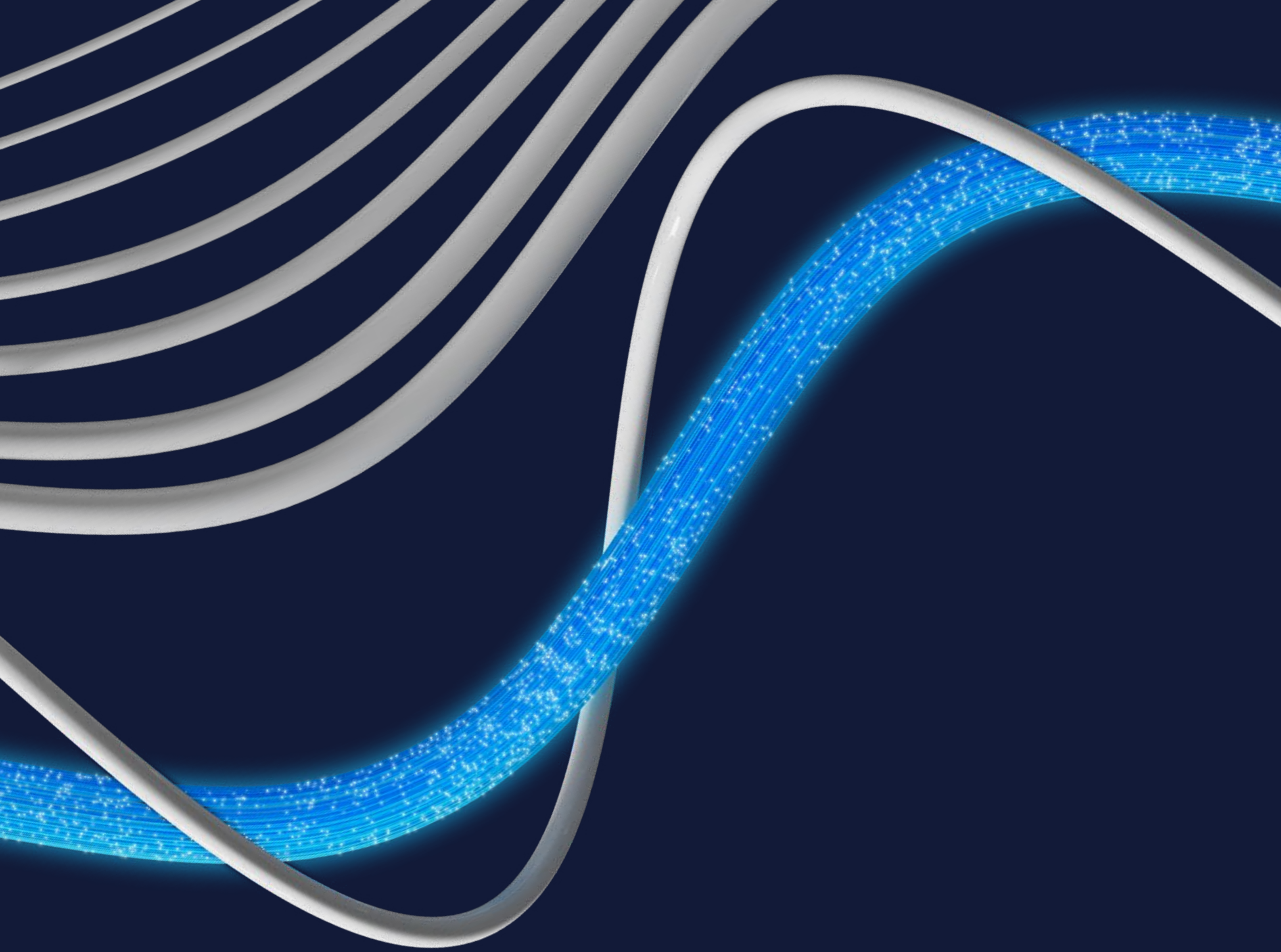
Airbus' Skywise platform demonstrates how the *Economy of Things* is evolving across the aerospace ecosystem. By connecting aircraft, maintenance systems, operational platforms, suppliers,



and airlines through a common digital environment, Skywise enables continuous data sharing and advanced analytics across the aircraft lifecycle.

Operational data collected from connected aircraft can be combined with engineering, maintenance, and supply-chain information to anticipate failures, optimize fleet performance, reduce downtime, and improve operational efficiency. As AI capabilities mature, such ecosystems are expected to move beyond analytics toward increasingly autonomous recommendations and coordinated actions across multiple stakeholders.

This illustrates the broader transition toward intelligent ecosystems where physical assets, digital platforms, and AI-powered agents work together to continuously improve operational outcomes, resilience, and sustainability.



03 Thriving on Data

Martijn van de Ridder

When shared with trust, care and commitment, data becomes a collaborative asset that accelerates innovation and AI-powered value creation, inside and outside the organization.

Data Sharing is Caring (But Take Care!)

What

The *Data Sharing is Caring* trend originates from a fundamental truth: collaboration is only possible when data is shared. When this idea is transposed to the Defense value chain, it becomes clear that data sharing is essential at every stage. In the R&D phase, experiments and validations generate valuable insights, often within closed environments. But once a product transitions from development to operational use, especially by public defense organizations, it enters a new context where technical and operational data is generated. This data becomes crucial for monitoring performance and feeding insights back into the development cycle.

In the defense context specifically, collaboration is not limited to a single domain. Missions often involve multiple disciplines—space, air, cyber, and more—each contributing to a piece of the puzzle. To form a complete picture of what is happening or what needs to happen, these pieces must be shared and integrated. That, at its core, is what this trend is about: enabling effective collaboration through meaningful and secure data exchange. It's now done by the concept of digital thread. It is a controlled stream of data flowing from design to maintenance, shared with stakeholders on a need-to-know basis across the supply chain. As supply chains become more complex, this helps ensure transparency and prevent shortages, especially in Aerospace & Defense where the ramp-up is significant.

In 2026, during this acute geopolitical crisis, warfare is shifting from platform-centric to network-centric. This requires connecting air, land, sea, cyber, and space, ensuring data is shared across all operational domains. A new framework launched this year is Combined Joint All-Domain Command and Control (CJADC2). The goal is to move data faster across domains to improve situational awareness and act faster than opponents. This requires extensive data sharing.

This year, we're also seeing the emergence of several promising technologies that could help overcome some of the persistent challenges in data sharing—particularly the issue of trust. Sharing data requires a strong foundation of trust, and that's not always present. However, new privacy-enhancing technologies are beginning to address this. These are often based on cryptographic methods that allow data to remain encrypted while still enabling certain types of analysis. Simply put, these technologies make it possible for one party to perform specific computations—like calculating an average—on another party's encrypted data, without ever accessing the raw data itself. This approach gives the data owner precise control over what can be done with their data, which is a significant shift from the current norm where full datasets are often requested without clear justification.

When it comes to both agentic and autonomous systems, data sharing plays a critical role. These systems operate in a loop—data is used to train the model; the model takes actions; those actions generate new data, and that data feeds back into the system. The more data you can feed into this loop, the stronger and more accurate feedback becomes, ultimately enhancing the system's capabilities. To make an AI agent truly useful and relevant, it needs to be trained not only on internal company data but also in information from the broader ecosystem in which the company operates. The richer and more specific the data, the better the agent can perform. In the Defense industry, where organizations are often cautious about using open internet sources due to security concerns, having access to internally shared, high-quality data becomes even more crucial.

Impact

From a Defense perspective—and increasingly visible in Aerospace as well—organizations are becoming more embedded in ecosystems where collaboration with both suppliers and buyers is essential. In such tightly connected environments, the emergence of privacy-enhancing technologies is proving to be a game changer. This approach enables secure, controlled data exchange, giving the data owner full authority over what can be accessed and how it can be used. As a result, more data can be shared across the ecosystem, which directly supports the vision of a connected defense. For instance, a fighter jet in operation generates data that, when shared securely with the manufacturer, can be used to improve predictive maintenance and asset performance. This kind of data sharing not only enhances the efficiency of the supply chain and product lifecycle but also significantly improves mission planning and command-and-control processes.

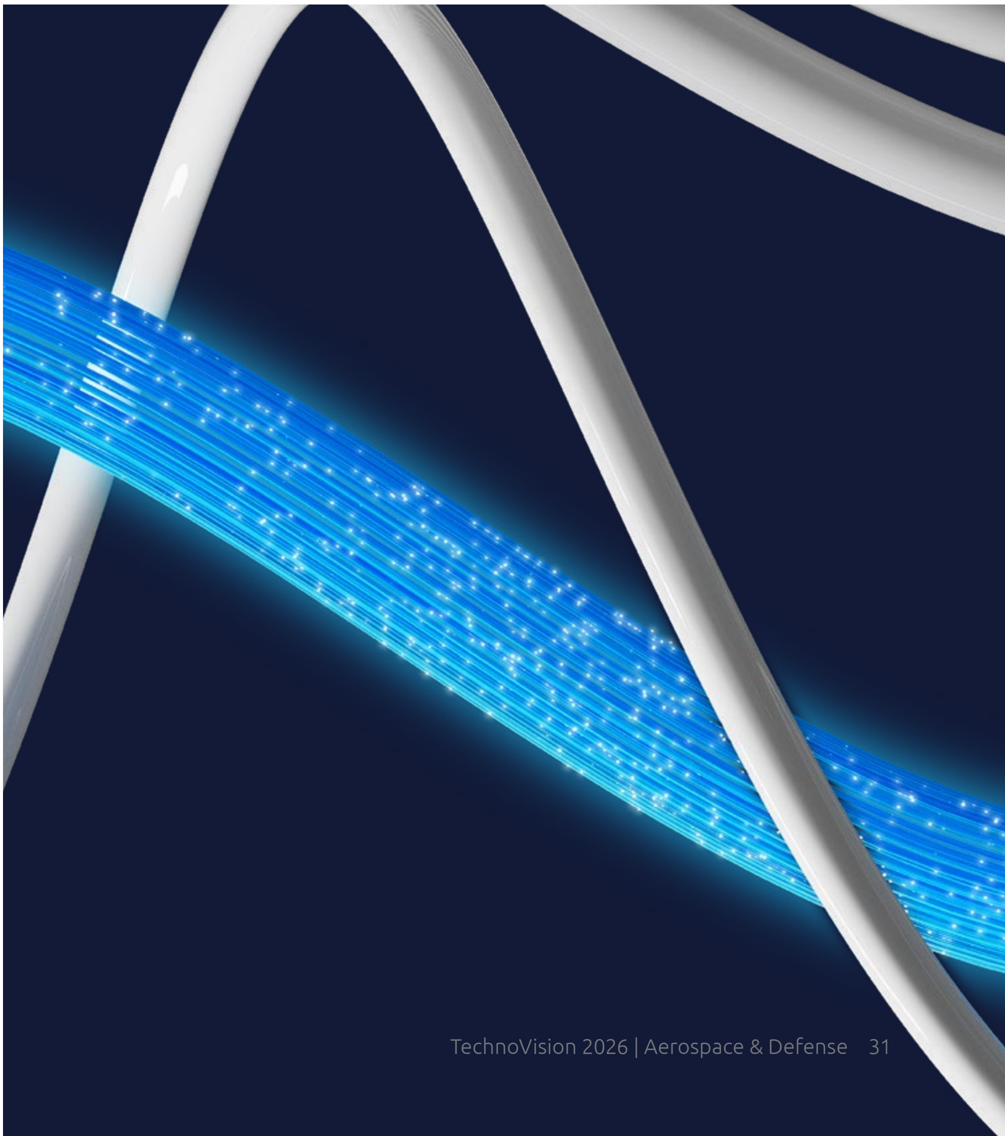
Additionally, interoperability between solutions and vendors must be maintained. The goal remains to ensure fast data movement across domains. From a warfare perspective, that's the end game. From a productivity perspective, this is enabled by the digital thread.

To achieve goals like circularity and net-zero aviation, data sharing becomes essential. You need to understand how systems and technologies are being used in the real-world, day-to-day operations. This includes knowing the impact of certain actions or interventions and being able to measure their outcomes in a data-driven way. Without access to that data, it's nearly impossible to make informed decisions or track progress effectively. In this context, no company operates in isolation; it's always part of a broader ecosystem. That means collaboration and data sharing across partners is critical to drive sustainability forward.

The overall impact of this trend is substantial—it fosters greater connectivity, enables smarter collaboration, and ultimately leads to more agile and effective defense operations.

Use case

Roseman Labs offers an innovative solution for organizations that want to collaborate on data analytics without the need to share sensitive data. Using their advanced Multi-Party Computation (MPC) platform, companies can jointly gain valuable insights from their data while meeting strict privacy and compliance requirements. This enables secure and efficient collaboration, regardless of the sensitivity of the information.



Philip Harker

A diverse mesh of different AI components, all with their own unique capabilities, provides better solution options while boosting the confidence level.

AI Meshed Up

What

AI has not yet reached its full potential in 2026. It will continue to excite and innovate beyond pure technological capability, while that capability itself continues to advance at pace. But the focal point of current spectrum is undoubtedly processing innovation through agentic AI. It's now less about the "how" it will get done, more about the "what" will get done.

As a part of the evolution of AI, technical enablers such as sensors/edge/monitoring and analytics are rapidly advancing. It is important to properly orchestrate and visualize these developments, so they stay aligned with real business needs. Time constraints often prevent "over-engineering or overworking the model" as part of the continuum of innovation in the Defense sector. However, operationally, governance and responsibility should not be seen as constraints but as enablers and share equal role of critical thinking to realize the potential of AI.

Never has it been more important to ensure trust in the underlying data. The promise of industrializing AI for more efficiency and effectiveness will likely be short-lived if undermined by inadequate data quality or modeled on inappropriate data sets for theatre of operation. Sovereignty of data is particularly important to the ecosystem, governing how data can cross geographical boundaries and how algorithms and process optimization are based on those models. The emergence on "air-gapped" provisioning from hyper-scalers can ease some of the difficult mechanics of hosting secure/sovereign data, but technology is only part of the whole picture. Data must meet the required standard of quality and classification for "air gapping" to be beneficial.

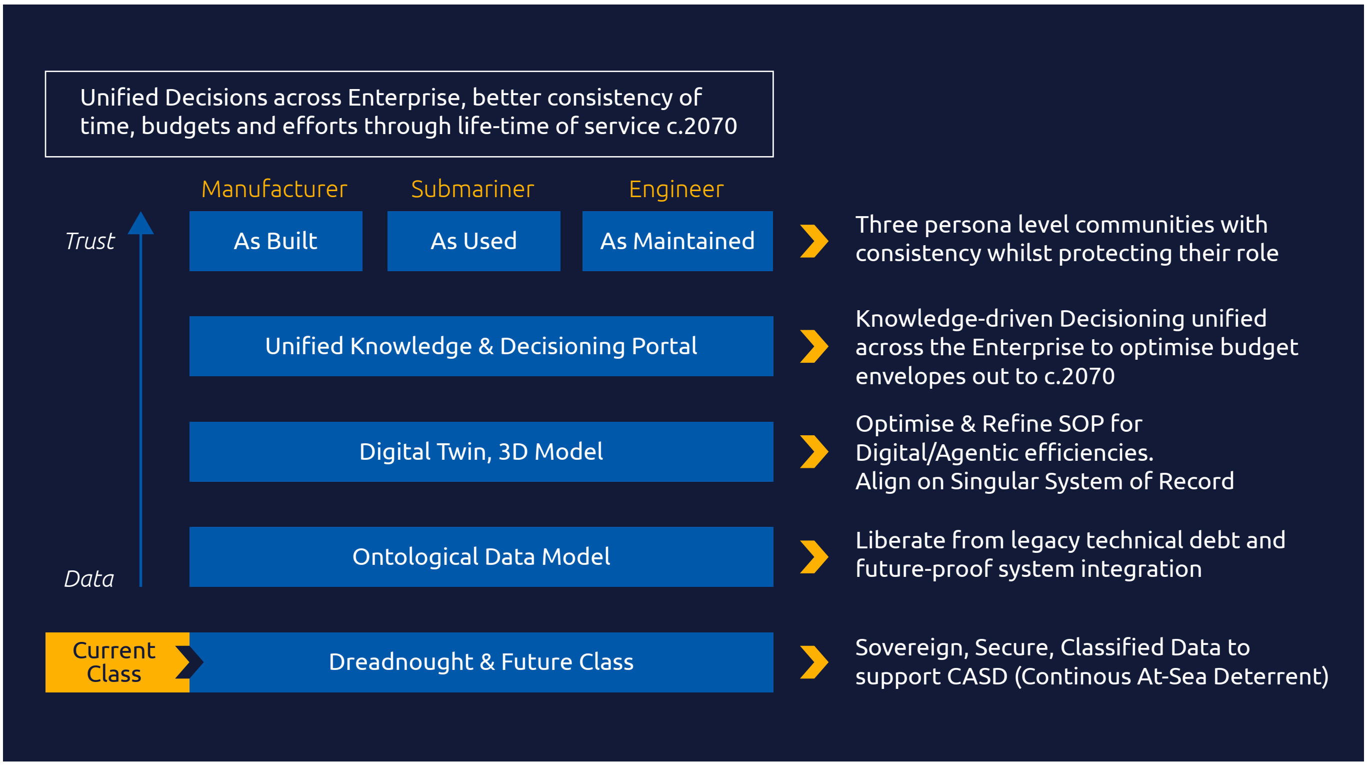
AI sovereignty must also be considered and developed step by step, with guardrails under AI governance and responsibility policies. This should align with national, governmental, and inter-governmental policies, including alliances like AUKUS and NATO.

Impact

The Aerospace & Defense industry is no stranger to complex innovation with a generational lifetime. Concorde's iconic image and sound over 40 years of flying service was a historic feat of engineering, a pioneering airplane of its time.

But its commercial demise taught us that pure innovation alone cannot outweigh expensive and escalating maintenance costs. The expected costs of the program in 1962 were £70m (~£1.5B in 2025 value), but these escalated ten-fold over the lifetime. Today, many in the industry are facing lifetime product value beyond 50 years, and as such it's a real and considerable planning consideration to address the enduring aspects of these often technically advanced products for their systems of use.

With the digital and data footprints of these leading-edge technology components, there is a mesh of data, standards, intellectual property, responsibilities, and very sophisticated integration to master. Despite these significant challenges, the industry remains a fertile ground for innovation and rapid technological advancement, especially in the use of general AI and generative AI. Indeed, it is an AI Mesh opportunity for many, that if applied correctly, could bring future innovations for generations to come.



Use case

The Digital Submarine project delivered by Capgemini for the UK Ministry of Defense (MOD) illustrates just how these enablement levers can be implemented in a mission-critical environment for enduring capability across decades.

First, an ontological data model forms the foundation, providing a catalogued and governed environment that represents the ecosystem of partners, (including builders, power systems, weapons, maintainers, and submariners).

From this data layer, a digital twin of the boat is derived, mastered by the "As-Built" community. Once the boat is deployed at sea, the "As-Used" community will use the digital twin to record and maintain operations whilst afloat. Post-mission, the boat will return ashore for regular maintenance and refit where the "As-Maintained'" persona uses the digital twin as the record of use, where service records are captured in a unified system. The top layer of the functional solution is the Large Language Model to query the knowledge library across the As-Built, As-Used, As-Maintained communities, empowering each persona with consistent information and in turn, feeding the knowledge library through their experience and a constant optimization of digital Standard-Operating-Procedures (SOP).

The enduring data and digital twin will ensure transparency and consistency is maintained through the lifetime of the aligned physical and digital boat.

Vincent De Montalivet

Data and AI are key to delivering net-zero ambitions. But in themselves, they need to be sustainable too. The battle against data waste is on.

Net Ø Data

What

For an Aerospace & Defense sustainability leader, the defining fact is that almost all material carbon sits outside direct control—in the use phase of products sold and across the supply chain, not in owned facilities. That asymmetry should govern the entire data and AI agenda: invest where the emissions actually are, not where they are easiest to measure.

The picture is compounded by a scarce and expensive sustainable-fuel market, immature propulsion technology, fragmenting regulation, and a defense-specific readiness tension. A credible net-zero strategy therefore becomes, in practice, a data and AI strategy—one that converts Scope 3 visibility and design-stage simulation into commercial advantage.

Four challenges are genuinely material.

Firstly, Scope 3 and use-phase dominance: an aircraft or engine sold today burns fuel into the 2050s, so the footprint is locked in at delivery. L3Harris cut Scope 1 and 2 emissions 49% between 2021 and 2023, still set no long-term net-zero target—proof that direct emissions are a rounding error against the total.

Secondly, the SAF supply-and-cost gap: SAF was only 0.53% of global jet fuel in 2024, cost 3 to 10 times conventional fuel, and only 24% of announced capacity was realized on time by 2024.

Thirdly, regulatory fragmentation and flux: Omnibus I entered into force on 18 March 2026, narrowing CSRD scope, while ReFuelEU, EU ETS, CORSIA and CBAM impose overlapping, divergent rules—and Europe is forcing the pace while US domestic demand has softened.

Fourthly, the defense readiness tension: there is still no commonly agreed method to measure military emissions, and the defensible framing is operational—energy security and lighter logistics as capability, not compliance.

These challenges translate directly into a five-layer data and AI strategy. The foundation is an emissions data fabric integrating ERP, PLM and procurement, since roughly 70% of manufacturing emissions hide in supply chains with little primary data. On top sits *AI/ML* for Scope 3 estimation and hotspot detection—analyzing supplier data, usage patterns and satellite imagery to produce granular product footprints. The highest-leverage layer is digital twins: factory twins for energy and a product/engineering twin to simulate the lifecycle carbon of design choices before they are committed. The fourth layer is *compliance automation*—one data layer re-mapping to ReFuelEU, ETS, CORSIA and ESRS while enforcing anti-double-counting rules. The fifth is *scenario modeling* to weigh SAF offtake against fleet renewal and efficiency on cost and green-premium curves.

Impact

The strategic payoff is a reallocation of effort toward where it actually matters. The counterintuitive headline for the boardroom: spend the data and AI budget on what you don't control. Finer Scope 1/2 metering feels like progress but is immaterial; the return is in use-phase modeling and supply-chain estimation. The deeper implication is that carbon is locked in at design, making the digital thread the decisive control point—embedding carbon as a first-class design parameter alongside cost, weight and performance is structurally higher-leverage than anything downstream.

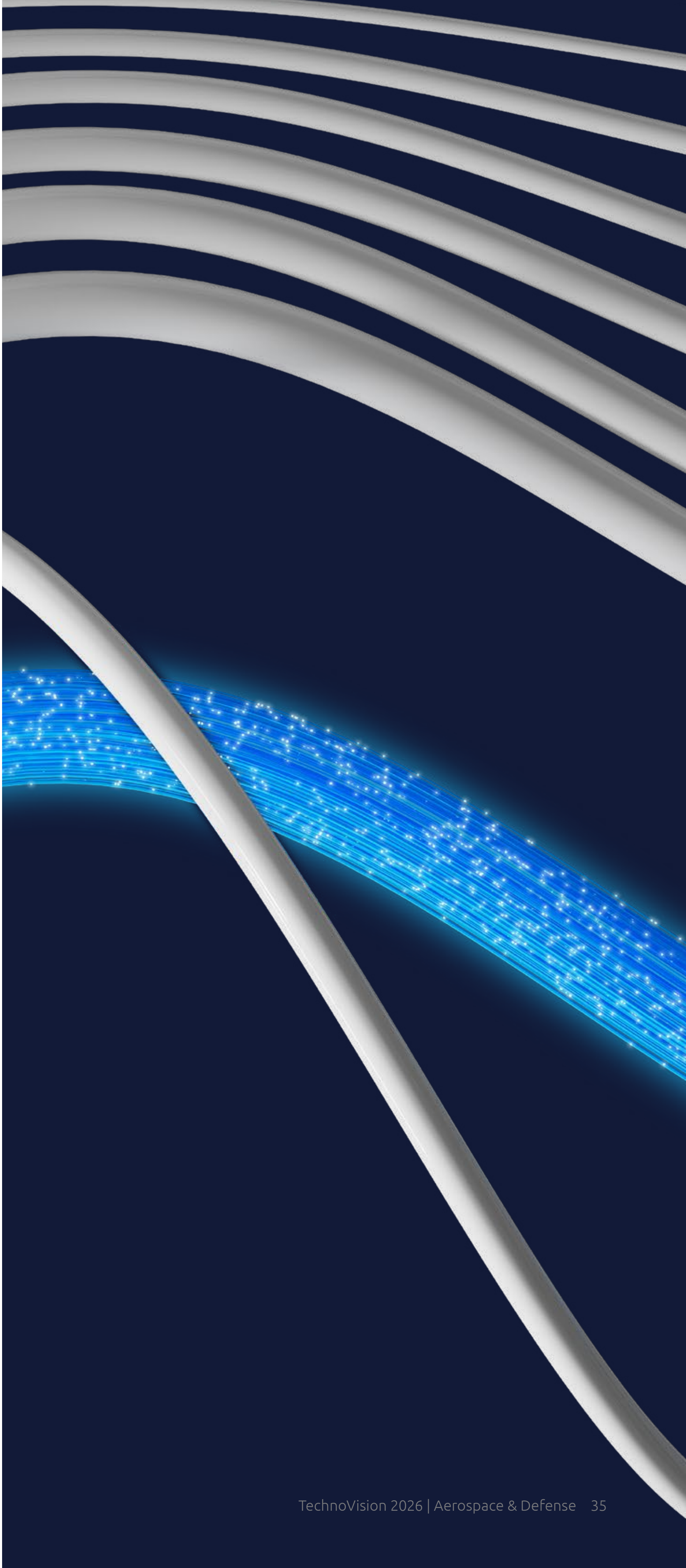
The financial case is increasingly hard. A late-2025 survey of 660 executives found an average 22% ROI from digital twins, with energy cuts around 20% and virtual commissioning reducing CapEx 10–15%.

On the fuel side, exposure is immediate and real: airlines paid a $2.9 billion premium for the limited SAF available in Europe in 2025. EY's framing captures the logic—the path to net zero will be paved by companies that align climate action with commercial value.

Use case

The clearest live Capgemini proof point is Airbus's Wing of Tomorrow program. Airbus faces the challenge of creating next-generation wings that reduce drag, fuel burn and emissions while raising production rate—attacking the use-phase emissions that dominate the footprint at source.

The Digital Assembly for Wing (DAWN) project, an Airbus-led consortium including Capgemini, Dassault Systèmes, CFMS, Cranfield University and the University of Sheffield, delivers an end-to-end digital smart-factory solution using digital twin, machine learning, IoT sensors, automated guided vehicles and robotics. A machine-learning algorithm predicts fastener quality to improve first-time assembly and reduce inspections, while connected data links the supply chain, workers and assembly assets to cut cycle time.



Christopher Gaube

An abundance of data going around at the edge within the Internet of Things turns objects into hyper-intelligent, connected assets near us.

The Thing with Data

What

In environments where multiple Internet of Things (IoT) sensors, platforms, and systems interact across vendors, domains, and security levels. The challenge is no longer just connectivity. It is orchestrating data in a way that delivers the right information to the right consumer at the right time. Information at the speed of relevance.

Standards such as the NATO Generic Vehicle Architecture (NGVA) remain critical, as they define the interfaces and protocols required to make heterogeneous systems interoperable. However, the role of data has evolved. It is no longer sufficient to collect and distribute data—it must be structured, contextualized, and made actionable across systems and users. This shift reflects a broader transition towards "code" over "steel". The value of platforms is increasingly defined by software, data, and AI rather than by physical characteristics alone. Vehicles, sensors, drones, and command systems become part of a continuously evolving, software-defined capability landscape.

