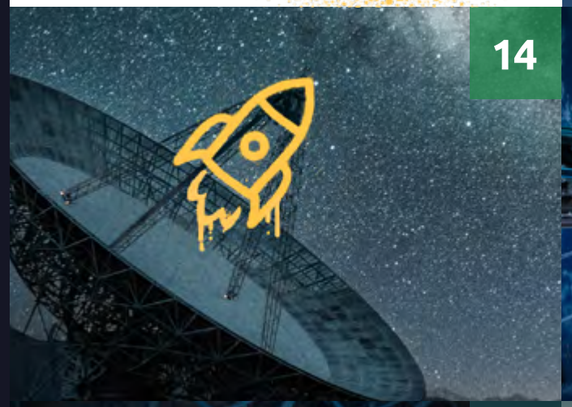
Capgemini

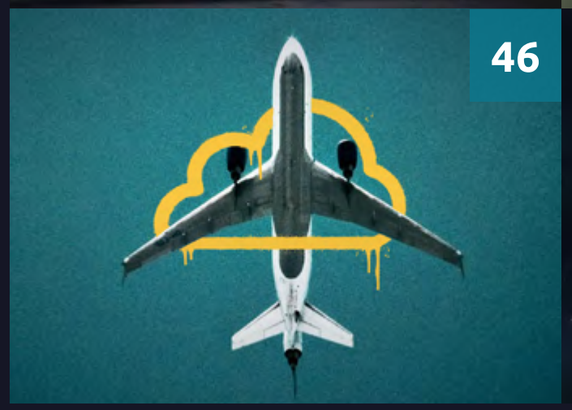
AEROSPACE AND DEFENSE

Prompt the future of A&D

/Prompt Which technologies will propel Aerospace and Defense to new heights?

TECHNO VISION 2024 /Prompt the future





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FOREWORD

PATRICE DUBOÉ
CTIO, Aerospace and Defense

A vision of technologies for Aero, Space and Defense!

Artificial Intelligence, Gen AI, Quantum, Digital Twins, Virtual Reality, and many more technologies are making the headlines. But what does it mean for you, for your team, for your company and for your clients? We created TechnoVision 16 years ago to share our vision on technologies and identify their benefits for our clients. This vision is just the first step, technologies and innovation have to be applied in real projects and programs before being deployed at scale at the enterprise level. Moreover, the maturity and impact of technologies will be different depending on the industry.

This year, I'm very pleased to introduce the first TechnoVision report dedicated to the Aerospace and Defense industry. With our expert teams, we have identified not only our vision for the coming years but also the best use cases deployed all over the world. I invite you to exchange with our Aerospace and Defense Top Guns to see how you can implement some of these innovations within your context.

Civil aeronautics is embracing a radical shift to clean energies while transporting more and more passengers every year. Electrical aircrafts, drones, eVTOLs, we see new ways of flying emerging.

Space has become a mature industry delivering services to all other industries worldwide, mainly with New Space optimizing the Low Earth Orbit and providing services used by each of us every day at a very low cost. We use GPS/GNSS while driving, cycling or running. We can be connected from everywhere through thousands of satellites and can use data from Space to better monitor and save our planet. Last but not least, geopolitics gave Defense a brand new role to protect countries and citizens with digital playing a major role to explore new innovations.

Navigating through the report, you will discover in the You Experience container, how the Experience² trend is supporting digital continuity, a de facto standard in civil aeronautics. You will then enter the Economy of Things trend exploring how new satellite constellations in Low Earth Orbit are providing brand new services to improve the supply chain for worldwide industry leaders or armies deployed globally. I invite you to discover the associated demonstrations available to you via a visit to one of our Applied Innovation Exchange spaces. And finally, why not learn how NATO has been illustrating the Data Sharing is Caring trend to manage the massive volume and diversity of data within a complex international ecosystem to improve collaboration, standards, and extract data value. But of course, these trends are only three out of the 37 trends included in this report!

I hope you enjoy reading this report as much as we did writing it.
3,2,1 Ignition!

INTRODUCTION

LEE ANNECCHINO
Global Industry Lead, Aerospace and Defense

TechnoVision 2024 was published earlier this year to assess the future of technology proposing the question… how will technology affect the future of our society and our business? TechnoVision is Capgemini's annual report to highlight emerging trends in technology and provide helpful insights, across industries and domains, that can inform decision-making and strategy for the future. This year's theme challenges readers to 'Prompt the Future,' to think about the trends that are changing the face of their businesses.

The insights presented address the transformative impact of technology for business around the globe and across industries. Each industry has distinct products, services and markets they serve, but they are increasingly leveraging similar tools and technologies that can be adapted to their individual needs. Advances in infrastructure, digitization, connectivity, AI/Gen AI… are just a few of the ways in which technology is impacting the way we do business.

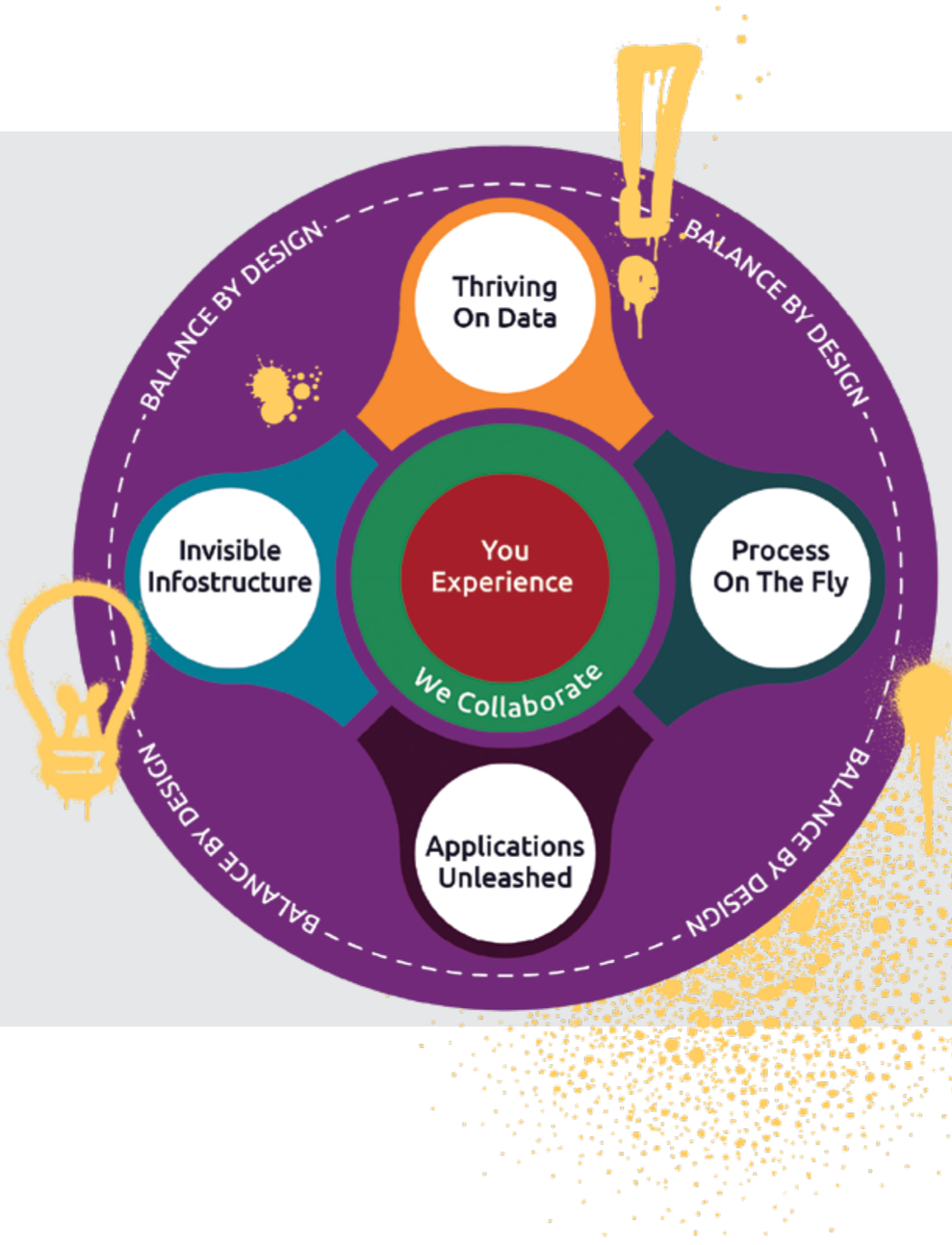
In this industry-specific Playbook, we take a deep dive into Aerospace and Defense (A&D), looking at the way in which technologies are impacting how A&D organizations do business. A&D players understand that business transformation is required to achieve their future vision, and implementing today's advancements in technology is a necessity.

The demand for A&D products is at an all-time high. Organizations are seeing some of the highest backlog records in years. Current geopolitical issues continue to push Defense production volumes to their limits. In parallel, the pressure to meet imminent sustainability goals continues to reach new heights, not only for CO_2 emissions of flying aircraft but of the production lines across the entire supply chain. Companies that can innovate to address these challenges will have a distinct advantage in the market.

For the A&D industry, we believe the solutions to these challenges lie in navigating, understanding, and implementing today's existing and tomorrow's emerging technologies. Therefore, we have published this industry-specific playbook with expert insights across civil Aeronautics, Defense, and Space to help you navigate a path forward. For example,

- Digital Continuity within Thriving on Data… creating a single source of data truth to better engineer, manufacture, and support products. And most importantly, creating measurable business value.
- Production Acceleration and Supply Chain Transformation within Process on the Fly… transforming physical and digital processes and tools to create a more agile production system while dealing with continuing labor shortages and supply chain disruptions.
- Connected A&D within Invisible Infostructure … shifting to new business models that leverage data, AI, connectivity solutions, cloud transformation, software driven solutions and business model transformation.
- Circular and NetZero Aviation … accelerating the transition to alternative propulsion fuels and leveraging technology for better eco-design practices.

Just as TechnoVision 2024 'serves as a lighthouse' to navigate technology trends, this Playbook serves as a lighthouse for the A&D industry. With 37 cutting-edge trends, each one with an A&D industry specific use case that spans across civil Aeronautics, Defense, and Space. Our goal with this Playbook is to provide a roadmap with the relevant insights, and questions for consideration, on how to implement technology throughout the A&D ecosystem. We believe the right solutions exist to build the future of tomorrow, and we're pleased to share with you, our recommendations.



Overview of TechnoVision 2024: Aerospace and Defense

TechnoVision categorizes technology trends into six 'containers', providing a snapshot of innovation from different perspectives (the 'what') – ranging from user experience and collaboration, via data and process automation, all the way to infrastructure and applications. A seventh container offers a series of overarching design principles to successfully apply the trends and create transformational impact (the 'how'). These principles help to build a sharp mindset, ready for any portfolio, program, project, architecture, innovation initiative, or idea.

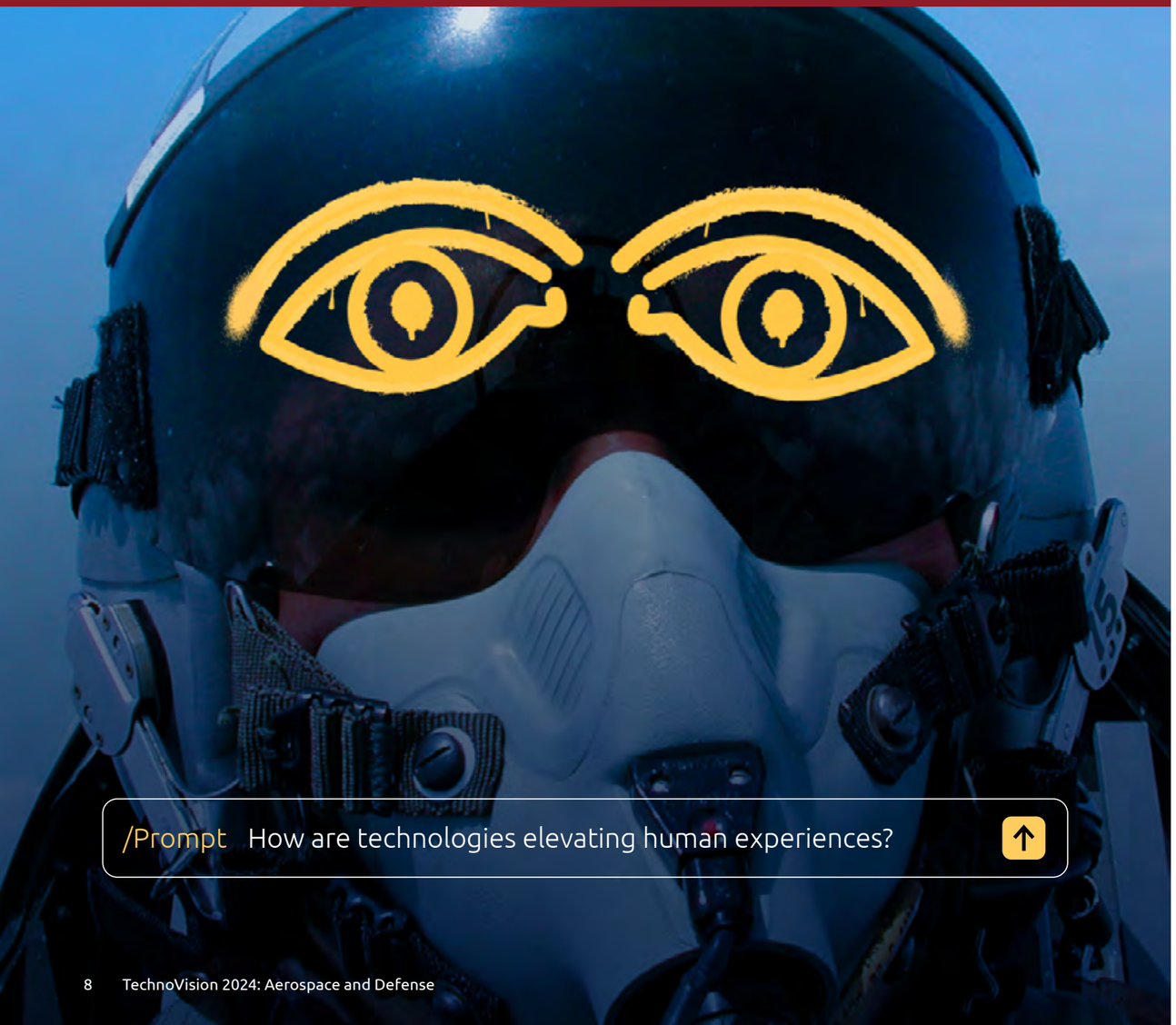
You Experience and We Collaborate are at the very heart of technology-powered change. This core foundation is surrounded by four enabling containers – Thriving on Data, Process on the Fly, Applications Unleashed, and Invisible Infostructure. This collection of trends is all wrapped up with Balance by Design, as the overarching container to be considered while working with the others.

Within each container, five key trends are presented as one-page summaries, designed to be crisp and to-the-point, yet appetizing enough to warrant further study. They all feature a 'What' section that describes the trend, an 'Impact' section that exemplifies the change potential of the trend, and a 'Use' section with an industry specific use case. Each trend also mentions an 'Expert in residence' with whom anyone can connect if they want to know more about the topic.

Balance by Design – our overarching container – follows a slightly different setup to the other six, offering views of how to shape balance within an organization using seven clear design principles.

YOU EXPERIENCE

The established customer experience is intertwined with employee and partner experiences, achieving common goals of attraction, retention, and engagement. All expect a better experience, with a positive impact on society and the environment. When it comes to providing these superior, compelling experiences, the Metaverse is the place to look at. It shifts retailers and brands from sellers to companions and reshapes the employee's workplace into a new and attractive virtual realm. And what if these experiences extend to industrial and business operations? Enter the Internet of Twins, which is designed to build highly efficient real-world operations in the most sustainable way. With emerging AI and mixed reality technology as drivers, experiences now have become so intuitive and natural that they hardly feel like a separate experience anymore. With that, the augmented You Experience is truly about 'You' and 'Me'.



/Prompt How are technologies elevating human experiences?

EXPERIENCE²

Imagining and delivering experiences as an integrated whole; seamlessly covering the perspectives of customers, employees, and partners, underpinned by the array of UX and interaction technologies.

What

A key trend we're observing is the crucial role of experience at industrial levels, particularly within the manufacturing lifecycle. This is where we anticipate the most notable impact, especially in terms of personnel training. The introduction of new technology blends is expected to enhance various phases of the lifecycle, from design and planning to simulation, with a primary focus on training and skill development. Overall, the integration of emerging technologies is poised to revolutionize perception, interaction, and collaboration within the Aerospace and Defense industry, creating substantial value across the board.

Impact

This human-like interaction, combined with AI functionalities, holds the potential to revolutionize collaborative experiences in the foreseeable future. Additionally, generative AI is reshaping content creation processes by automating tasks such as generating 3D environments and designing levels, tasks that were previously labor-intensive. This AI-driven automation not only streamlines workflows but also enhances the development of virtual worlds, ultimately enriching user experiences on a broader scale.

Use Case

Capgemini accompanies a European engine manufacturer in their Digital Continuity program all along the product lifecycle based on Dassault Systems' 3DX platform. The objective is to manage the support, maintenance, and the evolutions of the manufacturer's solutions and applications regarding Product Lifecycle Management, Manufacturing Execution System solutions and Computer Aided Design solutions. The target outcomes are skill mutualization, increased ramp up ability, price optimization and improved reactivity.

ALEXANDRE EMBRY

YOU EXPERIENCE

ME, MYSELF AND MY METAVERSE

Multiple new virtual worlds are augmenting real life, creating a potentially profound impact on the way we live, work, interact, behave, and express ourselves.

What

In this trend, we see a need to accelerate digital transformation endeavors within an industry facing intensified competition. Aerospace and Defense companies are increasingly prioritizing operational efficiencies, cost reductions, and streamlined planning processes to maintain a competitive edge while attracting and retaining top talent. The surge towards immersive technologies and AI-driven experiences is poised to play a crucial role in meeting these requirements.

Impact

Primarily, this transformation will unfold across various stages of the manufacturing lifecycle, progressively impacting operations. While the initial focus may be on design, engineering, training, and planning, the ripple effects will extend to operational efficiency improvements over time. There's a growing demand for enhanced collaboration and connectivity, paving the way for concepts like cooperative engineering and remote coworking. The ability to better visualize complex data, systems, and physical assets in immersive environments will revolutionize collaboration, planning, simulation, and design processes. This shift from traditional two-dimensional representations to immersive, three-dimensional environments will facilitate better decision-making and innovation.

Use Case

Capgemini helped an Original Equipment Manufacturer (OEM) in its Manufacturing Execution System (MES) digital transformation program to support the ramp up of production while improving and simplifying quality monitoring.

