

A woman is shown in profile, wearing a VR headset and smiling. Her hands are raised, interacting with a complex, glowing digital interface. The interface consists of various geometric shapes, lines, and points in shades of blue, purple, and pink, set against a dark background with a starry, nebula-like pattern. The overall scene is illuminated with vibrant, futuristic lighting.

Aerospace and Defense Technology Vision 2022

Metaverse: the new destination for Aerospace and Defense

How the continuum of technology and experience will reshape the industry

Imagine a team in 2030 working together on a new aircraft engine design. They've hit a problem and need to bring in an expert. But she's on a different continent. No problem. A quick call and her avatar pops up in their virtual collaborative workspace environment. Working directly on a digital twin of the new aircraft engine, together they can show the problem and see the effect of the design changes she suggests in real-time. Or imagine a virtual production facility. An executive based in the US can see how the movement of different assets in the facility in France would impact aircraft production, all without having to visit the actual site. This is the journey to the metaverse. Its destination? A collaborative virtual space that can be transposed onto the physical world.

Aerospace and defense companies are entering a land of opportunity in the metaverse. Accenture sees the metaverse as a continuum – a spectrum of digitally enhanced worlds, experiences, realities and business models — that is poised to revolutionize life and enterprises over the next decade. Leaders need to start making big leaps forward in how they think about their business — today.

The next era of disruption

It's an exceptional time to be in the aerospace and defense industry. After having to pivot rapidly during the pandemic, aerospace and defense companies embarked upon a new era of exponential transformation. The metaverse presents an even more significant disruption and will define the next big wave of transformation.

Over time, the metaverse will help transform every aspect of the aerospace and defense business:

How companies interact with customers

Understanding the metaverse landscape, and what customers are doing there, will be crucial for two reasons. First, for determining how a business's brand interacts with them. And second, for how brands need to integrate with the new platforms, commerce channels and immersive experiences that the metaverse contains. This could influence brand, marketing, products, services, content and customer service.

How work gets done

The metaverse will help reinvent how people work and learn. Connecting across an organization has been challenging in recent years. Immersive experiences are finding new ways to address some of the pain points across the workforce. The metaverse will also make hiring, onboarding and collaborating easier. How? By extending beyond email, video conferencing and chat, to instead create a digital center of gravity for organizations and teams.

How companies make and distribute products

With the enterprise digital twin, companies can create seamless virtual twins of the entire product lifecycle. This enables virtual design and testing of new approaches before executing them in the real world, and spans capabilities including digital twin, edge computing, smart connected workers and more.

How companies operate

The metaverse has the potential to change how entire operations are run by deploying digital twin technology, at scale. Creating and linking digital twins of machinery, operating models, processes, and a company's overall systems is driving material value. The ability to experience and work with digital twins of the entire business will reshape management capabilities. It will help facilitate more natural engagement with data, better insights, and connected actions that link the digital, physically augmented, and physical worlds.



Building the future, faster

Just 12 months ago, many companies reported that they were innovating with an urgency and call to action, with the pace of digital transformation in their company accelerating. Now, it's a different story.

The Accenture Technology Vision 2022¹ reveals that 90% of aerospace and defense companies have adapted to the disruption of the pandemic and have found a new normal.

93%

of aerospace and defense executives say that continuous advances in technology are becoming more reliable than economic, political, or social trends in informing their organization's long-term strategy.

100%

of aerospace and defense executives agree that emerging technologies are enabling their organization to have a broader and more ambitious vision.





It's no wonder that companies continue to invest in digital, given the stakes are so high. Aerospace and defense companies are no longer just competing for market share, they're competing in new markets such as commercial space travel and urban air mobility. The imperative? To build their vision of the future faster than the competition. Success may depend on their ability to accelerate and master change in all parts of their business, which in turn hinges on the technology decisions they make today.

Going forward, every business must become a metaverse business — whether they realize it or not. Every enterprise must prepare to step into the metaverse and engage in these new people-centric worlds. That's why we've introduced the "Metaverse Continuum." Many organizations are viewing the metaverse through their own limited lens only. Approaching it as a continuum will create starting points in aerospace and defense companies' strategies and services, ramping up for their journey to the metaverse.