Data management therefore becomes orchestration. Systems must request, prioritize, and consume information dynamically without overload. Similar to digital ecosystems, Defense requires mechanisms that allow systems to discover and exchange data efficiently.

A key principle is that data must be processed as close as possible to where it is generated. Edge computing enables systems to filter, analyze, and enrich data locally. Only relevant, mission-critical information is propagated to higher levels such as Fog, GovCloud or sovereign cloud environments. This not only reduces latency and bandwidth requirements but also strengthens control over sensitive data and supports operational sovereignty.

At the same time, AI becomes the central enabler for turning data into action. From sensor fusion to anomaly detection and decision support, AI systems rely on high-quality, well-structured, and accessible data. This requires treating data and models as managed, governed, and reusable assets rather than passive by-products.

To unlock this potential, services must be designed to scale across environments—from centralized development environments to resource-constrained edge systems. This requires modular architecture, clearly defined data models, and interoperable interfaces. Synthetic and unclassified data continue to play an important role, especially for training and validating AI models in environments where classified data cannot be used.

Overall, *The Thing with Data* is about transforming Defense systems into data-driven, software-defined ecosystems where intelligence is created, processed, and applied across all levels of operation.

Impact

The impact of The *Thing with Data* is most visible in connected, multi-domain operations. Effective data management ensures that relevant information is available at decision speed without overwhelming systems or operators.

Interoperability becomes critical. Standardized interfaces allow systems to exchange data efficiently and expose capabilities as modular services that can be reused across missions.

This modular approach increases flexibility and accelerates deployment. Instead of monolithic systems, Defense organizations can assemble capabilities dynamically from data sources, services, and AI models, enabling faster adaptation and shorter development cycles.

At the same time, data quality and synchronization are essential. Accurate time stamping, data fusion, and consistency determine the reliability of the operational picture, especially in real-time decision scenarios.

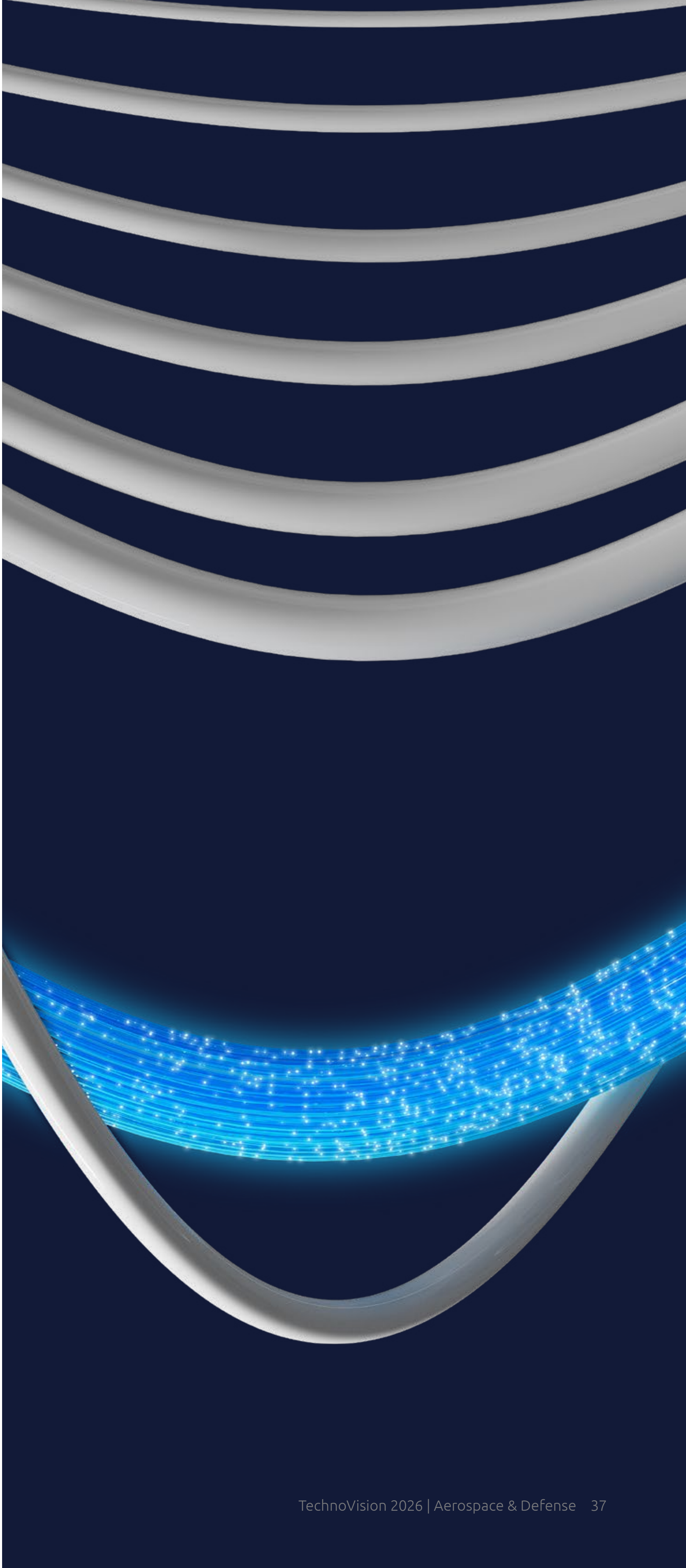
Edge processing strengthens resilience by enabling systems to act locally when connectivity is limited or contested. This ensures operational continuity in degraded environments.

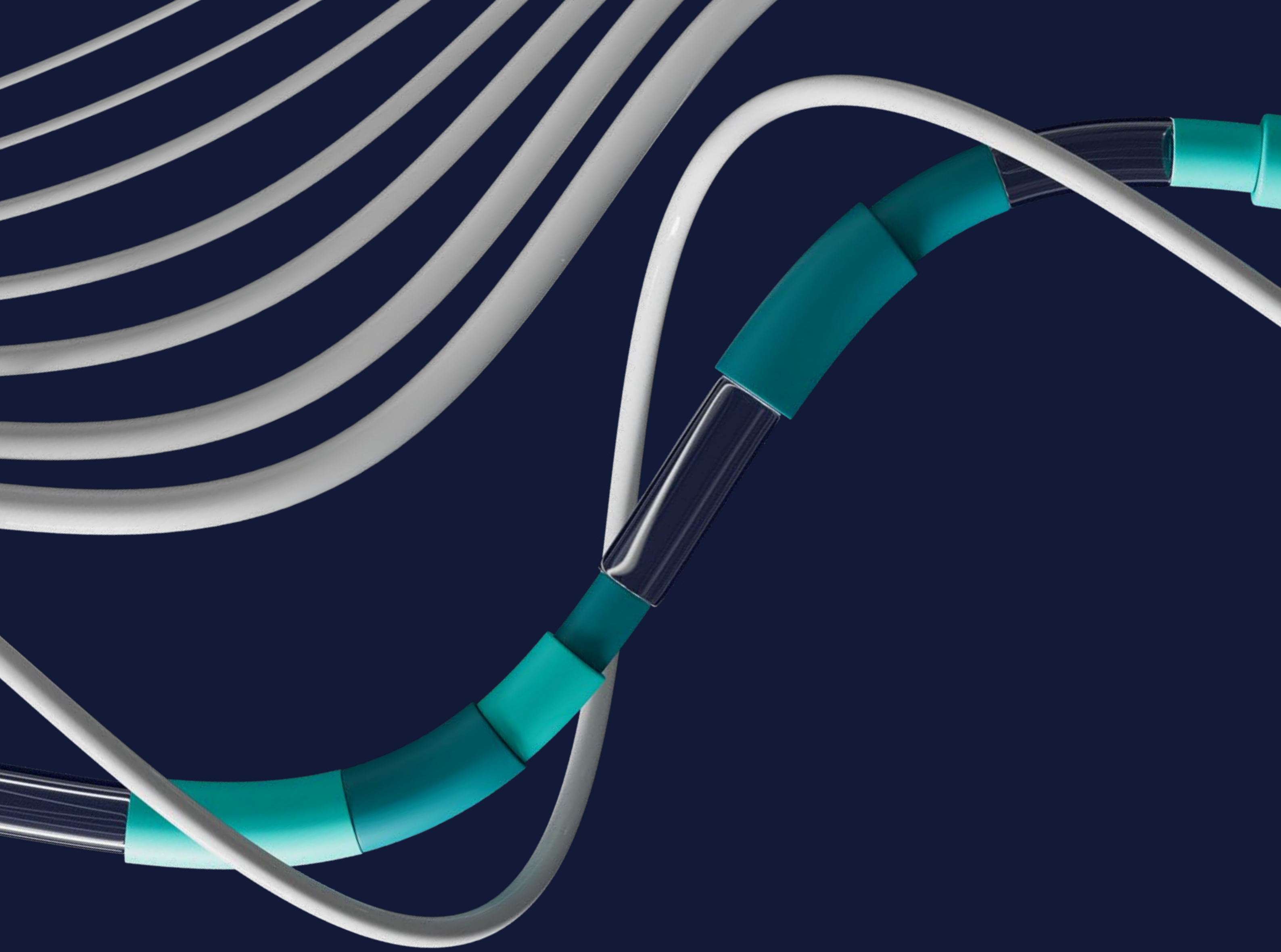
Another key impact is the emergence of AI-enabled feedback loops, where data from operations continuously improves development, production, and maintenance. Platforms evolve into adaptive capabilities.

Finally, data sovereignty becomes a defining factor. Organizations must balance interoperability with control to protect sensitive data while enabling collaboration. In this context, software acts as the backbone that orchestrates data flows, integrates AI, and connects edge environments with sovereign cloud infrastructures.

Use case

Lockheed Martin developed the CJADC2 Interoperability Factory, an open-architecture software stack designed to connect different military systems and enable fast, secure data exchange across domains. The solution translates between different system languages, enabling platforms such as aircraft, missile systems, and satellites to share data seamlessly and improve situational awareness. By integrating AI-enabled services and deploying them also at the tactical edge, the system accelerates decision-making and reduces kill chain timelines to machine speed.





04 Process on the Fly

Caroline Ball

A mesh of digital twins, robotics, and agentic AI fuses physical and digital intelligence into neural-inspired process flows. It adapts, evolves, and performs like a living system, driving innovation and resilience.

Whole Lotta Fusion

What

When the physical world fuses with digital intelligence, it's a highway to overdrive. Digital twins, high-fidelity replicas of physical systems and processes, let organizations simulate, monitor, and optimize without breaking a sweat. What better physical world to digitalize, than our own blue marble, planet Earth?

With the advancement of AI, the focus now shifts to first, integrating AI into these systems and second, harnessing the potential of digital twins to directly support AI driven services. Digital twins of the Earth are advanced, dynamic models that replicate the planet's systems and processes in a digital environment. These models can combine data from satellites, in-situ sensors, and other data sources to provide high-performance simulations. By doing so, they provide a highly accurate representation of the Earth's past, present, and potential future states. The ability to combine multiple data sources—data fusion—ensures that these models incorporate richer, more complex, and complementary information for both digital twins and the AI-based systems that use them.

Impact

Earth Observation programs have been on-going for decades but as our climate rapidly changes, with extreme climate events becoming more frequent and intense, these programs are perhaps even more in-demand than ever. Digital twins, updated with the latest measurements and observations from multiple sources, are instrumental in anticipating and adapting to the future.
They can simulate the impact of different climate scenarios, helping organizations, policymakers and researchers develop strategies to mitigate adverse effects. Better simulations mean better informed policy decisions, stronger climate adaptation strategies, and more resilient infrastructure planning. This capability to run "what-if" scenarios and assess potential outcomes makes digital twins invaluable for high-accuracy predictions and informed decision-making. However some corners of the Earth still remain mysterious: there are currently better maps of the Moon's surface than of the bottom of Earth's Ocean… Deep Space or Deep Blue?

Use case

Capgemini's Geo Based Services (GBS) illustrate how fused geospatial data can be transformed into operational intelligence across a wide range of non space industries. Bringing together Earth Observation data, geospatial analytics, and enterprise IT systems to help organizations embed the geographical dimension directly into their decision making processes. Within GBS, Geographic Information Systems (GIS) is a technology that is used to create, manage, analyze, and map all types of data. GIS connects data to a map, integrating location data with all types of descriptive information. This provides a foundation for mapping and analysis that is used in science and almost every industry. GIS helps users understand patterns, relationships, and geographic context.

Caroline Ball

Micro-sized, modular processes fuse AI, events, and post-agile orchestration into real-time flows that deliver value on a constant pulse.

Micro Process Magic

What

Micro Process Magic—it's all about unleashing the magic of the micro, breaking down monolithic processes into smaller pieces. Fueled by microservices, APIs, cloud technology and the Web3 mesh web, each piece can hold its own while seamlessly interacting with each other. From simple modularity to orchestrated intelligence, micro processes are designed to operate independently and collaborate dynamically across the system.

Today, agentic AI is making even more magic by accelerating coordination, automation, and optimization across services. Rather than changing the foundations of Micro Process Magic, agentic AI amplifies it, by enabling services to react autonomously. When you combine microservices, APIs and agents, you end up with many moving parts that all come together toward a single outcome. If last year was about the pendulum swinging, this year the emphasis shifts toward harmony and synchronization—sync rather than swing.

Impact

In the fast-evolving New Space era, new actors need to bring new solutions and services to the market at an accelerated pace. We saw this play out in Ground Segment as a Service (GSaaS) model that can be delegated in SaaS mode—and now we're seeing it further downstream in the form of Insights as a Service, insights derived from Earth Observation data seamlessly and transparently interpreted for non-expert users. Raw satellite data is highly complex and requires specialized skills to extract value. The objective is to break this complexity down such that the resulting insights become more accessible and useful for sectors and organizations that do not possess this specific expertise.

With growing private investment in the space sector and an increasing number of players entering the field, innovation and agility have become essential for standing out and adapting to a rapidly evolving market. For example, the decoupling of processes and the integration of cloud-based solutions has opened opportunities in "Direct to Cloud" innovations, where edge capacities on-board are directly linked to cloud-based ground segments, with some processes even deported on-board. Satellites are becoming smaller even as their capabilities expand, driving more processing to the edge or into orbit, with direct links to ground services. To deliver meaningful insights to industry, these services must operate in close coordination, functioning as a unified system or sticking close to our theme, in sync.

Use case

Leanspace, a European satellite operations technology provider, has developed a software platform for satellite and ground segment operations that provides building blocks for space companies to reuse and accelerate their operations. Their software product works for satellite monitoring and control, mission planning, ground segment orchestration, and testing of space hardware. Toward the end of last year, Leanspace announced that it has raised €10 million in Series A funding, one of the investors of which is ISAI Cap Venture, Capgemini's corporate venture arm. This investment is intended to support the expansion of large-scale, high-complexity, and security-critical space programs. Alongside this growth, Leanspace's new industrial partners are expected to provide additional value with managed services, operations engineering support, and local compliance with national security requirements in both Europe and the US.

Adrien Calvayrac

Blending human intuition with AI to create hybrid workforces in which automation amplifies creativity, ethics guide intelligence, and the human touch drives meaningful outcomes.

CTRL-ALT-Human

What

If the ***Process on the fly*** container is about becoming autonomous, the *CTRL-ALT-Human* trend is about how humans evolve to control and orchestrate it.

AI and automation become increasingly pervasive in Defense, automating whole workflows and processes with agentic capabilities or equipping unmanned systems with unparalleled levels of autonomy. These technologies augment human capabilities, allowing for operations that minimize direct human involvement, thus enhancing efficiency and safety. This includes the use of AI-driven systems that support humans in various tasks, from frontline operations and military logistics to recruitment and training of new recruits. Moreover, by combining Gen AI's rapid data processing and pattern recognition with human strategic insight, military design thinking can move beyond linear planning processes, enabling more adaptive, creative, and innovative solutions to a wide range of operational and strategic challenges. This approach can unlock novel capabilities in mission planning, threat analysis, and operational decision-making.

Impact

Given the increased automation, there is a balance to be found between autonomy and human oversight by maintaining the human in or on the loop, depending on the system. Particularly in critical applications like targeting, maintaining human control and oversight remain essential. Military operations must operate within strict ethical and legal frameworks, including rules of engagement, which must be explicitly integrated into any AI-driven solution to ensure responsible and lawful use. As the pendulum swings towards more automation, we must remember the Human in Ctrl-Alt-Human to drive creative but ethically sound innovation in defense.

Use case

A concrete illustration of the *CTRL-ALT-Human* trend is embodied in MAESTRO, a multi-agent concept that Capgemini designed to orchestrate end-to-end maintenance operations in complex industrial environments.

When an incident occurs, a network of AI agents is activated to analyze the situation, correlate operational, technical and historical data, and generate multiple diagnostic hypotheses within seconds. The operator remains at the center of the process, selecting or refining the most relevant hypothesis, ensuring that human expertise and contextual understanding are fully integrated into the decision.

Once validated, AI agents dynamically orchestrate the rest of the workflow: identifying required parts, allocating resources, planning the intervention, and generating a complete execution scenario. This scenario is seamlessly distributed across multiple devices—from control room interfaces to the technician's smartphone, smartwatch, and augmented reality glasses—ensuring continuity of intelligence from planning to execution. Designed specifically for A&D's constrained environments, everything runs locally on the devices, with no need to rely on cloud services.

During the intervention, the technician interacts with the system in real time, validating steps, capturing data, and accessing contextual guidance. At the same time, AI agents monitor progress and automatically generate a comprehensive intervention report without additional manual input.

Caroline Ball

Intelligent agents in adaptive processes continuously optimize operations, blending seamlessly into their environment to deliver performance, harmony, and innovation—without human intervention.

Autonomous Enterprise

What

Autonomous Enterprise harnesses the blend of human and technological capabilities to provide optimized processes. Beyond automation with the human-in-the loop for specialized tasks, the focus now shifts towards a more integrated blend of human and AI capabilities. Human-on-the-loop instead of human-in-the-loop. Here, AI, or to be precise, agentic AI takes a more important role while humans provide oversight only where it matters most. Human verification remains essential, after all accountability continues to sit with people, but this year the trend pushes further toward AI-led capabilities. Not only does this bring increased optimization when managed properly, also it brings a more powerful blend of capabilities between humans and technology.

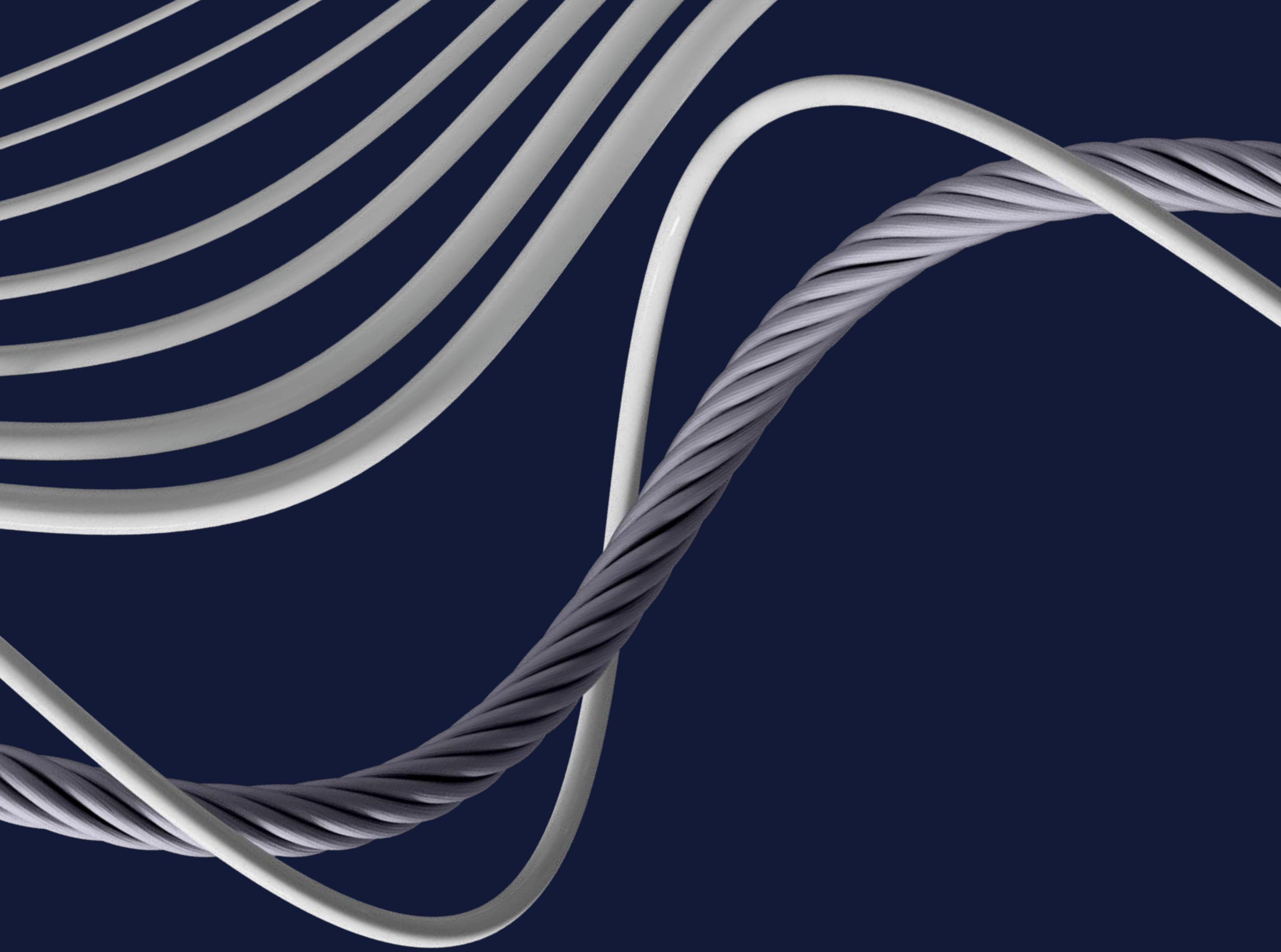
Impact

The use of smart manufacturing processes, particularly AI-enhanced automation, is pushing industries to innovate in a rapid manner. There are a rapidly increasing number of start-ups offering new and innovative manufacturing processes for satellites, launchers, and other Space structures. Whilst we are still far from a 'lights out' enterprise, as seen in other sectors, the trend is pushing private players to innovate, break into and stay in the market. But this also shines a light on the importance of pace to remain competitive and stay ahead of the curve. Launchers, in particular, represent a potential bottleneck or point of vulnerability as they are the gateway to services in orbit—a gateway that can be rocked by even the slightest delays.

All these advancements also bring forward the question of sovereignty. It's about being less dependent on other countries: not pushing autonomy so far that we become dependent on external services and lose sovereign capability. However, AI is evolving very fast, and regulation is always lagging. So, in this new human-AI balance, we also need to keep an eye on regulation—making sure we have the right governance, controls, and constraints on agentic systems.

Use case

Capgemini and Siemens's partnership has expanded to a plan to co-develop AI-native digital solutions for product engineering, manufacturing and operations. It will help organizations to bridge the gap between the business promise of technology and industrial reality, being more flexible, scalable, resilient, and sustainable. This expanded collaboration will help clients with long-standing challenges. These challenges include integrating IT and operational systems—unlocked now by harnessing frontier technologies like industrial AI, digital twins, and next-generation automation. Together, the two companies will lead with AI-native assets that complement Siemens technologies—for example, by using orchestrated AI agents to support collaboration across engineering and manufacturing silos.



05 Physical Matters

David Jackson

Breakthroughs in energy and materials are reshaping industries, transforming how we build, power, and sustain the physical world.

Material World

What

The trend, *Material World*, focuses on the fundamental aspects of engineering—centered on building at the core. However, in the current time, there are significant shifts in how materials and energy are used and deployed, alongside emerging capabilities and associated challenges.

It's about technologies—additive layer manufacturing, 3D printing, hybrid manufacturing, among others. It's also about advancements that are now possible when it comes to micro scale materials, nano materials, and advanced material science. This trend also focuses on diverse approaches to energy management—electrification, hydrogen usage, energy production and transformation.

With the turbulent geopolitical situation and the uncertainty over oil pricing, these priorities change on a day-by-day basis.

It is a two-sided coin. There are new capabilities and new technologies, alongside new challenges, particularly in the energy domain. Strategic materials and strategic elements are emerging as key areas of focus.

For Aerospace & Defense, there are continual cost pressures, a widespread significant ramp-up in defense, and a range of applications that are specific in their physics, materials, and requirements. There is much less room for error than in other industries.

Taking energy first: some sustainability trends and different energy models effective in ground transportation or static environments are not applicable in aviation. Hydrogen in aviation has different dynamics, with physical dependencies on weight, density, and energy density. Technologies around sustainable aviation fuels are always evolving and are very much subject to market pressures. The energy transition challenge—how we use, store, transfer and use energy—remains an enduring challenge. The immediate impact of the Iran situation says it all, one of the first impacts was on aviation and the shortage of aviation fuel. That is going to remain a key concern.

Electrical power technologies are an area where we can see some potential evolution. Solid-state batteries in ground transport may have applications worth exploring. There is a lot of external pressure driving these changes. In an industry where the mechanical properties of materials like titanium and aluminum are crucial, these factors are critical.

Impact

This is an inherently physical topic, not centered on digital continuity, but with direct implications for supply chain acceleration and how supply chains are structured and operated.

There are digital aspects around material science, including the use of AI to support novel materials. The materials and energy are crucial to circularity and net zero. However, the biggest challenges are context and changing priorities across markets and pressures. Industries are competing for access to scarce resources.

Aerospace & Defense continue to push boundaries in weight and strength. The application of AI to enable stronger, lighter, and more resilient materials is an area of growing interest. There is significant research underway in universities, focused on surface treatments and resilience.

Supply chain and energy supply chain are also major factors. Recent headlines suggested that their impact in the aviation industry is larger than the pandemic.

There are business challenges in using resources effectively under uncertainty. The defense sector is driving scale and ramp-up, while AI presents potential to address skills gaps.

There is also competition for physical resources and manufacturing capacity. Supply chain limits are already visible, especially in defense. Strategic minerals like heavy metals and rare earth metals are key, non-negotiable parts of systems. At the same time, there are emerging considerations around rethinking the use of technology in defense, including ethical and sustainability dimensions. These raise fundamental philosophical questions about sustainability within armed forces.

The bigger challenge, however, is agility. The Ukraine conflict highlights the importance of adapting unconventional solutions quickly. Additive manufacturing is important because it enables faster transition from digital design to physical deployment.

While security concerns remain, the bigger issue is availability of materials and components. Aviation systems depend on specific materials like lithium, rare earths, semiconductors sourced globally, which bring geopolitical implications. In this context, semiconductor supply chains and their geographic concentration are critical.