The outcome is a transformation from a paper-based approach to a digital-first approach to ensure high productivity by providing a digital recording of production data to ensure traceability and analysis. The project implements a complete workflow from the detection of Non-Quality to its resolution leveraging the real-time monitoring of production activities for faster quality checks.

ALEXANDRE EMBRY

INTERNET OF TWINS

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

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 and Internet of Things capabilities, organizations gain a clear understanding of current situations, evaluate potential scenarios, and receive guidance on the best course of action. For example, Digital Twins can help qualify market changes and ensure products meet top-level requirements more swiftly, particularly relevant in Defense when reacting to ongoing global conflicts. In Aerospace, Digital Twins facilitate the integration of engineering and manufacturing processes. This integration allows for more efficient production planning right from the design stage, significantly speeding up the manufacturing of complex products like aircraft.

Additionally, advancements such as optimization techniques and generative AI contribute to the evolution of Digital Twins into intelligent systems, capable of effectively managing complexity and providing valuable insights for decision-makers. Furthermore, the integration of cloud hosting and secure data analytics enhances collaboration among stakeholders and enables a comprehensive model-based approach to decision-making, starting from the early stages of product development.

Impact

The current trend emphasizes the need for a continuous interplay between the operating model, personnel, and digital enablers. This approach isn't just about adopting new tools or infrastructures; it involves fostering more collaborative processes that allow personnel from various functions to work together effectively. It also requires equipping people with the necessary skills to operate in a data-driven, digital context and find the right digital solutions that can support complex engineering environments.

It's crucial to employ a dual-level approach: demonstrating tangible benefits at the operational level through targeted use cases that address specific pain points, and simultaneously developing a long-term strategy that fundamentally reshapes organizational practices by integrating people, processes, and digital tools. This dual-level approach ensures that substantial investments in these technologies are made in areas where they can deliver the most value.

Furthermore, these technologies play a crucial role in attracting young talent by creating attractive, digital, and dynamic work environments that appeal to skilled engineers. This shift is becoming essential, as attracting top talent is now seen as a critical component to maintaining competitive advantage and operational excellence.

Use Case

Capgemini implemented a Digital Twin for an Aerospace and Defense OEM with an objective to optimize lead time and development cost. The solution included a two-tiered approach:

- Co-development: The product and its industrial system including operations and services modelled in a virtual environment, until best-in-class is achieved.
- Analytics, Execution and Services: Collecting real time data helped to tie back the physical twin to its digital avatar enabling improved products, manufacturing and services through anticipation and preventive actions.

Observed results:

- Set of specific industrial Digital Twin use cases defined and capitalized.
- Prioritized use cases according to the defined strategic product program roadmap.
- Direct reduction of Recurring Costs (RC) and Non-Recurring Costs (NRC) per factory.
- Reduced development lead time contribution.

PIERRE-ANDRÉ VANDELLE

I FEEL FOR YOU

Boosting both the individual and corporate EQ, by creating a more effective, meaningful, and satisfying symbiosis between people and their technology enablers.

What

The emotional aspect of the experience layer is paramount, drawing from insights in Customer Experience (CX). In service-oriented industries, it's evident that empathy and emotional connection are vital for user engagement. Even as we introduce virtual environments and immersive technologies into the workplace, maintaining this emotional connection remains crucial. Creating this human-like interaction within virtual environments is essential for enhancing user experience and driving adoption. Users should feel a genuine sense of connection and empathy, akin to interacting with a human colleague, as far as possible. This emotional dimension is what bridges the gap between virtual and physical interaction, making the user experience more immersive and fulfilling.

Impact

As AI continues to advance, it will inevitably impact various aspects of user interaction and engagement. Take, for instance, the concept of virtual advisors, particularly relevant in manufacturing activities within Aerospace and Defense. To leverage the guidance and support offered by virtual agents effectively, establishing an emotional connection is key.

Use Case

Capgemini supports an OEM, in its Flight Operations & Air Traffic Management Digital Solutions dedicated to airlines, airports, and Air Navigation Service Providers (ANSPs). The objective is to bring Digital, Product Owners functional expertise to support the OEM in developing its solutions dedicated to airlines, airports, and Air Navigation Service Providers and lay down a roadmap for the deployment of solutions for their clients. Capgemini will work to provide key resources through four main work packages:

- Project Managers: Lead deployment projects to ensure on time, on cost and on quality implementation of the products within their customers ecosystems.
- Business Analysts: Perform the technical tasks required to ensure the proper implementation of the products within the OEM's customer ecosystems.
- Product Owners: Turn the business/operational needs collected with Product Management into user stories and work closely with the development team to get these user stories properly implemented.
- Product Application Specialists: Provide expertise and technical support on the products, specifically providing accurate answers to the customer.

The target outcomes are improved customer experience, clarity on the solutions and deployment plans for the OEM's clients, easing customer operations and increasing customer visibility.

ALEXANDRE EMBRY

NO EXPERIENCE

Generative AI and immersive technologies bring controller-less interactions and the merger of the physical and virtual world, leading to a natural, intuitive, and stress-free experience of technology; like there is no experience at all.

What

One significant aspect is the emergence of advisors, a novel trend that will significantly impact the You Experience container. This entails incorporating visualization and collaboration interaction layers into the overall experience mix, catering to employees, engineers, customers, and industrial processes. The focus is on enhancing and preparing for the User Interface (UI) of the future, shifting towards natural interaction.

Impact

This trend is largely facilitated by devices like the Apple Vision Pro or the Meta Quest. These devices seamlessly blend virtual reality and augmented reality, allowing users to experience immersive content while remaining connected to reality. This innovation is poised to have a profound impact on experiences, particularly in training and learning scenarios.

Traditionally, immersive training sessions using purely virtual headsets has been limited, as users often find it challenging to remain fully engaged for extended periods. However, with these new devices, we're seeing improvements that address this issue, enhancing the overall training experience. Additionally, the integration of AI and Gen AI into this trend introduces the concept of spatial AI, where users interact not only with human colleagues but also with virtual agents or advisors.

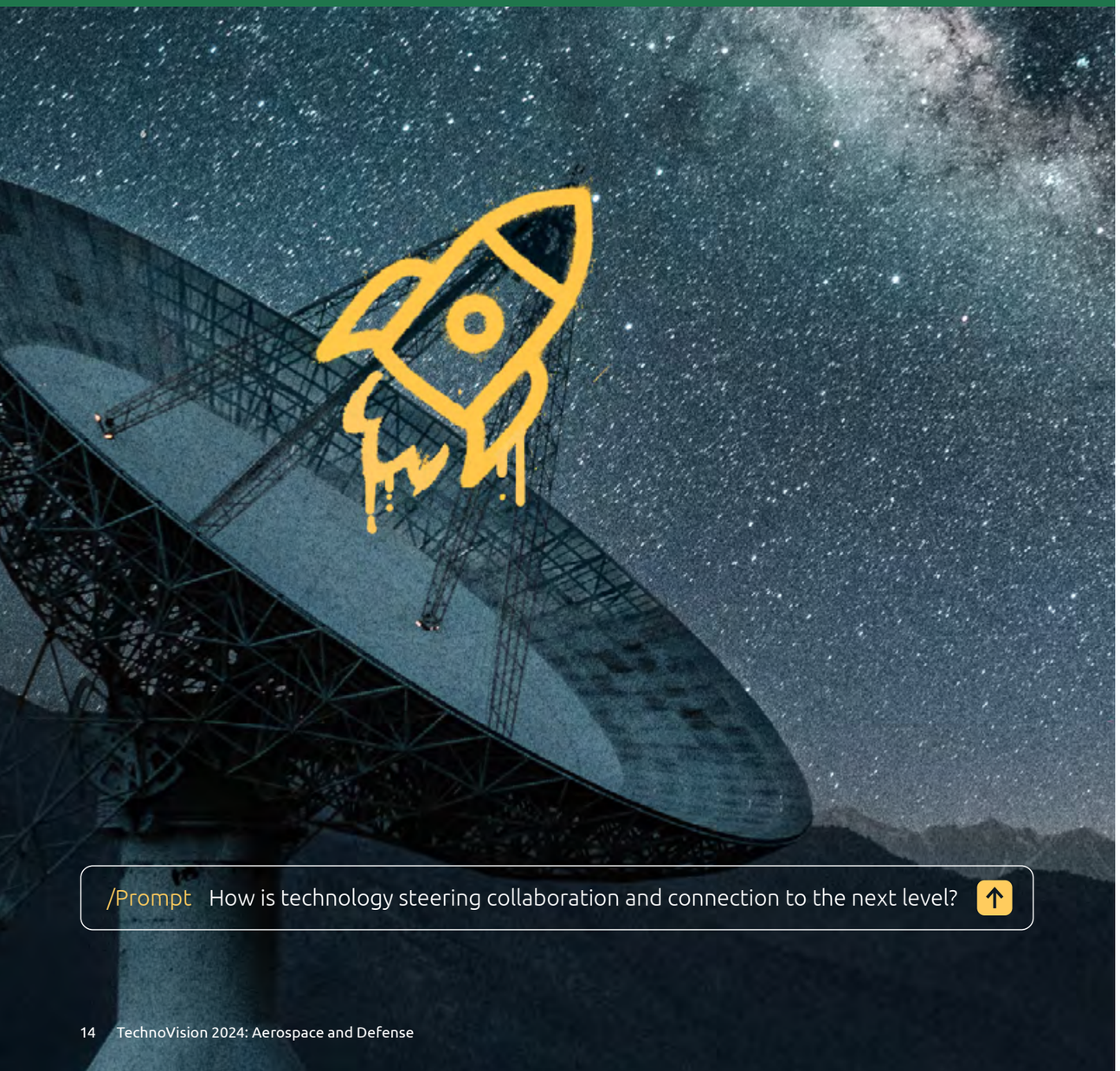
Use Case

Boeing and an AR company 'Red 6' have successfully flown and tested a virtual display system in a tactical aircraft. The objective is to provide pilots with practical training conditions while reducing the risks of getting injured. The system allows pilots to comprehend and interact with virtual aircrafts, targets, and threats (both in the air and on the ground), while also experiencing the pressures that come with flying an airplane.

ALEXANDRE EMBRY

WE COLLABORATE

How businesses operate and collaborate has changed irrevocably. Many aspects of value delivery are now entirely independent of location and time. People work together in teams in diverse ways, increasingly at the very edges of what used to be considered the 'core organization'. Consumers and employees expect creative, integrated experiences, which require a new level of cross-organization, cross-sector partnering to meet these expectations. Distribution is the leading design principle, together with mesh-style, loosely coupled collaboration – not only between people and organizations, but also from 'thing to thing'. Organization structures evolve towards a decentralized mode of operation, demanding fewer physical assets, less energy, less travel, less command and control. Within such a thriving ecosystem though, it is increasingly a matter of establishing what and who we are as individuals – owning and governing our identity data exclusively ourselves.



/Prompt How is technology steering collaboration and connection to the next level?

MY IDENTITY, MY BUSINESS

The rise of decentralized identity management, powered by the Web3 'Mesh Web', will empower individuals to reassert control over their own data in a complex, digital network.

What

Identity management and verification is going to be key for future Aerospace and Defense businesses and government organizations working in Defense and national security. We can do a lot more with open-source intelligence – that is, information which is freely or commercially available – to help us manage and authenticate identities online. The volume of data is increasing exponentially. And the increasing availability of all sorts of data is a threat to the status quo as well, because now it is not just closed parts of governments that have access to important military information, but more and more can be found quite openly online and companies are springing up to meet demand. We will need to make sure that businesses operate ethically and legally in accessing and using this kind of information – including data scraped from the internet to train AI models. We also need to think hard about how much we can trust the data – some people are preferring to only use data from pre-2022 over concerns that the widespread use of generative AI tools is polluting the data sets with 'hallucinated' non-facts. We need to get used to being skeptical about what we see, read or hear online and not assume any of it is real, or true.

Impact

Technology itself is not good or bad; its what people choose to do with it that matters. But we mustn't be naive in thinking that everyone will act rationally or for the common good. Plenty of people try to use technology to commit harm: and that is why there is a constant and accelerating 'arms race' in almost every emerging technology field such as AI, quantum, bio-engineering or the Internet of Things. We can't rely on technology to find the solutions to that, although we can certainly try to make it 'secure by design' and not open to vulnerabilities, but ultimately we need societies and governments to come together and develop good responses, drawing on our common shared values, ethics, and behavioral science insights into how people behave, and why, and how they can be influenced for positive outcomes. That comes down to people being people, and being socially networked individuals who trust one another – and that's really the key to good collaboration.

Use Case

Capgemini has been working with the UK Government on various projects that bring AI into the delivery of public services, but carefully and with respect to people's privacy and choice.

Developing trusted AI models and systems that are trained on good quality data, and have the right checks and balances in place, is key. But increasingly governments are having to get to grips with the messy 'open source' data out there: we have helped them to develop policy and review legislation through our 'market insights' work by interviewing a number of open source intelligence businesses and academics to explore the barriers they face in terms of policy, regulation, and ethics, and made a number of recommendations on how the UK Government can ensure that the open source intelligence they use is ethically and lawfully collected, including building skills, knowledge and expertise in and outside of government.

LUCY MASON

THE TEAM IS THE CANVAS

Enabling an agile and adaptable workforce with hybrid team-centric workspaces and tools is the perfect way to combine the power of human collaboration with digital spaces.

What

Everything is about the ecosystem these days. As technology increasingly connects us all, systems become more and more complex: systems-of-systems arise and how well the network functions can make or break organizations. But we don't often think in terms of networks, or value collaboration very highly, despite the clear commercial advantages of putting time and effort into getting that right. People who like to work 'horizontally' across sectors and who delight in joining people together are hugely undervalued by businesses. Organizations do not invest in the way they should in teaching people the skills to collaborate, incentivizing them, and rewarding them for doing so. The Aerospace and Defense industry is quite traditional in its hierarchical and commercial silos: but in the future, success will go to those who think differently. Technology and people are key. And that's why small businesses in so many sectors can be quite disruptive: because they can upset the status quo, experiment with new technologies and ways of thinking, and are not invested in old ways of working.

Impact

A lot of the challenges are the same across different sectors and organizations – how to respond to emerging technologies such as AI, quantum computing and the evolving 'New Space' sector and make them safe and secure; how to make effective use of data to give insights and improve efficiency and effectiveness; how to recruit, upskill and retain talent in the face of stiff global competition.

Because it's important for societies that we get these things right, co-operation is more important than competition. We need to be working with allies and across organizations and sectors to share information and best practices and innovate together to find solutions at the pace of need. In Defense in particular, we have seen play out in real time in Ukraine the huge tactical advantage of access to information and making good use of data, including satellite communications. People can come together to make things happen when they need to: we need to develop these kinds of government/industry partnerships in a slower time too and make them work much better than they do now.

Use Case

Commissioned by the UK Government, a blended team from Capgemini, the Accelerated Capability Environment (ACE) and independent contractors worked together for a 12-month pilot to experiment with 'Collective Intelligence' ways of working. They worked to develop fresh insights and solutions for some of the most complex problems facing governments in energy security, economic security, and securing quantum advantage. The project designed a mechanism to bring together diverse experts from academia, industry and beyond to explore together problems with no clear solutions in short timeframes, adding rapid value to policy makers needing to understand the issues, and then commissioning rapid sprints to develop solutions, drawing on multiple data sources to, for example, develop a digital model to explore economic resilience. The project resulted in six prototype 'proof of concept' tools designed for government, at least two of which were developed further with a view to implement them into central government. The prototypes were shared widely across government throughout their development through showcases, and events for senior civil servants. An independent evaluation of the work highlighted the benefits of these ways of working in generating novel expert perspectives and insight.

LUCY MASON

TAKEN BY TOKENS

Reimagining the future of value exchange through 'Token Economy'. Digitize. Decentralize. Democratize.

What

Before we can talk about a 'Token Economy' within the Aerospace and Defense Industry, we must first consider 'Tokens of Trust'.

Paper in the aviation industry is everywhere in the form of forms and records: Certificate of Airworthiness (EASA Form 25 / FAA 8100-2), Authorized Release Certificate / Airworthiness Tag (EASA Form 1 / FAA 8130-3), Statement of Conformity (EASA Form 52 / FAA 8130-9)…the list goes on, and everyone trusts the paper we create and sign to be accurate and true. But should we trust paper?

In late 2023, UK-based supplier AOG Technics sold parts for the CFM56 engines with forged paper. Not only was safety of flight compromised for hundreds of passengers of four airlines, hundreds of thousands of dollars were spent to remove engines from aircraft and remove non-conforming parts, re-inspect and re-install the effected engines.

Paper is failing the air transport industry and we've known this for years – decades. In response, Airbus, American Airlines, Boeing, Delta Air Lines, GE Aerospace, Safran, StandardAero and United Airlines formed the Aviation Supply Chain Integrity Coalition (ASCIC). The ASCIC initiative could be landmark because the challenge of moving away from the weak link of paper has not been technological, it has been collaborative, getting the industry to agree to processes and technology and data schema standards.

In the field of information technology, if you say you have a 'trust' issue, the answer will come back that you need 'immutability' which means you need distributed ledger technology (DLT) or more well known as blockchain technology. Unfortunately, the term blockchain is confused with bitcoin and cyber currency, a particular use case and domain of distributed ledger technology where the 'token' represents a coin and some financial value. It is said, aircraft are 50,000 parts flying in synchronized close formation. Each piece of paper in the design, manufacture, operate and maintain lifecycle of an aircraft is the proof of value, which could be represented by a token.

Immutability in blockchain is the property of a distributed ledger to remain unchanged and tamper-proof. Once a token has been committed to the chain, such as a smart contract transaction detail (e.g., Authorized Release Certificate / Airworthiness Tag (EASA Form 1 / FAA 8130-3)) its content cannot be altered or erased.

Impact

SkyThread is one company building a blockchain digital thread solution to ensure the 'back to birth' immutable value chain of electronic documentation which prevents unauthorized parts being used or even purchased. The value of such a solution has been estimated to be in the billions from manual work elimination, seamless or frictionless transactions, and supply chain efficiencies. Just finding the right part at the right place and time to support aircraft on ground (AOG) situations would avoid delays, cancellations, and improve customer experience worth millions.

Having said that, the use cases for tokens of trust in aviation are much more than 'parts pedigree'. The Aerospace Industries Association (AIA) organized the Aerospace and Defense Distributed Ledger Consortium (ADDC) comprised of stakeholders, including Capgemini, with the goal of creating a minimum viable ecosystem (MVE) to define appropriate use cases and promote DLT.

Blockchain technology is being used to control distributed additive manufacturing, create license and skills passports, conduct smart contract payment validation of AOG deliveries and is envisioned to address hazardous goods and the EU REACH (Registration, Evaluation, Authorisation and Restriction of Chemicals) Chemical Substance Declaration (CSD) mandate. In total, the ADDC has defined 32 use cases for immutable token distributed ledgers.