This continuum is expanding and evolving in multiple dimensions

- Contains multiple technologies including extended reality, blockchain, artificial intelligence(AI), digital twins, smart factories and edge computing
- Encompasses the "virt-real"— the range of experiences, from purely virtual to a blend of virtual and physical
- Describes the spectrum of emerging customer experiences and the business applications and models across the enterprise that will be reimaged and transformed
- Describes a constant state of change, and a journey from its current state to future innovations and experiences we've yet to imagine.



Four technology trends shaping the future

Aerospace and defense companies are starting to realize that in their drive to survive during the pandemic, the pivots they made and innovations they put in place, are foundational for the future that is starting to take shape. Though the challenges of the pandemic still weigh heavily today, businesses are starting to adapt to the new reality, and leaders are taking a more deliberate approach to shaping what comes next. Our Technology Vision 2022 research unearthed four key technology trends that companies must harness to reimagine every dimension of their enterprise, from operating models to their core value proposition, products and services — across the Metaverse Continuum



1. WebMe

Putting the Me in Metaverse

WebMe explores how the internet is being reimagined on two fronts: the metaverse and Web3. Metaverse and Web3 innovations are simultaneously transforming the virtual world. Metaverse initiatives are re-platforming digital experiences, letting users move beyond browsing to inhabit digital content, while Web3 developments are building a more distributed data layer, bringing an underpinning of provenance, veracity and value to the web.

Aerospace and defense companies had already started investing in augmented reality (AR) and virtual reality (VR) solutions for assembly, MRO, aircraft inspections, workforce training and so on. However, with the advent of the metaverse, the underlying efforts to reimagine how data shapes digital experiences will challenge businesses to rethink their presence online. That means shaping the next platform revolution as they build new ways to connect to customers, partners, and their digital workforce. For example, Boeing is looking to incorporate features of the metaverse to revolutionize its design and production processes. The company plans to enact sweeping changes within just two years, including mechanics fitted with Microsoft HoloLens headsets, greater reliance on robotics, and developing a single, integrated digital ecosystem of information.²

Enterprises need to understand the urgency of this moment. They still have a chance to get ahead of the market and lead the next wave of digital business. They need to start building new strategies today, rethinking their role in the digital world, exploring potential new products and services and putting the right technical foundation into place. Success today could mean defining what digital business looks like for decades to come.

Cloud platforms will play a key role in the development and hosting of digital experiences and services today, and in future metaverse technologies tomorrow. For example, Lockheed Martin is working with Omniverse (NVIDIA's end-to-end cloud-based collaboration and simulation platform) on an initiative called cognitive mission management to develop a strategy for emergency response and fire suppression.³

83%

of aerospace and defense executives state that the metaverse will have a positive impact on their organizations, with 54% seeing it as a breakthrough or transformational impact. (Figure 1)

Of the

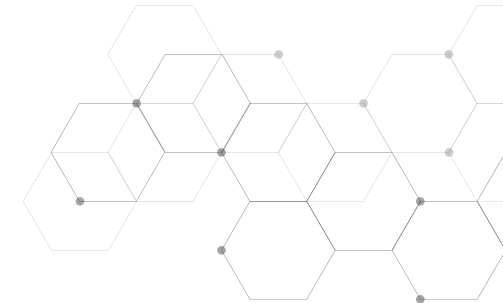
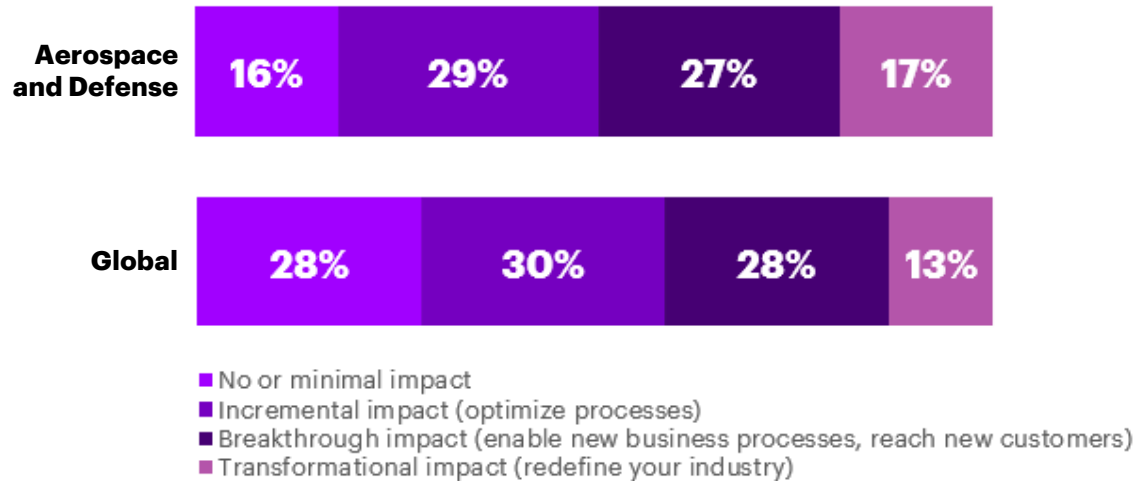
54%