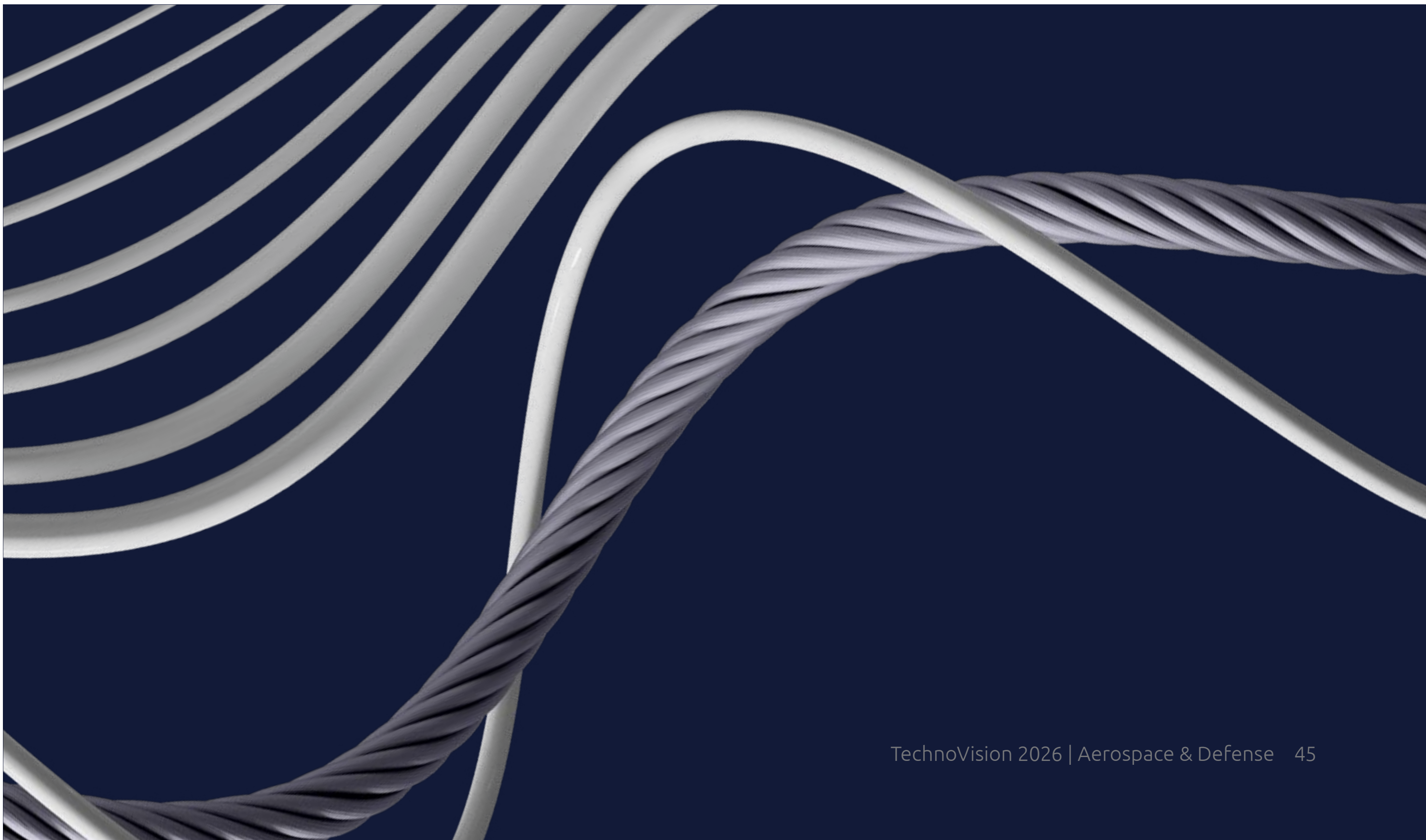
Use case

University of California Berkeley with Capgemini are developing innovative AI-Powered Methodologies transforming the design of sustainable components with intelligent, data-driven precision.

Ultrafast Femtosecond Laser Surface Treatment is delivering unmatched accuracy and efficiency — with low environmental footprint. Addressing corrosion, which is a key physical phenomenon in many industries particularly (as in A&D) where long-lived components are exposed to harsh environments.

Corrosion is a major issue in aviation, increasing maintenance costs, straining budgets, and pulling skilled resources away from strategic work. It also reduces fleet availability, as unplanned downtime cuts flight hours and weakens mission readiness across commercial and defense operations.

Reliance on outdated corrosion protection methods, often involving hazardous substances, creates environmental and health risks while stricter regulations add complexity. As corrosion impacts the entire aircraft lifecycle—from design to end-of-life—adopting innovative, sustainable solutions can reduce costs, improve performance, and support ESG goals.



Antonio Mazzoldi

Physical products evolve under pressure—gaining resilience, agility, and adaptability through incremental design, modular systems, and model-driven development.

Mission: Adaptable

What

This trend brings into focus how geopolitical volatility, supply chain fragility, and rapid technology cycles are pressuring Aerospace & Defense programs to adapt faster. These factors reinforce the need for resilience, rapid reconfiguration and agility to stay competitive.

The "Mission", delivering a set of capabilities either to armed forces or to the public, changes and evolves rapidly, as it does for the ability to develop and procure the enabling technology. Systems hence require to be "Adaptable" to ensure the capabilities are consistently delivered, even during disrupting events. Modular architecture, configurable product lines, and incremental upgrades are now a necessity to secure resilience.

Integrated, digital and interoperable systems for product development remain a key priority to enable faster cycles, while data security and technological sovereignty are gaining focus in the current context. With digital engineering enhancing product development speed and agility, the adoption of digital systems must synchronize with the ability to secure, direct and control how these systems operate. Digital speed must be balanced with physical reliability and human oversight.

Model-Based Systems Engineering (MBSE), digital twins, and collaborative platforms have been the main engine of the digital transformation in A&D product development. AI and augmented engineering mark next steps, with digital and autonomous approaches combining to enable agile processes and systems, capable of incremental development.

Impact

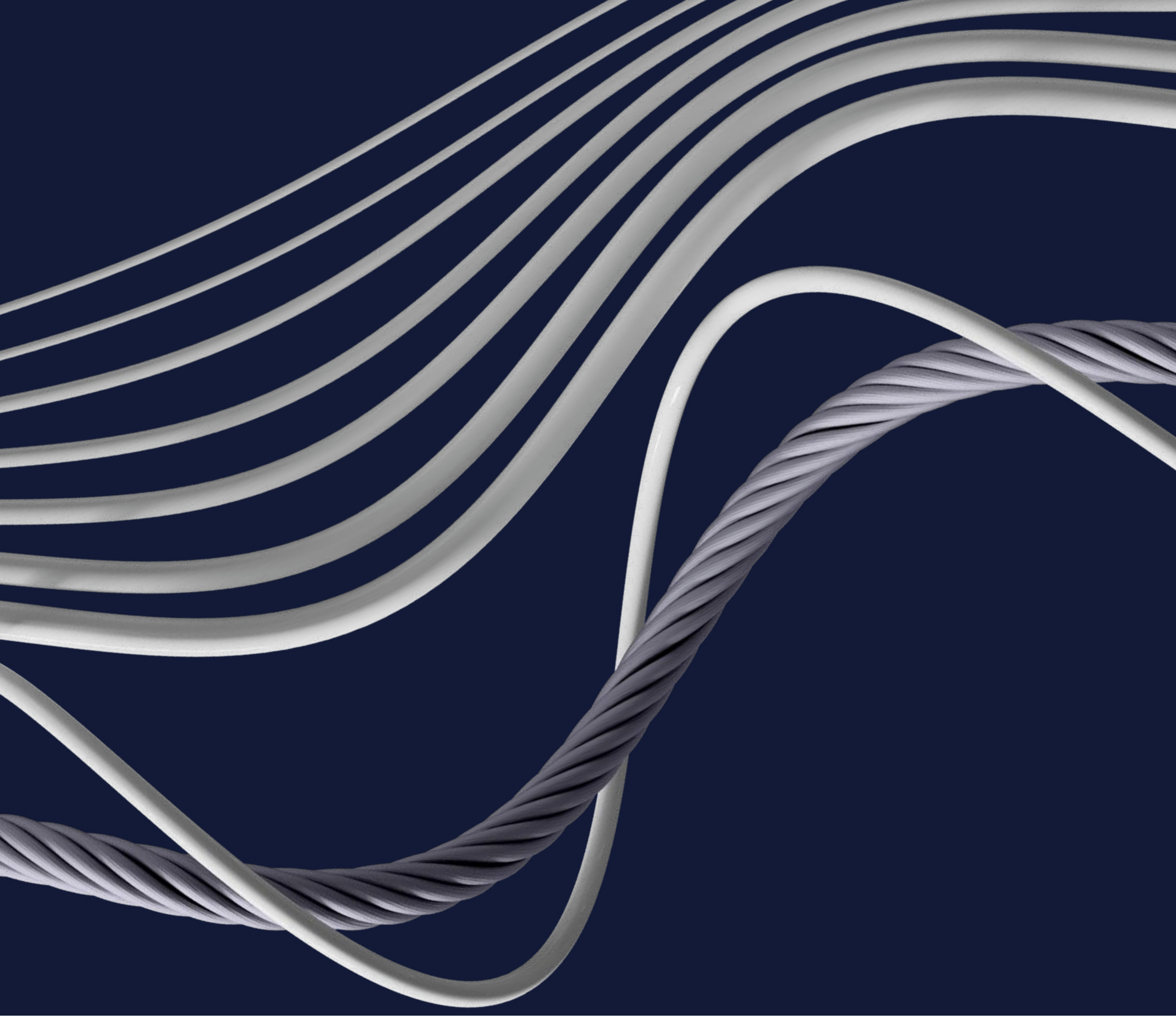
In the short term, organizations are gaining faster development capabilities with reduced risk. There's also increased re-use and enhanced traceability and transparency. Supply chain visibility is also improving, driving more resilient operations.

In the long term, and as regulations adapt to more digital-first approaches, continuous capability evolution at a lower lifecycle cost will ultimately transform A&D programs into adaptive, service-driven ecosystems, capable of operating in a fully integrated and connected environment.

Digital Continuity and digital thread remain focus areas for industry —a key enabler for model-driven development. Modular designs further support the vision for a connected A&D sector, providing interoperable and interchangeable systems, and support re-use and platform approaches contributing to sustainability goals in aviation.

Adopting a digital and augmented engineering operating model can be complex and costly, and it needs the whole ecosystem on board: business, IT and regulators. Certification processes may lag behind iterative and modular design approaches, delaying the opportunity to realize the value gains from the transformation.

As model-driven approaches expand from engineering to enterprise, organizations will be able to evaluate new business models and technologies more precisely. Agentic AI will further automate the development process, accelerating change implementation even more. Modular approaches will shift new product development to product configuration and lifelong updates tailored to extend mission capabilities.



These capabilities will deliver operational advantages and differentiation through increased adaptability and resilience. Collaboration across ecosystems will deepen, driven by interfaces standardization and creating more open and interoperable Aerospace & Defense ecosystems.

Increased autonomy and AI-driven decisions require strong governance, transparency, and human oversight, especially in industries where regulatory compliance, and evidence thereof, is key for certification and safe operation. Modular upgrades must consider lifecycle sustainability and strategic dependency in the supply chain. Data security, interoperability standards, and responsible AI use will be critical as adaptability scales.

Use case

Capgemini has observed how model-driven development facilitates a more incremental design and the shift from monolithic products to adaptable platforms:

- In collaboration with the Georgia Tech Aerospace Systems Design Laboratory, we developed the Enterprise Digital Twin to demonstrate how models can be leveraged to evaluate how different digital technologies supports agility and resilience, and what they require.
- We successfully implemented model-driven approaches in a leading aerospace OEM, leveraging standardized ontology to drive automated and secure operations.
- We supported defense OEMs in adopting Model-Based Product Line Engineering and adopting model-based engineering frameworks aligned with the Modular Open Systems Approach.

Bob Oates

Technology is advancing in both capability and the degree of physical autonomy which we grant it. This velocity impacts our responsibilities, including safety, security, and ethics.

Terminal Velocity

What

The trend, *Terminal Velocity*, reflects more than rapid technological progress, it marks a critical shift: as technology evolves, so must the frameworks that govern it.

In Aerospace & Defense, digitization was already advancing steadily. The rise of agentic and generative AI has dramatically accelerated that pace. Organizations now see opportunities for step-change improvements, greater efficiency and stronger competitiveness, but these come with new demands. Success depends not only on robust data and technology infrastructure, but also on governance that ensures responsible deployment and reliable outcomes.

AI is converging with advances in energy storage, low-cost sensors, robotics—unlocking embodied AI and highly autonomous systems. This opens new frontiers but also introduces greater risk. Errors driven by AI recommendations were once concerning, now, independently acting systems introduce the potential for catastrophic outcomes.

This shift demands a new approach to system design and oversight. Traditional A&D safety frameworks have focused on two questions:

- Can we prevent the system from doing what it shouldn't?
- Can we ensure it only does what it should?

With AI, those questions remain, but they are no longer sufficient. We must also consider unintended consequences that emerge from complex interactions within cyber-physical environments.

Legal and regulatory frameworks are beginning to catch up, with growing emphasis on accountability. Developers and deployers are increasingly responsible for the outcomes AI systems produce. A&D does have an advantage. Its deeply established safety and security culture provides a strong foundation. While not a complete answer, it places the sector ahead of industries now facing these challenges for the first time.

As governance evolves, it must be grounded in real-world applications. AI-assisted tools in software development and quality assurance already offer value by augmenting human design work, making them viable within current regulatory frameworks when paired with strong quality checks.

Similarly, AI enhances risk management activities such as safety and security analysis. These processes improve with effort, and AI expands how much can be done; raising quality, safety, and security. This also accelerates development timelines. In A&D, design work is typically slow and expensive due to governance requirements. AI helps maintain high standards while reducing manual effort, a meaningful step forward.

At the other end are autonomous applications: drones, cyber defense, and real-time analytics for root cause identification. These systems bring both opportunity and exposure. AI strengthens defense capabilities, but also empowers attackers and introduces new vulnerabilities, from LLM jailbreaking to data exfiltration and evasion attacks.

Hybrid environments, where humans and autonomous systems operate together, add another layer of complexity. Ensuring human safety in these contexts becomes a critical challenge.

A key issue is the growing gap between technological advancement and regulation. Some AI applications remain restricted, while others evolve faster than frameworks can accommodate. Defense tends to move more quickly, while aerospace faces a heavier regulatory burden requiring substantial evidence to demonstrate safe and secure operation. Beyond this, innovation is accelerating through a feedback loop: AI advances improve supporting technologies, which in turn enhance AI.

For example, AI-driven mathematical proof systems can support aerospace software assurance, where formal verification is essential, potentially reducing time and cost. Combined with accessible cloud platforms, open frameworks, and rapid prototyping tools like 3D printing, these advances are lowering barriers to entry.

The result is a democratization of innovation. Smaller companies and startups can now build prototypes without massive investment, driving competition and fresh ideas within A&D.

Impact

Technology alone won't determine success. Adoption is ultimately a socio-technical challenge. Public perception, user acceptance, and even fear, shapes what is considered acceptable. Engaging in open public dialogue is essential. Organizations must create environments where developers can experiment and take calculated risks, without compromising safety. This requires investment in controlled testing environments and collaboration with regulators.

In the short term, A&D will see new applications and efficiency gains within existing frameworks. Programs such as autonomous taxiing are already informing airworthiness standards. Over time, regulation may need to evolve, potentially using AI itself to keep pace. Assurance models are shifting from one-time certification to continuous validation through monitoring, updates, and retraining.

Significant challenges remain. Predicting unintended consequences and identifying ethical risks are inherently difficult. Maintaining public trust is equally critical.

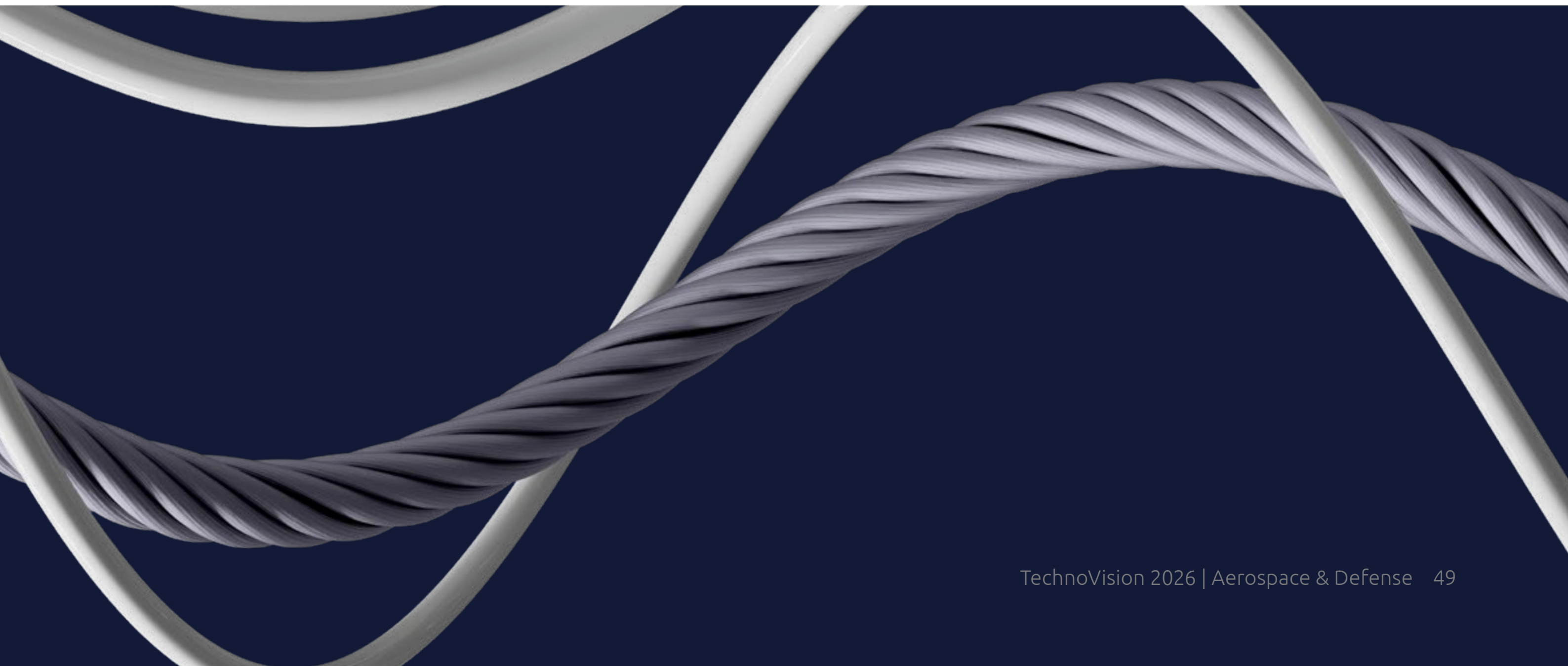
Ethical concerns range from autonomous weapons and bias to behavioral influence. Operational factors, such as culture, fatigue, morale, and cognitive load are hard to measure but essential.

In defense, growing data volumes risk overwhelming decision-making and driving dehumanization. Environmental concerns, including the energy and water demands of AI, are also increasing. Addressing these challenges requires right-sized models, efficient solutions tailored to specific tasks, especially in constrained environments.

Use case

One promising area is trust and safety assurance. Work at institutions like the University of York on structured safety cases for AI systems offers a compelling approach. These frameworks provide a structured argument for demonstrating safety, security, and ethical compliance.

Importantly, they span both technical and socio-technical dimensions across AI, robotics, and autonomous systems, helping bridge a critical gap by enabling the safe deployment of advanced AI while maintaining accountability and trust.



David Jackson

Technology enables us to conceive and deliver products unachievable by the human imagination—what we will create next is beyond our current intelligence.

To Intelligence... and Beyond!

What

This trend includes the ambitious applications of AI—autonomy, agentic systems, and distributed architectures, with enormous impact, particularly in the defense sector. There is a high degree of deployed autonomy with autonomous vehicles, capabilities, and sensor networks. Agentic systems, edge systems, multimodal systems, hybrid systems—technologies that extend the reach, capability, and integrity of AI. It also includes smart connected systems, feeding more sophisticated models than the traditional ones.

One interesting area is AI in product design—accelerating simulation. Rather than doing large simulations on demand, you simulate across an entire design space and train AI models on behavior, then interrogate the models to find solutions rapidly as a design evolves. Some startups are making this possible in transonic aerodynamics. It accelerates design in aircraft fluid dynamics and structures, advancing the boundaries of AI.

Impact

In Aerospace & Defense, everyone expects acceleration: new products, faster innovation. But there is a degree of caution. The industry has constraints—certification in aviation cannot keep up with rapid innovation, so the bottleneck shifts remains.

There is physical AI. What happens when AI becomes part of the product? This is more likely to happen in defense rather than aerospace. As AI becomes core to products, it becomes the crown jewel, making security and sovereignty non-negotiable.

Key areas of advancements include usage of agentic AI and multimodal AI—not just in text, but in signals, 3D data, and advanced data models. All of this ties into sovereign nation models and architectures. Deployment of new technologies is changing how products are developed, accelerating innovation significantly. But deployment raises many questions. We need new skills, infrastructure, data capabilities, people, and systems to drive it forward.

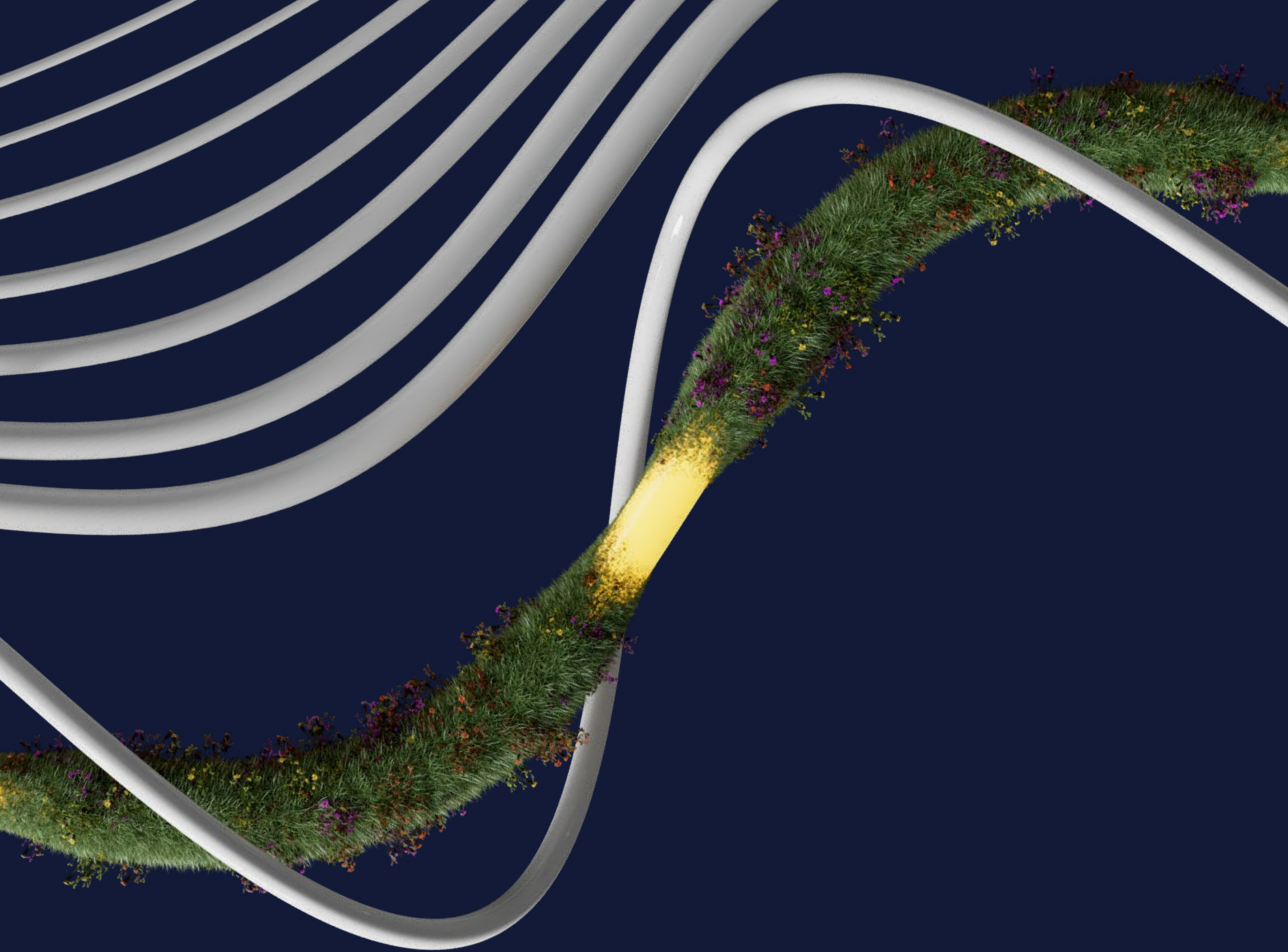
Use case

An example of this transformation is Luminary Cloud's SHIFT-Wing AI model, which accelerates transonic wing design by rethinking traditional simulation.

Instead of relying on time-intensive computational models, SHIFT-Wing enables instant, mesh-free predictions. Trained on high-fidelity data and powered by NVIDIA's PhysicsNeMo, it enables accurate, flexible design exploration while reducing computational cost and engineering bottlenecks in early-stage aircraft design, unlocking broader design possibilities and minimizing late-stage rework.

Aircraft designers are constrained by existing simulation tools and simplified physics models, limiting exploration of advanced wing designs and overlooking aero-structural-control interactions early in development. SHIFT-Wing expands the design space by enabling high-fidelity, low-risk experimentation, helping manufacturers identify superior aircraft designs earlier in the design cycle opens up the design space for aircraft manufacturers by enabling aerospace engineers to experiment with new designs with high fidelity and low risk.

The impact is significant: commercial aircraft development and redesign often face major cost overruns, while regulatory compliance and certification can take years and cost millions, stifling breakthrough innovation.



06 Nature's Code

Marcus Fiege

Advances in solid-state chemistry are redefining batteries, delivering safer, denser, and more sustainable energy storage across mobility, healthcare, and personal tech.

My Chemical Advance

What

Solid-state batteries address a structural bottleneck: lithium-ion technology no longer scales fast enough to meet next-generation energy, power and safety demands. What began as replacing flammable liquid electrolytes with solids has evolved into rethinking how energy is stored, integrated and certified.

In Aerospace & Defense, mission ambition increasingly outpaces energy capability. Electrified flight, autonomous systems and distributed architectures require leaps in energy density, intrinsic safety and system simplicity that legacy batteries cannot deliver.

Solid-state architectures meet these needs: lithium-metal anodes and high-capacity cathodes increase energy density and eliminate liquid-related failure modes, while improved thermal stability reduces the need for complex cooling and containment.

Beyond incremental gains, solid-state enables new design freedoms in A&D—energy storage can be embedded, distributed and co-optimized with propulsion and mission systems. Energy shifts from a constraint to an enabler.

By the end of 2026, solid-state will move from lab promise to early validation, with pilot deployments in drones and other platforms marking a staged but tangible transition. In line with the *Sync Swing* theme, progress will balance breakthrough potential with industrial realism through hybrid approaches.

Impact

Solid-state batteries reposition energy storage from a limiting constraint to a strategic design variable in A&D. In the short term, impact is targeted but tangible: extended UAV endurance, safer and more certifiable battery systems, and early viability of electric air mobility. Over time, the effect becomes systemic—unlocking new aircraft/drone classes, reshaping mission profiles, and reducing dependence on conventional fuels.

The trend directly reinforces key A&D priorities. It enables tighter cross-domain integration, strengthening digital continuity. It powers distributed, edge-based and autonomous platforms, advancing connected A&D. It drives new material ecosystems and production approaches, supporting supply chain transformation. And it underpins electrification pathways aligned with circular and net zero aviation ambitions.

Scaling, however, remains complex. Industrializing solid-state manufacturing, ensuring long-term interface stability, and certifying new chemistries in safety-critical environments are significant hurdles. At the same time, supply chains for novel materials must mature to support large-scale deployment.

Despite these challenges, the opportunities are substantial. Early adopters can redefine platform architectures, capture emerging markets such as electric air mobility and high—endurance systems, and leverage cross-industry innovation cycles. Combined with AI-driven engineering, development accelerates across tightly coupled system domains.

Looking ahead, solid-state batteries will mature through staged integration into hybrid and fully solid architectures. Their full impact will unfold alongside advances in digital engineering, autonomy, and system integration. Governance frameworks will need to keep pace - particularly in material sourcing, lifecycle management, and certification transparency.