Looking to the future, imagine urban air mobility where hundreds of eVTOL air taxis and autonomous unmanned aerial vehicles are sharing airspace with helicopters, business jets and commercial aircraft. The speed of the current air traffic planning, control and management will not come close to the future requirement, which is why multiple companies involved in the NASA-led Advanced Air Mobility (AAM) initiative are leveraging distributed ledger technologies for air traffic management innovation.

At the beginning of the century of aviation, Wilbur Wright said, "Carelessness and overconfidence are usually more dangerous than deliberately accepted risks." We are willingly careless and overconfident to continue to believe we can rely on paper to ensure safety and airworthiness when electronic tokens of trust are only a collaborative decision away.

Use Case

Air France Industries KLM Engineering & Maintenance and SkyThread signed an agreement to launch SkyThread for Parts which has been initiated at the AFI KLM E&M component support pool in Amsterdam. This unique data management platform facilitates, improves and secures the sharing of data throughout the ecosystem. Every link in the chain – the aircraft manufacturer, airline, equipment manufacturer, etc. – shares their data, then allows other users direct access to that data. Built on secure blockchain technology, it is unalterable and decentralized, which ensures an extremely high level of data security. Data shared on the platform remains the property of the entity that created it – SkyThread is not in any case the data owner. Already deployed in operations mode on a Boeing 787 fleet, producing satisfying results, SkyThread for Parts will be, in the near future, deployed to every type of aircraft in the Air France-KLM fleet.

MICHAEL WM. DENIS

WE COLLABORATE

YOUR BUSINESS IS A MESH

Enabled by efficient decentral 'mesh' technology, it's easier than ever for organizations to join forces, even if it is lightweight, just for one day, for one occasion, or for one customer.

What

The future will likely see an increasing reliance on digital platforms that enhance collaborative efforts across global and cross-sector environments. The key will be managing these technologies in ways that maintain security and trust while fostering innovation and inclusivity. The focus should be on enhancing data sharing and collaboration across traditionally siloed sectors to address common challenges effectively and securely. Huge value can be generated from sharing data, information and solutions across Defense and aligned sectors – even in completely parallel sectors where dual use technologies may create new capabilities in new ways. Technology can both enable and incentivize cross-sector collaboration, making it easier to access and share information. The transformative effects of generative frontier AI – as it develops further and has sufficient safety measures built around it to ensure it is reliable and true – will help us parse and make sense of huge data sets in a way never before possible.

Impact

Real-time, detailed information about what is happening will become ever-more available. And that is going to transform decision-making, because the same information can be made available to many people at the exact same time, in ways which allow them to have better informed discussions and a better sense of the evidence. Technology can also enable diversity, opening up discussions to a much wider range of people in different geographies and time-zones, through collaboration platforms and virtual networking – again provided that we have enough security built in to trust that we are engaging with the person we think we are talking to and not a convincing AI-generated deepfake!

Use Case

One noteworthy case study that exemplifies innovation in the Aerospace and Defense industry is the development of engines like the Trent 7000 by Rolls Royce. These engines incorporate advanced technologies to meet strict emission standards while also significantly reducing noise levels. Airbus' implementation of castellated engines on the A350 further demonstrates the industry's commitment to innovation in noise reduction and environmental impact. The collaborative efforts between manufacturers and aircraft producers have resulted in benchmark aircraft like the A350 and 787, which set new standards for noise and pollution levels.

MIKE DWYER

WE COLLABORATE

ECONOMY OF THINGS

In a digital dance of devices and decentralization, a new Economy of Things emerges; business as usual gets a revolutionary remix.

What

The Internet of Things (IoT) has been both emerging and with us already for a number of years now. Huge amounts of work have gone into exploring the privacy, ethics, trust, security, and risk implications as a highly interconnected world has emerged – that is, 'cyber-physical' connected devices, all sorts of things with networked sensors embedded in them. There is still huge potential in joining devices together – it will develop smarter transport systems, smart cities, smart homes and smarter supply chains. It gives rise to all sorts of challenges too, from technical challenges in doing computational activities with low power at 'the edge' – making it faster and cheaper for the consumer – but also how to manage the cybersecurity challenges which arise from those kinds of hyperconnected networks.

Impact

There are huge advantages of everything being connected and having sensors in everything, like real-time decision-making, giving you an almost fully informed picture of everything that's happening in the moment and has happened. However, there are challenges around the potentially exponential effects of something going wrong – accidentally or deliberately being introduced – that can infect the system and go everywhere very quickly because everything is connected, and that doesn't stop at national borders. Then there are more subtle inferences from IoT data, about patterns of life and activities. Who has access to that sort of data, and how do we manage that?

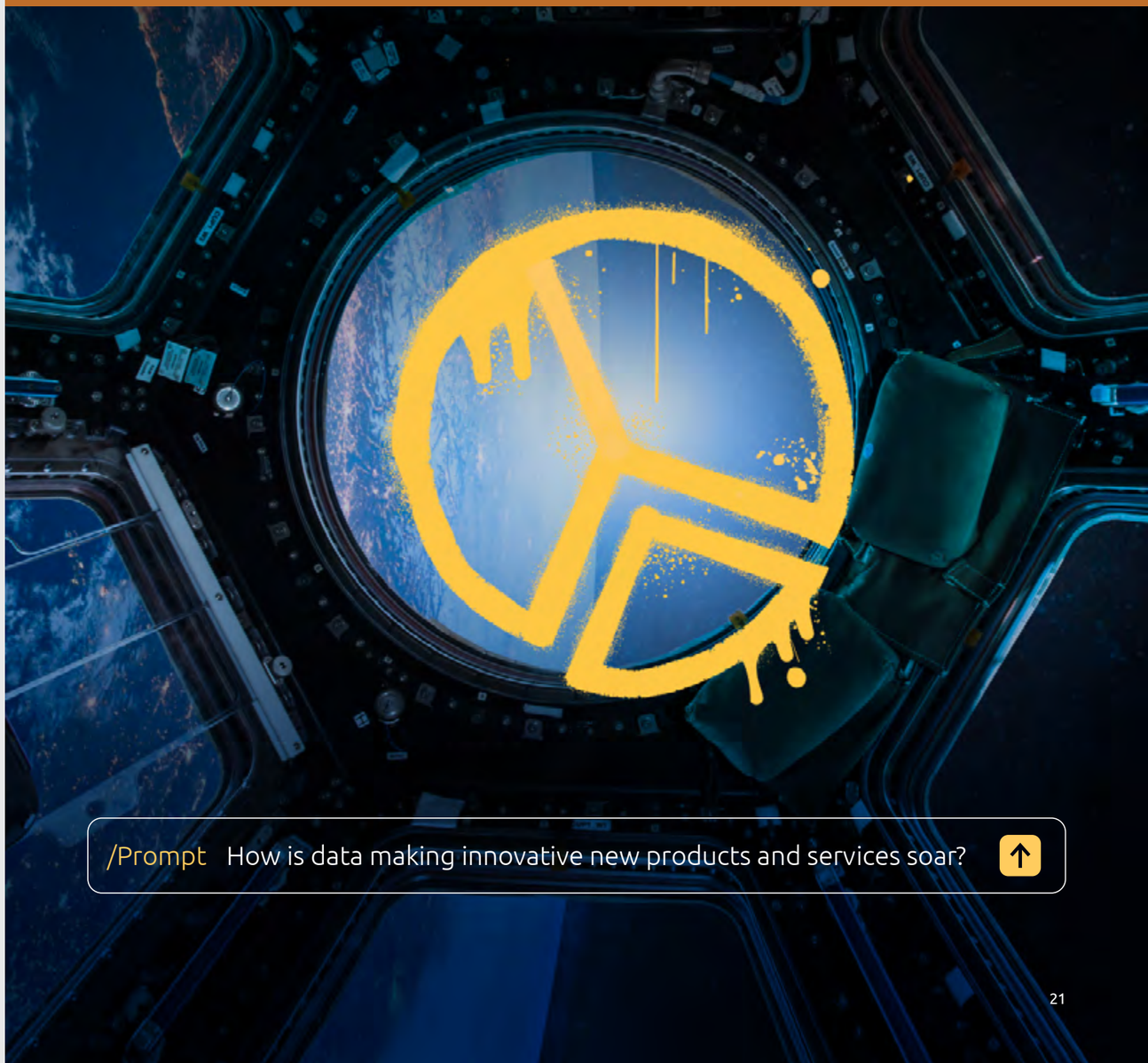
Use Case

The Capgemini Applied Innovation Exchange in Toulouse has developed an IoT satellite-enabled tracking prototype based on the Kinéis and Astrocast technologies. This proof-of-concept showcases how IoT devices linked to Low Earth Orbit (LEO) satellite constellations provides sensor information for track and trace across the globe, even in remote environments. IoT devices equipped with humidity, temperature, or other sensors, alongside GPS location tracking, open up cross-sector use-cases in supply chain, transportation and agriculture.

LUCY MASON

THRIVING ON DATA

It is no wonder organizations aspire to thrive on data, to be data-powered enterprises. With every business now being a de-facto Technology Business, data is at its core, dare we say, every Business is a Data Business? Data powers superior customer experiences, highly tuned operations, and smart, self-optimizing products and services. Data provides resilience, predictability, and effectiveness, but also enables organizations to achieve their sustainability ambitions. And do we even need to point out the potential breakthroughs generative AI is bringing? It is, therefore, time to see data for what it is: a first-class product; carefully and sustainably owned, managed, and activated by business domains, close to where it is created and used. All of this while shared in lively exchanges inside and outside the organization.



THRIVING ON DATA

DATA SHARING IS CARING

Participating, collaborating, or even leading in data ecosystems gets much more value out of data; and what works for the outside marketplace might do miracles for internal data sharing as well.

What

In the Defense context, there's a significant 'data hunger'. Modern military equipment, such as planes, drones, and submarines, are essentially data-producing entities. Additionally, people generate immense amounts of data, creating vast opportunities for the Defense industry to utilize this data effectively. Given the current geopolitical situation, particularly within NATO and Europe, there's a push to ramp up the production of Defense materials. Countries need to ensure they can stand their ground on their own or in a coalition. This requires a robust supply chain and collaboration, which relies heavily on data sharing. Data sharing involves information about inventories, demands, source materials, delivery times, and more. From the industry perspective, Data Sharing is Caring is important for everything to run smoothly. This emphasis on data sharing is essential for the industry to meet its production demands and maintain readiness.

There are also new technologies that excel at detecting threats, making the goal of achieving information superiority — or a dominant information position — crucial. Data and AI-powered solutions are used to help identify targets and track troop movements. These tools are essential for providing the right response and creating effective interventions at speed. From the coalition point of view, countries no longer act in isolation but collaborate in groups like NATO. In such coalitions, it's essential to share data during and before missions. NATO is developing standards and architectures to ensure seamless data sharing among Member States, making data-driven operations a crucial aspect of coalition activities.

The concept of data sharing with edge computing in connected Defense encapsulates the vision of a seamlessly integrated Defense system. Imagine a scenario where a fighter jet in the sky is linked to ground troops, a moving squadron, and headquarters. Information flows effortlessly, with drones providing real-time reconnaissance. This interconnection allows for coordinated movements, informed decisions on when to hide or advance, and overall strategic superiority. This vision represents the direction in which Defense is evolving, a landscape where data sharing and connectivity play pivotal roles in ensuring operational efficiency and effectiveness.

Impact

The geopolitical factors (like the war in Ukraine) have significantly underscored the importance of technologies like the cloud and AI. These technological shifts in the future hold immense significance. It has highlighted the importance of bringing data out of silos and securely sharing it in the right form, at the right time, to the right location, based on the requirements of a specific user who is in a position of data analysis and decision-making with those data forms. For example, for an analyst working at a desk, multiple screens may be used to display data for analysis and scenario planning. On the other hand, a field operative wearing tactical gear may have limited interaction capabilities, such as using a tablet or voice commands, while an AI system dealing with hypersonic missiles must quickly determine points of impact and take preventive actions, focusing on immediate responses rather than detailed analysis. Similarly, when briefing a general, the focus is on providing key insights and recommendations rather than presenting all data and possibilities. The interface design must cater to the user's needs and context to ensure effective decision-making and action. The information presented to them needs to be clear, actionable, and directive, known as actionable intelligence.

The foundation of data sharing lies in trust. Without trust, data sharing becomes selective and risky, potentially leading to data poisoning. In the NATO context, trust between Member States is essential.

NATO has established standards for data sharing, focusing on interoperability through concepts like Federated Mission Networks (FMN) and Coalition Shared Data. They have developed standard agreements that define data structures and ontologies. While these standards allow for some flexibility in interpretation, they provide a framework for data governance and management. NATO operates on a 'comply or explain' basis, where Member States are expected to adhere to these guidelines to ensure NATO's operational effectiveness. Failure to implement these standards could hinder NATO's ability to function efficiently.

Use Case

Airbus, in collaboration with partners in the APROCONE project, developed a data sharing platform to improve supply chain efficiency and reduce development costs. This platform facilitates real-time sharing of design data, enabling faster and more collaborative product design processes. By streamlining data sharing, Airbus can engage with new technology providers and researchers, fostering innovation while optimizing its supply chain operations. Additionally, the enhanced transparency and collaboration in data sharing contributes to more environment friendly outcomes, aligning with efforts to reduce the industry's carbon footprint. The APROCONE project demonstrates how sharing engineering data can revolutionize the Aerospace industry's design processes.

MARTIJN VAN DE RIDDER

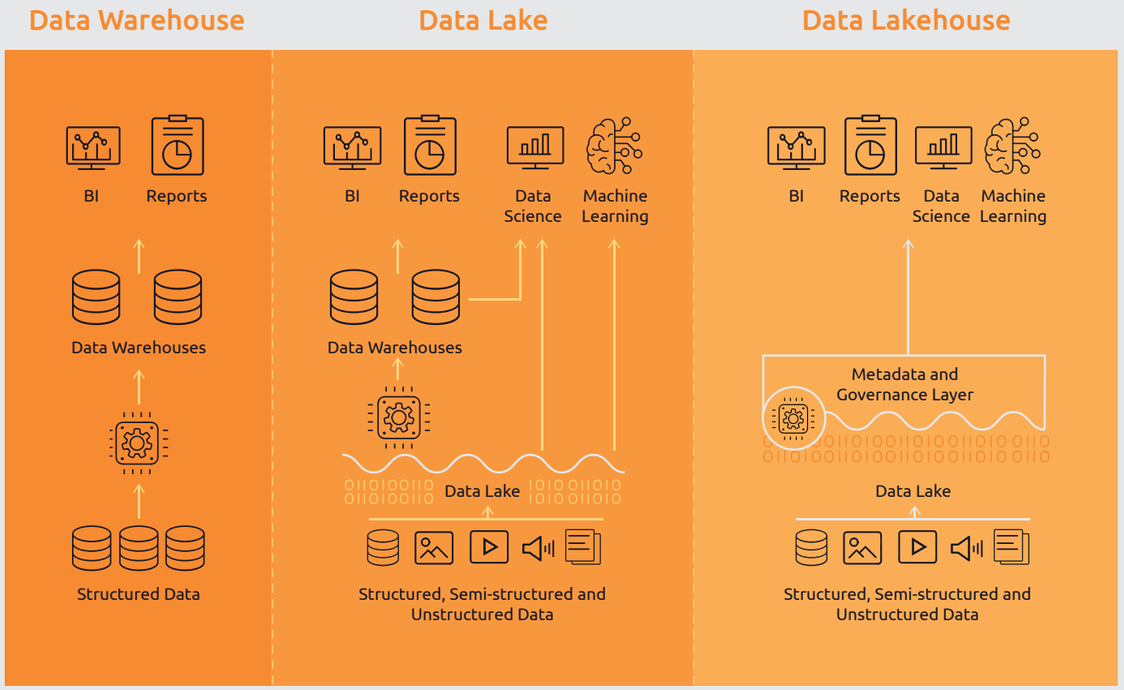
POWER TO THE PEOPLE

A growing scarcity of specialized skills, the need to activate data as close to the business as possible — plus powerful AI and automation tools — are all driving the unstoppable self-service data revolution.

What

Contemporary data strategies involve decentralizing data management, distributing it across various business domains with IT systems tailored for specific data needs. This approach not only addresses the immediate needs of business units but also alleviates the burden on central IT systems, ensuring better performance and more relevant data usage. Within this strategy, there is an ongoing dialogue about data ownership and management that continues to evolve, reflecting a broader shift towards more distributed and user-centric data governance models. Here the concept of 'data empowerment' is critical. By decentralizing data ownership and governance, we enable business users to reclaim authority over their data. This shift is crucial for businesses aiming to leverage data effectively and align it closely with user needs and business objectives.

The ease of access provided by the cloud has fundamentally changed the landscape of data management. Databricks exemplifies this shift by focusing on business-specific needs, allowing for high-performance data processing tailored to domains. For instance, companies such as Airbus are adopting the Data Lakehouse model to streamline their data strategies.



Impact

This change marks a significant transition from the traditional role of IT systems as the primary caretaker of data to a role where IT is the provider of the necessary tools for data management. In turn, this shift requires business units to develop competencies in handling data, including technical skills that were traditionally reserved for IT professionals, such as the integration of AI and data pipeline management within their operations. This transfer of responsibility signifies a broader trend where business units are not just passive recipients of data services but are actively involved in shaping how data is utilized to support business cases.

Strong governance structures are crucial in this context, facilitating swift transitions and decision-making across different departments. This integrated approach not only speeds up incident resolution but also enhances the agility of product development. It allows for the creation of both large-scale products, like aircraft, and smaller components that are vital to the operation and innovation within these fields. Companies across the Aerospace sector are leveraging this approach to refine their product conception processes, enabling faster responses to market demands and technological advancements.

Use Case

Skywise is a data platform tailored to the aviation industry that facilitates the integration of data across different departments, transforming raw data into actionable insights.

One practical application of Skywise is in managing airline incidents. For example, when an issue is reported — such as a problem with an aircraft's electrical system — the data is initially handled by the customer services department. This department acts as the data owner and organizes the information into a shareable data product. This product is then utilized by the engineering department to analyze the incident and determine its cause, such as a misconfiguration or a typical wear and tear scenario. The concept of a 'data product' within Skywise is pivotal, as it requires validation by designated data officers or custodians who ensure the accuracy and appropriateness of the data. This approach not only enhances data utility and relevance but also aligns closely with the strategic objectives of the business domains involved.

NICOLAS YDDER

MY AI GENERATION

Generative AI enables individuals and organizations to express themselves creatively like never before while boosting productivity — but human oversight and guardrails are key.