of executives who believe the metaverse will have a breakthrough or transformational impact on their organization, 100% believe it will be within the next 4 years

99%

of aerospace and defense executives agree that future digital platforms need to offer unified experiences, enabling interoperability of customers' data across different platforms and spaces.

Figure 1: Level of positive impact the metaverse will have on organizations in future



2. Programmable World

Our Planet, Personalized

The Programmable World tracks how technology is being threaded through our physical environments in increasingly sophisticated ways. It projects how the convergence of 5G, ambient computing, AR, smart materials — and more — are paving the way for businesses to reshape how they interact with the physical world. As technology becomes part of the fabric of our environment, it allows us to treat our environment more like technology — unlocking unprecedented fidelity of control, automation, and personalization.

This is the next revolution that will reshape our relationship to the physical environment. The emerging “programmable world” will make new business models and real-world experiences possible, introducing a new competitive landscape for enterprises.

Opportunities to lead in the programmable world are vast — from designing new connected environments and operations, to architecting hyper-personalized and hyper-automated real-world experiences and to launching the next generation of products and services made from novel materials. Aerospace and defense companies see the potential of this trend in a wide range of AR use cases. (Figure 2) But to succeed, they need to start developing the strategies that will allow them to navigate this change and ensure they are staying at the forefront of real-world innovation.

The data and intelligent digital services that can augment the physical world are the foundation for the programmable world.

The interoperability of data in digital solutions and the intelligence that can be built on top of these combinations unlocks a path to seamless augmentation that creates a new interaction layer in the physical world. For example, Airbus is using its “Operability Virtual Reality Room” in Toulouse to test the maintenance of new designs implemented on A321XLR. By mixing VR masks and trackers for full-body tracking, leap motion for hand tracking, AR masks, and 3D printed parts — concurrently with physical mock-ups — more realistic environments are available to test the accessibility, tools positioning and equipment removal paths. This offers the opportunity to propose design evolutions and reduce the number of tests needed on the actual aircraft.⁴

80%

of aerospace and defense executives report the number of IoT/edge devices deployed in their organization significantly or exponentially increased over the past 3 years.

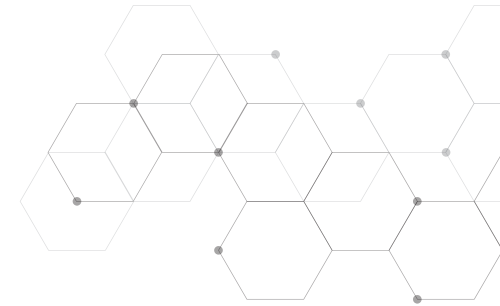
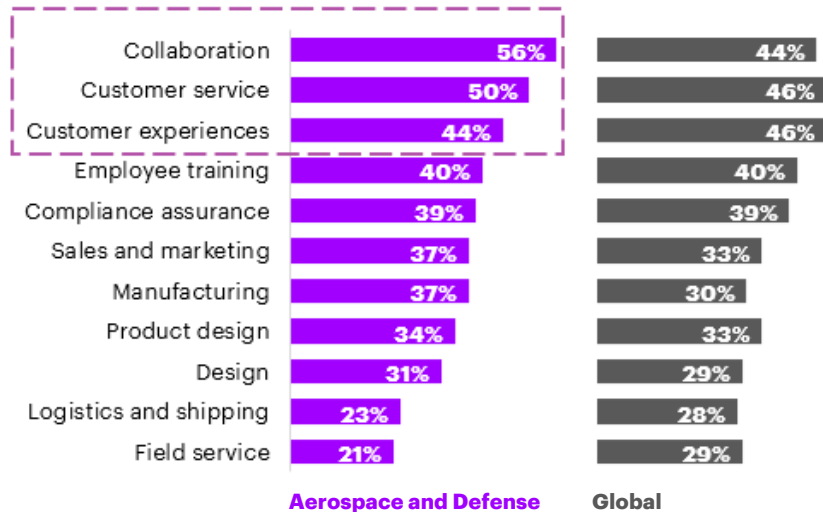
93%