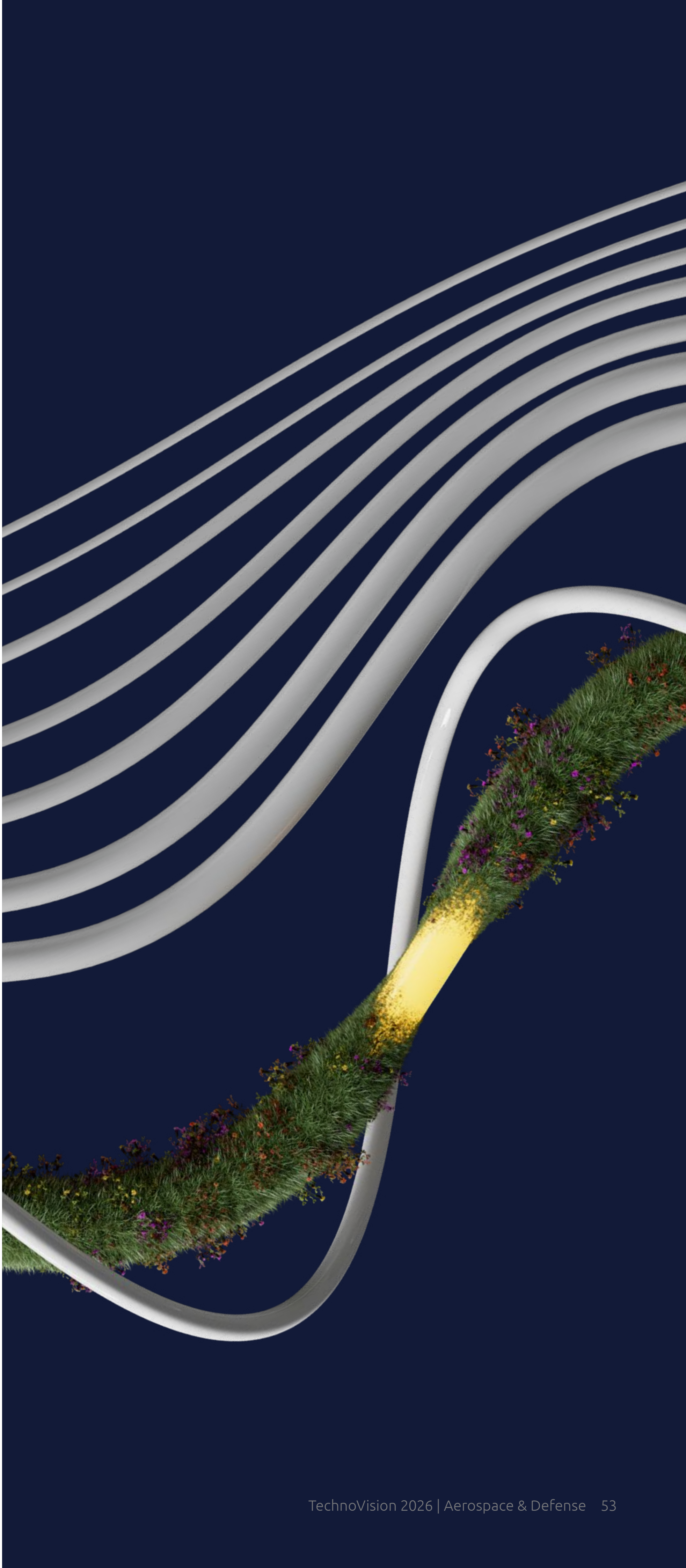
Use case

Long-range unmanned aerial systems (UAS) are becoming a critical asset in modern Aerospace & Defense operations, enabling persistent surveillance, reconnaissance, and communication support across extended distances. Their effectiveness, however, is fundamentally constrained by energy storage.

Extended missions require a careful balance between payload, endurance, and reliability. Conventional lithium-ion batteries limit flight time and introduce safety and degradation challenges, particularly under demanding operating conditions and repeated mission cycles.

Solid-state batteries directly address these constraints. Higher energy density enables longer flight endurance or increased payload capacity, while improved thermal stability enhances operational safety in mission-critical environments. At the same time, increased durability supports more predictable performance over repeated deployments.

While much of the technological momentum is driven by frontrunners outside Europe, a new ecosystem is emerging: companies such as Basquevolt and Blue Solutions represent a distinctly European approach, while players like ProLogium, Factorial, SolidPower etc are establishing localized manufacturing capabilities. Together, these developments highlight that future UAS performance will depend not only on battery innovation, but also on resilient and regionally anchored supply chains.



Marco Morone

AI is accelerating biotechnology innovation, reshaping how discoveries are made, protected, and commercialized.

Language of Life

What

In the past year, the way we work has undergone a significant shift, not only in products and systems, but across industrial field and technology. This is mainly driven by technological advances in AI and Gen AI that has an important impact on multiple industrial domains.

In particular, it was observed that there's a clear shift in how work is structured in aerospace, with increasing client interest in everything AI.

This shift creates a challenge. The challenge is to develop new skills for engineers, enabling them not only to be highly proficient in core engineering skills, but also in emerging technologies. What the market asks for is augmented engineering—the merger of traditional competence with the power of AI. It permits a reduction in the time to market for product development across several fields.

This is where *Nature's Code* becomes real. We are moving toward physical agentic systems. In the past, AI was confined to computers, without a direct connection to reality or mechanical components. Now, we are creating a link between robotics, Gen AI, and machinery.

Engineering competence, especially in mechanical and system engineering and robotics, will always remain essential, as it enables the transfer of agentic AI to the real world. We need to evolve the way we design mechanical systems to allow maximum efficiency in agentic interconnection.

Many people talk about efficiency when discussing AI, but reliability is equally important. With Gen AI, we can improve quality of deliverables and reliability.

For biotechnology and bioengineering, this trend has an important impact because we can accelerate diagnostic processes of several phenomena using Gen AI. We can reduce healthcare costs and enable more people to access new technologies.

With agentic AI, we can manage medical devices automatically and perform tests without humans in the loop. We can also improve analysis of test results. With Gen AI, we can analyze results faster and perform more tests, allowing earlier diagnosis of diseases.

Recently, Capgemini worked to develop a new medical device. Compared to the previous version, this is a smart device. This device is related to transport of organs. For this type of transport, environmental conditions must be controlled carefully, including vibration and impact.

It can take into account parameters like temperature and humidity using a real-time AI and machine learning model. It can adapt temperature and device functions to reduce errors and improve performance. With a real-time prediction model using neural networks, it is possible to maintain stable temperature inside the device and ensure safe transport of the organ.

Impact

The introduction of Gen AI is a game changer, impacting all industries and mechanical products. However, long-term forecasting of this trend remains difficult, as the technology is evolving rapidly.

We can expect significant improvements in image processing and 3D modeling with Gen AI, which will strongly impact biotechnologies and medical analysis. There will be a reduction in time to market for new products. It will boost capabilities of devices and improve medical and biotechnology systems. It will help anticipate disease analysis and make treatment easier.

The main connection lies in a stronger integration between digital and mechanical competencies, leading to digital continuity across systems. Devices will be interconnected, and data management will become critical. Data volumes will increase, but industries must structure this data properly. Without structured data, AI and machine learning are not effective.

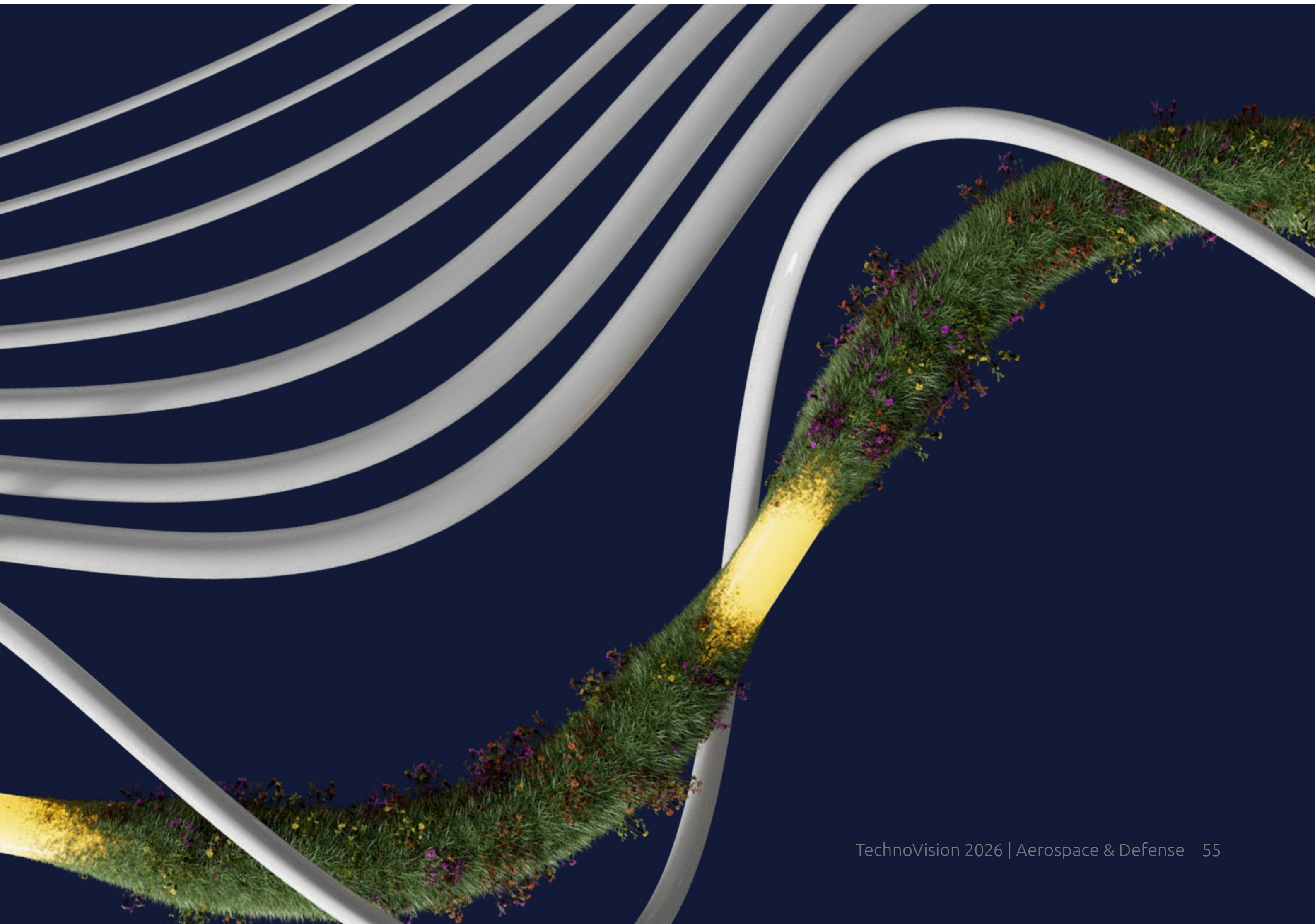
The main challenge is that with agentic AI, you cannot be 100% sure about hallucinations or errors. So, the solution is a hybrid automation approach: partly managed by AI agents and partly by scripted code. For results that must be 100% accurate, scripting should be used. For flexible tasks, Gen AI can be applied.

For example, Gen AI can power user interfaces, while core functions like temperature or flow control should rely on scripting.

In critical industries such as nuclear or military, reliability must be extremely high, so a hybrid approach will be required.

Use case

Augmented engineering is used always and always in space program with a particular focus on simulation analysis. The mechanical and physical engineering analyses presented enable the design and verification of systems for human spaceflight. For example, one dimensional and three dimensional CFD simulations are used to characterize pressurized cabin ventilation, quantifying pressure losses, airflow rates, recirculation patterns, and velocity fields to verify compliance with crew related requirements. Thermal and fluid analyses of the I HAB coolant control system assess representative, worst case scenarios, and cold case operating scenarios, including pump behavior and electronic heat dissipation. Reduced order thermal models of electronic units, based on machine learning and AI, support hotspot identification and design optimization, contributing to reliable thermal control for sustained human habitation in space.



Tom Watson

Programmable light is reshaping communication, computing, and sensing, positioning photonics as a foundation for the next technology revolution.

Paint it Light

What

Paint it Light trend is about the increasing ability to control light with precision, and the growing number of domains where that capability is now practical and economical to deploy. Photonics is not new; it has underpinned telecommunications and imaging for decades. What is new is the breadth of applications it is now reaching: computing, sensing, energy delivery, and defense systems that were previously built entirely around electronics or Radio Frequency (RF).

This expansion is happening across multiple scales and formats, from large free-space optical systems in satellites and directed energy platforms, to chip-scale integrated photonics. The chip layer is where much of the current innovation is concentrated, particularly in silicon photonics, but it is one part of a much broader story about photonics penetrating into new domains.

In Aerospace & Defense, that penetration is especially significant. Unlike data centers, where conditions are tightly controlled, A&D environments are harsh, contested, and unforgiving. Photonic systems deployed here must be highly reliable and built for long operational lifetimes, requiring new materials, post-processing approaches, and more robust designs than commercial variants.

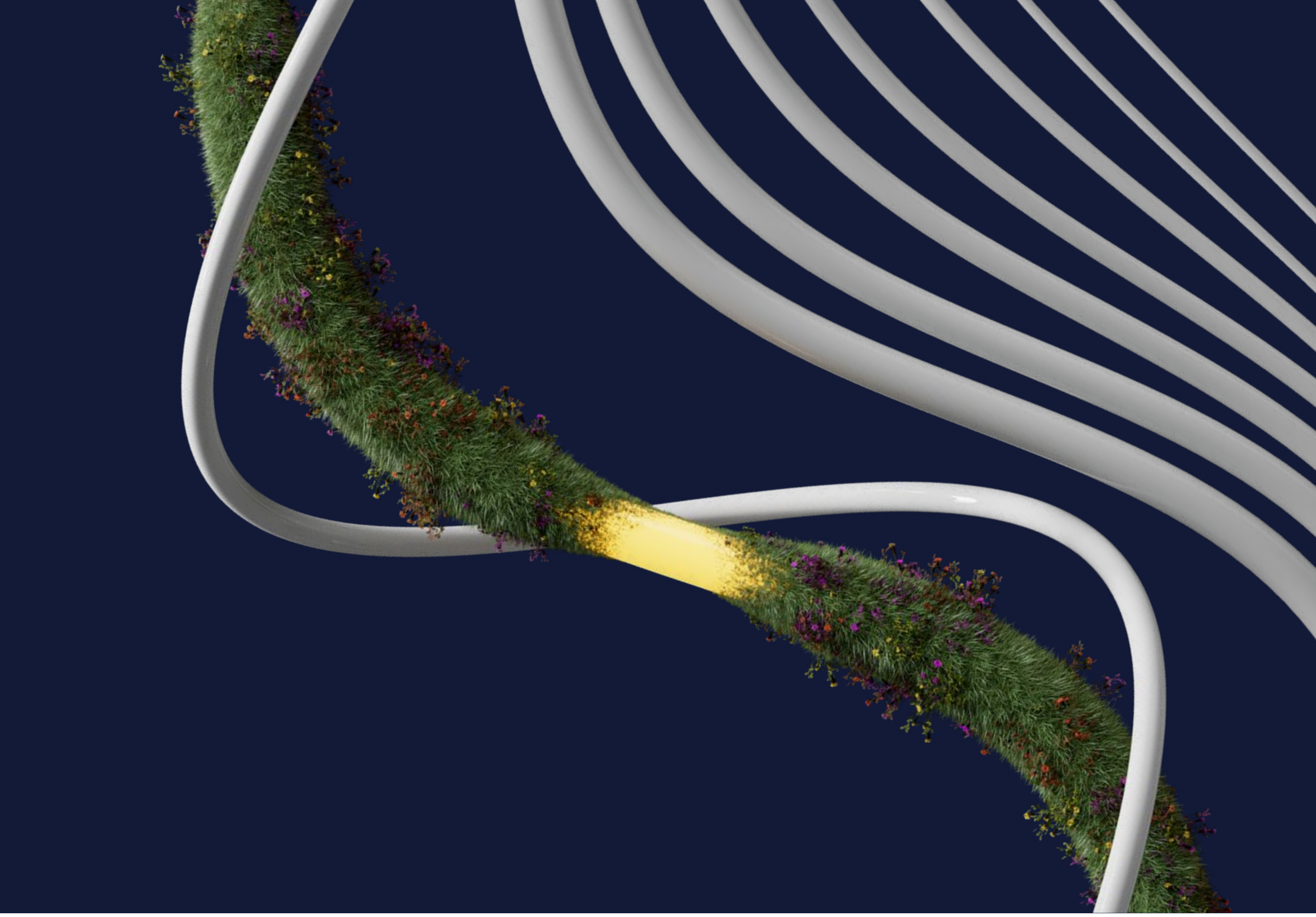
A major driver across all of these domains is that RF alone can no longer meet every requirement. Light is a more efficient medium for communicating, sensing, and delivering energy over distance, and the engineering tools to exploit that are now mature enough to deploy at scale.

Impact

Directed energy is one visible consequence. Laser weapons are moving from demonstration toward limited operational deployment, enabled by more efficient fiber amplifier lasers with higher peak power and coherent beam-combining techniques that merge multiple lasers into a single high-power output. The result is weapon systems that are more compact, damage-resistant, and energy-efficient.

Free-space optical communications follow the same logic. Using a narrow laser beam instead of RF, optical links offer higher directivity, which reduces the probability of interception and improves security in the field. Investment in this area has accelerated sharply with the deployment of optical inter-satellite links in LEO constellations, which has validated the technology at scale. Advances in stable optical systems, efficient lasers, and low-noise amplifiers have enabled compact terminals that consume less power and recover signals from very low light levels. These systems can survive launch, operate reliably in space, and extend naturally to quantum and encrypted communication applications.

Optical computing is also gathering momentum, though its deployment model is still being defined. Where latency is the binding constraint, doing computation in the optical domain before conversion to electronics can offer a meaningful advantage. Image-based optical computing, where optics replace conventional lenses to classify objects directly, is one emerging approach. The benefit only materializes, however, when coupled to a fast



closed-loop control system that can act on the result.

Photonics investment has grown sharply over the past few years, compounding as the technology proves itself in data centers, LEO satellite communications, and directed energy programs. High visibility attracts further investment, which accelerates adoption, a cycle now clearly in motion.

Building photonic systems for Aerospace & Defense comes with challenges, especially due to global semiconductor supply chains where no single country controls the full ecosystem. This creates dependencies and risks. In response, governments are investing in local capabilities to produce photonic products at sufficient, if not mass, scale for A&D needs.

Critical materials are an additional vulnerability. China dominates the upstream supply of gallium, accounting for approximately 98% of global primary low-purity gallium production, a key material in photonic and semiconductor devices. As photonics scales, diversifying access to such materials becomes strategically important. From a commercial perspective, building a product that depends on a single-source material in a constrained supply environment is difficult to justify; there are no guarantees of access, and a competitor with better agreements or alternative sourcing holds a structural advantage.

Looking ahead, agentic AI is beginning to change how photonic systems are designed. Companies are building AI-driven simulation environments that allow a single specialist to explore many more device iterations in parallel than was previously possible. Traditionally, photonic design tools required complex setup and long simulation cycles; AI agents managing those workflows significantly improve accessibility and throughput.

Use case

Anello Photonics, has commercialized a silicon photonics optical gyroscope that matches the performance of traditional fiber optic gyroscopes at a fraction of the size, weight, and cost. Their platform is targeting navigation and inertial measurement on UAVs, autonomous vehicles, and guided munitions, making it one of the clearest examples of photonics displacing an incumbent technology in A&D at commercial scale.

Bill Hodson

By reading signals and context, neural interfaces enable technology to work the moment you think of it.

Mind over Machine

What

The trend, *Mind Over Machine*, revolves around the evolution of neural interfaces. It explores how neural interfaces are increasingly augmented by complementary sensory inputs, technologies, modelling approaches, and data streams.

The expected outcome is true human–machine teaming, where interactions become intuitive, communication of human intent to machines is more seamless, and machines are equally capable of providing meaningful, real-time feedback to humans.

There are different ways to measure brain signal measurements, from the invasive to the non-invasive. However, we don't ully understand these signals yet. The technology for measuring and monitoring brain signals has been for the longest time, very bulky, lab-limited, noise-sensitive, and environment-sensitive piece of equipment. And even with the right environment and devices, obtaining a clear signal and interpreting that signal remains very difficult.

Currently, however, consumer-grade brain–computer interfaces are gaining traction, with newer devices becoming smaller and easier to use. They increasingly rely on AI to filter noise and extract meaningful insights from brain signals.

This technology will evolve over the next few years, and we'll see better readouts and advanced sensors. We won't need a tight-fitting cap, and it may be possible to integrate these systems into our everyday wearables. Some examples do exist today, for instance, helmets in defense applications come with integrated sensors that automatically begin taking measurements when worn.

With increasing investment in both invasive and non-invasive brain–computer interfaces, alongside rapid advances in AI and data science, device reliability is expected to improve significantly in the coming years. At present, however, these systems remain limited in their consistency and dependability.

Parameters such as cognitive load, situational awareness, focus, and stress are considered particularly valuable to monitor. However, there remains an open question as to whether brain–computer interfaces are the most effective approach for capturing these insights.

Mapping specific brain regions to emotions, thoughts, or actions is not straightforward, as signals are heavily influenced by their surrounding context. The same brain signal can vary significantly across environments, whether in a room, on the road, or while operating an aircraft or drone. Even in controlled settings, external factors, such as an unexpected siren, can alter brain activity and affect the signals captured. As an example, consider a drone pilot remotely operating in a high-stress situation. The environment involves multiple simultaneous inputs; control commands, incoming instructions, real-time reconnaissance data, visual feeds from the drone, operational controls, and unpredictable environmental noise, such as people or other external disturbances.

Such environments are highly prone to cognitive load, which can lead to errors, increased stress, burnout, diminished situational awareness, and ultimately, poor decision-making.

To interpret these signals effectively, the AI system must understand the full context. This includes the mission, the state of the drone, the presence of any threats, the volume of information received over time, and likely future developments. It also requires historical context about the individual, such as how they respond to high noise levels and how they perform in similar or previous missions.

Without this context, it becomes difficult to accurately determine whether a given signal indicates a particular change in human state.

Impact

The Aerospace & Defense sector remains inherently human-dependent, as certain functions cannot be fully automated. As a result, humans must remain present, controlling operations or staying in the loop. As long as a human is involved, processes are ultimately constrained by human capacity.

At present, human errors occur because of persistent variability—across skill, expertise, seniority, and even mood—meaning even highly experienced individuals can underperform on a bad day. In safety-critical sectors with high consequences, this variability has a significant impact. If systems can adapt to our users, we can effectively elevate everybody to be our best user.

The safety and security implications are critical, as these technologies can be perceived as highly invasive, monitoring an individual's mental and physical state and influencing how they work. If applied incorrectly, this can lead to harmful outcomes. For example, without proper contextual understanding of human behavior, signals may be misinterpreted, potentially resulting in individuals being wrongly deemed unfit for a role, with severe personal and professional consequences.

Privacy is a significant concern, raising questions about users' willingness to have such data monitored. This can be addressed through approaches like avoiding raw data storage and using edge-processed, abstracted data without transmitting personally identifiable information to the cloud.

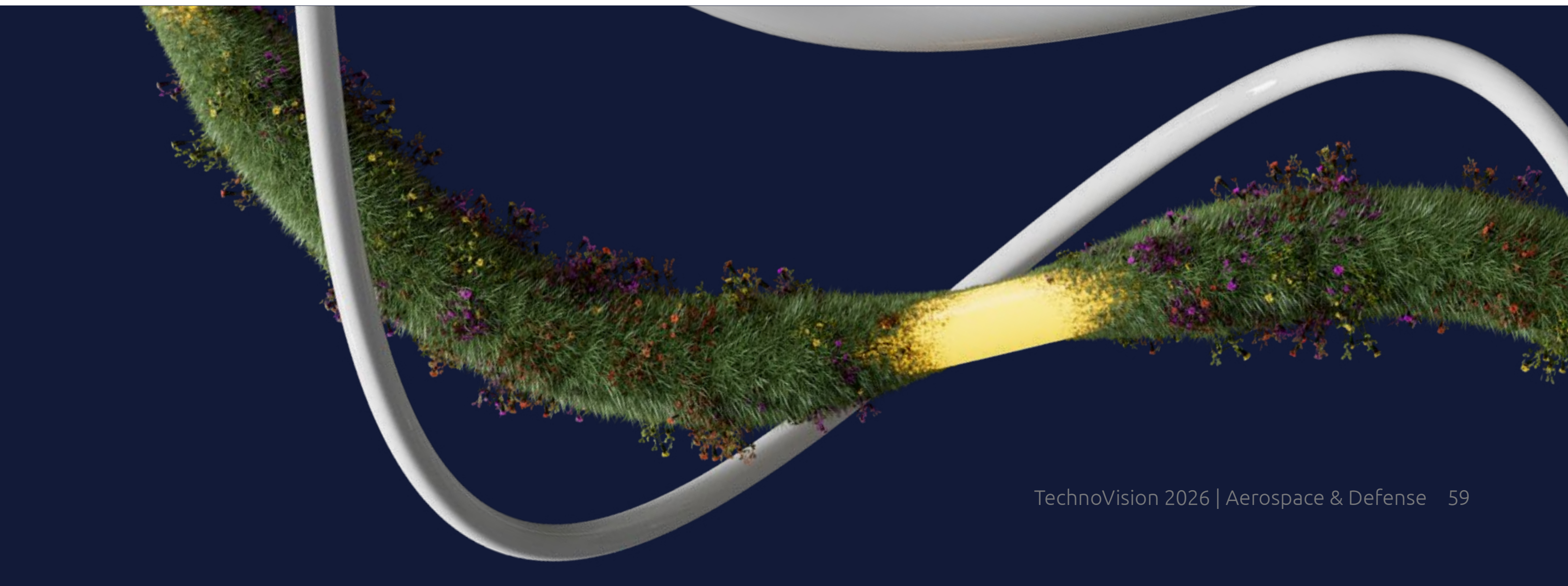
Use case

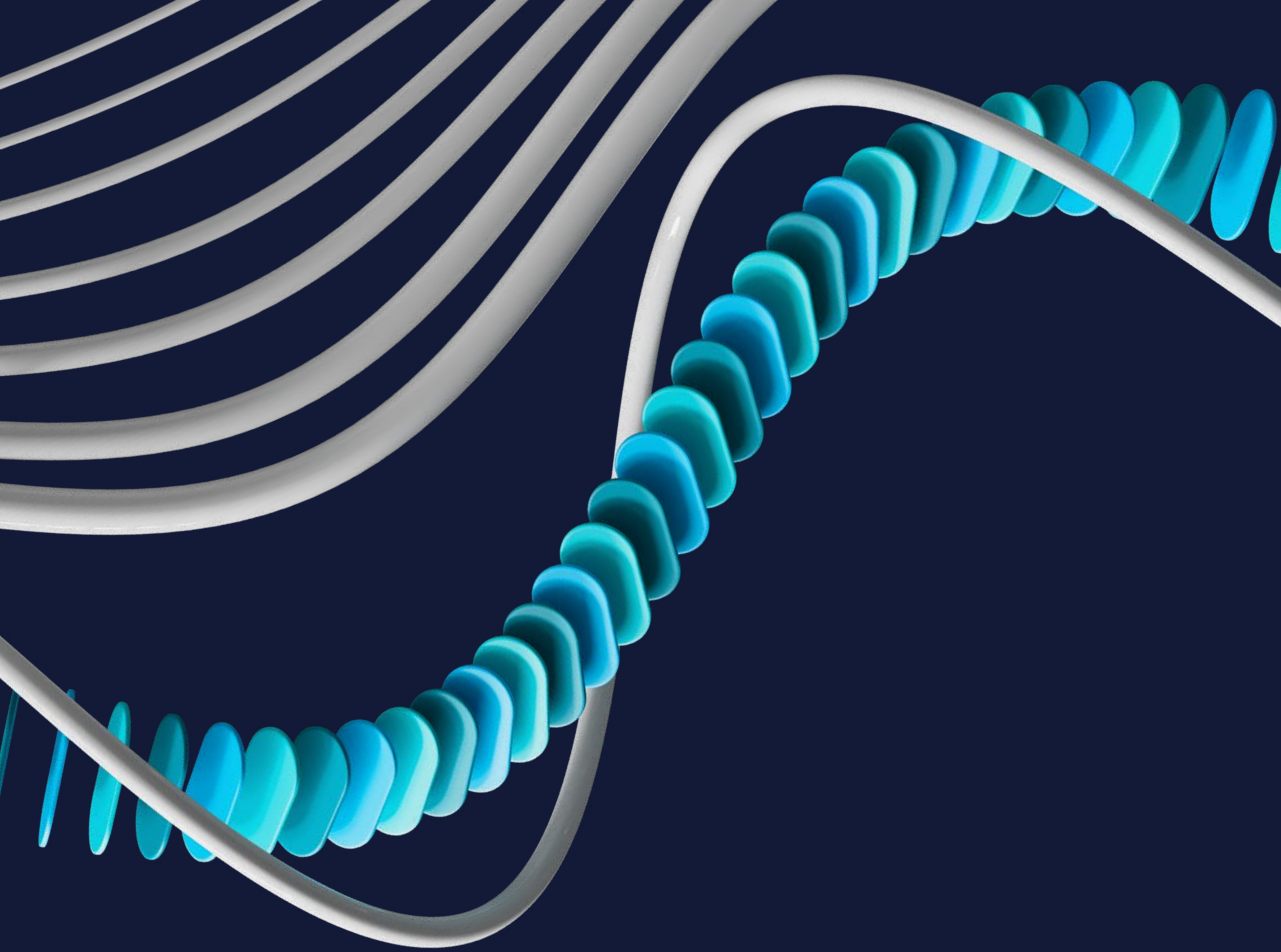
The multinational EPIIC program, led by Airbus Defense and Space, is advancing next-generation concepts to strengthen defense capabilities and technological sovereignty in Europe. A central focus of this effort is redefining the fighter cockpit through adaptive human–machine interfaces and immersive operational environments.