What

In the Aerospace and Defense industry, there is significant interest in generative AI (Gen AI), with over 90% of decision-makers discussing its potential use cases. The industry is in the early stages of exploring how to leverage Gen AI, focusing on increasing productivity and integrating Gen AI solutions into military products. This sector has high standards for digital software integrity and security, and the rapid improvement in Gen AI models, supported by necessary hardware, is driving a dynamic situation. There is curiosity about liquid AI, which suggests models are becoming more efficient, allowing them to be used on the edge or within products. Key requirements for Gen AI models in this industry include traceability, explainability, and on-premise deployment due to high IT security standards. Additionally, partnerships with open-source and commercial models like Mistral and Aleph Alpha are crucial for meeting industry requirements.
The fundamental benefits of Gen AI include optimizing efficiency and enhancing decision-making processes, which can help with classification, export control, and many repetitive daily tasks.

Impact

The adoption of Gen AI in the Aerospace and Defense industry promises to significantly increase productivity and efficiency by automating repetitive tasks and optimizing decision-making processes. Integrating Gen AI into products can enhance capabilities, especially for military applications, while maintaining high standards for digital software integrity and security ensures reliable and secure applications. Rapid advancements in Gen AI models and necessary hardware will drive continuous innovation in the industry. However, challenges such as hardware limitations, cost management, and mindset shifts among employees need to be addressed to ensure successful implementation. Overcoming these challenges involves ensuring access to necessary hardware, managing costs effectively, and investing in extensive training programs while maintaining ethical standards and human oversight. In the long term, Gen AI is expected to transform how the Aerospace and Defense industry interacts with technology, leading to new applications and improved processes. Clear communication about Gen AI's capabilities and limitations is essential to manage client expectations and address biases, ethical standards, and legal constraints, ensuring responsible and transparent integration of Gen AI solutions.

Use Case

Aleph Alpha offers a full-stack Gen AI solution, covering everything from hardware to the Gen AI platform and its own models. In contrast, Mistral focuses on optimizing the performance of its models. This means you can combine the strengths of both: use Aleph Alpha's intelligence layer as a platform and integrate Mistral or other open-source models like LLama. This approach allows you to benchmark and compare model performance for different use cases, whether generating text, classification, or other tasks.

Capgemini has partnerships with both Mistral and Aleph Alpha, both are among the most promising Gen AI providers in Europe.

CHRISTIAN WEBER

NET Ø DATA

Data is key to delivering net-zero ambitions. But data itself needs to be sustainable, too: the battle against data waste is on.

What

Let's start with the obvious, the Aerospace and Defense industry can change the face of the planet; it is responsible for making, using, maintaining, and decommissioning the most complex machinery ever made, and with a constant rate of innovation and engineering evolution. The Sustainability agenda is front and center in the minds of those innovating and evolving, given the significant impact and responsibility of the industry. The industry recognizes this, and although regulation and legislation around Environmental, Social, and Governance (ESG) are not a new bedfellow to an existing regulated industry, it is not a simple fix. Indeed, the creation of the International Aerospace Environmental Group to steer the Aerospace industry, along with other International Air Transport Association (IATA) members, plan Net-Zero carbon emissions by 2050 for Aviation travel.

In 2024, digital and data initiatives are not new but are rapidly gaining momentum across the lifecycle to tackle the challenges ahead. From early prototypes and proof of concepts to mainstream adoption, harnessing inherent organizational data and embracing new AI concepts like generative AI and Large Language Models (LLMs) will provide deeper insights and enhanced analytic capabilities. For instance, using LLMs to interrogate the supply chain can help remodel a less carbon-intensive logistics plan, while recalibrating performance to optimize mean-time between failures based on actual performance, rather than supplier estimates, will increase efficiency and reduce waste in operations.

Technologies or innovations like Digital Twins and 3D visualization are providing ways to overcome ESG challenges. These visualization technologies, when layered over Product Lifecycle Management (PLM) or asset data, is not only more cost-effective in terms of compute power and affordability but also when combined with LLMs, can illustrate the opportunity to drive a more holistic ESG impact beyond just financial or operational efficiencies. Using Digital Twins to simulate design and usage will deliver time and financial savings, and the environmental savings from reduced engineering, and manufacturing waste will also have a positive outcome.

The use of AI, particularly generative AI and LLMs, incurs costs in terms of computing power. While these costs are reduced with increased efficiencies, their impact should be considered when setting objectives for modelling possibilities. AI alone will not solve the ESG challenge, but it can help and will evolve as LLMs develop to specifically target ESG.

Impact

Pioneering organizations across industries that have embraced ESG are finding that boardrooms now have a more inclusive purpose linked to the overall Corporate Social Responsibility (CSR) agenda. This results in a more engaged workforce and, in manufacturing, a more connected and supportive local environment. The impact is evident with significant strides made when organizations embrace the opportunity to address ESG challenges through learning the skills to optimize and refine processes, and embracing technology. For example, Rolls Royce has created Digital Twins of their commercial engines, allowing the company to collect real-time data to assess engine performance, ultimately saving 22 million tons of carbon.

In terms of the immediate effect of NetØData on businesses, industries, and societies, many organizations have

initially been hesitant to embrace the opportunity, viewing it as another burdensome task to comply with additional regulations. However, those that address ESG challenges through the People-Process-Technology perspective can reap immediate 'green adoption' benefits or, conversely, avoid being associated with not contributing to the resolution of a much bigger problem. Engaging with shareholders, employees, and the broader market about the magnitude and approach of the organization, and sharing authentic and meaningful action, is more likely to attract investors and talent. As demonstrated in unity of the Chief Technology Officers of the seven major aviation manufacturers in a letter of collaboration to address industry technology solutions.

Early adopters of this trend may face challenges due to a lack of knowledge about regulations and legislation, as well as a deficit in the data needed to comply with these requirements. It's not just about the lack of readily available trusted data for reporting; there is often a need to gather additional data (e.g., emission data from welding) to complete the picture. The available data is typically inconsistent, raw, incomplete, and inaccurate, so there is a business need to ensure that reporting is accurate and timely.

The trend creates opportunities for innovation and competitive advantage when addressing the challenge by treating carbon as a cost and assigning a monetary value to it. Game changers have developed an end-to-end approach to carbon accounting, leading to a comprehensive business oversight centered around an Environmental Profit and Loss metric. This approach represents true leadership, and organizations that have adopted it are now among the most pioneering and transparent in terms of understanding how their products and services impact the planet.

The trend of moving towards Net Zero is not just a passing trend; it is becoming a mandatory requirement for businesses. Achieving Net Zero requires dedication and focus on authentic actions to address the challenges. This journey is as important as reaching the ambitious destination of Net Zero.

Use Case

Many organizations are exploring ways to understand and address the need for ESG regulations. In manufacturing this is following a similar evolution to Health and Safety standards for employees, for example, Personal Protection Equipment for welding to monitor and protect the welder, will also monitor gases and emissions to monitor and protect the atmosphere. This requires knowledge of the regulation, the process, and the requisite data to govern and ensure it is valid and accurately reported. A good example is BAE, where over the past 15 years at Portsmouth Naval Base, they have helped reduce energy-related carbon emissions by more than 40%. Moving from ESG reporting to optimization on this 'journey of enlightenment'.

PHILIP HARKER

THE THING WITH DATA

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

What

In the scenario of multiple Internet of Things (IoT) sensors communicating in diverse languages, a robust data management strategy is essential to perform meaningful data analysis. The NATO Generic Vehicle Architecture (NGVA) plays a pivotal role in standardizing vehicle data protocols, thus facilitating the extraction of valuable insights from the collected data. NGVA is the approach selected by NATO and related industries to standardize the interfaces and protocols for military vehicle systems integration.

Managing data flow is not just about broadcasting all the data; it's about understanding who has what information and who needs which information. Similar to how the internet works with search engines, there needs to be a system in place for requesting and providing information in a connected Defense scenario. This data management system must be high performing, with low latency and real-time capabilities, especially for tasks like tracking enemy positions or following coordinates. The goal is to enable soldiers while reducing their cognitive load. It's not about having massive amounts of data, but about having the right information at the speed of relevance. This requires collaboration between technology experts who can provide the data and clients who just need the information, finding a balance that meets both sides' needs.

This makes cascading services essential. While a laboratory can provide a wide range of high-quality data and services, the real challenge lies in cascading these services down to the edge where resources are more limited. This means defining data clearly, using the right protocols and language, and implementing the right algorithms. Additionally, it's crucial to generate dummy or synthetic data, especially for training AI models. Using classified data for training is often not feasible due to security concerns, so having synthetic data allows for effective learning and improvement of services, software, and algorithms. Overall, unclassified data is key to leveraging its full potential for enhancing services and technologies.

Impact

The impact of The Thing with Data trend is significant, especially in the context of a connected battlefield or Defense system. Effective data management ensures that relevant data is available where and when it is needed, without overwhelming the system or causing performance issues.

To avoid overwhelming everyone with a lot of data and causing a denial of service, it's crucial to speak the right language and define protocols and interfaces with global standards or API standards for coalition partners. This ensures interoperability and modularity, allowing sensors to provide microservices that can be used in various solutions, leading to an increase in flexibility by assembling solutions from these microservices. This approach enables high-performance use of sensor data.

In practice, adapting sensors to the NGVA is essential to understand their performance. Time stamping is important for data accuracy, as delayed data can lead to incorrect information. This becomes especially critical when using screens for real-time monitoring, as delayed data can distort the picture. Therefore, it's important to assess sensor performance up front, especially for AI development and decision support, as data synchronization is key. In a connected world, time synchronization is fundamental, as unsynchronized data and information lack coherence.

To handle such huge data, we need software. It not only emphasizes the importance of software for managing data but also presents opportunities to reduce lead times and maximize resource utilization end to end.

Use Case

Capgemini's Software Framework Solutions (SFS) Portable 4G/5G Software Platforms are designed for either vehicular or battery-powered backpack deployment for emergency or public safety use cases.

The LTE/5G Centralized Unit (CU) / Distributed Unit (DU) can fit into small form factors and power various use cases, such as airborne base stations for tactical communications. It is pre-integrated with ultra-low power SoCs and includes Integrated Access Backhaul (IAB) for establishing mesh networks. The 5G Core Network Solution is suitable for small-footprint ARM and x86 processor systems, including ruggedized laptops and small industrial PCs. It features integrated Graphic User Interfaces (GUI) for easy configuration and supports multiple applications, such as drones, vehicles, or Satcoms, providing connectivity for both public and private networks. Network in a Box for LTE and 5G integrates CU, DU, and Next Generation Core (NGC) into one system for high portability and field usage, enabling quick setup as a fully functional network in isolated locations.

CHRISTOPHER GAUBE

PROCESS ON THE FLY

Strategy tends to be eaten for breakfast, by culture – but also by a lack of operational execution. Organizational aspirations are simply “blah blah blah” without the ability to turn insight into action, quickly respond to events, overcome business silos, or go with whatever flow the corporate purpose supposes. And all that goodness must be delivered against a scarcity of both human resources and natural resources, plus the drastic need to reduce travel and energy consumption. This is where Process on the Fly comes to the fore and shines ever brighter. Breakthroughs within intelligent automation, digital twins, micro processes, and a taste of touchless execution have firmly placed this container center stage. And do we see the notion of 'lights out', autonomous business processes already looming on the horizon? It might be what a Technology Business ultimately becomes – a confluence of all disruptive technologies. It sure leads to exploring the new role of humans within that future, just as much as rediscovering the corporate purpose.

PROCESS IS MINE, MINE, MINE

The 'Process is Mine' trend is a constant. While many trends may be specific to particular moments, the need for well-defined processes and process ownership remains fundamental.

What

Organizations seek orchestrated central processes, yet the reality is that many still operate in silos, adhering to a 'Process is Mine' mentality where each unit wants to control how these processes are designed and implemented. There is a desire for standardized central processes but also a strong preference for individual design, resisting adjustments to higher-level decisions. Standardized processes are crucial. These processes should focus on the entire value chain and a comprehensive approach, rather than being limited to smaller, department-specific operations or single outcomes. This holistic view ensures a more cohesive and effective system, benefiting the organization as a whole.

Processes are often designed top-down, focusing on overarching objectives and regulatory compliance. However, the execution of these processes, particularly in a Defense context, is bottom-up and driven by immediate operational needs. This top-down versus bottom-up approach creates inherent conflicts of interest and challenges in aligning strategic goals with practical implementation. Thus, communication and change management emerge as critical characteristics in navigating these complexities.

Regardless of the technology, having robust processes and clear ownership is essential. This stability in process management is one of the most critical aspects of organizational success as in the end, it's always a balance. You might not always want to design the process upfront, but sometimes technology itself can determine the process. This dynamic interplay between technology and process design highlights the evolving nature of operational frameworks and the importance of adaptability in organizational strategy.

Impact

The actors designing these processes are changing, significantly impacting organizations. In the past, the approach was to start with a functional design, followed by a technical design, where the prior dictated the process to be implemented. Now, however, various technological trends are driving the Process is Mine, Mine, Mine mentality. One notable example is the automation of processes, including the use of unmanned systems and autonomous decision-making, which has significantly influenced the Defense sector. The rapid evolution of AI is a major driver of this trend, whilst maintaining a human in the loop to ensure ethical and safe decision-making.

However, the pace at which technology is evolving is both disruptive and, at times, unsettling. For example, the situation in Ukraine highlights how quickly accessible technologies, like drones, can be repurposed for immediate needs without long-term investment. This rapid deployment of technology reflects a shift towards using readily available solutions to address immediate challenges. As a result, organizations are adapting their processes to keep pace with technological advancements.

In the long term, the Process is Mine, Mine, Mine trend is one that will always be present, though it will be triggered differently and will have varying impacts over time. Currently, the trend necessitates flexibility due to the involvement of various actors, requiring constant reshaping. Picture it like an octopus with multiple tentacles — diverse yet interconnected. This foundational trend will persist, adapting its form to the evolving environment.

Use Case

Capgemini’s collaborations with Airbus and the Space Division of the Dutch Air Force are prime examples. The challenge lies in determining how to utilize satellite data effectively and which processes can benefit from it. This requires rethinking traditional business models to leverage the connectivity provided by these technologies. In practical terms, the need for reliable communication becomes critical with satellites playing a vital role in this context. However, the choice of satellites is also influenced by geopolitical considerations. The key is to adapt to these evolving technologies and integrate them into existing processes to enhance efficiency and decision-making. The ability to harness data from various sources, including satellites, and process it effectively can provide a significant strategic advantage.

JASMIJN BALDINGER

SILO BUSTERS

Busting corporate silos by adding flexible process layers on top of them, rather than breaking or rebuilding established structures.

What

Cross-functional collaboration within Aerospace and Defense has traditionally been hindered by functional silos, where manual handoffs between different teams slow down processes and create inefficiencies. Inter-departmental issues and friction often exacerbate this, leading to delays and cost overruns. In an industry where accelerating Defense capabilities and getting products to market quickly is crucial, breaking down these silos is essential. Organizations need to remove barriers and foster close collaboration both within and across organizations. This involves minimizing unnecessary interfaces and handover points, focusing on efficient collaboration to complete engineering, manufacturing, and supply chain tasks. Investing in automation and insight platforms, along with coordinating the entire value stream, can improve speed, efficiency, and value transparency. Cross-functional collaboration ensures that each part of the process contributes to delivering the final product to operational contexts swiftly and effectively.

Impact

The shift towards cross-functional collaboration in Aerospace and Defense creates significant opportunities for innovation, competitive advantage, and operational efficiency. By bringing together highly skilled individuals around a single topic, organizations can eliminate communication barriers and foster empowered scrum or squad communities. These teams, equipped with the right tools and data-sharing capabilities, can work together effectively using agile principles or other iterative design methodologies. This enhances speed and accuracy, especially in a virtual work environment where seamless data connectivity is crucial. Additionally, aligning engineering and manufacturing more closely can address the increasing demands for production ramp-ups and urgent operational needs. As a result, companies can reduce costs, energy consumption, and CO_2 emissions while driving better economies of scale. Ultimately, cross-functional collaboration enables Aerospace and Defense organizations to deliver reliable, safe products efficiently, maintain competitiveness, and drive broader societal and industrial transformations.

Use Case

The Skywise platform from Airbus allows operators to take advantage of a better aircraft experience through big data at scale. As a partner, Capgemini plays a key role in fostering collaboration across teams, enabling individuals to be more productive, make decisions faster and trust the data provided. A key piece in digital continuity, the platform enables each step of the chain to ensure what they do positively impacts the surrounding steps. The platform has inspired other industries and government agencies to look at their data and ways of collaborating through a new lens.

MIKE DWYER

MICRO PROCESS MAGIC

Miniaturizing processes into micro-sized forms to achieve greater speed, agility, and efficiency —while learning more about daily operations.

What

In an industry where processes are built to last for decades not years, legacy monolith systems are often commonplace but difficult to upgrade, optimize and improve to enable greater agility and scalability. Micro Process Magic is all about unleashing the magic of the micro, breaking down monolithic processes into smaller and 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.

In the Space sector, we see this play out in ground segments, where rather than custom-built end-to-end systems, integrators look to leverage ready-to-use building blocks with limited customization on-top. By breaking down the once monolith system, ground segments systems utilize standardized APIs and cloud-based solutions to accelerate development time and enable the exchange of one building block for another. As a result, the associated processes are segmented, leading to the emergence of Ground Segment as a Service (GSaaS) models that can be delegated in a SaaS mode. Such GSaaS models are based on the virtualization of traditional ground segment components that are generic and re-used for each mission, with little need for customization. Services such as Command and Control, Space Surveillance or Flight Dynamics can be provided by off-the-shelf solutions, enabling rapid deployment at reduced cost.

Impact

In the fast-evolving New Space era, new actors need to bring new solutions and services to the market at a fast rate. By unleashing the power of independent reusable units, providers are better able to swiftly adapt and innovate, cherry-picking the best from the market. This is particularly important in the Space for All paradigm, whereby Space services are utilized across industries, as non-Space industries look to leverage technologies without the need for in-depth expertise in the Space domain.

Furthermore, with ever-increasing private interest in the Space sector, resulting in more and more players in the field, innovation and agility enable players to stand out from the crowd and respond to this evolving market. For example, the decoupling of processes and the integration of cloud-based solutions is opening up ‘Direct to Cloud’ innovations, where Edge capacities on-board are directly linked to cloud-based ground segments, with some processes even deported on-board.

Use Case

The mission center is a core component of the ground segment within Earth Observation satellite operations, managing real-time imaging requests and optimizing the planning of the satellite or the constellation. It interconnects with all the other components. Capgemini has developed an industrial and scalable solution, designed for an optimized cloud environment, to allow for the agile integration of new requirements and to enhance the operational efficiency of operators. The solution allows the optimization of the satellite programming plan, in order to offer increased simplicity and reactivity to meet multiple user needs. It has already been implemented for Prométhée, as part of the ground segment of their nanosatellite constellation JAPETUS.