In the cockpit of the future, pilots operate within a highly integrated, context-aware system designed to enhance decision-making and reduce cognitive load. Helmet-mounted displays project real-time mission-critical information directly into the pilot's field of vision, while immersive interfaces provide continuous situational awareness. Gesture-based controls enable seamless interaction with onboard systems, allowing pilots to acknowledge updates or command unmanned platforms without diverting attention.

The Next-Generation Nonsurgical Neurotechnology (N3) program aims to develop high-performance, bi-directional brain-machine interfaces for able-bodied service members.

Such interfaces would be enabling technology for diverse national security applications such as control of unmanned aerial vehicles and active cyber defense systems or teaming with computer systems to successfully multitask during complex military missions.





07 Applications Unleashed

RaviKanth Pasumarthy

Next-generation agile applications, built on the concepts of microservices, API-first, cloud-native, and headless (MACH), make up an applications portfolio that is cradled by AI and delivered via developer platforms.

Honey, I Shrunk the Applications

What

2026 will mark an inflexion point, with an uptake of next generation satellite networks aligned with 3GPP based architecture, driving the overall solution evolution towards 6G network architecture, where ubiquitous networks are one of the prime themes.

This implies the solutions should not only support NTN based deployments for LEO/MEO/GEO constellations but also enable integration with HAPS, LLEO, and private networks or terrestrial networks. In the future, satellites will likely be equipped with greater computing power to process data locally via edge compute functionality, as well as part of the Payload to handle the applications onboard, rather than transmitting data back to Earth for processing. This approach not only saves bandwidth but also ensures more immediate and efficient data utilization.

Innovative software solutions are transforming connectivity and networking in Aerospace & Defense.

The shift is happening towards definition of open platform standards that can enable software to be deployable in multiple form-factors with software reusability being a driver.

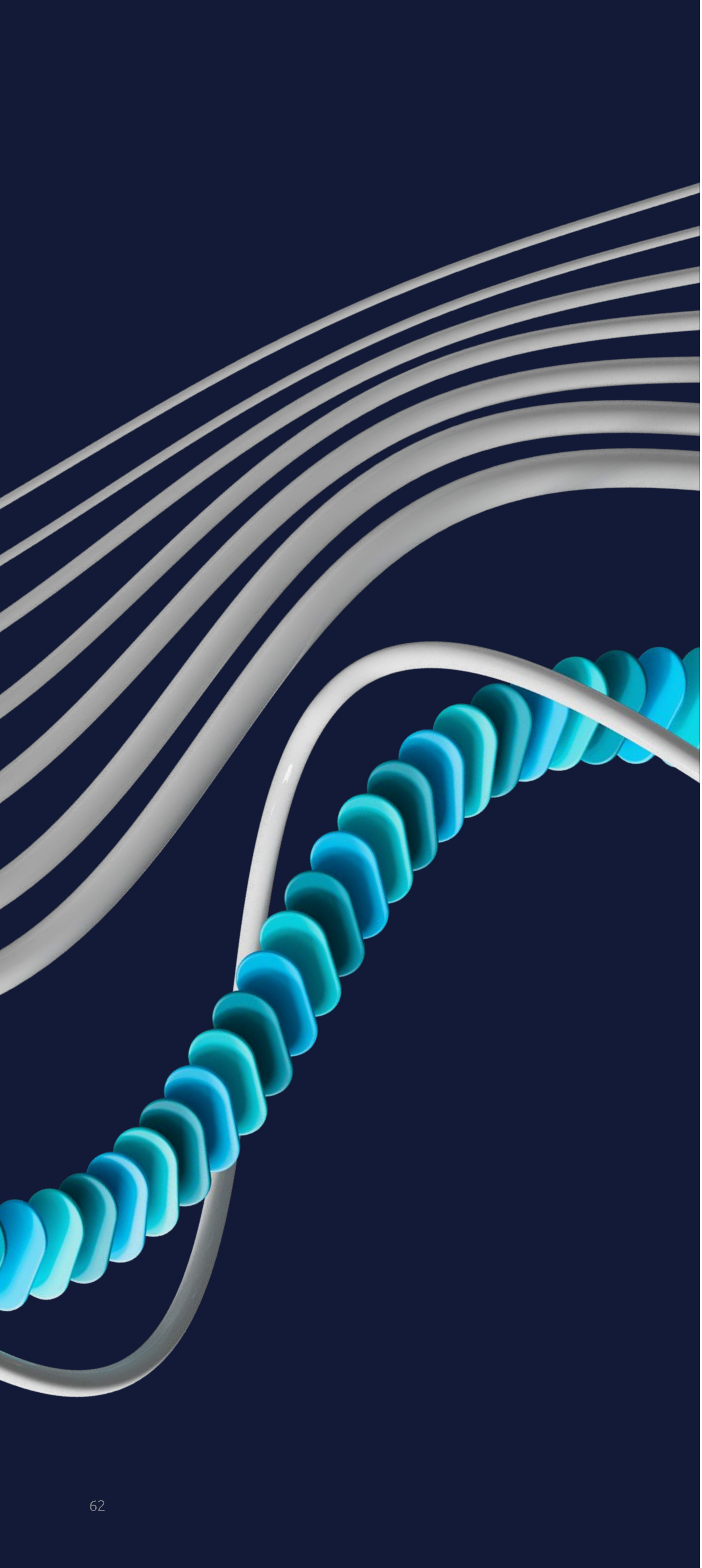
Open interfaces is another key trend that not only enables onboarding of applications to drive the network performance but also ensures interoperability to drive towards multi-operator, multi-constellation and multi-orbit deployments. The application portfolio shrinks as we move towards common software that can be used across multiple deployments with the flexibility to add independent applications as well.

AI-based architecture is the foundational shift that needs to be considered as we design, develop and deploy these complex solutions. The applications need to embrace AI-based approach in the overall network solution to be able to address key concepts like predictive intelligence, predictive optimization and autonomous life-cycle management. This gets supplemented by a digital twin-based architecture, that is transforming the way solutions are built by providing the replica of every node to simulate the orbit, atmospheric conditions, satellite movement and the controls, and link-budget, to optimize the network performance and meet SLA targets with the network.

However, digital twins need to evolve from semi-static models to dynamic, AI-augmented simulation environments, that can run what-if scenarios especially to understand satellite movement and prediction of cell to satellite mapping, reconfiguration of satellite mapping. They should be able to predict coverage gaps before they occur, impact of feeder-link and feeder-link management to be able to deploy autonomous network without human intervention.

Impact

The business model impact of building the solution based on standards shall, in the near to medium term, enable a shift from connectivity-as-infrastructure to connectivity-as-a-platform. In the long term, the convergence of AI-native architecture, ubiquitous networks backed up with digital twin-based modelling will enable a class of applications and networks that are autonomous in their operation.



The strength of these innovative solutions lies in the ability to develop software and environments that can address the above defined requirements.

Use case

The Capgemini Software Framework Solutions (SFS) for Networks offers software frameworks such as Centralized Unit (CU), Distributed Unit (DU), Core, RAN Intelligent Controller (RIC), and Service Management and Orchestration (SMO) that enable Satellite Communication (SatCom) providers to develop their products quickly in this competitive market.

Capgemini, with its experience in developing solutions based on 3GPP, O-RAN and TMF based architectures, can work with SatCom providers to realize orchestrators that enable ubiquitous networks considering SNO-SNO and MNO-SNO interop.

In addition, Capgemini can also work with SatCom providers in enabling digital-twin based applications building solutions to evolve toward autonomous network.

Neil White

Pair programming with an AI assistant can significantly boost coding productivity and quality while accelerating progress up a steep learning curve—if you know what you're doing.

When Code Goes Know

What

Whilst AI isn't new, the continued drive around generative AI has brought into sharper focus the range of possibilities AI can provide in the realm of software development. Aerospace & Defense has historically had lower software productivity than other industries, which means a lot of opportunity, but the need for proven accuracy and safety remain paramount.

New and improved development assistant solutions have secured their place in the next generation of AI-enabled software development. Developer augmentation has far surpassed autocompletion and basic testing. Current tooling augments developers with suggestions of architectural patterns, code and test generation, high-level reviews, and rapid deployment pipelines. All of this is done through dialogue in plain, natural language. Gen AI-based solutions are built upon Large Language models that have been trained using the knowledge available from the open-source community, vast amounts of excellent, publicly available source code.

Taking the next step is combining natural language dialogue with snippets of unambiguous notations for technical material to enable more precise code generation. LLMs that have been trained on company specific material—e.g. code standards and policies, preferred templates and patterns—take a generic augmentation tool to the level needed for domain specific excellence.

Impact

We are already seeing how these augmented software development solutions have the potential for far-reaching impact, across the entire Aerospace & Defense industry. For experienced developers the biggest impact of augmented development is increased productivity and enhanced organizational agility through a significantly faster time-to-market for new business and support applications. Augmentation, and agentic workers, allow an experienced developer to become the oversight of a high-performing team. For junior developers, it allows faster climbing of the steep learning curve, with fewer dead ends.

However, for all developers, these tools must be used with caution. An experienced eye remains crucial for validation and optimization of results. Junior developers still need to learn the fundamentals and develop the skills to spot nuanced, but impactful flaws.

Both human and AI developers make mistakes—our test and validation processes need to be both robust but also tailored to the types of mistakes that can occur from our development chain.

Use case

Google's Gemini Code Assist is integrated into popular IDEs like VS Code and IntelliJ and it supports developers by generating code from natural language comments, suggesting real-time completions, and explaining complex logic.

Anthropic's Claude Code focusses on more complex tasks—for example taking on agentic refactoring.

In both cases, the tools enable a fluid, conversational workflow where the developer guides the process while the assistant handles code generation, testing, and debugging. This dynamic mirrors traditional pair programming, with the AI often taking the "driver" role and the human developer acting as the "navigator."

Naimeesh Chauhan

AI-augmented interaction in plain, natural language is emerging as the dominant application paradigm.

Chat is the New Super App

What

The concept of *Chat as the New Super App* has evolved significantly. What began as a unified conversational interface to simplify digital interactions is now transforming into an AI-driven execution layer that orchestrates enterprise work.

In highly complex and regulated industries such as Aerospace & Defense, organizations face persistent challenges: fragmented supply chains, increasing engineering change cycles, stringent regulatory compliance, workforce shortages, and the need to make high-stakes decisions in real time. Traditional systems, spread across PLM, MES, ERP, and QMS, create silos that slow down decision-making and increase operational risk.

Chat-based systems are emerging as a unified interaction layer across this fragmented ecosystem, but their role has expanded beyond interaction. Today, they function as conversational gateways to enterprise systems, knowledge hubs integrating structured and unstructured data, and also agentic platforms where multiple AI agents collaborate and execute tasks.

These systems are no longer just answering queries—they interpret context, generate insights, and trigger actions across workflows.

This evolution is driven by agentic AI, where multiple intelligent agents operate in coordination, interacting not only with users but also with each other. This creates a dynamic ecosystem capable of end-to-end task execution, from querying data to initiating corrective actions within enterprise processes.

In Aerospace & Defense, this manifests as a digital workbench, where engineers, quality teams, and operators interact through a single conversational interface to:

- Generate and update quality artifacts (PFMEA, Control Plans).
- Analyze non-conformances and root causes.
- Access compliance requirements instantly.
- Guide operations through intelligent recommendations.

These systems are referred to as the "new super app" not merely because they aggregate functionality, but because they act as an intelligent layer that connects, interprets, and executes across legacy and modern systems in real time.

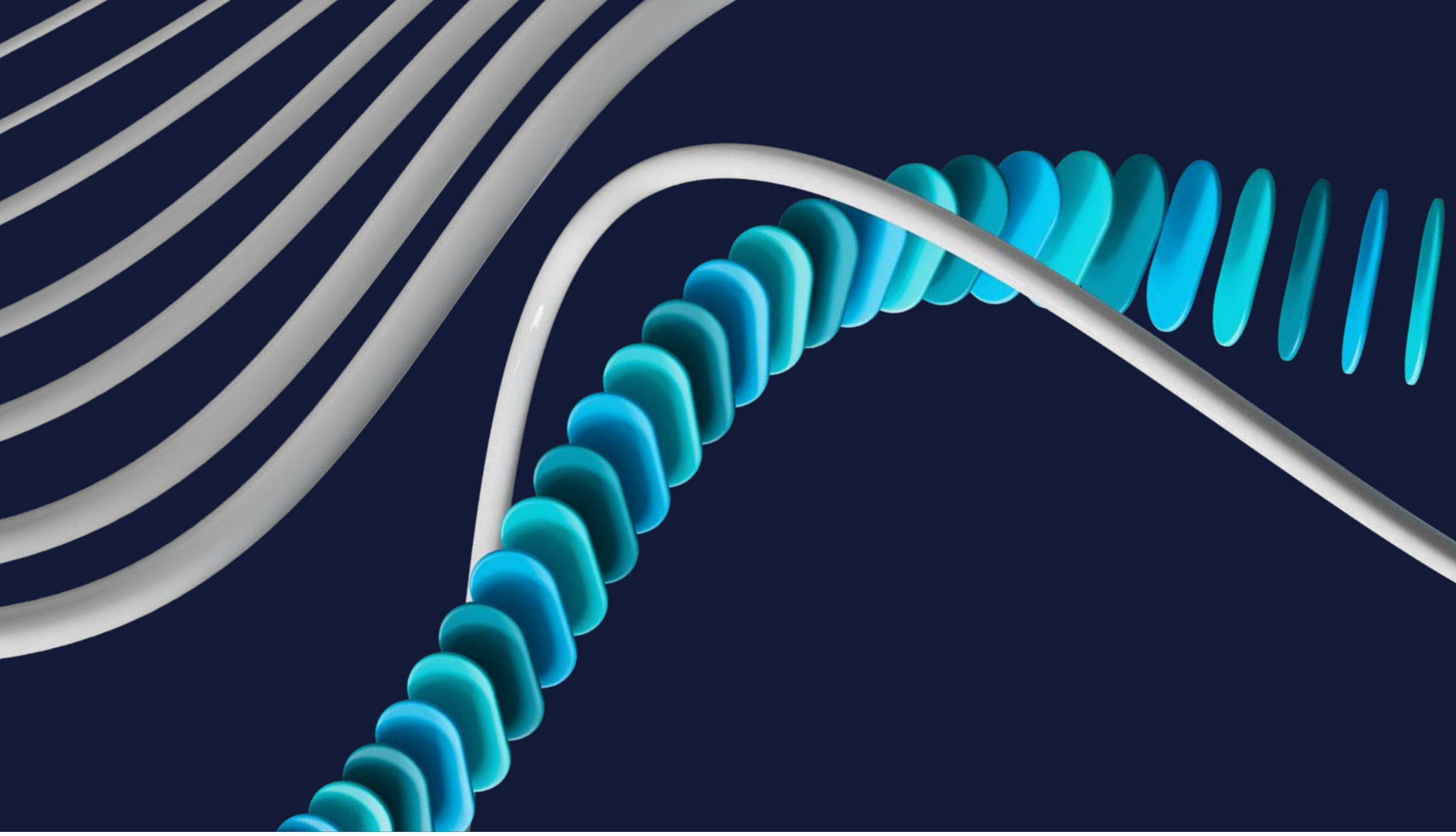
Impact

Chat-based platforms are rapidly evolving into AI copilots and autonomous agents, fundamentally changing how work is performed.

When trained on enterprise data—such as process capability metrics, historical non-conformance records, and compliance frameworks—these systems move beyond reactive support to proactive and autonomous execution. They detect risks early based on patterns and historical trends and recommend or initiate corrective actions. They also trigger workflows such as non-conformance management or audit preparation, and last but not least, continuously learn and improve from outcomes.

This shift enables organizations to transition from information-driven operations to execution-driven intelligence.

In the context of quality excellence, chat interfaces become digital quality copilots, reducing reliance on tribal knowledge and democratizing access to expertise across teams.



Key benefits include faster decision-making with contextual insights, reduced cycle time for quality processes, improved compliance through standardized and auditable interactions, and enhanced collaboration across engineering, manufacturing, and services.

However, this transformation also introduces important considerations:

- Over-reliance on AI may reduce deep domain engagement.
- Validation of AI outputs becomes critical in safety-critical industries.
- Governance and explainability are essential for regulatory compliance.

To mitigate these risks, organizations must adopt a structured approach. They should build strong foundational domain expertise, gradually integrate multimodal and conversational interfaces, and transition towards human-supervised AI systems. In this model, humans evolve from executors to supervisors and decision arbiters, ensuring that AI-driven actions are accurate, safe, and compliant.

A strong data architecture and knowledge management strategy remains foundational. Without high-quality, integrated data, even the most advanced conversational systems will fail to deliver value.

Use case

A leading Aerospace & Defense organization faced significant challenges in managing non-conformances (NCs). The process was highly manual and time-consuming, dependent on incomplete or inconsistent data inputs, reliant on multiple interactions between quality, engineering, and manufacturing teams and prone to delays, impacting production schedules and cost of non-quality.

To address this, Capgemini Engineering implemented a Gen AI-powered conversational agent embedded within the quality workflow.

The solution introduced a chat-first AI assistant acting as a “Quality Co-thinker”, capable of guiding operators interactively during NC creation, automatically identifying and completing missing information, standardizing NC descriptions and resolution steps, suggesting corrective and preventive actions based on historical data, integrating directly with QMS workflows to trigger resolution processes and reducing redundant or unnecessary NC creation.

The assistant leveraged Natural Language Processing (NLP), generative AI, and contextual enterprise data to create a seamless and intelligent user experience. Unlike traditional chatbots, this system did not just provide information. It actively participated in the execution of the quality process.

The implementation of the agent delivered significant operational improvements. It improved data quality and consistency in NC records, reduced resolution lead time and process bottlenecks, enhanced collaboration across functions, and increased operator productivity and decision confidence.

Most importantly, it enabled a shift from reactive non-conformance to proactive and guided quality execution.

Mike Dwyer

Robots are no longer just machines—they're programmable, intelligent agents, adding new dimensions and opportunities to the craft of A&D innovation.

App = A Robot

What

This isn't just about automation—it's about building digital helpers that augment everyday productivity and outcome. We need speed, creativity, innovation—core to aerospace industry since the Wright brothers. Humans and machines need to be curious together to achieve that.

The *App = A Robot* trend is all about creating intelligent, friendly agents that help us get work done efficiently and intuitively – aerospace Robots or "aerobots", if you will. These agentic capabilities are designed to simplify your day-to-day tasks by helping you assess risks, identify the next steps, and respond quickly to program needs. This is more than just automation—it's about building digital helpers that augment productivity, creativity, and experiential learning. Creative aerobots enable innovation, like copilots for scientists or engineers. Task-oriented aerobots work on speed, accuracy, orchestration and trust across tasks, workflows and the organization. Meta-human aerobots are used for learning and experience transfer. We need all three!

Emerging aerobots, with artificial curiosity, will augment us in exploring new solutions, rapidly with confidence whilst staying grounded in physics, maths and real constraints, thereby mitigating hallucinations. Physical AI must also be considered so that digital innovation becomes a physical reality autonomously, e.g. ultra rapid product development!

Whilst agentic and generative aerobots can significantly boost productivity and speed, they must operate within a framework of safety, reliability, and accountability. In A&D, it's never just about efficiency. It's about the right job, the right data, and the right time, so the right consequential decision can be made with the right model and trained aerobot.

Aerobots must be trustworthy, transparent and adaptable. While younger generations and newcomers may adopt these tools quickly, they often don't fully understand what's happening behind the scenes. The cultural pendulum must swing carefully. Blind trust in technology can prove to be risky, we must remain aware of what AI is doing, how it augments our work, and where its limits lie. Decisions in A&D carry real consequences whereby trust must be earned, then continuously monitored. It's about understanding, when you give an aerobot agency, how much autonomy you can give it.

Impact

The impact is speed—the outcome is innovation and operational readiness at scale. Tools that become trusted as my digital helper, my app as a robot.

There are three considerations to connect: productive daily work; optimal product/system design and operation; and employee readiness through skilling up and transferring experience.

An aerobot that is on 24/7 is orchestrating and checking, can be helpful. The world changes regularly, so constant support means when you step away and come back, these systems would still be working. Can aerobots execute tasks, find problems, and fix them overnight? Yes. Repetitive, error-prone tasks can be mitigated by aerobot capabilities that continue to evolve and improve data accuracy and workplace productivity. The goal is simple: do things once, do them right, have intelligent support systems in place to validate and process them efficiently.

For operational products, we must work twice as fast—deliver quicker, reduce costs, and mitigate environmental impact. Aircraft need to fly farther, use energy better, and use materials more efficiently, sustainably. This is too complex for humans alone and needs coordinated work with machines. Linear processes no longer work. Closer collaboration between people and machines can speed things up, though it requires a big shift for organizations. Aerobots improve productivity and help spot issues early, especially in fleet monitoring, supply chain, and logistics.

They also help employees learn faster, build skills, and be more productive. New talent expects digital support, so organizations must help them be job-ready and engaged from day one. The workplace is already evolving with next generation expecting AI in ways we never imagined. Aerospace remains a strong career path, and aerobots can let people solve bigger problems and make a real impact.

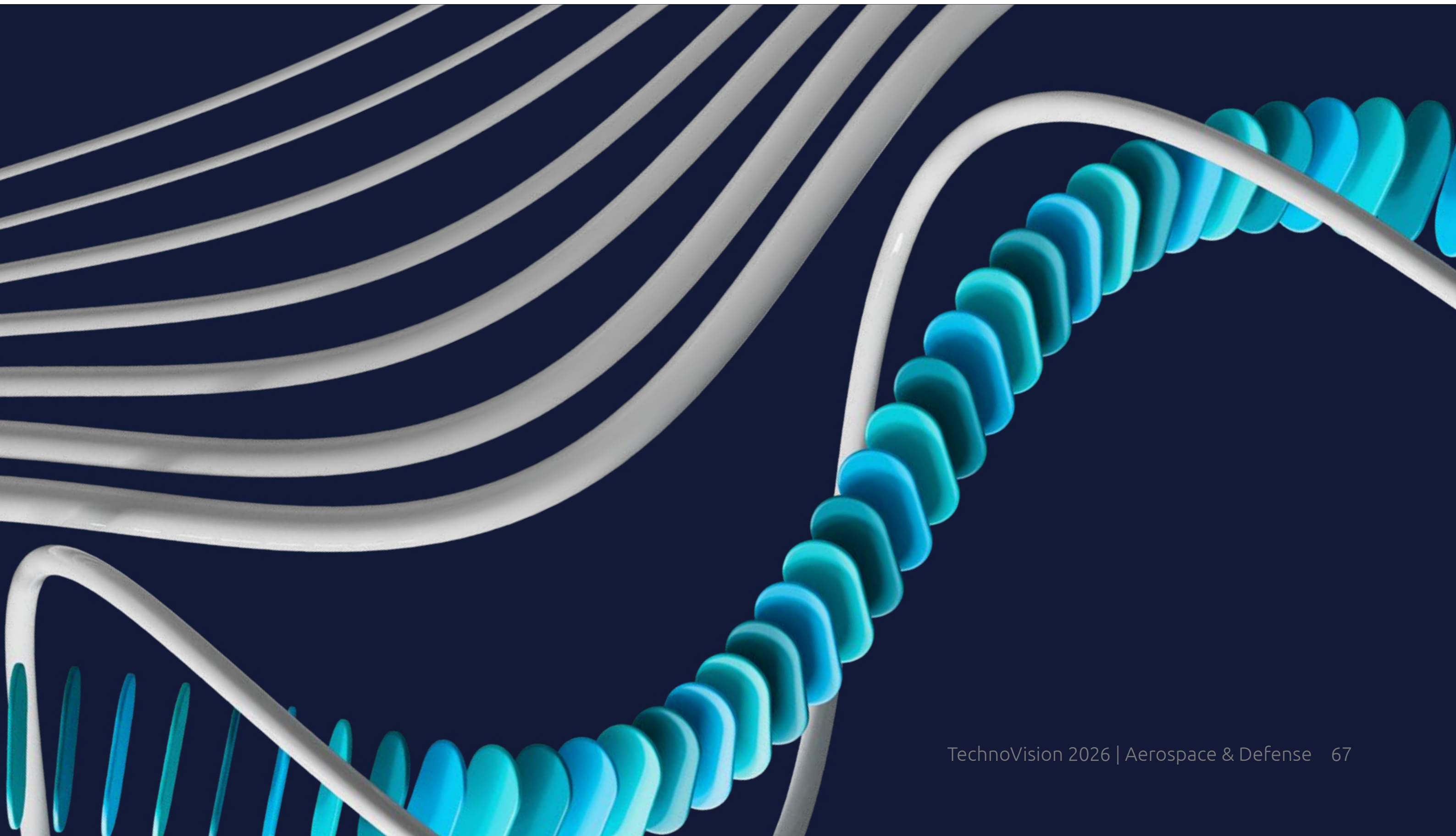
A&D organizations and practitioners have a unique global opportunity to adopt these technologies to remain competitive. If they don't, the long-term consequences could be significant. Flying may become economically unsustainable from reducing equipment market share and increased global competition. Defense products could become prohibitively expensive due to overly complex requirements and a lack of automation in design and manufacturing. That kind of economic pressure could have real social consequences.

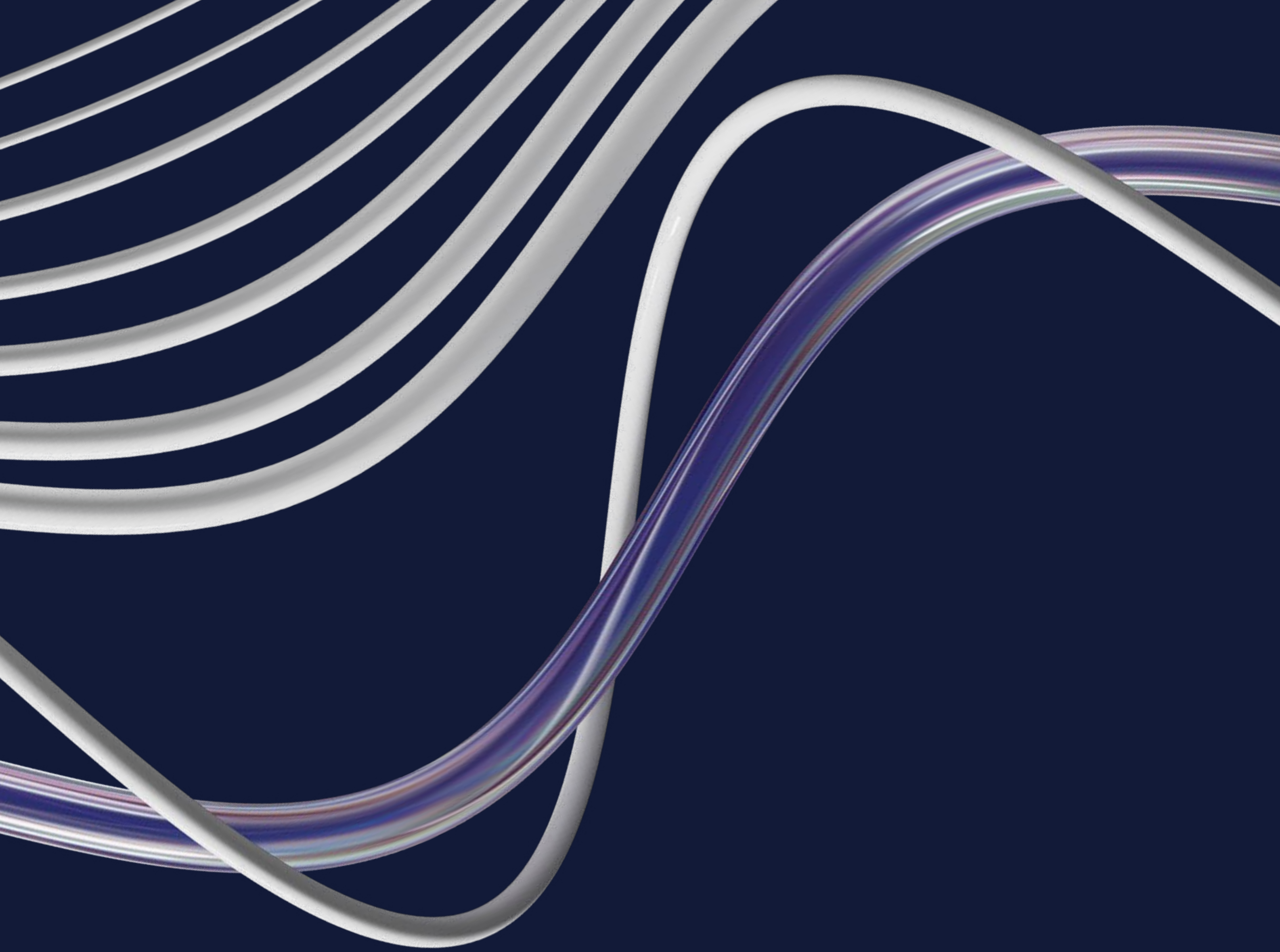
I often think back to my own experience growing up, flying regularly on a 747 from London to Colombo to visit family. It was affordable then, and we, as today's leaders, have a responsibility to ensure that such opportunities remain open for future generations.

Use case

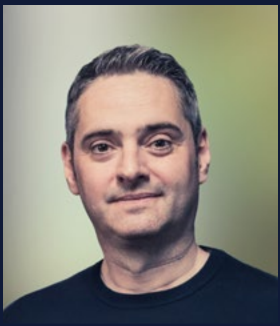
Capgemini is collaborating with a global manufacturing leader to enable productivity improvements in engineering and manufacturing. The team has worked closely together to build and validate an agentic agent to support autonomous tool pathing from 2D drawings.

"Marc" supports manufacturing engineers to produce components quickly, understanding the cost and complexity before making a final decision on the tool path and method. It coordinates image processing and layout analysis that is underpinned by a complex knowledge graph. By ingesting several thousand drawings, material data, and machine data, a high variability of components can be prepared for "on the fly" manufacturing; saving time and resources in manufacturing engineering and on the shopfloor.





08 Invisible Infostructure



Rob Kernahan

With the cloud evolving and maturing, it's time to create a new, secure, smart mix of sovereignty, sustainability, agility, deployment options, and specialized capabilities where AI is everywhere.

Cloud Encounters of the Third Kind

What

The AI revolution has well and truly landed and impacted the way work gets done in the Aerospace & Defense sector.

Defense is moving quickly to adopt cloud and gain access to best-in-class AI capability, nurturing an environment which supports high frequency operations.

In this sector, there is also significant pressure on organizations to accelerate. Order books are flowing over, and while legacy technology is holding them back, the lure of cloud native ways of working and AI for faster results is compelling.

This brings us to the need to deliver a more dynamic platform strategy, one that provides access to the services that can propel these organizations to the future.

However, the challenges in these environments are complex and difficult to manage:

1. Legacy technology needs significant work to make it compatible with the new ways of working.
2. The cost models behind AI are highly complicated and moving significantly as time goes by, making business cases difficult to build.
3. The access to the chips and infrastructure to power the latest AI is contended.

Impact

The answers to the challenges need organizational wide adoption and change that goes beyond the IT department:

1. Think vertically. You must merge technology into business operations and consider the total cost of ownership, not just the IT cost model.
2. Rethink end to end, the way you get work done. AI isn't about replacing humans; it's about redefining how we deliver experiences and outcomes differently.
3. Break traditional ways of working and thinking about risk. Be willing to dramatically reduce the time to prove value with technology.

All of this is underlined by the need for flexibility, a need to think on demand but in a way that has balanced and manageable approaches.

Cloud is the key that unlocks this new world. Without it, the digital realm is complex to navigate around and with many organizations still adapting to a digital way of working, this added complexity of bringing AI to effective operation means now it is well and truly time to smash the traditional way of thinking.

Cloud technology and providers are rising to allow organizations to meet this challenge. They are creating new and diverse models to allow high-security organizations to enable this mission with strong controls and sovereign postures. You can get flexibility and best-in-class technology that can be delivered with the necessary controls.

The last year has brought a dramatic shift in how cloud capabilities are accessed and how AI is delivered at speed. Traditional players are reinventing their delivery models, while neo-cloud providers continue to rise rapidly. The market is evolving at an extraordinary pace, but one thing is clear: adoption is accelerating just as quickly. Those who move with urgency and adapt fast enough will lead the AI race; those who hesitate

may soon regret not evolving the way work gets done.

Use case

Capgemini has partnered with Microsoft with the intent of offering clients a comprehensive, fully integrated, managed cloud service model designed to embed sovereignty, compliance and business continuity into every stage of digital and business transformation. Through the partnership, Capgemini will deliver end-to-end sovereign solutions that help clients accelerate their adoption of Microsoft Sovereign Cloud portfolio and innovative AI technologies. Clients can balance sovereignty and innovation by choosing the most appropriate Microsoft cloud solution, seamlessly operate across sovereign public, sovereign private, and national partner clouds, and rely on established resiliency plans to maintain business continuity if regulatory, geopolitical, or operational conditions change.

Capgemini is also expanding its collaboration with Telenor AI Factory through a partnership agreement aimed at bringing sovereign AI closer to Norwegian businesses. The agreement combines Telenor AI Factory's sovereign, secure and sustainable AI cloud services with Capgemini's AI and industry expertise to support Norwegian and Nordic companies in implementing sovereign AI solutions. Together, Telenor AI Factory and Capgemini will support companies across public and private sectors to faster explore and operationalize sovereign AI, from early tests to full scale implementations.

Charles Alexandre de Taisne

Connectivity has become the foundation of a hyper-connected world, seamlessly linking devices, industries, and ecosystems to drive unprecedented innovation.

Everything, Everywhere, All at Once, Connected

What

Connectivity has significantly advanced to become the key enabler for various applications in Aerospace & Defense. The shift from Wi-Fi to 5G/6G in recent years, which offers better reliability, lower latency, and higher throughput, is crucial for applications that require consistent and high-quality service. Some technologies are expected to be more mature with 6G, which will have native AI embedded in the systems. This will lead to autonomous orchestration of the networks, improve quicker response to problem solving and make networks more reliable.

Additionally, the emergence of satellite connectivity, particularly with the advancements brought by Low-Earth Orbit (LEO) constellations, has further enhanced the possibilities for global connectivity.

In the defense sector, 5G enables trunking for fleets, where data from maintenance sensors can be offloaded before equipment (e.g. ships or tanks) return to base, thus streamlining maintenance operations and supply chain processes. On the battlefield, 5G mesh technology is enabling the creation of tactical bubbles, ensuring continuous connectivity even if one point is lost. Moreover, the integration of AI and machine learning with 5G connectivity allows for advanced applications like real-time detection of allied or enemy forces using AI at the edge.

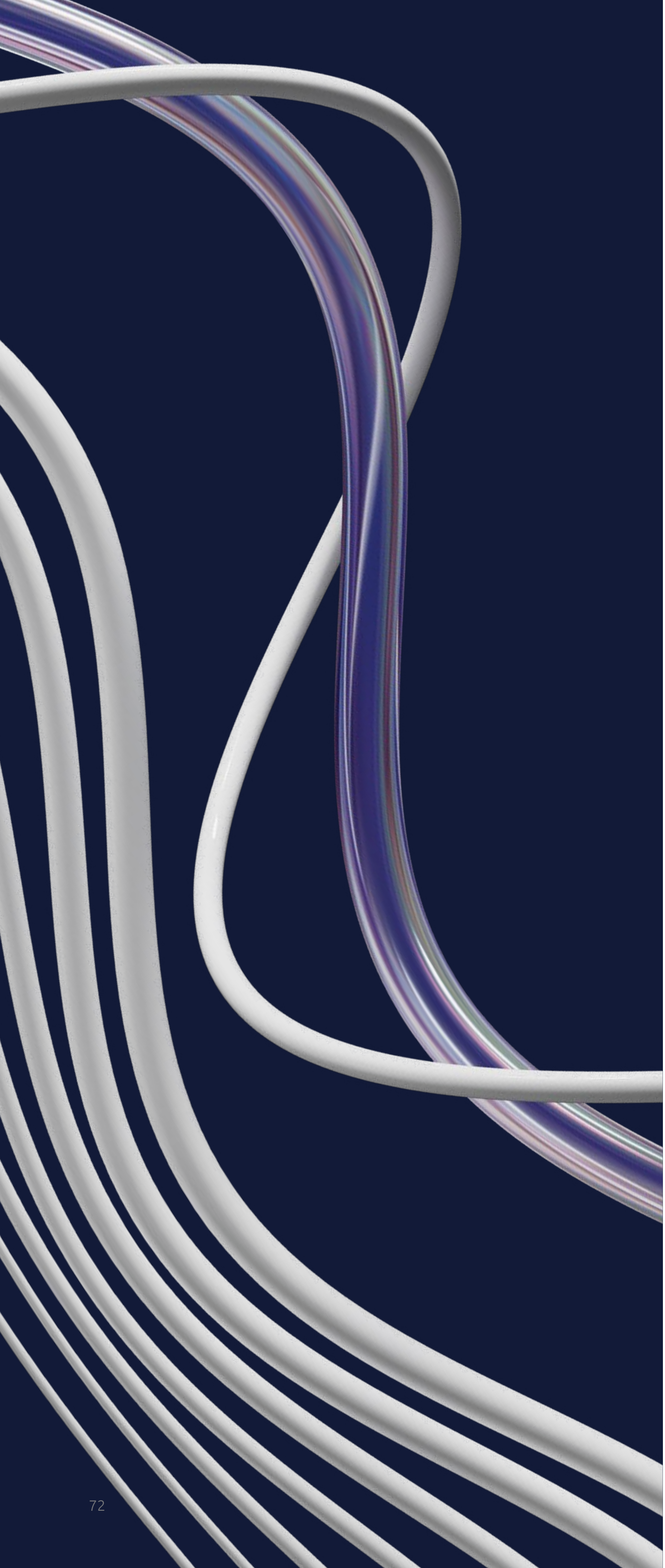
Away from the front line, connectivity also extends to the manufacturing and production. The combined use of digital twins, AI, and 5G/6G can enhance production efficiency, track and trace assets, and improve overall supply chain management. This is particularly relevant given the volatile geopolitical situation and the need for rapid production and deployment of equipment, both for civil avionics and defense.

However, there are significant challenges related to cybersecurity to maintain secure 5G signals. The potential for jamming and interference with 5G signals is a critical issue to be addressed, to ensure continuous and secure connectivity. Furthermore, with the increased use of 5G-NTN (Non-Terrestrial Networks), the seamless connectivity between TN (Terrestrial Networks) and NTN is becoming a key challenge in delivering end-to-end services. Firstly, the technologies are not yet ready for seamless integration between TN and NTN. Secondly, orchestrating services between two different operators, a satellite operator and a terrestrial operator, is complex. You need to build a bridge to provide reliable end-to-end service. It also leads to questions on responsibility, ownership of technology, and control in the connectivity flow. Organizations are working with MNOs and satellite manufacturers to find solutions.

Impact

This trend encapsulates the transformative impact of advanced connectivity technologies like 5G/6G and NTN on the Aerospace & Defense industry. These technologies enable new use cases, improve operational efficiency, and support critical applications, but must be used wisely by addressing the challenges of cybersecurity, integration and sovereignty.

Now it's not only about connectivity and edge bringing new scenarios, but also about where to place AI agents. Should they be at the edge—meaning closer to the user—or elsewhere? For example, AI could be placed in the phone of a soldier, in a backpack, on a vehicle like a tank,



or at a base camp. This depends on latency, connectivity reliability, and use case.

With satellites, there is significant research on what can be done. Currently, connectivity satellites mainly propagate signals. They are not intelligent. The next generation will embed AI, so when signals arrive at the satellite, AI can process them and respond directly to the ground while maintaining connectivity with base stations. This is a strong research and development trend with significant investment. For example, this can be used in satellites used for climate observation. Currently, they take images and send them to the ground. With edge computing and embedded AI on satellites, images can be analyzed directly in orbit. In case of climate disasters, AI could process data onboard and send insights directly to the relevant client. This avoids delays caused by sending data to the ground first for analysis. It reduces time and computational costs while improving efficiency.

Use case

The IRIS^2 (Infrastructure for Resilience, Interconnectivity and Security by Satellite) Satellite Constellation is the European Union's third flagship, addressing long-term challenges of EU's security, safety and resilience by offering enhanced connectivity services to governmental users. The new multi-orbital constellation of 290 satellites will combine the benefits offered by Medium Earth Orbit (MEO) and Low Earth Orbit (LEO) satellites. It is set to provide secure connectivity services to the EU and its member states as well as broadband connectivity for governmental authorities, private companies and European citizens, while ensuring high-speed internet broadband to cope with connectivity dead zones.

Christopher Gaube

Core edge technologies like 5G and upcoming 6G, system-on-a-chip, and embedded AI have moved the boundaries, bringing the power of IT infrastructure close to real-world operations and people while decreasing energy consumption.

Simply the Edge

What

In Aerospace & Defense environments, the edge is no longer just an extension of central IT systems. It is becoming the execution layer where, in a multi-domain context, data is generated, processed, and acted upon in real time. Platforms, sensors, and operational systems increasingly operate in distributed architectures where decisions must be made close to the mission, not in centralized environments.

This shift is driven by the growing need for speed, resilience, and autonomy. Military operations take place in dynamic and often contested environments, where connectivity is not guaranteed and latency directly impacts mission outcomes. As a result, computing capabilities must move closer to the source of data. Edge and fog systems need to be compact, energy-efficient, and capable of running advanced workloads, such as AI inference under constrained conditions.

At the same time, the convergence of Operational Technology (OT) and Information Technology (IT) becomes a defining factor. Systems that were previously isolated—such as platforms, sensors, and industrial assets—are now part of a connected, software-defined ecosystem. This requires seamless integration across hardware, software, and networks, supported by standardized interfaces and modular architectures.

Connectivity remains a key enabler, but no longer the default. Technologies such as satellite communication or 5G enable high-performance, low-latency communication, especially for mobile and distributed systems. In parallel, concepts such as mesh-based communication in swarms extend this further by enabling systems to exchange and route data dynamically between nodes without relying on fixed infrastructure. This creates adaptive, self-organizing networks that can operate even in the absence of centralized connectivity.

AI plays a central role in this context. Embedded AI at the edge enables local decision support, anomaly detection, and autonomous system behavior. It reduces the need to transfer large volumes of raw data, allowing systems to act immediately on insights.

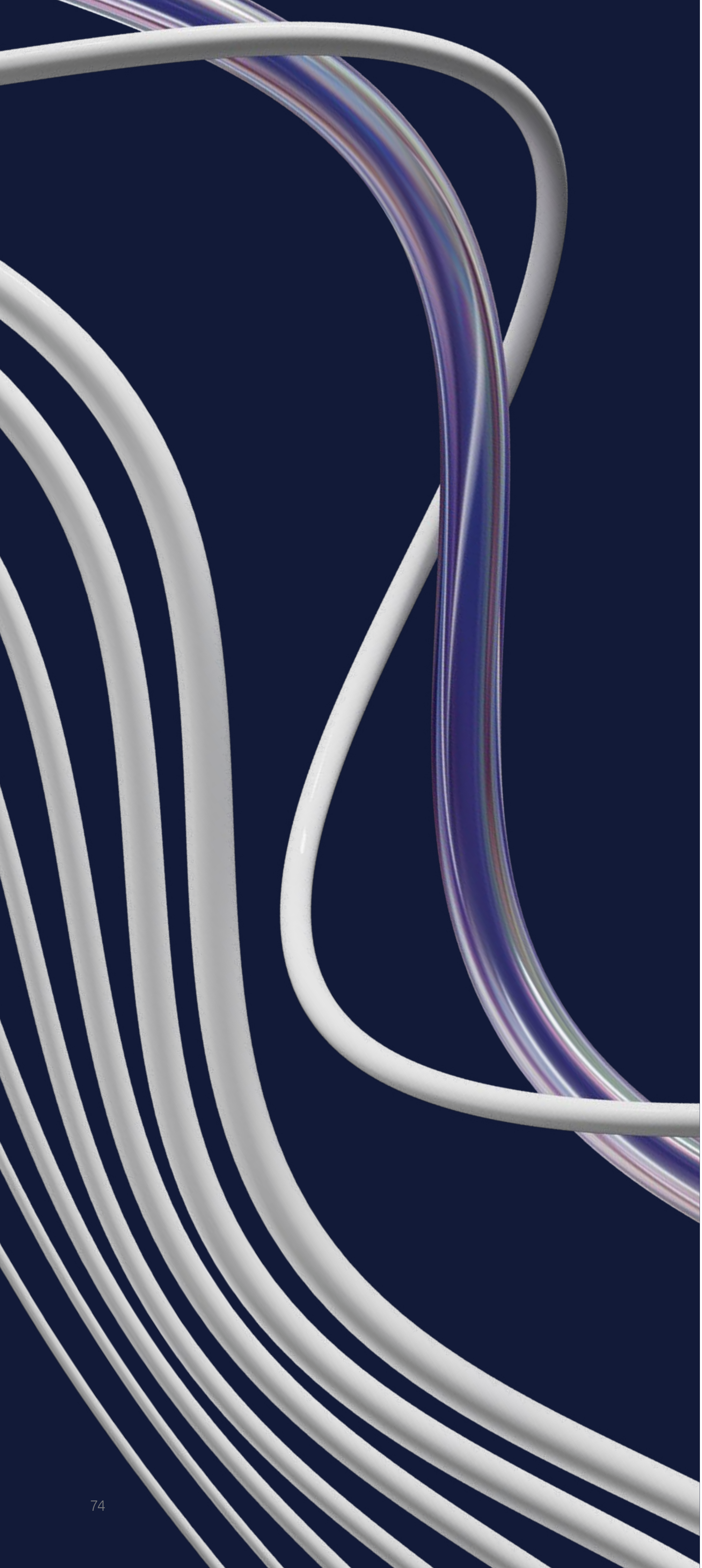
Overall, Simply the Edge describes the transition from centralized infrastructure to distributed, mission-ready computing environments where software-defined capabilities are executed under real-world conditions.

Impact

The impact of *Simply the Edge* is visible across operations, platforms, and the defense industrial base. By moving compute and intelligence closer to the mission, organizations can significantly improve decision speed, operational resilience, and overall system efficiency.

One of the key benefits is reduced dependency on centralized infrastructure. Systems operating at the edge can continue to function even when communication links to command centers or cloud environments are disrupted. Processing data locally ensures that essential capabilities remain available in contested and congested environments.

Another key impact is the optimization of data flows. Instead of transmitting large volumes of raw data, edge systems process and filter information locally. Only relevant or mission-critical data is shared with higher-level systems. This reduces bandwidth usage, improves performance, and supports data sovereignty. Raw data will be computed later at the fog or core level.



Edge computing also enables new levels of autonomy and human-machine collaboration. AI-driven systems can assist operators directly at the point of action, enhancing situational awareness and enabling faster decisions without relying on centralized analysis. In distributed setups such as mobile units, this allows systems to coordinate actions in real time through local data exchange.

In industrial environments, the same principles apply. Platforms and production systems generate vast amounts of data that can be processed locally to improve performance and maintenance. Aggregated insights are then synchronized with central systems for further optimization.

At the same time, challenges remain. Edge deployments must balance performance with size, weight, and power constraints, while also ensuring security across distributed architectures.

Use case

The German Armed Forces (Bundeswehr) are testing AI-enabled drone swarm capabilities that connect reconnaissance drones, software, and loitering munitions into a single operational system. During trials, unmanned systems detect targets, share information in real time, and enable rapid engagement decisions within a highly digital, networked environment. By combining autonomous coordination with distributed data processing at the edge, the system significantly reduces the time between detection and action and enables resilient operations even in complex battlefield conditions.

Mark Chang

New computing architectures are emerging, such as in quantum, AI, and neuromorphic chips, rewriting the rules and possibilities of innovation.

Ok Qompute

What

Quantum computing has spent 40 years crawling from Feynman's blackboard sketches to lab queens chilling near absolute zero. Today, after a decade of the Noisy, Intermediate-Scale Quantum (NISQ) era, even the physicists who coined the term are asking if we are at the end of this phase. Here's the key point: Quantum computing is poised to offer a huge transformational shift in compute capability imminently, and organizations need to prepare now for this change. Quantum technologies create opportunities, and also threats.

Why are quantum computers so (theoretically) powerful?

A quantum is the smallest possible, indivisible unit of any physical item, the fundamental building block of the universe. At this subatomic level, the standard rules of physics no longer apply. Quantum technologies exploit these properties like tunnelling, used by transistors to control electron flow in ways we could not do with classical physics. More recently, we have learned how to manage superposition (Schrodinger's cat) and entanglement (where particles are linked over vast distances) which has opened the doors to increased capabilities across sensors, clocks, integrated chips and the sum of all these parts, quantum computers.

Quantum sensors are already spookily good, so we expect even more for quantum computing as the most ubiquitous application of this technology. Unlike classical computers, which process information using "bits" that are either 0 or 1, quantum computers use "qubits" which exist in multiple states simultaneously (superposition), so can exist as a 0 or a 1, or both, simultaneously, exponentially increasing the compute power by evaluating multiple possibilities at the same time. Using entanglement, qubits can also be linked together, scaling compute power even more as more qubits are added.

Current quantum computers are not scaled sufficiently, and several key problems will need to be overcome. Physical qubits are fragile and difficult to control, requiring complex error correction architectures that must work while the quantum states are available. The outputs after stabilization and correction are logical qubits, linked by quantum gates. Scaling from today's few hundred qubits to useful numbers (millions) is still to be solved in a cost-effective way.

So, with NISQ we are in the awkward teenage phase. These machines can't correct all their errors, yet are shockingly good at certain sampling problems, the kind that tie classical supercomputers in knots. Classical/quantum hybrids, with quantum systems for gnarly math while classical compute deals with the "paperwork", show promise. Drug discovery, logistics and materials science are among the many areas we are making progress. The next five years (2026-2030 inclusive) are potentially transformational, with error-corrected logical qubits arriving at scales that are operationally useful. Technically this ranges from 50 to 1000 physical qubits with limited coherence and error rates of around 1%.

Impact

Creating fault-tolerant systems at 1,000+ logical qubits will break conventional public key cryptography. At around 10,000 logical qubits, quantum computing will yield truly transformational advances. With big quantum computing companies targeting as many as 80,000 logical qubits (based on 2 million physical qubits) by the end 2027, there is going to be a real shift in our infrastructure,

which will percolate out to produce new computing capabilities. 2030 may be quantum computing's key year we will see opportunities through the impact of quantum clocks in mobile communications and entanglement chips in proof-of-concept assets, for example.

We are also at risk of a major threat. Quantum computing is likely to be able to break standard public key encryption algorithms which rely on factoring very large numbers: these secure today's internet, and most organization's data and communications. This means that bad actors can profit from gathering encrypted data now in the expectation that it will be possible to decrypt in the very near future. This can be mitigated right now by migrating to encryption algorithms that have been judged to be quantum safe in a post-quantum-cryptography (PQC) world by the US' NIST. As technologies are replaced, organizations should ensure that new systems are both quantum-ready and 'crypto-agile' – that is, designed to swap out cryptography algorithms easily as new threats emerge. Where distances are vast, as with satellite enabled communications, quantum key distribution (QKD) can be employed to catch eavesdroppers in real time.

Think of introducing PQC and QKD changes like retrofitting your home before the on-coming hurricane hits. It is essential. Do it now.