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CAROLINE BALL

PROCESS ON THE FLY

CAN'T TOUCH THIS

A process seamlessly adapting to its environment, delivering optimal performance — all without human intervention on the spot, all remotely managed.

What

The Aerospace and Defense industry is highly dynamic with increasing demand driven by the current geopolitical situation. To meet these demands, organizations have many challenges, a key one is the need to focus on efficiency and business process stability. The 'Can't Touch This' trend highlights the importance of stable and efficient business processes, supported by reliable applications. This trend maintains that organizations must ensure stability and efficiency to thrive in this evolving landscape. The most important characteristics of this trend are its scale and efficiency. Traditionally, the acronym E2E stood for End-to-End when focusing on a business process-centric approach. Today, the process focus remains but has now evolved to mean Edge-to-Edge, expanding the scope to include edge technologies and devices that hang off core business processes. This trend is therefore not about taking the longest journey but about achieving efficiency throughout the entire process, from edge to edge.

The desire for touchless systems has been in the IT industry for many years, you could say it has been the focus of business applications since the advent of ERP and maybe even before. Even so last year, Gartner created the concept of the 'Digital Nervous System', which is a clear description of the goal for many organizations. Touchless systems enable organizations to understand and manage their operations more effectively. When it comes to technologies and innovations, established technologies such as workflow tools and business process management tools are crucial for delivering touchless operations.

Another important aspect of maintaining 'touchlessness' is the integration of embedded quality engineering (QE) and service reliability engineering (SRE). These capabilities ensure that touchless processes are stable and resilient, preventing failures when processes run autonomously.

Finally, looking to the future, Gen AI is transforming the landscape. Previously, touchless operations were rules-based, requiring explicit instructions for IT and business applications systems. With Gen AI, we have a more dynamic partner that not only helps establish a touchless environment but also evolves it, enhancing efficiency and adaptability.

What differentiates this trend from others is its focus on business processes rather than solely on IT. Previously, touchless operations were often associated with automation in a very IT-specific or transactional context. Now, the trend emphasizes the integration of business processes as the front end, closely linked to IT. This shift means that we need to look at how business processes are delivered and optimized. Another key aspect is the need for systems to be self-healing, predictive, and preventative. This involves more sophisticated exception management, ensuring that automated processes can anticipate and address issues before they become problems.

Impact

The trend toward touchless operations is reshaping organizations by freeing up employees' time for more valuable tasks. Automating routine processes allows for tactical continuous improvement as well as more strategic contributions. However, this trend requires a deep understanding of business processes and data to avoid chaos. This change means that organizations must become more data-centric, requiring accurate data for effective implementation. In the A&D industry, touchless operations are crucial for applications requiring high availability and resilience. Traditionally, responding to business process issues involved many people on standby. However, with touchless operations, robotic monitoring systems predict and prevent incidents, enhancing efficiency. This trend also frees up time, allowing employees to focus on broader tasks.

Considering the immediate effects of the trend on the business, one significant impact is increased supply chain efficiency. Additionally, applying touchless processes to the development lifecycle can shorten the delivery time of products, which often span several years in the Defense industry. While the touchless trend itself is impressive, its true value lies in enabling people to focus on higher-value tasks, driving innovation and efficiency across the organization.

In the longer term, this trend will abstract complexity for people, letting them focus on finding new ways to improve processes and innovate, enabling not only the generation of more ideas but also their faster implementation. Despite these benefits, challenges exist, such as ensuring data quality and consistency, and getting humans to trust touchless processes.

In the future, we can expect to see touchless networks expanding into various areas such as supply chains. This expansion will be facilitated by technologies like Gen AI, which will help manage interfaces in situations where touchless processes encounter challenges.

Use Case

At GE Aerospace's Singapore site, the engine maker has been using an AI-powered robotic system for inspections. Around 90% of CFM56 engine airfoil fluorescent penetrant inspections for repair are being done using the AI-powered robotic system. This system takes data from thousands of turbine blades to formulate and comply with a technical standard that takes subjectivity out of the inspection.

GARY JAMES

PROCESS ON THE FLY

AUTONOMOUS ENTERPRISE

Harnessing AI, the autonomous and unattended 'lights out' enterprise continually optimizes itself, bringing harmony and blending capabilities between humans and technology.

What

Autonomous Enterprise harnesses the blend of human and technological capabilities to provide optimized processes, putting the emphasis on automation with the human-in-the-loop for specialized tasks. By putting the human in the loop only where necessary, and where they bring the most value, regular processes requiring little expertise, can be autonomized. Not only does this bring optimization but a better blend of capabilities between humans and technology. This is fully in-line with the TechnoVision 2024 theme, 'Augment Me!', the concept of using technology to augment humans and act as a catalyst for responsible technological progress.

New Space actors are driving satellite launches into the thousands, essential for the constellations providing global coverage. The small satellite market is estimated to be valued at USD 166.40 billion in 2024, reaching USD 260.56 billion by 2029. This growth highlights the increasing demand and diverse applications of small satellites in Space missions. To keep up, we see a need for transformation in the Space manufacturing process, not only for the satellites but launchers and in the long-term space vehicles, whereby the Space industry must adopt smart manufacturing processes, including automation, advanced robotics and 3D printing, to meet the growing demand. This means enhancing and streamlining processes to enable production ramp-up and keep up with the increasing demand. A significant step change from the traditional processes that enabled the production of a single satellite to modern, smart processes capable of producing hundreds, or even thousands.

Impact

The use of smart manufacturing processes, particularly automation, is pushing the industry to innovate in a rapid manner. There are more and more 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 seen in other sectors, the trend is pushing private actors to innovate to break into and stay in the market.

But this also means that keeping up with the pace is vital 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 – an opportunity for innovators to change the market as seen with SpaceX's Falcon 9.

A positive impact of this trend is the increased focus on sustainability in Space manufacturing. Greater private investment has brought a critical eye on sustainability, in a sector not traditionally known for its green virtues, but again is pushing private actors to innovate, change the as-is and rethink ways of doing things that have been in place for generations.

Use Case

UK-based launch provider Orbex has been awarded DKK 23.7 million (€3.08 million) in funding from Innovation Fund Denmark to establish a 'Green Propulsion Excellence Centre' in Copenhagen.

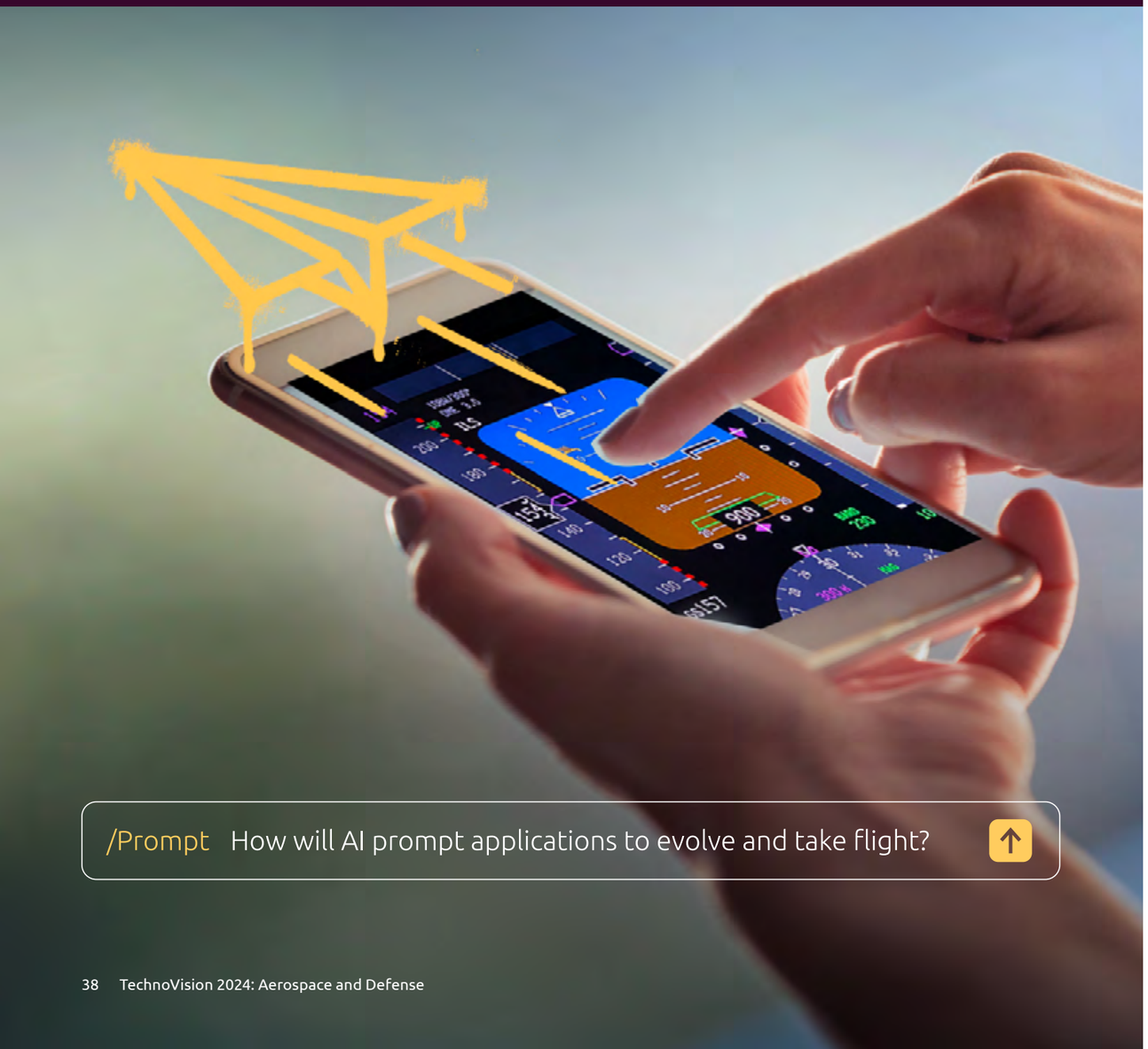
Orbex is developing a two-stage rocket called Prime that will be powered by BioLPG. Once operational, Prime will be capable of delivering up to 180 kilograms to low Earth orbit. The company is also in the middle of building out its own 'ultra-green' launch facility on Scotland's North coast.

The Green Propulsion Excellence Centre is to be a collaboration between Orbex and Danish company FORCE Technology. Orbex will use the center to design, produce, and test green propulsion systems for its rockets. FORCE Technology will contribute with the development of a 'high-energy CT X-ray facility' that will ensure the quality of Orbex's 3D-printed rocket engines before launch.

CAROLINE BALL

APPLICATIONS UNLEASHED

At the heart of any Technology Business is its applications portfolio; the thriving heartbeat of the organization – part of the business, responsive to every demand. These applications mirror the new business dynamics, built, and continuously changed at high speed and high quality, and in whatever incarnation necessary. Yet, many applications no longer look like the ones we used to know, as they morph into a connected mesh of lightweight, much more sustainable microservices. With agility and minimum viable products as established concepts, the quality of application services needs to be at an enterprise level, with a continuous, flawless deployment throughout all business operations. But the biggest change in the application landscape may be the way application services are activated by their users: through natural language and an explorative, self-learning dialogue – invoked from a chat, rather than from a menu.



/Prompt How will AI prompt applications to evolve and take flight?

HONEY, I SHRUNK THE APPLICATIONS

Next-generation agile applications, built on the concepts of Microservices, API-first, Cloud-native, and Headless, make up an applications portfolio that is continuously tidied.

What

Innovative software solutions are transforming connectivity and networking in Aerospace and Defense. Advanced frameworks now facilitate non-terrestrial networks, ensuring seamless connectivity from ground stations to satellites. This software-driven approach supports applications by providing robust computing power within these frameworks.

In Defense, comprehensive wireless and wired networking capabilities are enabled through sophisticated software solutions. Initiatives like Defense Advanced Research Projects Agency (DARPA) are driving algorithmic innovations, further enhancing the capabilities of these Defense frameworks. In Space, we see increasing interest in Space exploration, with major projects like NASA's Artemis program aiming to return humans to the Moon and Mars. Software solutions play a crucial role in this mission, providing connectivity through Low Earth Orbit (LEO) and Geostationary Orbit (GEO) satellites. These satellites, equipped with advanced software, offer terrestrial-like connectivity in space, ensuring continuous communication and computing power.

Over time, AI and machine learning applications will extend into space. These applications will analyze data to uncover new trends and possibilities and will facilitate the discovery of new potentials in space, driven by data analysis and continuous connectivity.

Impact

The strength of these innovative solutions lies in the ability to update and upgrade systems remotely through software, eliminating the need for physical retrieval of equipment. This enhances efficiency and aligns with the broader trend of achieving comprehensive, software-driven connectivity beyond Earth. The vision is to make Space more accessible and interconnected, leveraging software to extend the reach of networks into the final frontier. You could say "Honey, I Took the Connectivity Beyond Earth"!

In the future, satellites will likely be equipped with greater computing power to process data locally. This capability will enable them to handle some complex tasks onboard, rather than transmitting all raw data back to Earth for processing. This approach not only saves bandwidth but also ensures more immediate and efficient data utilization.

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 allow Satellite Communication (Satcom) providers to launch their products quickly in this competitive market. The solution is already compliant with 3GPP and has been tested with industry trusted simulators for channel and doppler variations, as well as 3GPP release 17 for compliant User Equipment (UE). Capgemini is involved in the Satcom journey from design and architecture to deployment and post-deployment support services.

ASHISH YADAV

WHEN CODE GOES KNOW

Pair programming with an AI assistant can significantly boost coding productivity and quality while steepening your learning curve — if you know what you're doing.

What

Whilst AI isn't new, the hype around generative AI has brought into sharper focus the range of possibilities AI can provide, in particular in the realm of software development. New and improved development assistant solutions represent the next generation of AI-enabled software development, augmenting developers by providing autocompletion, code and test generation, and high-level reviews. All of this is done through dialogue in plain, natural language. Gen AI-based solutions are built upon Large-Language models (LLMs) that have been trained using the knowledge available from the open-source community, vast amounts of excellent, publicly available source code.

Impact

This trend has the potential for far-reaching impact, across the entire Aerospace and Defense industry. 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 and a faster learning curve for junior software engineers. In the face of scarcity of specialized software developers, such solutions can open up opportunities for employees across the board to test out ideas and spark innovation, without needing decades of software development experience to get started. However, they must be used with caution. An experienced eye remains crucial for validation and optimization of results as inexperienced developers simply do not have the skills to spot nuanced, but impactful flaws, in the generated code. This is not a one-size-fits-all approach, critical and complex code requires rigorous validation processes in place before such solutions can even be considered for use. Within Aerospace and Defense this is especially important in systems that impact operational safety.

Use Case

Rolls-Royce started using Microsoft Power Apps to provide a way for citizen developers in the business to develop their own applications. Rolls-Royce is running sandboxes where employees can create and test apps to satisfy the requirements of one person, a team, a department, or the entire company. Employees can create business-supporting apps by extracting intelligence from datasets.

JOHN FREDERIKSEN

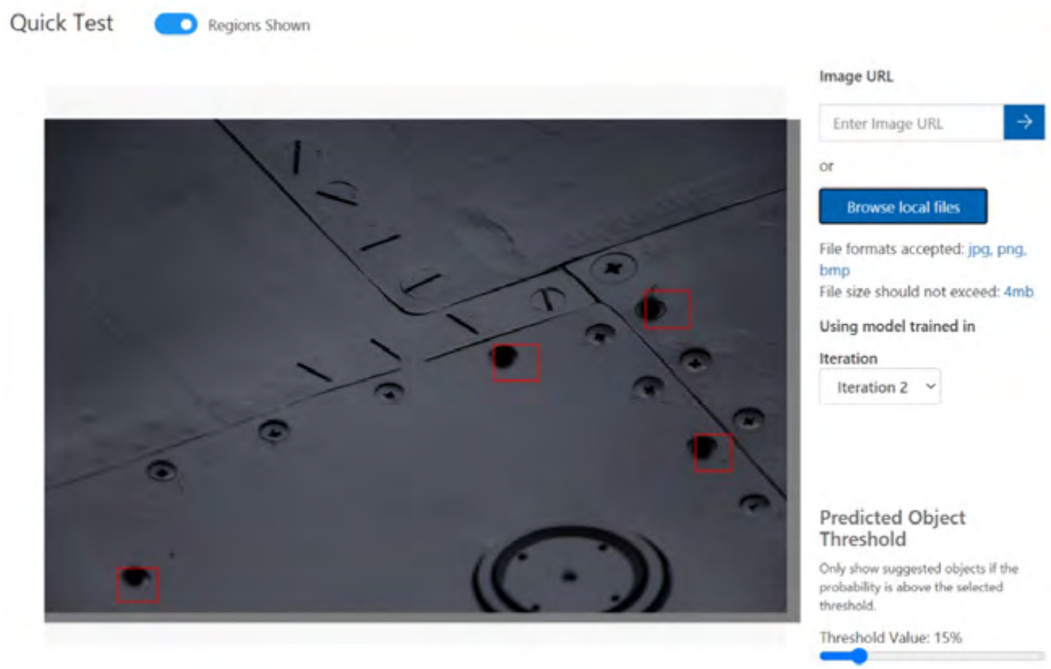
APPS ♥ AI

Systematically augmenting new and existing applications with AI capabilities, making them smarter, more powerful, and — as a result — more valuable.

What

The Apps ♥ AI trend in Aerospace and Defense leverages APIs to enhance data retrieval for applications by integrating AI, particularly through Large Language Models (LLMs) and learning management systems, to analyze existing and new data sources. Setting up microservices APIs allows easy and efficient data access, bypassing traditional methods. This trend focuses on identifying specific use cases and acquiring relevant data, as the effectiveness of generative AI depends on data quality. APIs ensure speed, simplicity, and targeted problem-solving, delivering high-quality and secure data outputs. Mitigating risks like data poisoning and prompt hijacking is crucial in maintaining data integrity and reliability.

In 2024, advancements such as specialized AI models are shaping this trend. Although not reaching Artificial General Intelligence (AGI), the focus is on creating 'agents' to handle distinct workflow tasks, improving efficiency. Hardware advancements by companies like NVIDIA and increased compatibility with Linux platforms are reducing infrastructure costs, making AI more accessible and fostering innovation. For instance, at the A4 Enablement Hackathon, a Capgemini team used generative AI to identify missing aircraft hardware and gain insights from tech manuals, FAA regulations, and maintenance data, as shown in the image below.



The trend emerged from recognizing that both locally run LLMs, and cloud-based AI models have their advantages, depending on the use case. Local LLMs can be cost-effective but require substantial infrastructure, security measures, and response quality monitoring. In contrast, cloud-based offerings provide scalability and ease of access to up-to-date data while avoiding the infrastructure costs of hosting a local model. Microservice APIs bridge these options, enabling users to choose the best approach for their specific needs while enhancing the performance of smaller, open-source models. Expanding token capacities enable more data to be processed per call, enhancing analysis. Gen AI is versatile when managing legacy data or inventory, identifying trends, optimizing processes, and uncovering opportunities across industries.

Impact

Transforming the Aerospace and Defense industries is gradual, akin to maneuvering a large aircraft carrier. Companies are driving significant shifts by investing in AI for predictive maintenance and computer vision to accelerate inspections.

The impacts are multifaceted, transforming traditional roles and processes. Introducing AI-driven machinery can face resistance from employees fearing replacement. However, showing how these technologies augment human capabilities builds trust and fosters collaboration.

AI enhances design, manufacturing efficiency, cost reduction, and scheduling. Long-term changes involve lighter materials, fly-by-wire systems, and replacing hydraulics with electric systems for more efficient, eco-friendly aircraft. Despite investment and quality challenges, AI offers innovation opportunities, improving quality control, efficiency, and safety. However, addressing sustainability concerns like high energy consumption and ethical issues remains crucial for responsible AI integration.

Use Case

Boeing Insight Accelerator is a predictive maintenance tool offering advanced analytics and customized alerts. It analyzes Quick Access Recorder/Continuous Parameter Logging flight data to provide prognostic insights and create unique airline alerting algorithms. Built-in augmented analytics identify patterns of premature component failure, enabling pre-emptive maintenance and avoiding disruptions, without requiring data science or advanced programming skills.

JASON HEATH

LITTLE GREEN APP

Engineer applications to be less demanding in terms of resources and energy with superior performance: Get more sustainable, but also better software.

What

An essential lever for the Aerospace and Defense industry to reach Net Zero is carbon offsetting, which provides a mechanism for companies to manage their remaining carbon footprint through voluntary and mandatory markets. This lever is closely linked with the adoption of sustainable aviation fuels (SAFs), which currently represent the largest component of the Aerospace industry's decarbonization pathway. The industry's shift towards these fuels not only addresses environmental concerns but also digitalizes the fuel supply chain, enabling more flexible and transparent market operations for SAF, which is critical for the widespread adoption and integration of these greener alternatives. To facilitate the use of SAFs, platforms are emerging, designed to digitalize the fuel supply chain and create a more flexible and transparent market for these fuels. The digital platform aims to unify pricing and standardize transactions across the industry, simplifying the process and encouraging wider adoption of SAFs.

Impact

The central focus is on convening key regulatory and lobbying bodies, such as international aviation environmental groups and Clean Joint Aviation Undertaking, around the same table to establish norms for the digitalization of SAF impact. The main objective is to ensure that the credits represent actual liters or gallons of SAF used, and to avoid any potential greenwashing. Cybersecurity measures are also significant, as any credits issued will need to be directly linked to SAF production.

Collaborations between companies are underway to develop SAF processes locally to ensure airports are well-supplied. This initiative includes using digital platforms to manage and trace SAF use, enhancing transparency and accountability in the industry's shift towards sustainable practices.

The timeline for scaling up SAF production is considerably lengthy, with projections extending to 2050 when 70% of jet fuel is expected to be sustainable. As of 2022, only 0.1% of total jet fuel used was sustainable, underscoring the monumental scale-up required.

Use Case

The RSB platform enables airlines and other stakeholders to manage their use of SAF more efficiently by allowing them to purchase SAF or corresponding credits through a standardized system. This system also offers the ability to 'book and claim' sustainable fuel usage, where an airline pays for SAF and claims the environmental benefits, even if the actual fuel used is conventional. This mechanism is vital in regions where SAF is not readily available, ensuring that airlines can still meet their sustainability commitments by supporting the global availability of SAF.

SEBASTIEN KAHN

APPLICATIONS UNLEASHED

CHAT IS THE NEW SUPER APP

AI-augmented chatting and talking in plain, natural language becomes the new app to rule them all.

What

The Chat is The New Super App trend emphasizes the importance of chat applications as central hubs for digital interactions in the Aerospace industry. AI-powered chatbots have evolved into sophisticated interfaces that act as personal assistants, remembering context and entities. In Aerospace and Defense, these chatbots navigate complex maintenance procedures, provide real-time information on requirements and documents, and connect to other systems for relevant data. This trend signifies a shift towards more intelligent and integrated chat systems, offering seamless and efficient interactions.

A key characteristic of this trend is the development of chatbots as copilots, improving how people engage with AI systems. These systems now have a more conversational tone and are more intuitive in their interactions, understanding the natural language on the fly. Additionally, AI assistants using speech-to-text and text-to-speech models assist aircraft workers daily, enabling hands-free interaction and improving efficiency. In 2024, the focus is on creating chatbots with specific personalities and roles, such as aviation advisors, providing on-demand expertise through prompts. This highlights the power of prompts in driving specialized and personalized chatbot interactions.

Advancements in AI models and platforms like Hugging Face are reshaping the landscape by providing access to open-source models and easy integration APIs. This trend expands the market beyond major players like Microsoft, Google, Amazon, and OpenAI, fostering innovation and competition. With models reaching trillions of parameters and more frequent data updates, the AI industry is becoming more accessible and powerful, driving the shift towards efficient, customized interactions and solutions in Aerospace manufacturing, maintenance, and scheduling.

Impact

AI-powered chatbots are accelerating feedback and adaptation in the Aerospace industry. As planes collect increasing amounts of data, AI helps companies effectively utilize this information, identifying and addressing gaps to ensure every part meets necessary standards. This trend reshapes organizational operations and process management, with AI-driven prompt engineering diversifying IT support.

The impact on transparency, accountability, and safety is profound. AI streamlines the maintenance of record-keeping processes, making it more efficient and transparent, which enhances safety and reliability. Companies use AI for defect detection, improving communication, and regaining trust from stakeholders by openly sharing AI's role in ensuring safety and quality. Over time, AI will become a standard practice, driving the industry toward a future where data-augmented assistants manage various aspects from manufacturing design to maintenance.

Challenges include overcoming the fear of change and job displacement, particularly for mechanics interacting with AI tools. Companies should adopt a flexible, incremental approach, starting with specific problems to identify where AI fits best. Gaining buy-in from all stakeholders, including quality assurance teams and ground employees, is crucial for widespread adoption. Opportunities for innovation are immense, with AI enabling optimal airplane design, virtual testing, and rapid iteration, ultimately revolutionizing the Aerospace industry.

Use Case

Air India rolled out a generative AI virtual agent named Maharaja, that handles 6,000 queries an hour, in four different languages. When the AI encounters an issue it can't resolve, the customer gets transferred to a live agent.

JASON HEATH

INVISIBLE INFOSTRUCTURE

The odyssey towards a truly invisible IT infrastructure is ongoing. The cloud, a signpost of increasing 'invisibility', is the default choice with a diverse range of deployment options. Plain acceleration has given way to a focus on value extraction, sustainability, industry contextualization, technology debt removal, and security, all while maintaining operational resilience. A software-and- AI-driven, nearly autonomous supply chain is key to that, providing an approach to deal with both the scarcity of skilled experts and excess energy consumption and CO_2 emissions. Expanding its practical applications, quantum computing is gradually becoming a phenomenal addition to the IT infrastructure potential, providing yet unheard and unimaginable opportunities. But IT infrastructure also expands its reach, integrating Operational Technology and 'things' at the edges of central IT, bringing technology closer and closer to real life.

/Prompt What does the runway for future infrastructure look like?

LORD OF THE CLOUDS

Cloud adoption moves far beyond the middle earth realm of cloud migration, now also driven by sustainability, distribution, sovereignty, 'FinOps', multi-cloud options, and even autonomy — all for that precious, better business flow.

What

Business objectives are increasingly focused on enhancing connectivity, exemplified by the need for seamless interaction between aircraft, ground services, and satellites. This requirement has led to significant changes in cloud architecture, supporting more robust and interconnected operations.

Cloud architectures now often incorporate a mix of on-premises and cloud-based solutions, often driven by regulatory needs or specific use cases that demand sovereign cloud solutions. For instance, where critical apps and data are hosted on-premises and applications that assure the performance of the whole IT ecosystem are in the cloud. Furthermore, the architecture is becoming increasingly modular, accommodating distributed cloud instances that are essential for edge computing. This setup is crucial for handling data-intensive operations, where quick processing and response times are necessary.

The industry is mindful of the carbon footprint of their cloud infrastructure, aiming to integrate sustainability into the architectural design from the outset.

The need to manage increasingly complex architectures, along with controlling costs and ensuring compliance with sustainability standards, is driving the adoption of advanced AI-driven tools and methodologies in cloud management.

Impact

The evolving architecture of IT systems is primarily aimed at better aligning IT with business objectives, providing enhanced flexibility, particularly in the treatment and processing of data. This flexibility allows for the preprocessing of data as soon as it is received — for instance, data coming from aircraft — and its subsequent transmission to a central architecture for further postprocessing.

However, with increased flexibility and a more modular architecture, there comes a crucial need for robust cybersecurity measures. As the architecture becomes more distributed, managing cybersecurity effectively becomes more complex. The adoption of zero trust principles is essential in this context, helping to secure a distributed architecture where users and services are widespread. This approach ensures that security protocols are rigorously applied at every stage of the data handling and processing chain, maintaining strict access controls, and minimizing potential security vulnerabilities.

There is an emerging sense of 'cloud fatigue' affecting various sectors due to the complexity and cost associated with maintaining cloud infrastructures. This fatigue is prompting organizations to reconsider their return on investment (ROI) strategies and explore alternative solutions. To address these challenges, some organizations are implementing financial and sustainability strategies, such as FinOps and GreenOps. These frameworks help manage and optimize cloud expenditures and environmental impact, ensuring that cloud deployments align closely with business objectives.

Use Case

A European Aircraft Business company renewed a project with Capgemini, the objectives of which are to ensure a more efficient operational efficiency of the production system, establish an autonomous delivery team proficient in incident resolution and change flow, and facilitate the transition to the cloud over the next few years (public cloud and sovereign cloud). Capgemini developed a new solution that is fully autonomous from an operational point of view, implemented a joint transformation plan for operational efficiency, and integrated cloud-ready modules to support the client in their cloud transformation roadmap. This has led to reduced downtime, enhanced operational resilience and agility, and cost-effectiveness.

JEAN-GEORGES SAURY

MY INDUSTRY, MY CLOUD

Industry-specific clouds — focusing on data and solutions for a particular industry, domain, or even region — realize the value of cloud faster and focus on business outcomes rather than technology.

What

The Aerospace and Defense industry stands at a pivotal crossroads, grappling with multifaceted challenges that demand wide-reaching solutions. Both manage some of the most complex things that humans can do and require a complex ecosystem to power them. Intricate coordination is essential to manage the deep complexities involved. As every day passes the complexity continues to rise. For example, both the civil Aerospace and Defense industries face significant challenges with production ramp-up, struggling to build products quickly enough to meet demand.

As a common example, focusing on production ramp-up, we see a need to expedite progress through the value chain, core capabilities such as research and design, product lifecycle management, manufacturing, logistics, control, supply chain ecosystem, and aftercare. Each of these segments demands accelerated processes and tighter integration to keep pace with global needs. To address these challenges, new thinking, with novel approaches, is required.

The key issue is how to create an integrated ecosystem, that is connected, has the right data at the right time, meets the security and sovereignty needs of nation states and can meet the deep complexity needed. For example, consider a plane that lands with engineers already prepared with the correct part to fix an identified issue that was detected in flight and a design team that are also notified of the issue. Data flows through the ecosystem for all that needs to understand it. This ensures the plane can return to service quickly, while the designer gains insights to potentially improve the aircraft in the future. This scenario highlights the importance of collecting, processing, managing, and disseminating information efficiently — a complex task given the global dispersion of these devices. Connecting these assets involves significant distributed technology, using satellite communications, 5G, and other technologies to ensure timely data transmission. The establishment of a platform that can harmonize and abstract the problem makes it easier for Aerospace and Defense organizations to focus on the value and forget the plumbing.

Impact

The long-term critical outcomes for the Aerospace and Defense industry are significant. The ultimate aim is to transform the industry by significantly, increasing efficacy and efficiency. To meet these needs, industry must undergo a complete transformation in operating models and skills.

Digital technology must be embedded into every aspect of the organization, from engineering to manufacturing and aftercare so that all will be using technology to their maximum advantage. The industry must modernize its processes and systems, to support the creation of complex and well-made assets with pace and urgency. The long-term goal is to transform the Aerospace and Defense industry to ensure that the assets being created, whether for civilian travel or national defense, are supported by the right digital ecosystems.

To establish new operating models, the ability to decouple and access resources easily with prompt innovation is key. This is where cloud shines, however some key constraints need to be solved:

- Security – Aerospace and Defense has the highest bar with respect to security controls.
- Complex systems – Aerospace and Defense uses some of the most complex systems to build and maintain assets over 40-year cycle times.
- Global data integration – Aerospace and Defense needs to be connected anywhere on the planet.

The management of these challenges is complex but when applied in operating models of Product and Platform then we can apply critical thinking and separation of concerns to tackle the issues. Platform thinking allows us to deal with the complex issues discussed above, removing painful toil from the products that can then focus on value.

The market understands this challenge and is rising to meet it. The Cloud Service Providers (CSPs), as an example, know their role in platform thinking and are making significant, multibillion dollar investments into their platforms to solve these tricky issues. Simultaneously, large vendors in product lifecycle management and manufacturing are integrating their products into these cloud environments. Finally global communication networks, with integrated Satellite Communications (Satcom) and 5G are simplifying the connectivity challenge. This allows the Aerospace and Defense industry to access more capable environments much faster, aligning with the '30-30-30 strategy': achieving tasks 30% faster, 30% cheaper, and with 30% better accuracy and control.

These strategic shifts by the market enable the Aerospace and Defense industry to leverage technology similarly to other industries like retail or entertainment, which have successfully embraced cloud solutions despite the regulatory and control challenges they face. This inflection point is allowing the industry to finally adopt and benefit from innovative technologies.

Use Case

An aircraft's operational maintenance is one of the key activities in the civil aeronautics industry. When aircraft maintenance is required, maintenance data from existing assets are used, updated, and need to be supplied with their complete history. This is an intricate task that's performed manually. With an intention to solve this issue, Capgemini has developed a solution called 'Lifecycle Optimization for Aerospace' to accelerate adoption of circular economy best practices within the civil aeronautics industry. Built on Amazon Web Services (AWS), the solution analyzes parts documentation and inspection processes, allowing optimization of its lifecycle by turning unstructured usage data into digital assets. The solution also promotes re-use of parts and assets and consolidates historical data and reconstructs a complete traceability of all the constituent parts of an aircraft.

ROB KERNAHAN

OPS, AI DID IT AGAIN

AI renders IT operations fluid, proactive, and resilient, improving efficiency, sustainability, and reliability while it learns — on its way to a handsfree, 'NoOps' autonomy.

What

Artificial Intelligence holds transformative potential for the Aerospace and Defense industry, which traditionally experiences long development cycles and stringent technology readiness levels. AI can accelerate these processes through optimization and advancements in language processing and Large Language Models (LLMs). While human expertise remains crucial, AI complements and enhances the efficiency of these processes, potentially revolutionizing the industry's operational landscape. One of the most significant aspects of AI in the A&D industry is that nothing should be excluded from its influence. While humans may be reluctant to let AI handle tasks, it's important to recognize that AI performs a fundamentally different role. AI can analyze numerous data points simultaneously and process vast amounts of data beyond simple statistics, addressing complex patterns and problems. AI's impact spans design, simulations, and enhancing collaboration among experts. Organizations are responding to this transformative power by establishing Centers of Excellence and integrating AI into their structures, making these exciting times for the industry.

The trend of AI is propelled by several key technologies and innovations. The steady reduction in the cost of computing power has made advanced AI more accessible, while the availability of powerful computing resources enables more complex AI applications. Additionally, the development of AI-specific hardware, such as AI chips and compute units designed specifically for AI tasks, has significantly contributed to this trend.

Gen AI has been demonstrated to be a game-changer. It is proving its worth across the entire value chain with significant use cases like Documentation and Reporting, Compliance and Regulation, and Natural Language Understanding especially in the Defense context by improving situational awareness and expediting the analysis of Defense scenarios.

Talking about how Gen AI is evolving from AI, we can say that Gen AI introduces a transformative capability: generating diverse types of data and content beyond text. Gen AI is distinguished by its ability to handle and generate various forms of data, including 3D models, imagery, and complex reports that integrate hybrid data such as charts, tables, and explanatory text. This versatility allows Gen AI to support a wider range of applications, from designing intricate systems to simulating complex scenarios.

Moreover, today Gen AI leverages fine-tuned models and sophisticated supporting algorithms to deliver exhaustive and accurate outputs quicker than traditional AI systems. This efficiency reduces the burden on human operators, who remain in place to validate the AI's outputs. The generative AI capabilities also offer greater degrees of freedom and power compared to traditional AI methods. This generative aspect is the game-changing component, enabling AI to move beyond mere data analysis to actively produce useful and innovative outputs.

Impact

Advancements in Gen AI are reshaping organizations by emphasizing the importance of effectively utilizing data. Organizations must harness their data assets through Gen AI, which brings challenges earlier than expected, pressuring them to scale up, digitize, and become more data-driven. This shift necessitates equipping the workforce with the skills to manage and leverage AI technologies. Consequently, companies are creating more data-centric roles and departments, even at the executive level, to address the evolving trends and demands brought by Gen AI and prepare for the future.

The immediate impact of AI on businesses/industries/society is that it unlocks investments in AI that were previously withheld or delayed, leading to an increase in efficiency in business processes and helping companies become more competitive. It can also impact society by influencing how we interact with companies and AI, potentially raising user and operator expectations. In the long term, the impact of AI could be expected to be even more significant than we can imagine today. With AI's ability to continually improve and the ongoing advancements in computing power and cost-effectiveness, there seems to be no hard limit in the quality of models that can be achieved or the tasks that can be automated.

Organizations may face several challenges when adopting this trend. Firstly, there is often a technical department that needs to be addressed to ensure the organization is equipped to handle AI effectively. Secondly, there is a challenge in deciding the right timing for adoption, as there is often a feeling of 'being late to the party'. It's crucial to define clear milestones along the journey and understand the role and risks involved. From a sustainability perspective, the use of AI can lead to increased energy consumption, which is why organizations must ensure that they use renewable energy sources to mitigate these impacts and fulfil their ethical responsibilities.

Use Case

An example from the Defense industry involves the implementation of LLMs in communication systems to enhance natural language understanding in voice commands, chat interfaces, and written communication by quickly generating human-readable messages from the received information. This can be valuable for command-and-control systems, improving the efficiency of communication between personnel and automated systems and resulting in significant timesaving in the operation and the involved human-based decision-making.