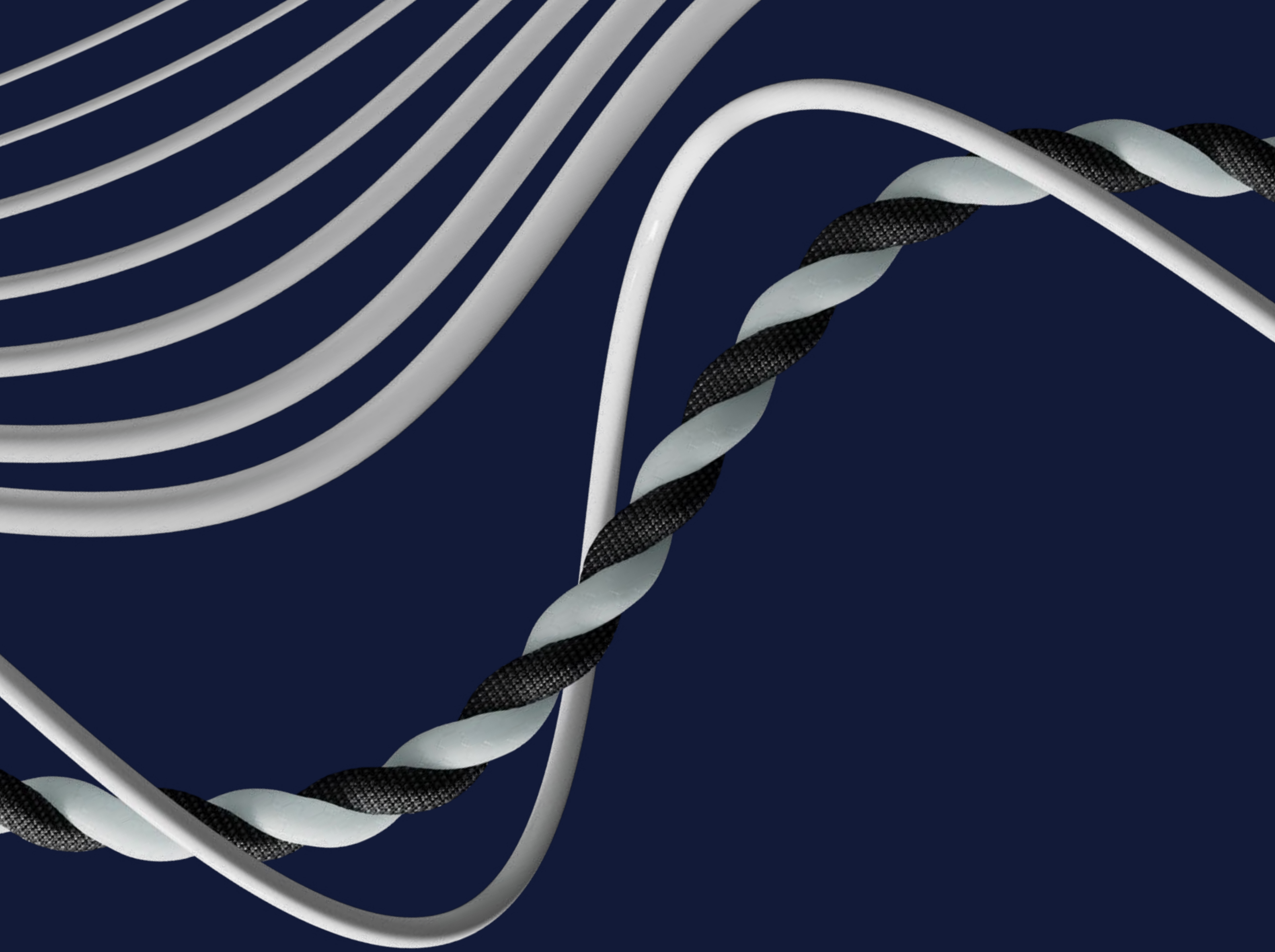
By 2030, we bet that hybrid classical-quantum systems will be employed in niche industrial use. That's the moment quantum stops being a promise and starts to be a pipeline of deliveries. The NISQ era will experience a slow fade. If done well, the real shift will not be dramatic. It should be a slow, fascinating grind in the same way all the best technology changes happen.

Use case

Capgemini' s Quantum Lab (QLab) partnered with Airbus to address the challenge of corrosion in aerospace aluminium alloys, which causes significant maintenance costs and aircraft degradation. Simulating the exact micro-level surface reactions, such as the Oxygen Reduction Reaction (ORR), requires deep computational chemistry models that are too complex for traditional supercomputers.

The project developed a hybrid quantum-classical computing workflow to simulate these surface reactions at the molecular level. The proof-of-concept successfully established a foundational framework for quantum chemistry in aerospace. It clarified the quantum error-correction and algorithmic advancements needed to simulate full-scale material corrosion and coating.

This hybrid quantum computing workflow was the first of its kind. As a result of these collaborative efforts, Capgemini and Airbus established an essential foundation for applying quantum computation to atomistic modelling, highlighting its potential to address complex, business-relevant challenges in aerospace and materials science. Though this research represents a big step forward for organizations, it also underlines the need for significant advancements in quantum hardware, algorithms, and error-correction techniques to make quantum computation viable for business use. This list of "must haves" is being addressed step-by-step, leaving us to simply say: OK Qompute! Let's see what you've got next.



09 Balance by Design

Adrien Calvayrac

Move from alignment to unity of business and IT, creating a seamless technology business of strategy and operations, delivering a continuous flow of value.

Technology ∈∋ Business

What

Every business is a technology business. Once a brand new TechnoVision slogan, it is now a structural fact. Technology has become the backbone of every business.

In Aerospace & Defense, this statement rings true, especially in 2026. Technology is pervasive and keeps organizations at the edge of the market. We are now seeing a convergence of technologies in this sector—more multi-domain programs, more software-defined products, and a large dependency on ecosystems, supply chains, partners. Everything is more interconnected and data driven. There's also a need to master sovereignty of technology, data, and infrastructure. All these factors are putting increasing pressure on the technology side of the business.

Aeronautics is pursuing the quest to a better industrial performance, enabling to secure the ramp-up it needs while preserving an imperative quality. Full digital aircraft is also slowly appearing at the horizons, progressing at technology pace, and so does its sustainability.

Defense, an industry used to decade-long cycles, is stressed to speed them up—from innovation to product development and deployment. At the same time, the unstoppable move from product-driven to software adapted to software-defined defense is mostly driven by new entrants living at technology state of the art.

And New Space is all about a new unity between technology and business. Defined by new players, services and business models, this era has enabled greater innovation, opening the doors for other sectors to leverage space technologies for business development. From startups to GAFAM, the space playing field is expanding like never before, bringing new space services to all other industries.

So, this trend is no longer about digital transformation. Technology is no longer an enabler of the business—it is the core of the business. Products, operations, and decision-making are becoming inseparable from digital capabilities, data, and AI. The boundary dissolves, giving rise to a unified, technology-driven enterprise, where value creation is continuous, adaptive, and embedded into every system.

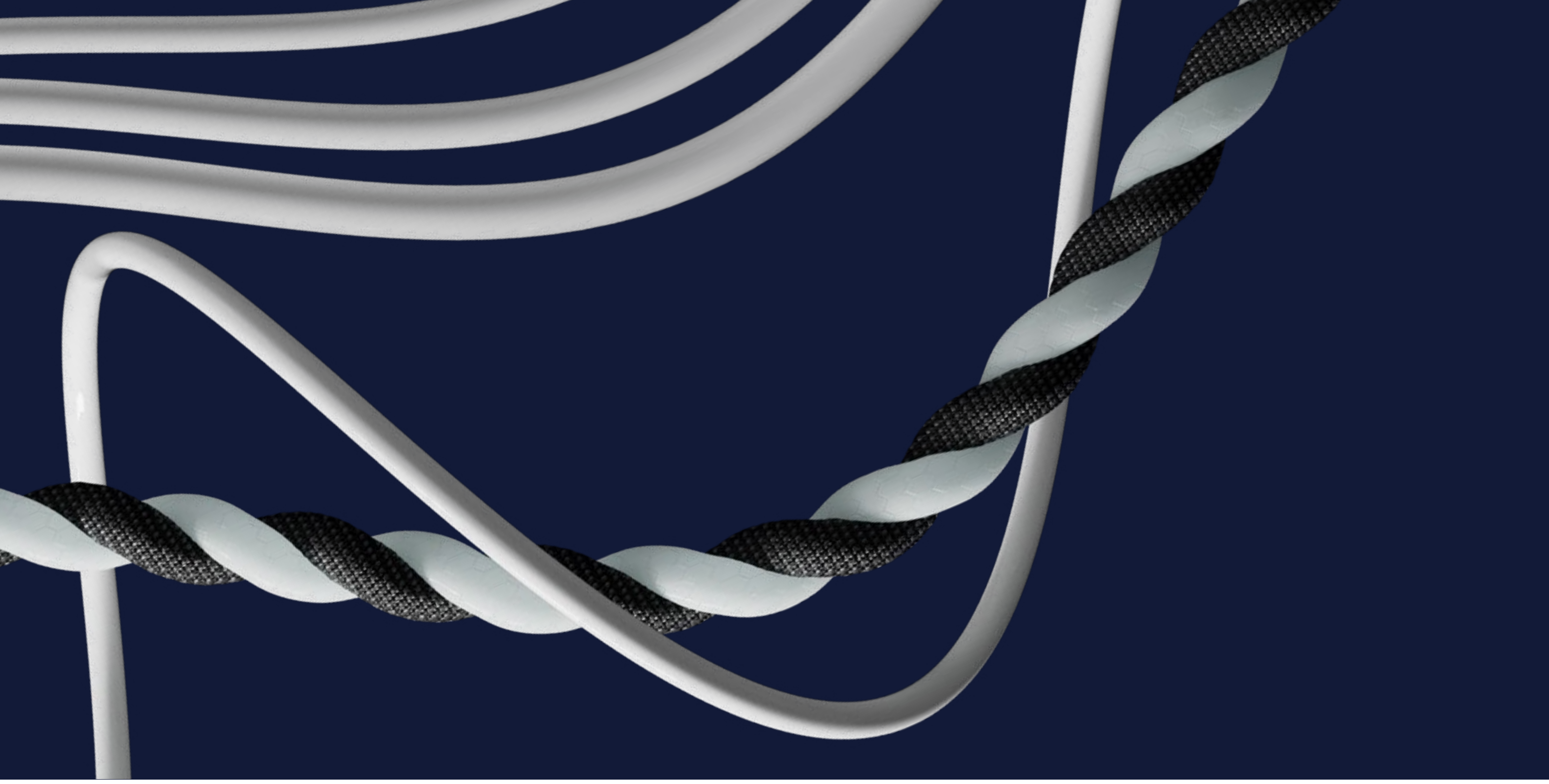
The challenge is no longer to align IT with business—but to design systems where technology and business are intrinsically fused by design.

Impact

A&D is undergoing a massive technology-driven transformation, shaped by AI, where we could see four main axes—moving from siloed engineering to a multi-domain integrated digital continuity, redesigning workflows and defining a new humans-agents working model, evolving from static processes to adaptive operations, and succeeding the transition to software-driven products.

Technology enables adaptive operations across design, manufacturing, and supply chain. There is productivity expectation, time-to-market improvement, data reliance to achieve transformation. The target is a new industrial model characterized by autonomous systems, self-orchestrated supply chains, and production environments managed through simulation and digital twins.

However, achieving this vision comes with several challenges, including the need for strong AI governance, effective integration of legacy and modern systems, and ensuring sovereignty over data, infrastructure, and models.



Organizations must also address a significant talent gap, which requires not only upskilling but also a shift in mindset and capabilities. toward human-AI collaboration.

These transformations are materializing differently across the main segments of the A&D industry, where the convergence of technology and business is reshaping operational models in a very concrete way.

In the space sector, the rapid expansion of satellite constellations is forcing the space industry to rethink its industrial model. Manufacturing is shifting toward high-volume, software-driven production, requiring more automated and data centric processes. At the same time, the increasing dependency on launch capabilities highlights the need for resilient and scalable access to orbit. Sustainability is also becoming a critical concern, driving innovation in reusable launchers and in-orbit services such as debris removal and satellite maintenance. Together, these dynamics are reshaping the space economy toward a more industrialized, service-oriented, and technology-intensive model.

In the defense sector, the convergence of technology and business is even more critical. Modern warfare is increasingly shaped by software-defined systems, AI-driven decision loops, and multi-domain operations. The ability to process vast amounts of data, generate actionable insights, and execute decisions at machine speed is becoming a key differentiator. This shift is driving a transformation from platform-centric to capability-centric models, where value lies in integrated systems and real-time adaptability. As a result, defense organizations must ensure both technological superiority and full control over data, systems, and AI models, making sovereignty a core strategic imperative.

Use case

The exponential growth of AI workloads is putting increasing pressure on terrestrial infrastructure, facing constraints in energy, cooling, land, and sustainability. In response, a new paradigm is emerging: moving compute capabilities directly into space.

Early initiatives such as Starcloud's deployment of AI modules powered by NVIDIA H100 chips demonstrate the feasibility of processing Earth observation data directly in orbit, delivering high computational performance while leveraging solar energy and passive cooling.

At the same time, major players like SpaceX, Amazon, and Google are exploring large-scale orbital data center infrastructures, combining satellite constellations, optical communication, and distributed compute capabilities to create a fully integrated space-based cloud ecosystem.

This approach offers unique advantages: virtually unlimited solar energy, reduced environmental impact, global coverage by design, and proximity to data sources such as Earth observation systems. It also opens the door to new architectures where data is processed at the edge—in space—before being transmitted back to Earth.

While still emerging, and with a lot of technological challenges to unlock, orbital data centers illustrate a radical evolution of the Technology ∈∋ Business paradigm: infrastructure itself becomes part of the value chain, redefining where and how digital capabilities are delivered. In the long term, this could fundamentally reshape AI infrastructure, enabling new space-driven services and transforming the role of space in the global digital economy.

Philippe Koffi

Design every process with the ambition of full, hands-free automation, yet never lose sight of the ultimate goal: to amplify human intelligence. Let AI handle the routine, repetitive, and resource-hungry tasks, so people can focus on creativity, judgment, and purpose.

WE augment!

What

In Aerospace & Defense, human augmentation is no longer only about equipping individuals with better tools, displays, sensors or AI assistants. It is increasingly about augmenting the collective ability of commanders, operators and coalition forces to understand, decide and act faster in complex, contested and software-defined environments.

As defense capabilities become more distributed, data-driven and autonomous, humans are surrounded by a growing ecosystem of sensors, effectors, unmanned systems, AI services and command-and-control platforms. Yet these technologies only truly augment human decision-making if they can interoperate. Without interoperability, information remains fragmented, autonomy remains trapped in silos, and operators face greater cognitive burden rather than greater operational clarity.

This makes interoperability a foundational condition for human-machine teaming at scale. It enables data, mission services and operational intent to flow across platforms, domains and nations. It allows AI-enabled systems to support humans with relevant, contextual and timely recommendations. And it helps transform multiple independent systems into a coherent operational system-of-systems.

But interoperability is also a constraint. In coalition operations, each nation brings its own platforms, security rules, data models, sovereign technologies and operational procedures. The challenge is therefore not only to connect systems technically, but to design architectures that allow partners to collaborate while preserving control, trust, sovereignty and mission assurance.

Impact

In increasingly software-defined defense environments, interoperability becomes both an operational accelerator and an architectural discipline. It allows coalition forces to integrate new capabilities faster, combine manned and unmanned assets, and adapt mission systems as threats evolve. It also creates the conditions for AI and autonomy to support the human at the right level: not by replacing judgment, but by reducing friction, surfacing options and enabling better-informed decisions.

For defense organizations, this changes the way capabilities must be conceived, procured and deployed. Interoperability can no longer be treated as a late-stage integration problem. It must be designed from the start through open architecture, common data models, shared semantics and ontologies, modular interfaces, edge-ready services and clear governance of what can be shared, with whom, and under which operational constraints.

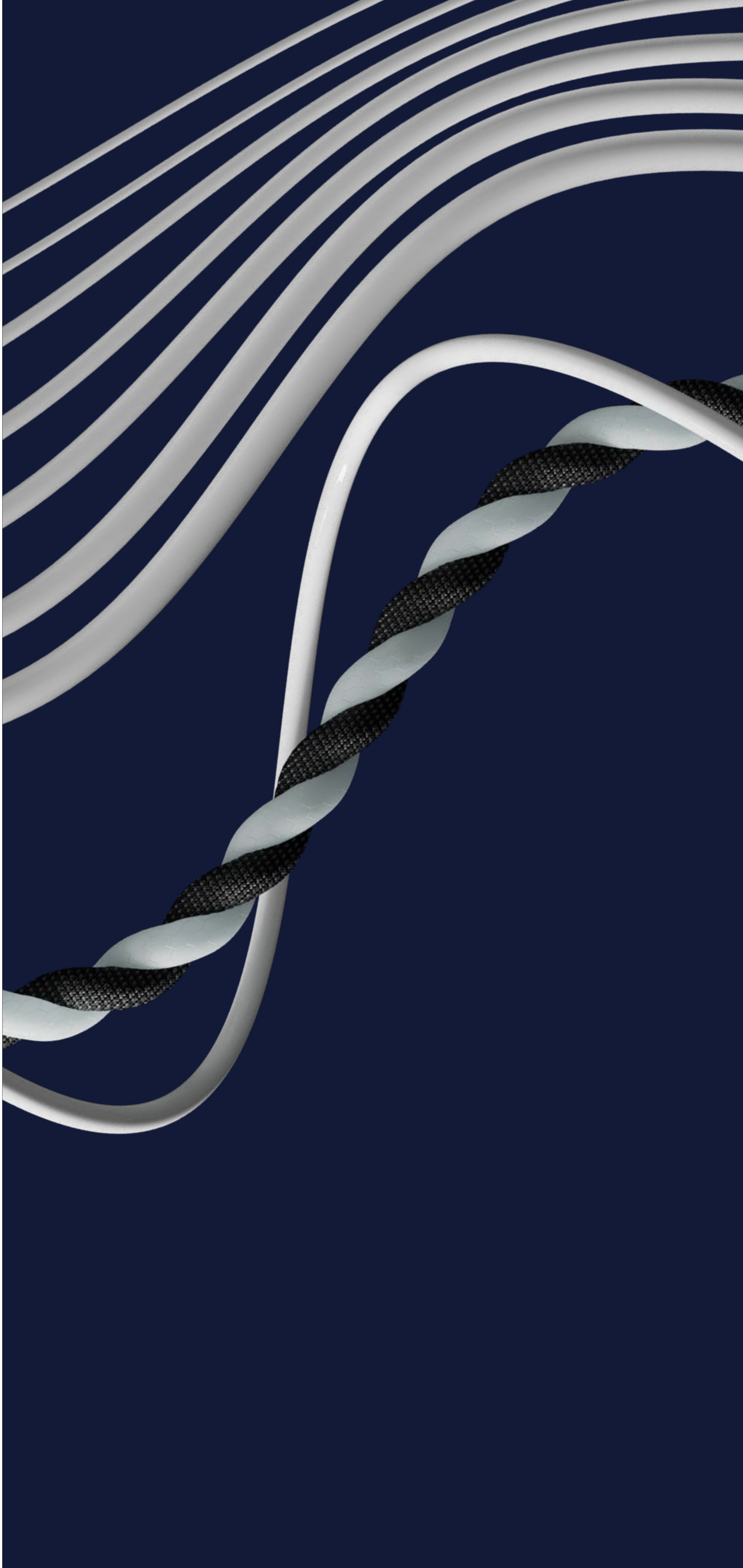
This is particularly critical for coalition operations, where the speed of action depends on the ability to connect heterogeneous systems without forcing all partners into a single technology stack. The future of augmentation will therefore rely on architectures that are vendor-agnostic, mission-configurable and sovereign by design, enabling forces to plug in new assets, applications and AI services while keeping humans firmly in command.

Use case

Capgemini is supporting this shift through the development of software-driven defense architectures that enable interoperability between command-and-control systems, autonomous platforms, edge services and mission applications. By combining expertise in systems integration, AI, data architecture, cyber-secure platforms and human-centric design, Capgemini helps defense organizations move from isolated capabilities to interoperable mission ecosystems.

One emblematic example is the development of the Mission Operating System (MOS) concept that allows heterogeneous unmanned systems, sensors, effectors and C2 platforms to be orchestrated through a common software layer. Such an approach can help coalition forces integrate new mission applications, connect different classes of unmanned vehicles through a canonical data interface, and support human operators with a clearer and more actionable operational picture.

In this model, augmentation is not limited to adding more automation. It comes from giving commanders and operators the ability to compose, supervise and adapt complex mission systems in real time. Interoperability becomes the enabler of trusted human-machine teaming: connecting assets across domains, reducing cognitive overload, accelerating operational tempo and preserving human control in the face of growing technological complexity.



Julie Albert

Drive sustainable aerospace transformation by prioritizing high-impact initiatives, leveraging technology to optimize trade-offs, and deliberately reducing complexity and resource consumption across the lifecycle.

Do Good, Do Less, Do Well

What

Sustainability in Aerospace & Defense has entered a new phase—one defined not by vision alone, but by urgency and execution. The challenge is no longer to define the destination, but to move decisively toward it, in a context where time, resources, and industrial capacity are increasingly constrained.

Across the industry, a clear direction is emerging. The ambition to decarbonize remains strong, but it is now coupled with a more disciplined approach to delivery. Organizations are prioritizing solutions that can be deployed at scale, within existing operational and economic realities, while acknowledging that not all technological pathways will mature at the same pace.

This evolution is driven by a broader shift in context. Sustainability is no longer only an environmental imperative; it is becoming a defining factor of competitiveness and sovereignty. Supply chains are under pressure, critical raw materials are increasingly constrained, and access to key resources is shaped by geopolitical dynamics. In this environment, design choices take on a new strategic dimension. Materials, architectures, and sourcing strategies must now balance performance, environmental impact, and long-term resilience.

As a result, the industry is progressively embracing a principle that has long been underutilized: simplification. Reducing complexity, focusing on scalable platforms, and prioritizing high-impact initiatives are becoming essential levers to deliver both sustainability and efficiency. This "do less, but better" mindset is also reshaping investment strategies, directing capital toward solutions that can deliver tangible benefits in the near term, while maintaining a measured commitment to longer-term innovations.

This is particularly visible in the energy transition. While breakthrough technologies continue to shape the long-term vision, the immediate focus is on solutions that can be implemented today. Sustainable Aviation Fuels are gaining momentum as a key enabler of emissions reduction, precisely because they can be integrated into existing fleets and infrastructures. At the same time, their deployment highlights a critical reality: sustainability at scale depends not only on technology, but on the ability to align supply, demand, policy, and investment across the ecosystem.

Technology is a central enabler of this transition. Advanced simulations and AI are transforming how trade-offs are managed, enabling engineers to integrate sustainability constraints directly into design. Digital twins provide visibility across the lifecycle, while data platforms ensure traceability and transparency across increasingly complex value chains. Together, they allow organizations to make more informed, more deliberate decisions—turning sustainability from aspiration into operational discipline.

Impact

This shift toward pragmatic sustainability is reshaping the aerospace value chain at its core, redefining how decisions are made across engineering, supply chain, and business strategy.

In engineering, sustainability is becoming a non-negotiable constraint. Design is no longer optimized for performance alone, but must integrate material criticality, recyclability, and environmental impact from the outset. This leads to more intentional designs, where trade-offs are explicitly managed through advanced simulation and data-driven approaches.

Supply chains are undergoing a parallel transformation. The growing pressure on raw materials and the increasing volatility of global trade are pushing organizations to rethink sourcing strategies. Diversification, substitution, and enhanced visibility across tiers are becoming essential to balance resilience and sustainability. What was previously optimized for efficiency must now account for robustness and sovereignty in an increasingly uncertain environment.

The energy transition further illustrates this rebalancing. The industry is aligning solutions that can deliver measurable results within current constraints. Sustainable Aviation Fuels are emerging as the most immediate lever for reducing emissions, while also exposing the structural challenges of scaling production and ensuring economic viability. This shift reflects a broader realization: progress depends as much on industrial and financial alignment as on technological innovation.

At the same time, digital technologies are enabling a more integrated approach. The emergence of end-to-end digital value chains allows organizations to connect design, manufacturing, and operations, embedding sustainability metrics throughout. Data becomes central to ensuring compliance, transparency, and trust, particularly in the context of increasing regulatory scrutiny and stakeholder expectations.

These combined dynamics are leading to a redefinition of competitiveness. Organizations are moving away from fragmented initiatives toward more focused, high-impact strategies. Success increasingly depends on the ability to concentrate efforts, orchestrate ecosystems, and align innovation with market and regulatory realities. Collaboration between industry players, policymakers, and financial institutions is becoming critical to enable scale and ensure consistency between ambition and execution.

Ultimately, a new equilibrium is emerging. Performance, cost, sustainability, and resilience are no longer treated as separate objectives, but as interdependent dimensions of a single system.

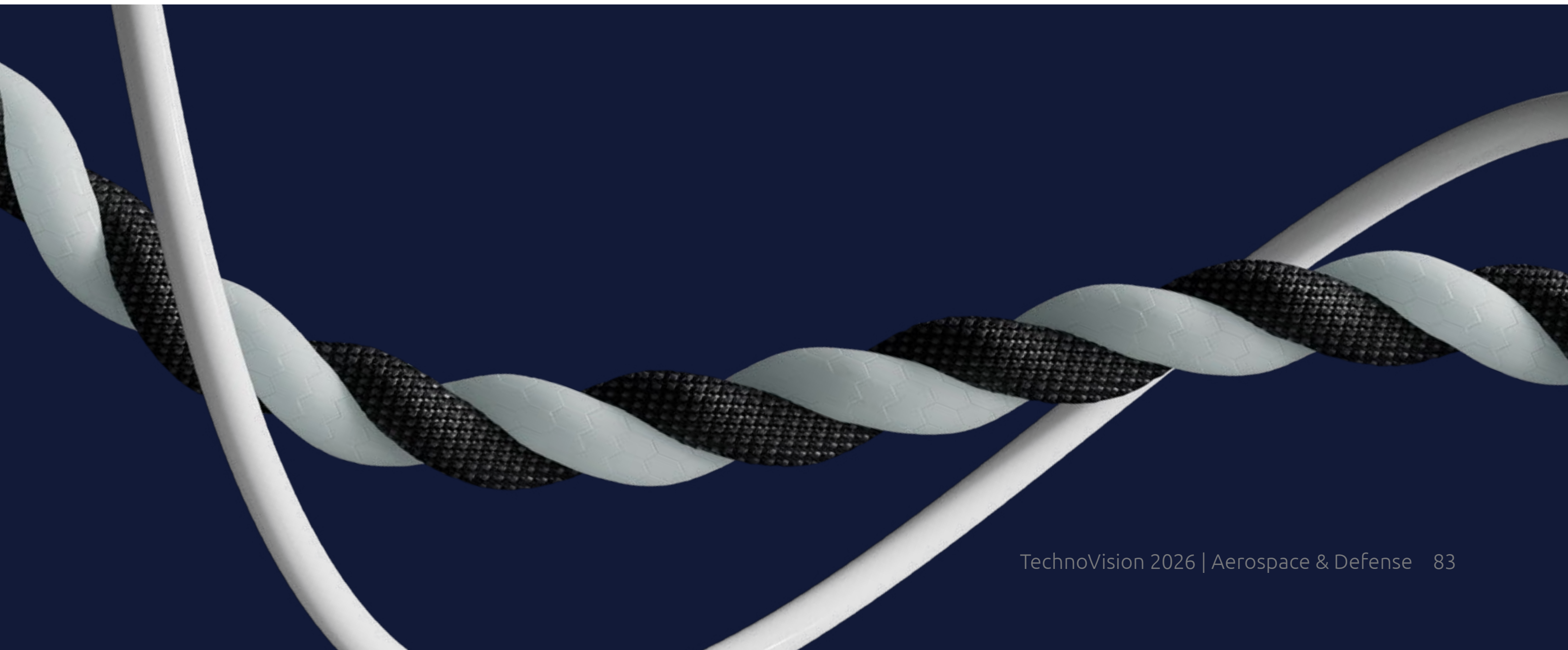
Use case

The partnership between Capgemini and Ascendance provides a concrete illustration of how this new balance between ambition and execution can be achieved.

Through its hybrid-electric propulsion system, STERNA, and its VTOL aircraft, ATEA, Ascendance is developing solutions that combine technological innovation with practical deployability. By leveraging modular architectures and hybrid energy systems, these solutions offer a credible pathway to reduce emissions while remaining aligned with industrial and operational constraints.

Supporting such initiatives requires more than technological expertise. It demands the ability to scale, industrialize, and integrate solutions within a broader ecosystem. Capgemini contributes through its end-to-end capabilities, spanning engineering, industrialization, digital continuity, and data-driven transformation. This integrated approach enables a holistic view of performance and sustainability across the lifecycle.

This collaboration highlights a key lesson for the industry: sustainability is not achieved through isolated breakthroughs, but through coordinated transformation. It requires aligning technology, industrial capacity, and ecosystem dynamics to turn innovation into measurable impact.