FELIX BALHORN

INVISIBLE INFOSTRUCTURE

SIMPLY THE EDGE

Intelligent devices, at the 'edge' of central IT and close to operations and OT, add a powerful dimension to the existing IT infrastructure — merging virtual and 'real' worlds.

What

If we delve into the realm of 5G, we will realize that processing, storing, and deriving information from data is crucial. Data serves as this foundation, enabling the development of new capabilities. Military operations, however, don't occur in controlled environments; they are subject to various constraints. For instance, at the edge, there are limitations in terms of weight and capacity. This necessitates solutions that are compact and power-efficient, given the constraints of carrying equipment in vehicles, backpacks, or vests. Urban environments further emphasize the need for portable solutions, as constant access to large equipment isn't feasible. This underscores the importance of size, weight, and power considerations, including the critical aspect of battery life. Processing power and storage capacity are also crucial considerations. The last factor to consider is transmission, especially when disconnected.

In the civilian and commercial spheres, 5G has emerged as a reliable transmission technology, capable of handling large volumes of data. 5G excels in latency, data rate, and power efficiency, and supports various applications such as AI, machine learning, cloud infrastructure, and security. In 2024, there has been significant progress in recognizing the potential of 5G technology in military applications. For example, advancements have been made in reducing detectability and ensuring data transmission even in situations where continuous connectivity is not guaranteed. Machine learning and the increasing need for AI on the battlefield help facilitate faster and better decision-making. This is where 5G technology plays a pivotal role. It enables enhanced data distribution and information sharing, allowing for quicker and more informed decisions. By leveraging 5G, military operations can achieve greater efficiency and effectiveness, ensuring that resources are used thoughtfully. Whether on the battlefield or in infrastructure supporting military operations, 5G offers a versatile and powerful toolset.

One of the key advantages of 5G is its ability to maintain connectivity even in fast-moving vehicles, allowing for capabilities like conducting a virtual meeting while on the move. This level of mobility and connectivity is unmatched by other technologies. Therefore, as more systems of systems are entering the battlefield, data transmission is gaining importance.

Impact

5G has a significant impact on various aspects of Defense operations, especially in logistics and maintenance, where it enables the collection and transmission of vast amounts of sensor data. Major Defense Original Equipment Manufacturers (OEMs) with their commercial fleets are collecting terabytes of data. This data is processed on the edge, within the aircraft, with only essential information being transmitted during the flight or upon landing for further analysis or software upgrades. For platforms like tanks, continuous data collection is crucial. When these platforms return to the depot or barracks, they need to offload the accumulated terabytes of data for analysis, bug fixing, and software upgrades. 5G plays a vital role in this process, allowing for quick and efficient data transfer.

The Defense industry has much to gain by adopting a more software-centric approach. Shifting towards software could open up new business opportunities and revenue streams. These advancements are driving the industry forward, emphasizing the significance of features like low energy consumption, excellent latency, compact size, and lightweight, regardless of whether it's 5G or 6G technology.

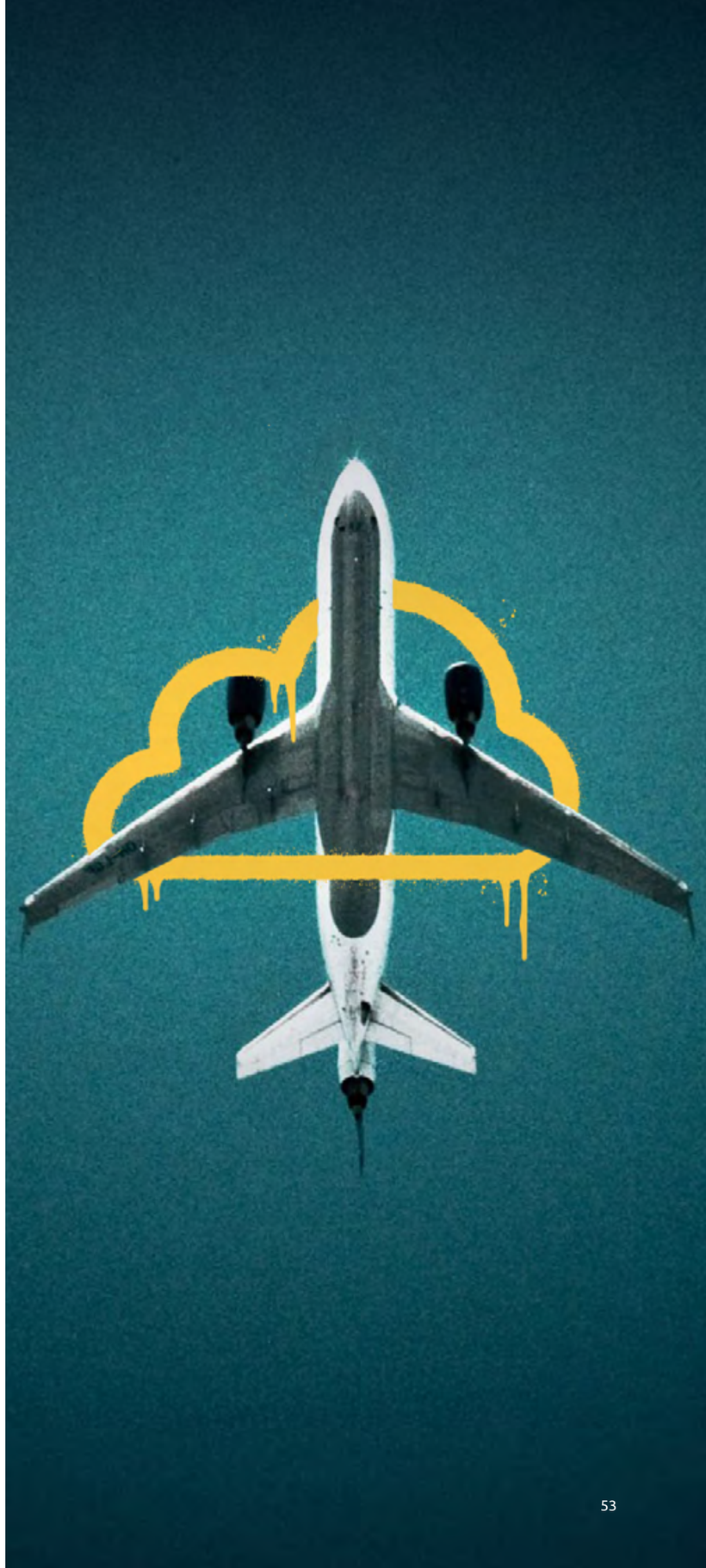
In terms of challenges, one of the most pressing 5G security concerns revolves around ensuring our independence from low-quality and vulnerable products and chips. This issue is critical as it impacts both sending and receiving data, making it a potential entry point for cyber-attacks.

Use Case

Capgemini's Software Framework Solutions (SFS) Framework is used for better coverage via drones for moving users on the ground. The objective was to create a drone-based mesh network using 5G technology to provide connectivity to ground-based devices. Capgemini utilized an ultra-low power SoC, such as Octasic, and fitted the CU/DU software on lower ARM core processors, specifically using a 3 ARM A7 architecture. The SoC was then mounted on drones to enable wide area coverage. This setup supported multiple UEs along with Integrated Access Backhaul (IAB) for backhaul connectivity, creating an IAB-oriented 5G mesh.

The solution also included mobility support, allowing seamless transitions from one gNB to another, whether on the ground or a drone and supported up to 32 UEs. The solution featured 5G SA TDD/FDD, providing enhanced coverage and mobility through the IAB mesh. The complete system was optimized to fit within small core footprints while being powerful enough to host 32 UEs and meet the throughput requirements for video uploads and downloads.

CHRISTOPHER GAUBE



OK QOMPUTE

New horizons of more organic computing are emerging, driven by quantum and neuromorphic chips — breaking the spell of bits and bytes, opening up entirely unexplored opportunities.

What

Considering the potential of quantum computing in the Space domain, it's essential to understand how it fits into the various segments: upstream, midstream, and downstream. In upstream activities, we're talking about the physical aspects of Space, such as satellites and spacecraft. Midstream involves communication and control systems, including radio links and ground stations. Downstream encompasses the business and end-user applications affected by space activities. Breaking it down further, we can examine the different pillars of space-based functions. Communication, remote sensing imagery, and navigation are crucial pillars that serve various objectives, from environmental monitoring to Space exploration.

In 1968, astronaut William Anders took a famous photo from the Moon: 'Earthrise'. It was a picture that captured everyone alive then, except him. From 1972 onwards, every human has been Earthbound until the 21st century. The last time every human was on our Earth at the same time was 6 November 2000; since then, we have always had people in Space, orbiting our home planet. Exploration is at the core of being human, and quantum computing holds the promise of unlocking new frontiers and pushing the boundaries of what we can achieve in Space. With humanity's growing presence beyond Earth, including the possibility of permanent off-world settlements, quantum computing could revolutionize the way we analyze and manage our future endeavors.

Impact

When considering the application of quantum technologies in space exploration, it's essential to view it from the perspective of Earth's sustainability and the protection of our planet. This perspective drives the need to gather information to safeguard our environment.

In the realm of Space exploration, we can break down the use of quantum technologies into three main verticals: communications, positioning-navigation-and timing (PNT) and remote sensing. Overlaying these verticals are security measures and algorithms, which play a crucial role in mission planning, orbital trajectories, and remote sensing data processing.

Performing tasks such as spacecraft orbital trajectory calculations on conventional computers has been laborious and time-consuming and is not always possible to optimize fuel efficiency and minimize travel time without increasing risks. Mission planning activities also involve scheduling and optimization, often dealing with vast amounts of data and complex spatial dynamics. Quantum computing has the potential to revolutionize these calculations, reducing processing times from hours or days to mere moments.

Quantum computing presents opportunities in remote sensing data processing, particularly in synthetic aperture radar (SAR) data. Traditional computing struggles with stitching together data from multiple smaller radio telescopes to form a cohesive image, resulting in lower resolution and accuracy. Quantum computing, however, shows promise in enhancing resolution and fidelity, potentially enabling imaging at the meter level rather than kilometer level. This improvement in resolution has far-reaching implications, enhancing our ability to observe and analyze space phenomena with greater detail and accuracy. Advanced image processing, coupled with precise orbital trajectory planning, revolutionizes Space exploration by offering unprecedented control and insight into mission execution. It's a transformative pathway for Space technologies, promising a future of enhanced capabilities and discoveries.

Beyond quantum compute capabilities, Post-Quantum Cryptography (PQC) represents a shift from traditional perimeter-based security to a more nuanced approach that incorporates quantum principles to safeguard communication channels in the face of evolving technological threats, particularly from quantum computing. It replaces the classical layer of protection with quantum robust security measures. However, implementing these algorithms on edge devices or satellites presents challenges due to their size and computational requirements. Changes to the cyber-architecture can accommodate this or even solve the challenges, but it is not a simple exercise.

Use Case

EQUALITY is a consortium project led by Capgemini and involving Airbus, Fraunhofer ENAS, the German Aerospace Centre, INRIA, Leiden University and PASQAL. It was selected by Horizon Europe, the EU's main funding program for research and innovation. It aims to develop state-of-the-art quantum algorithms to solve strategic industrial problems by developing strategies for the optimal use of scarce and noisy quantum resources and developing a set of algorithmic primitives that can be used in various industry-specific workflows, including differential equation solvers, material simulation algorithms and quantum optimizers.

Several of the use cases developed in the project (e.g. Space mission optimization and Space data analysis) can be directly applied in the domain of Space observations, while others (e.g. computational fluid dynamics) can be used in the context of research and development activities in the Aerospace domain. Moreover, the core algorithms and approaches developed in the project for solving optimization problems on neutral atom quantum computers are very relevant to the subject matter, as the project uses a hybrid approach of classical and neutral atom quantum computers.

MARK CHANG

BALANCE BY DESIGN

The essence of designing a Technology Business is to find and preserve the right balances: between the interests of stakeholders, both short- and long-term, centralized and decentralized, friendly and authoritative, purposeful, and spontaneous, value-delivering, and sustainable, innovative, and trustworthy, fact-driven, and empathic. The balance act becomes even more delicate within the realm of Twin Transformation[2], having to navigate digital transformation and sustainability transformation concurrently with augmentation and human centricity. As a guide for this, besides the 'what' of technology trends, TechnoVision provides a view of 'how' to adapt, to help shape balances within the organization — by purposeful design. Exploring technology drivers can be an enticing exercise but applying these principles will determine the actual success of the transformation afterwards. Through them, control questions are provided for executives, next to a bouquet of perspectives for architects, or anybody involved in a Technology Business portfolio, program, project, or initiative.

/Prompt How can we chart a secure, positive course for the future of our industry?

TECHNOLOGY ∈∋ BUSINESS

Move from alignment to unity of business and IT, creating a seamless Technology Business of strategy and operations.

What

The New Space era represents a perfect example of how a changing landscape can give rise to a new unity between Technology and Business. This era, defined by new players, services and business models, has enabled greater innovation, opening up the doors for other sectors to leverage Space technologies, coined Space Tech, to develop business. Interest from private investors, particularly driven by the GAFAM, has opened up the playing field in Space, sparking curiosity and interest in the development of new commercial Space services.

An ecosystem of new actors, including many start-ups and scale-ups, are bringing new services based on Space Tech to other industries, allowing them to leverage Space Tech in new ways within their sectors. The wider public's interest has also increased, well beyond that of recent times, with the public watching launches live on YouTube and SpaceX becoming a household name. This opening up of Space Tech for use across all sectors, coined 'Space for All', is bringing business opportunities to be seized today and over the long-term, that are in turn driving innovation in technologies.

Impact

Today, we already see many use-cases where Space Tech in enabling better businesses processes. For example, Non-Terrestrial Networks (NTN) combined with IoT devices and/or 5G networks bring global end-to-end coverage, even in remote locations. In supply chain, we see IoT satellite-enabled devices used for track and trace across the global supply chain anywhere in the world. In connectivity, large-scale constellations bring high-speed, low latency broadband on a global scale.

Back on the ground, Earth Observation data will continue to be critical in the fight against and mitigation of climate change. In the coming years, the European Space Agency (ESA) will expand its Copernicus Sentinel program with 6 new missions, all providing high volumes of valuable data to address challenges caused by climate change. In insurance, we already see Earth Observation data is providing additional data and insights to enhance risk assessment and improve damage assessment. The challenge, particularly with the exponential use of AI, will be ensuring the integrity of the data for end-user services. Ensuring traceability to prove that the data hasn't been tampered with and is true.

With an ever-increasing number of satellites being launched into orbit to respond to new business demands, manufacturing and engineering processes in the Space sector must transform to keep up. Manufacturers are now building constellations with thousands of satellites, rather than lone satellites, pushing the industry to adopt smart processes and intelligent industry practices. And not just for satellites, the availability of reliable launchers is critical to avoid delays in bringing services online. Whilst production levels are no way near those of the Automotive sector, the Space sector can learn from intelligent industry practices to drive the transformation required.

The ramp up in satellite launches and increasing public awareness is bringing greater scrutiny on the sustainability of Space activities, which has traditionally held a poor reputation. On a terrestrial level, sustainability concerns are driving innovation in launchers, whether it be reusable launchers, like those developed by SpaceX, or adapting to more sustainable fuel sources. In orbit, the lifecycle management of satellites has come into focus, with ever-increasing concerns in the levels of Space debris. Several New Space actors are developing services in-orbit to either remove debris or enable satellite maintenance in-orbit. For example, Infinite Orbits is developing services for asset inspection, lifespan extension and end of life management.

Use Case

The Amazon Kuiper project has the objective to increase global broadband access via a constellation of 3,236 satellites in Low Earth Orbit (LEO), bringing fast broadband to remote communities more difficult to reach by traditional means. The launches will be provided by several providers (Arianespace, Blue Origin, SpaceX…) to reach the constellation size required. Amazon has also taken the choice to include active propulsion systems, seen as a sustainable choice as it enables each satellite to actively maintain a safe distance from other spacecraft and therefore, avoid debris, rather than rely only on gravitational forces.

DENIS DALLEZ

BALANCE BY DESIGN

AI'LL BE THE JUDGE OF THAT!

Leverage rapidly emerging forms of AI-driven knowledge and insights, even in the absence of complete understanding and transparency — applying a symbiotic form of judgment between humans and AI.

What

The emergence of generative AI has opened new ways of exploring information and knowledge. Large Language Models can be fed with an infinite amount of data and with the Chat is The New Super App trend, this information can be easily explored, and knowledge can be extracted. Workers across industries become more knowledgeable and gain insights quickly. Thousands of pages of technical documentation on helicopters or other complex aircraft become readily accessible for engineers through voice assistants and chatbots. In addition, armed forces think about how to augment the Observe, Orient, Decide and Act decision-making loop with 'battle bots', where commanders can plan and strategize their own actions.

Impact

Generative AI applications in highly reliable and highly sensitive environments such as Defense products and military operations must fundamentally incorporate human judgment. The concept of 'human in the loop' underlines the trend AI'll Be the Judge of That. That is, ultimately human agents are responsible for decision-making and judging the information retrieved from Gen AI applications. Therefore, the data quality underlying such models is pivotal for increasing confidence in AI-generated answers. Designing Defense AI applications thus relies on built-in explainability and trustworthiness features allowing to trace the source of answers thereby enhancing transparency and reliability.

Use Case

Capgemini is partnering with major European Gen AI Start-Ups such as Mistral and Aleph Alpha to develop reliable and secure Gen AI solutions that are available on premise. To improve the document management of a client in the Defense sector, Capgemini has developed a reliable and explainable AI assistant for the entire documentation process.

BENJAMIN SCHULTE

DO GOOD, DO LESS, DO WELL

Make your organization thrive by embracing initiatives that create a positive social and environmental value alongside economic value, while rejecting activities that damage the biosphere or destabilize society and compromise humanity.

What

Sustainability within the Aerospace industry encompasses various aspects, primarily focusing on commercial aviation. While Defense remains a crucial sector, the spotlight is currently on commercial aviation due to its significant emissions. The primary concern revolves around reducing carbon emissions generated from aircraft operations, particularly fuel combustion. This requires a shift towards alternative propulsion methods and fuels.

Different aircraft categories, such as vertical take-off and landing systems (eVTOLs), short-range, medium-range, and long-range aircraft, require tailored sustainability approaches. For example, eVTOLs are increasingly powered by hybrid electric or electric systems to cater to emerging mobility needs, such as urban air mobility. The sustainability efforts then must focus on the batteries. Meanwhile, efforts to explore hydrogen-powered options are underway for mid-range aircraft, while sustainable aviation fuels (SAFs) derived from synthetic processes or bio-based sources are being considered for long-range flights.

Although less important in terms of carbon footprint, decarbonizing operations is another key aspect, involving both the manufacturing processes and the design of aircraft. Addressing material criticality is also essential, ensuring that materials used in aircraft construction are sourced and utilized sustainably. This encompasses not only reducing emissions but also adopting sustainable practices throughout the supply chain.

In essence, sustainability in the Aerospace industry is a multifaceted endeavor, requiring innovations across propulsion systems, materials, and operational practices to ensure a greener and more sustainable future for air travel.

Impact

Ultimately, achieving sustainability in Aerospace requires a shift towards a holistic approach that considers both performance and environmental impact. This may involve trade-offs, such as sacrificing some performance for increased sustainability. However, it's essential to strive for a global optimum where aircraft are not only high-performing but also environmentally sustainable throughout their entire lifecycle. Research into smart materials and alternative fuel sources further demonstrates the industry's commitment to addressing these challenges comprehensively.

Regarding manufacturing, the focus is on ensuring efficiency and aligning operations with sustainability goals. For instance, initiatives like the Energy Command Centre in India aim to optimize energy usage throughout the production process. This involves measuring and potentially optimizing production lines to minimize energy consumption, but also waste and water. Additionally, the concept of Digital Twins, including facility Digital Twins, plays a crucial role. These tools enable us to link production decisions with considerations such as lead time and sustainability metrics.

It's essential to think globally during operations, considering aspects like water reuse, waste reduction, and material recycling. For example, reusing water from machines and implementing strategies to repurpose scrap materials are key practices.

Overall, sustainability in operations requires a 360-degree approach, addressing various aspects of resource management and energy management. It's a complex but essential endeavor that requires continuous improvement and innovation.

Use Case

The Aerospace industry, represented by the International Aerospace and Defense Environmental Group (IAEG), consisting of 60 major players, has demonstrated a collective commitment to sustainability. Last November, a working group was established within the IAEG to address sustainable aviation initiatives. This reflects a widespread recognition among Original Equipment Manufacturers (OEMs) and aircraft manufacturers that sustainable practices, including alternative fuels and propulsion methods, are crucial for the industry's future. This initiative aims to understand and implement the necessary adaptations for a seamless transition to SAF. By collaborating, the Aerospace manufacturing industry seeks to avoid disjointed and divergent approaches, minimizing unnecessary costs and confusion on the journey to Net Zero emissions. Additionally, efforts extend beyond propulsion systems to include material sustainability and circularity, with multiple working groups dedicated to these areas. The collaborative approach within the industry underscores the importance of sustainability as a shared responsibility.

JULIE ALBERT

BE LIKE WATER

Ensure the built-in 'water-like' capabilities of agility, flexibility, responsiveness, resilience, and openness.

What

Both Aerospace and Defense companies as well as Ministries of Defense need to Be Like Water and adapt to a new industrial paradigm and a fundamentally changing future operating environment. We are currently witnessing the shift within the Aerospace and Defense industry towards software-defined Defense, meaning that future capabilities encompass not only the physical platforms such as fighter jets but are increasingly driven and defined by the software capabilities that unlock informational superiority and faster decision-making. This innovation increasingly occurs outside the confines of the traditional Defense players but at research labs, in start-ups, and technology firms. Future capabilities thus will be created and integrated not by a single player but by a whole innovation ecosystem. Defense organizations thus need to learn how to adapt – akin to the fluidity of water – and integrate innovations rapidly into military capabilities.

Impact

This adaptability is driven by technologies, new operating as well as new business models. Intelligent supply chain solutions for instance can improve forecasting and increase the resilience of critical Defense supply chains. Moreover, the emergence of numerous innovation labs focused on emergent and disruptive technologies in military organizations underlines the need to set up dedicated units outside the traditional hierarchies to adapt to change. These innovation labs drive cultural change and enable entrepreneurial activities throughout the organization via innovation challenges. Lastly, the Aerospace and Defense industry is transforming from being mostly reactive to public proposals to becoming more proactive with business models that are more product-focused and integrate innovation from the ecosystem by design.

Use Case

Capgemini has supported projects in the German military and armed forces to teach soldiers about entrepreneurship, fostering innovation from within. This innovative mindset and skill throughout the organization can truly define the principle of Being Like Water.

Capgemini supports an initiative to bring investors, industry, and academia together to exchange ideas and drive innovation into Defense. This openness is needed to absorb ideas from the outside and transform it into viable innovations in Aerospace and Defense.

BENJAMIN SCHULTE

IQ CQ RQ EQ UP

Ensure a properly measured and monitored balance between four — sometimes conflicting — assets: the corporate Intelligence Quotient, Creativity Quotient, Robotic Quotient, and Emotional Quotient.

What

IQ CQ RQ EQ UP, abbreviated from Intelligence Quotient, Creativity Quotient, Robotic Quotient and Emotional Quotient, is a concept that militaries and companies around the world are increasingly adopting when considered in terms of responsible AI. The goal is to shape and align the development of AI and other digital technologies with moral values, going beyond what is merely legally forbidden or allowed. It's a relatively new trend but aims to create a global agreement on a set of standards. These standards are intended to guide how these technologies are developed and used, considering the different laws and definitions across countries. What is new for this trend in 2024 is that NATO has initiated several research task groups to develop ethical guidelines for digital technologies (such as Gen AI) in the military, along with a digital responsibility board to address related issues. This is because Defense and military organizations are embracing this 'dual'-natured technology, which has many benefits, but also associated risks, especially concerning cultural and emotional intelligence (EQ) considerations. The development of ethical principles is beyond merely setting up a few guidelines, but aiming to develop a structured framework that examines the entire lifecycle of a given technology within its given context.

The increased focus on ethical practices is not just a matter of growth in concern but is closely tied to questions of accountability. These questions are integral to the efficiency and adoption of AI models. Moreover, these efforts extend to moral values. The trend is also emphasizing making these principles measurable and actionable. It involves addressing trade-off decisions between competing principles, such as the privacy of workers versus security, or fairness in terms of equitable versus equal treatment. This trend holds people accountable for actually being ethical in their conduct, requiring them to justify their decisions in greater detail. While ethics and legal questions often supplement each other, they are not the same. It's possible to act legally but unethically, and vice versa. This distinction is particularly important in the Aerospace and Defense industry, where the impact of ethical conduct is profound.

Impact

While no organizations are fully transformed yet, there's a growing seriousness about ethical AI. This is driven by client demand for ethical considerations, which often get mixed up with legal issues. It's crucial to educate clients that while lawyers are essential, understanding the emotional and ethical impacts of technology on the workforce and stakeholders requires insights from social sciences, ethics, and philosophy, not just law.

The distinction between IQ, EQ, and Creative Quotient (CQ) is important, but they shouldn't be seen as disjointed either; they will continually influence each other. Companies and society should prepare for this shift in the long term, as demonstrating ethical alignment will become a competitive advantage. Some of the challenges that organizations may face in adopting it are:

- Mystification of AI and modern technologies making them hard to understand and scrutinize.
- Novelty and development as digital ethics is a relatively new field and some industries do not take it seriously yet.

- Funding and resource allocation, including setting up oversight boards and positions like ethical compliance officers.
- Balancing business and ethics so that companies can forego potentially lucrative developments if they raise moral concerns.

However, these quotients will also bring opportunities for companies that demonstrate a commitment to ethical and human-centric technology and ethically align their products and services. Ethical practices can build long-term brand value and reputation and are likely to attract top talent and foster customer loyalty. In the future, there will be a shift towards prioritizing projects based on ethics rather than just the established factors like cybersecurity, for example. Also, considerations regarding epistemology and cultural differences are paramount. Cultural norms and individual preferences vary greatly, so it's crucial to account for these differences when developing policies or practices on a large scale.

Use Case

NATO's Science and Technology Organization (STO) delivered a von Kármán Horizon Scan (vKHS) on AI that assessed the implications of AI on deterrence and Defense over the next 10 years. Recognizing NATO's forward-leaning efforts in promoting Principles of Responsible Use (PRU) for AI, as well as ongoing work strands on data exploitation and digital transformation, the experts considered the establishment of coherent management structures for data and AI applications during their development, procurement and use, to support and maintain human accountability.

Another on-going NATO STO activity set to end next year at the earliest is the Ethical, Legal and Moral (ELM) impacts of novel technologies on NATO's operational advantage, coined the 'ELM Tree'. The activity aims at improving NATO understanding of the ELM challenges to future operational advantage in the context of game-changing technologies, such as artificial intelligence.

MATTHIAS KLAUS

TRUST THRUST

Power up the entire trust ecosystem — from the organization's core to its edges — securing your existing business and pushing forward to its next permutation.

What

Technology can both enable and incentivize collaboration and make it easier to access and share information. The transformative effects of generative frontier AI – as it develops further and has sufficient safety measures built around it to ensure it is reliable and true – will help us parse and make sense of huge data sets in a way never before possible. Real-time, detailed information about what is happening will become ever more available. And that is going to transform decision-making, because the same information can be made available to many people at the exact same time, in ways which allow them to have better informed discussions and a better sense of the evidence. Technology can also enable diversity, opening up discussions to a much wider range of people in different geographies and time-zones, through collaboration platforms and virtual networking – again provided that we have enough security built in to trust that we are engaging with the person we think we are talking to and not a convincing AI-generated deepfake!

Impact

If we get it right, we can tap into the 'collective intelligence' of a much wider group and come up with better and more innovative solutions, avoiding groupthink and finding that original 'left-field' idea which is going to give us the strategic advantage.

Use Case

Working with the UK Government, a team from Capgemini, Cranfield University and the Government's Accelerated Capability Environment (ACE) piloted using Collective Intelligence approaches to tackle complex challenges the UK is facing, covering Energy Security, Economic Security and Quantum advantage. The project designed a mechanism to bring together diverse experts from academia, industry and beyond around de-classified problems, augmenting expert insight with open-source data, and then using the results to commission the UK's science and tech ecosystem to start tackling those problems at speed. The prototype development was guided by a consortium of 'customers' from across central government departments in the spirit of collective intelligence.

The project resulted in six alpha tools designed for government, at least two of which were developed further with a view to implement into central government. The prototypes were shared widely across government throughout their development, by hosting an event at Admiralty House, Whitehall, for senior civil servants across government. The project enabled multidisciplinary areas of government to come together around a shared problem.

LUCY MASON

NO HANDS ON DECK

Assume full, hands-free, zero-touch automation as the default for all new Technology Business processes.

What

In terms of the operational aspects of the No Hands on Deck trend, we can focus on the manufacturing supply chain and related areas. It's important to highlight the parts of operations that are poised to be fully automated, especially those already on the path to automation. The convergence of Operational Technology (OT) automation with machine learning (ML) and AI will significantly elevate the automation of these processes. Certain processes involving machinery, like triceps machinery or autoclaves for composites, will undoubtedly see increased automation over the next three years. However, some challenging environments, such as the interior of an aircraft fuselage, will present obstacles to robotic automation and it is unlikely that we will see significant automation of these processes within the next three years.

Organizations are increasingly investing in various elements to adapt to this trend and technology. One notable approach is the collaboration between robots and humans leading to more automated operations with enhanced robotics. Another is the adoption of ML and AI algorithms to control processes. Many companies are testing new algorithms tailored to specific use cases.

While the No Hands on Deck trend has been ongoing for the past five years, what is new for 2024 is the application of generative AI. However, this won't be in the form of Large Language Models like GPT but rather in the form of liquid neural networks for three main reasons:

- First, these models are easier to train and use far fewer computing resources. They can even run on a Raspberry Pi, which accelerates the time to market for these solutions. With simpler training requirements, you can refine your algorithms more quickly and don't need expensive computing power to run them.
- Second, the accuracy of these models is significantly higher than that of GPT-like models, especially for engineering applications where precision is crucial. Standard GPT models are more general, whereas these liquid neural networks focus on engineering topics, providing more accurate algorithm results.
- Third, and importantly, these models are not a black box; they are explainable. Engineers can understand and trust the results of these jelly algorithms, making them more practical for engineering use.

What makes this No Hands on Deck trend unique is its balance between automation and human involvement. In the A&D industry, while some tasks can be automated, many still need human input. Complete automation remains unrealistic, with significant hands-off operations unlikely within the next three years.

Impact

When examining the impact of this trend and its transformative influence on organizations, it primarily manifests in two significant ways. Firstly, it is freeing up highly skilled experts from repetitive tasks, allowing them to focus on more cognitively demanding work. Secondly, organizations must expand their ecosystems. It is nearly impossible for A&D companies to possess all the necessary knowledge and expertise internally. The convergence of different technologies requires access to top-tier resources in various fields of engineering. This means organizations must collaborate more extensively, even in areas that provide a competitive advantage, or what can be termed the 'enabling core'. These changes are driving a shift in how organizations operate, promoting a more collaborative and resource-efficient approach to harnessing technological advancements.

In businesses, industries, and society, the immediate effect of this trend will likely be the repurposing of people from repetitive tasks to more cognitively demanding roles. It's not a sudden breakthrough, but a steady progression towards increased productivity. In the long term, this trend will lead to increased consistency in a way that operations will become more consistent, reducing variability and enhancing reliability. Also, in the long term, the coexistence of robots and humans will be crucial.

Organizations will need to determine which tasks can be safely automated by robots and which tasks should remain human-centric. It's unlikely that within the next three to five years, humans will be entirely replaced, however, the presence of robots will increase, requiring thoughtful assignment of tasks between humans and machines.

Adopting the trend, however, can be challenging for organizations that have not yet implemented such technologies. One major obstacle is the cultural mindset within the organization, which may be resistant to change and automation. Building trust in the automation process and its results is crucial but takes time.

Additionally, implementing automation requires extensive planning, maintenance, and upskilling of employees to work with robotic and automated systems. Overcoming these challenges will require a shift in mindset, a commitment to training and development, and building trust in the new technologies being implemented.

Use Case

An aircraft components manufacturer wanted to have better control of their drilling and riveting operations for one of the control planes. Traditional ways of working required that all drills and rivets be manually inspected by an experienced worker, resulting in longer cycle times, increased cost and more variability. A machine learning algorithm running on a 5G edge node was developed to have continuous control of the process parameters, resulting in a significantly reduced number of manual checks after the operations and higher quality of the process.

RAMON ANTELO

A FEW MORE THINGS

By design, in TechnoVision, we keep our feet firmly on the ground, exploring the innovations you can bet on for immediate or near-future gains. Now, as we venture into 'A Few More Things,' consider this as the part where we let our feet dangle a little bit more over the edge, indulging in the 'what-ifs' that are just beyond arm's reach. Here, we'll engage with three ideas that might require a leap of faith or a moon-shot mindset — technologies that are not quite ripe for today's Aerospace and Defense landscape but may soon be budding on the branches of innovation. It's a nod to the thinkers and dreamers who are mapping the terra incognita of tech, where the next giant leap for mankind awaits, wrapped in the promise of tomorrow's science.

Civil Aeronautics: Alternative Materials

The civil Aeronautics industry is poised to make significant strides by leveraging advanced materials and manufacturing technologies. Carbon fiber composites will continue to be a cornerstone, significantly reducing aircraft weight, which in turn enhances fuel efficiency and lowers emissions — key to meeting stringent environmental regulations. Additive manufacturing, or 3D printing, is set to transform production processes by enabling the creation of intricate, lightweight parts that reduce both production time and material waste. Advanced titanium alloys will play a crucial role, offering an optimal balance of strength, weight, and heat resistance, making them indispensable for high-performance applications in engine components and airframe structures. Cutting-edge manufacturing processes like friction stir welding and automated fiber placement are expected to further improve assembly precision and strength, streamlining production while reducing costs.

In the longer term, industry players are exploring the potential of smart materials, such as shape-memory alloys, which could introduce adaptive engine components that significantly enhance efficiency and performance. Nanomaterials, including carbon nanotubes and graphene, are expected to become more prevalent due to their exceptional strength and electrical properties, which can greatly improve structural components and enable advanced damage detection systems.

In general, a commitment to sustainability will drive the development of engines compatible with sustainable aviation fuels (SAFs) and the design of aircraft that minimize environmental impact using innovative materials and processes.

Space: IoT Connectivity

New satellite constellations, such as Kinéis and Sateliot, open up a world of possibilities for IoT services. Imagine nanosatellites, weighing less than 30 kg, orbiting 650 km above our heads , connecting millions of objects all over the planet, even in the most remote areas. Kinéis, for example, with its 25 nanosatellites, will allow in 2025 near real-time bidirectional connectivity, ideal for water resource management, early detection of forest fires, and maritime monitoring. Sateliot, on the other hand, aims to provide ubiquitous global connectivity for 5G NB-IoT devices. The costs of these services are also falling thanks to miniaturization and the increase in Space capacity. Imagine being able to follow your flock of sheep in Patagonia or monitor your crops in the middle of the Australian desert, all for the price of a Netflix subscription! These advanced technologies are transforming global connectivity, making IoT more accessible and efficient than ever. So, are you ready to embark on this space adventure?

Defense: Brain Computer Interface

Brain Computer Interface derives functional intent, the desire to change, move, control, or interact with something in your environment, directly from our brain activity. In other words, control an application or a device using only our mind. Translated to Defense, there are applicable use-cases in remote control of machinery, such as controlling a drone swarm or utilizing AI to control robots, and direct communication between soldier's minds, the direct sending and receiving of thoughts. In a context where reacting fast to a changing situation is key, having a shortcut between thought and action provides an advantage over one's enemy.

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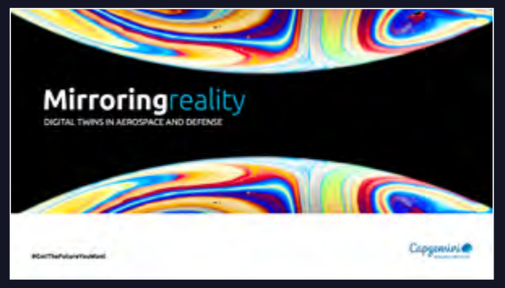
FURTHER RESEARCH

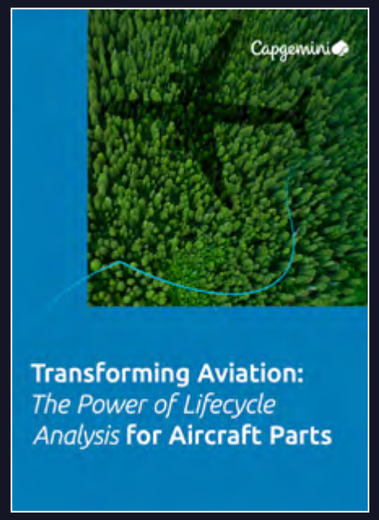


DIGITAL TWINS IN AEROSPACE AND DEFENSE

REINDUSTRIALIZATION OF EUROPE AND THE US

ENGINEERING THE NEXT

INTELLIGENT SUPPLY CHAIN IN A&D



LIFECYCLE OPTIMIZATION FOR AEROSPACE

DIGITAL CONTINUITY IN AEROSPACE AND DEFENSE

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