John Ogden

Ensure defense organizations exemplify agility, resilience, and connectedness to deliver a continual flow of innovation whilst regaining sovereign control over their most critical assets.

Be Like Water

What

The central challenge is balancing sovereignty with agility and innovation. Defense organizations must continually evolve industrial paradigm and operational environments. The age of delivering "perfect systems" to a decades old requirements is over. Success now means delivering ~90% of capability early, then rapidly iterating based on operational feedback. Sovereignty concerns are changing the dynamic between demanding exclusive national control and defaulting to global providers. Resilience is now based on mutual interdependence among allied nations with hybrid sovereign cloud addressing autonomy alongside its traditional focus avoiding undifferentiated heavy lifting.

Strategic autonomy must be a launchpad, not a fortress, hence, transformation must be prioritized to translate political intent into technical reality. This cannot be achieved without a deep understanding of the evolving services a minimum viable company depends upon. Building autonomy demands widescale interoperability, portability between providers, and a new class of product-integrators able to rapidly recombine diverse product sets and ownership models to meet fluid needs.

We are entering the age of software-defined defense. Capabilities are no longer anchored solely in physical infrastructure like submarines; software has become the connective tissue across the digital value chain. Unlike hardware, software is rapidly iterated, enabling a more connected operational environment, where effective decision making requires faster, better-informed analysis to drive better outcomes.

Artificial Intelligence is accelerating both decision-making and product development. Meanwhile the volume and complexity of software is growing, and security patches increasingly resemble a firehose. Systems are becoming simpler, cheaper and faster to produce; this distorts the economics of mission environments and demands ever greater innovation to counter.

Impact

The "Well of Innovation" increasingly sits outside traditional defense players; research labs, startups, and technology firms are redefining the landscape bringing pipelines of problem-focused solutions to market faster. Secure borderless collaboration is demanded; whether for design, manufacturing, logistics, operations, or maintenance. Future capability will be created from this international ecosystem, not a single prime. Like water, defense organizations must rapidly absorb and channel these innovations.

Sovereignty has shifted from a technical concern to a boardroom priority—with roadmaps based on risk and business impact rather than ideology. Innovation cycles have compressed from years to weeks. Procurement and planning must adapt accordingly, shifting from rigid, waterfall-defined contracts to models that prioritize the continuous flow of innovation and sovereign autonomy. Digital feedback loops must provide real-time insight, enabling R&D to focus on the highest impact needs. "Real lab" environments are emerging, where startups and operational units co-develop, test, and deploy solutions at unprecedented speed.

Like water, innovation and sovereignty flow fastest when unimpeded. Defense is therefore embracing practices once considered incompatible: cloud services augmenting bespoke infrastructure retained on-premises; "need-to-share" and public attestations balancing the secrecy of "need-to-know", and resilience through mutual reliance on allied nations. Innovation must not come at the expense of security. However, defense organizations are increasingly moving away from periodic accreditation, with zero trust principles and continuous assurance becoming the foundational enablers of change acceleration.

Use case

Capgemini is the largest EU-based systems integrator; offering broad collaborations across Aerospace & Defense. Our partnerships with leading dual-use pioneers and startups like Blackshark.ai demonstrate how advanced technologies can be rapidly adapted for defense. Capgemini also supports the next generation of dual-use ventures; partnering with the BASED initiative—an ambitious effort to develop Europe's next generation of defense unicorns. Through these partnerships, Capgemini bridges the gap between commercial innovation and defense needs, combining startup agility with operational impact.

Lucy Mason

Power up the entire trust ecosystem—from people to platforms, from the edge to the core.

Trust Thrust

What

Trust is one of the most important things for people. Trust is when we believe that a person, process or system can be relied upon to do what we need it to do. Falsity, unreliability, and obscurity all erode trust. Lost trust can rarely be regained.

In Aerospace & Defense systems, trust is critical. Systems (i.e. technologies, people and processes working together towards a goal) are deployed in highly unpredictable, risky, environments. Decisions are distributed across multiple actors, often time-critical, and informed by data that needs to be shared across organizations and allies. People need to trust that systems will operate as intended. Huge amounts of effort and money is spent making systems robust, secure, and reliable.

Trust is, therefore, a core design principle. But why is it so hard to achieve?

Complexity is one reason. In Aerospace & Defense, systems are complicated, dynamic, multi-layered, and accrete over time, introducing uncertainty and a lack of transparency. Systems designed for one purpose may not work the same in a different context.

Another reason is, unfortunately, people. Insider threats are a well-understood problem—when someone in your system is working against your goals. Also, people make mistakes.

We are also in a highly adversarial geopolitical ecosystem. Other countries and organizations are motivated to infiltrate and steal secrets, or try to break or control their adversaries' systems. Sovereignty means having the right levels of jurisdiction, control, survivability, and deniability to protect your systems.

There are other structural and technological challenges which erode trust. Trusted computer systems such as at higher security classifications are usually air-gapped in access-controlled locations: but as software services move to cloud platforms, it will likely be harder to deliver cutting edge capabilities using these traditional approaches. Value is driven from joining up data and increasing real-time data analysis: but doing so creates vulnerabilities and can introduce error. AI can generate incorrect information, which can be fed back into the training models. AI "agents" create a new layer of complexity by acting on our behalf to achieve a goal: whether they can be trusted to do so is key.

Impact

So, what can we do to ensure trust?

Imlpementing Secure by Design principles ensure security and trust are considered at the outset, because retrofitting trust to untrusted systems is far more difficult and costly.

"Zero trust" approaches assume no implicit trust in users or devices, by enforcing continuous verification and strong cryptographic protections, thereby enabling flexible, secure operations. Zero trust is a set of capabilities, technologies and processes to be adopted enterprise wide. The model supports bring-your-own-device and multi-device connectivity, essential for a modern hybrid workforce and cross-border collaboration.

Data centric security, Identity and Access Management Systems (IAMS), and Fully Homomorphic Encryption (FHE) together can protect sensitive information at every stage. Data- centric security protects data through encryption, tagging, and usage policies rather than just securing the perimeter, critical in highly interconnected supply chains. IAMS ensures only verified personnel and systems have access. FHE is an emerging privacy-enhancing technology which enables computations on encrypted data in situ without exposing it in transit or decryption.

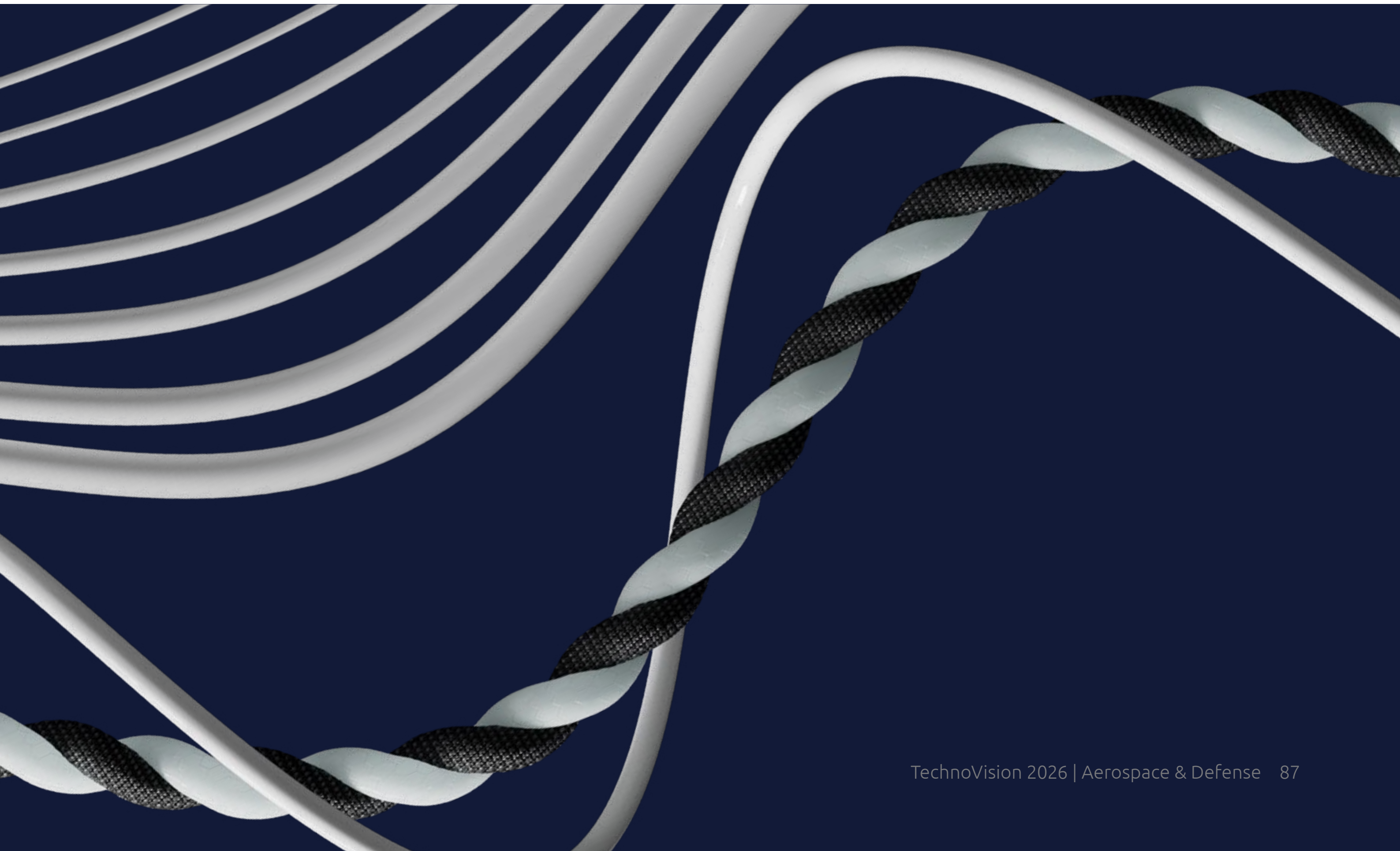
The third layer of trust is strengthened governance and assurance mechanisms. For AI, this means developing AI assurance frameworks, improved model validation and auditability, and enhanced data governance. Clear guardrails for the deployment of autonomous and agent-based systems must be established.

Most of all, trust must be treated holistically, across people, organizational, and technological layers. This means strong leadership, continuous management, psychological safety to raise challenges, and good risk/benefit approaches. There needs to be cultural adoption and compliance.

Trust is not about slowing innovation down. It is what enables innovation to scale safely, operate reliably, and deliver enduring advantage in increasingly complex and contested environments.

Use case

Bleu is a joint venture between Capgemini and Orange to make familiar Microsoft solutions available in a trusted cloud environment, focused on the public sector, and organizations operating in critical industries, in the French market. Bleu was specifically created to meet the stringent SecNumCloud certification set by ANSSI (the French National Cybersecurity Agency). Bleu provides a trusted sanctuary for highly regulated organizations to process their sensitive workloads, allowing them to legally engage with sensitive clients.



A few more things... in Aeronautics

Frédéric Grousson
VP and Head of Aerospace & Defense,
Capgemini Engineering

A defining decade for the industry

Civil aeronautics is entering a period of intense activity as the industry must continue delivering current aircraft while preparing its next generation of aircraft, expected to enter service between 2035 and 2040.

Over the next three years, manufacturers will work toward designing these new programs, marking a critical phase for the entire ecosystem. The effort involves all major Original Equipment Manufacturers (OEMs), including Airbus, Boeing, and the Commercial Aircraft Corporation of China (COMAC). It also depends on a large supply chain, with suppliers building nearly 80 percent of the aircraft across multiple tiers, from Tier 1 to Tier 7. This means the entire ecosystem must scale simultaneously.

Talent as the core structural constraint

As this ramp-up accelerates, the main challenge becomes clear: talent. The industry will need an estimated 500,000 engineers worldwide, and this demand will rise quickly. However, there are not enough people available, especially in Western countries such as Europe and the United States. Aeronautics schools train about 80,000 engineers each year, while around 110,000 experienced professionals retire annually. This creates a clear gap between demand and supply.

This gap is not only about numbers; it also reflects a loss of experience. Many people who retired joined the industry in the 1980s and 1990s, and when they leave, they take critical knowledge with them.

The situation becomes more complex due to changes in national priorities. Many countries aim to bring work back within their borders and strengthen the local industry. However, this does not always align with where talent is available. Companies must find a balance between building local capabilities and accessing skilled people, while also considering nationality, security, and confidentiality requirements. Countries such as India can provide talent at scale, but leveraging this talent must align with these constraints.

AI: a natural but constrained response

In this context, AI is often viewed as a lever to mitigate both the talent shortage and the loss of expertise.

AI can improve engineering productivity and capturing knowledge from experienced professionals before they retire, and many organizations are already working on this. However, aviation authorities have established clear rules. Regulatory authorities such as the Federal Aviation Administration (FAA) in the USA and the European Union Aviation Safety Agency (EASA) impose strict boundaries do not allow AI to replace human designers, as aircraft design must remain predictable and fully traceable. In addition, certification frameworks for AI are still maturing, with strong requirements on data, traceability, and explainability. These constraints significantly limit the deployment of AI in critical engineering. As a result, AI can support engineers, but it cannot replace them. It will bring some efficiency gains in the near term, but it will not reduce the need for engineers in the short term. It will deliver only limited savings over the next three to four years. The most realistic use cases are likely to focus on **AI as an engineering assistant**. However, even that requires strong safeguards, including traceability of errors and false positives. There is also a human factors risk: if an AI tool proposes an answer, engineers may rely too much on it, fail to verify it sufficiently, or introduce cognitive bias into critical decisions. This creates a need for new expertise across the aerospace ecosystem. Companies will require skills in systems engineering and architecture, safety analyses such as FHA and FMEA, AI, data science, mathematics, statistics, human factors, and certification standards, including learning assurance and AI assurance. It also creates an opportunity for engineering partners to build dedicated pools of aerospace AI and certification experts, participate in regulatory and standardization working groups, and support clients in proof of concept and advanced research. As a result, the need for talent remains a key challenge, especially as demand increases toward 2030.

Technological evolution of the next generation aircraft

While engineering practices are evolving, the aircraft itself is also undergoing significant transformation. The next generation of aircraft will introduce many improvements:

- Advanced materials
- Increased electrification
- More efficient propulsion systems

Concepts such as hybrid propulsion (combining fuel and electric power) and open rotor architectures are actively being explored. These innovations will deliver meaningful efficiency gains compared to today's aircraft, although they remain largely evolutionary rather than disruptive.

A partial response to the sustainability challenge

Despite these advancements, this next generation aircraft will address only part of the environmental challenge. It will still rely on fuel-based propulsion systems, including hybrid solutions that combine fuel and electricity. As such, it is likely to represent a transitional step before more significant changes driven by 2050 net-zero goals.

Today, there is no complete solution for zero-carbon emissions in large aircraft. For now, Sustainable Aviation Fuel (SAF) is the only available option. SAF can reduce emissions and can be produced from sources such as used cooking oil. However, production remains limited and cannot meet demand on a global scale. It works for early adoption, but not for the whole market, and a fully scalable synthetic solution is not yet available.

Innovation at the edge of the market

At the same time, smaller players and startups are driving innovation exploring the latest ideas. Startups are developing hybrid-electric (such as Ascendance, which we support in their development) and fully electric aircraft for short-distance travel, usually carrying between four and 20 passengers. This smaller size makes technologies easier to test, and these projects act as early examples of what future aircraft could look like.

Rising demand and industrial tension

All of this is happening while aircraft demand continues to grow. The industry expects a need for around 40,000 aircraft over the next 20 years, while current production is already at full capacity. Launching a new program in this situation will require more people and stronger coordination across the ecosystem.

Balancing talent, AI, innovation, and regulation

The next decade will test the civil aeronautics industry in many ways. The industry must simultaneously scale its workforce, preserve critical knowledge, adopt new technologies, and deliver a new generation of aircraft under increasing industrial and environmental pressure.

Its success will depend on its ability to leverage AI as a productivity enabler—while operating within stringent safety and certification constraints.

Ultimately, this balance between talent, innovation, and regulation will define the future competitiveness and sustainability of the aviation industry.

A few more things… in Space

Patrice Duboé

EVP, CTIO Aerospace & Defense,
CTIO South & Central Europe, Capgemini

The space industry is moving beyond its role as a specialized sector and becoming a foundational layer of the digital economy. What started with lower launch costs and the democratization of access to orbit has evolved into something much larger. Space is no longer simply about launching satellites. It is about creating intelligent, interconnected infrastructures that enable communication, navigation, observation, computing, and security on a global scale.

Over the past decade, commercial players have transformed the economics of launch and satellite production. Today, the next wave of disruption is reshaping how value is created in orbit. Low-Earth Orbit constellations are becoming part of everyday digital infrastructure, delivering broadband connectivity, direct-to-device services, positioning, environmental monitoring, and real-time intelligence. At the same time, satellites themselves are evolving from passive sensors into software-defined platforms that can be continuously upgraded and increasingly perform AI-powered data processing at the edge.

This transformation is creating a new space economy where value is no longer driven primarily by hardware, but by the orchestration of data, software, and digital services. Earth observation has become an operational layer for industries ranging from agriculture and energy to logistics, finance, and defense. Businesses are no longer consuming satellite imagery; they are consuming insights. The competitive advantage now lies in the ability to transform massive volumes of orbital data into actionable intelligence through AI and advanced analytics.

As space becomes embedded within critical economic activities, the strategic importance of sovereignty and resilience is growing rapidly. Connectivity, navigation, and Earth observation capabilities now underpin national competitiveness, security, and economic stability. This explains the acceleration of sovereign initiatives such as Europe's IRIS² program and the increasing investment in secure communications, space domain awareness, and dual-use infrastructures capable of serving both civilian and defense missions.

The next frontier extends even further. The space sector is beginning to move from an Earth-to-space economy toward a true in-orbit economy. Emerging capabilities such as on-orbit servicing, refueling, autonomous operations, orbital computing infrastructure, and future cislunar logistics networks are laying the foundations for entirely new value chains. Space is progressively becoming not just a destination, but an operating environment for digital and industrial services.

In a world increasingly defined by interconnected ecosystems, the challenge is no longer launching assets into orbit. It is ensuring that terrestrial and space infrastructures operate as a coherent whole. The organizations and nations that succeed will be those capable of integrating AI, cloud, cyber resilience, connectivity, and space capabilities into adaptive and trusted platforms.

Space is no longer a remote frontier. It is becoming part of the invisible infrastructure that powers our economies, enables our sovereignty, and shapes our collective future.

The future of space will not be measured by the number of satellites in orbit, but by the intelligence, autonomy, and digital value generated through the interconnected systems they enable.

A few more things… in Defense

Bruno Bouf
EVP, Defence Europe Group Accelerator,
Global Lead Aerospace & Defence, Capgemini Invent

Defense is no longer defined by the power of platforms, but by the speed and intelligence of the systems that connect them.

Defense is entering a decisive decade where speed, scale, and sovereignty define mission readiness and operational effectiveness. The nature of conflict is shifting from platform-centric power to software-defined, data-driven and AI-enabled capabilities, where effectiveness is measured not only by assets, but by the ability to sense, understand, and respond rapidly in complex and dynamic environments.

The trends outlined in TechnoVision highlight the convergence of technologies to reshape the landscape for the A&D industry, and the defense sector is no exception. For defense, this convergence is accelerating the transition from fragmented systems to connected, adaptive mission ecosystems. The convergence of AI, digital twins, and real-time data is driving a fundamental shift: from reacting to events to improving preparedness and enabling informed, timely responses.

From platforms to software-defined capability

The center of gravity in defense is shifting away from standalone platforms toward integrated, software-defined systems-of-systems. Aircraft, vehicles, drones, sensors and command systems are no longer isolated assets; they are nodes in a continuously evolving operational network. This transition is accelerated by AI-enabled capabilities that support coordination across domains under human oversight, digital twins and simulation to anticipate outcomes and reduce operational uncertainty, and data-centric architectures that connect design, production, and operations through the digital thread. The result is a move from static capabilities to continuously upgradable, mission-adaptable systems, where software cycles now outpace traditional hardware lifecycles.

AI at the core of decision advantage

AI is rapidly becoming the primary lever for decision dominance. Beyond augmenting individual tasks, AI is reshaping the entire operational model—from intelligence gathering to mission execution. In practice, this means:

- Moving from data overload to prioritized, contextual insights
- Transitioning from human-driven coordination to AI-supported coordination
- Enabling real-time, multi-domain decision-making at machine speed

Defense organizations are evolving toward human-centric models, where AI agents support decision-making under strict governance and human control, particularly for mission critical decisions.

Multi-domain, connected operations as the new standard

Modern operations are inherently multi-domain—spanning air, land, sea, cyber, and space. Achieving operational effectiveness increasingly depends on the ability to connect and synchronize these domains in real time. This requires interoperable architectures and open standards to integrate diverse systems, edge computing and resilient connectivity to operate in contested environments, and secure data sharing across allies and ecosystems. Information fluidity becomes a decisive factor, enabling faster response cycles, enhanced situational awareness, and coordinated action across complex operational theaters.

Sovereignty as a strategic imperative

In an era of geopolitical tension, technological sovereignty is no longer optional—it is foundational to national security. Defense organizations must maintain control over critical data and AI models, cloud and edge infrastructure, and supply chains and digital platforms. At the same time, sovereignty must be balanced with ecosystem collaboration, as innovation increasingly comes from a broader network of startups, technology firms, and partners. The challenge is to build open yet controlled ecosystems—enabling cooperation without compromising independence.

Security, trust, and governance as enablers of scale

As autonomy and AI scale, trust becomes the critical enabler of adoption. Defense systems must operate with the highest levels of security and cyber resilience, explainability and auditability of AI decisions, and ethical and legal compliance. Zero-trust architectures, embedded governance, and continuous assurance are becoming integral to system design—not as constraints, but as foundations for scaling innovation safely.

The new defense paradigm

Defense is no longer defined by what systems can do individually, but by how effectively they work together—continuously, intelligently, and securely—to deliver mission outcomes. The emerging paradigm is defined by a set of structural shifts:

- **From vertical platforms to interoperable ecosystems**, where openness and integration form the foundation of operational advantage
- **From hardware cycles to software speed and ultra-adaptability**, enabling continuous upgrades and rapid evolution of capabilities
- **From reactive operations to predictive, simulation-driven missions,** leveraging digital twins and advanced modeling to improve decision-making and optimize resource allocation
- **From technology-led design to doctrine-aligned architectures**, where systems are built to reflect and enable military strategy and operational concepts

In this environment, AI plays a critical enabling role—enhancing protection, accelerating response to threats, securing operations in contested environments, and orchestrating complex systems at scale—while remaining under human direction and control.

Advantage will belong to organizations that can integrate AI, data, and interoperable systems at scale, while maintaining sovereignty, trust, and operational control.

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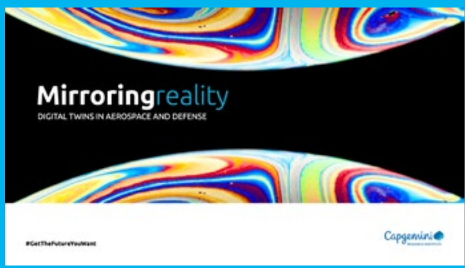
Further Research

TechnoVision 2026

Top Tech Trends of 2026

The strategic edge: How digital continuity drives business outcomes in aerospace and defense



Digital twins in aerospace and defense - Capgemini

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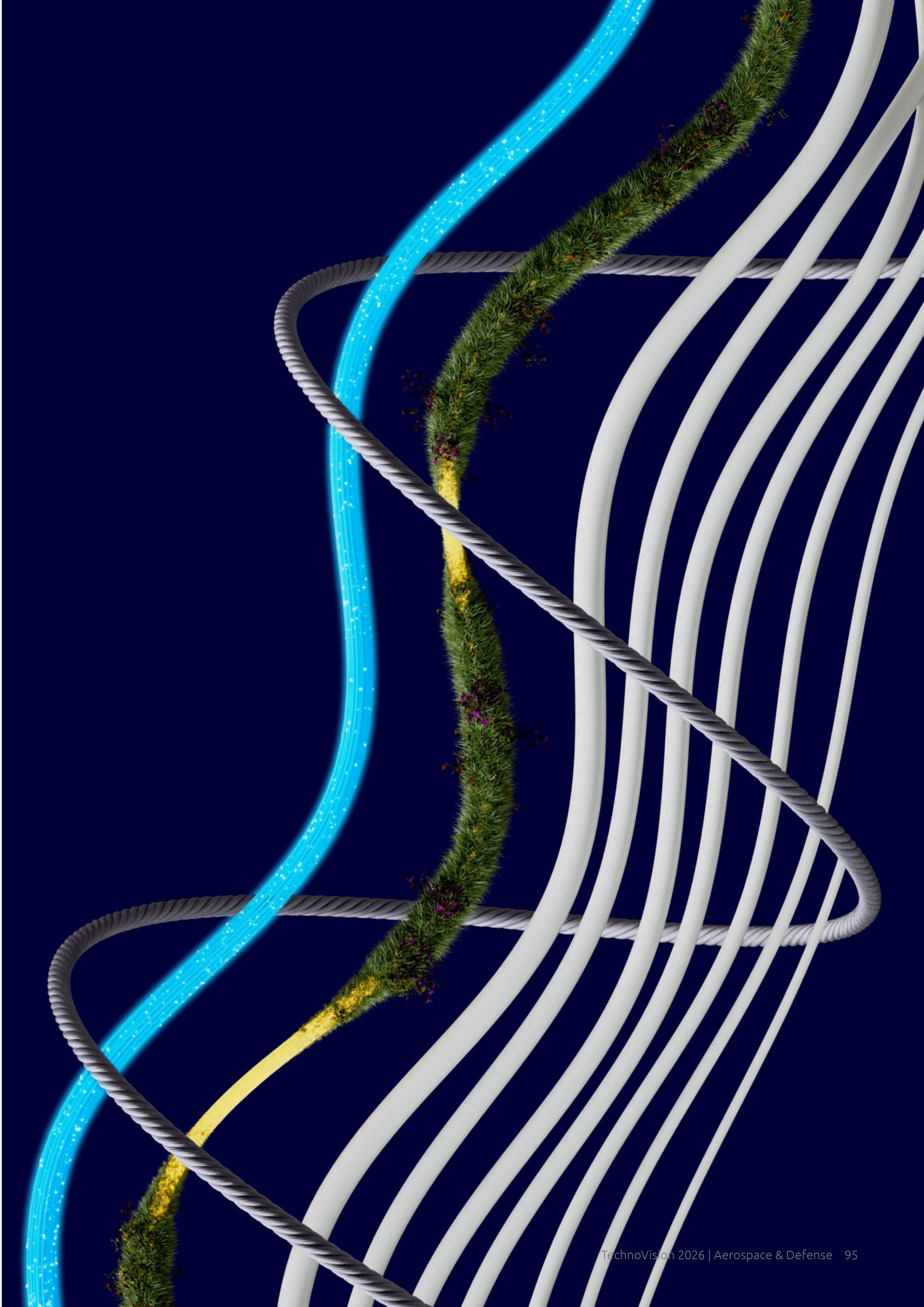

About Capgemini

Capgemini is an AI-powered global business and technology transformation partner, delivering tangible business value. We imagine the future of organizations and make it real with AI, technology and people. With our strong heritage of nearly 60 years, we are a responsible and diverse group of over 420,000 team members in more than 50 countries. We deliver end-to-end services and solutions with our deep industry expertise and strong partner ecosystem, leveraging our capabilities across strategy, technology, design, engineering and business operations. The Group reported 2025 global revenues of €22.5 billion.

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