of aerospace and defense executives believe programming the physical environment will emerge as a competitive differentiation in their industry and 84% agree that AR will disrupt their industry in the next 3 years.

99%

of aerospace and defense executives report that their organizations would expect AR technologies to bring them improved operations such as increased employee efficiency, improved real time collaboration, improved design and manufacturing processes as well as workplace safety.

Figure 2: Potential use cases for AR in the next 3 years



3. The Unreal

Making Synthetic, Authentic

“Unreal” qualities are becoming intrinsic to the AI, and even the data, that enterprises aspire to integrate into mission-critical functions. At the same time, people are coming face-to-face with bad actors using this technology — from deepfakes to bots and more – igniting a growing concern that may turn into the biggest hurdle for enterprises looking to grow their use of AI. Like it or not, enterprises have been thrust into the forefront of a world questioning what’s real, what isn’t, and if the line between those two really matters.

AI algorithms are getting better at creating synthetic data, images, voice, video, and conversational experiences, and enterprises are starting to push AI into more collaborative and creative roles. One company exploring the benefits of the unreal world is Airbus. Through a partnership with synthetic data provider OneView, Airbus conducted a pilot project testing the use of synthetic data for the machine learning (ML) analysis of satellite imagery.⁵ Analyzing satellite imagery with ML algorithms has wide-ranging applications but can be limited by the fact that lots of images, and images of unique scenarios, are often needed to train the ML algorithms in the first place and gathering this data can be a lengthy and expensive process. Synthetic data, on the other hand, can fill out training datasets much more quickly and cost effectively. Airbus and OneView’s trial, which was based around aircraft identification, compared three training datasets: one with real images only, one with synthetic images only, and one with a combination of 95% synthetic and 5% real. The results showed that the mixed dataset performed 20% better than datasets comprised of only true images.

Synthetic realness can push AI to new heights, but using these technologies forces enterprises to face questions about what’s real, what’s not, and when the difference matters — especially considering that bad actors are using the same technologies to create deepfakes and disinformation that undermine people’s trust. The answers to these questions could be enterprises’ strategic advantage or could damage their reputation. The risk of malicious AI raises several security concerns for aerospace and defense companies. (Figure 3)

Technologies will be key to using AI authentically and to verify the provenance of digital content and identity — thereby demonstrating authenticity — for example, with distributed ledger technology (DLT). For instance, Honeywell has introduced a multi-faceted authentication system, based on serialized codes, security inks and blockchain, to protect its aerospace components from counterfeiting.⁶ The new system – developed with iTRACE and SecureMarking — employs two-factor authentication to allow customers to ensure Honeywell aerospace parts are genuine.

96%

of aerospace and defense executives agree that AI is becoming pervasive across their organization's business processes, while 91% report that their organization is dependent on AI technologies to function effectively.

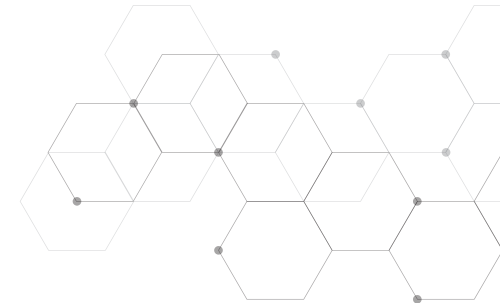
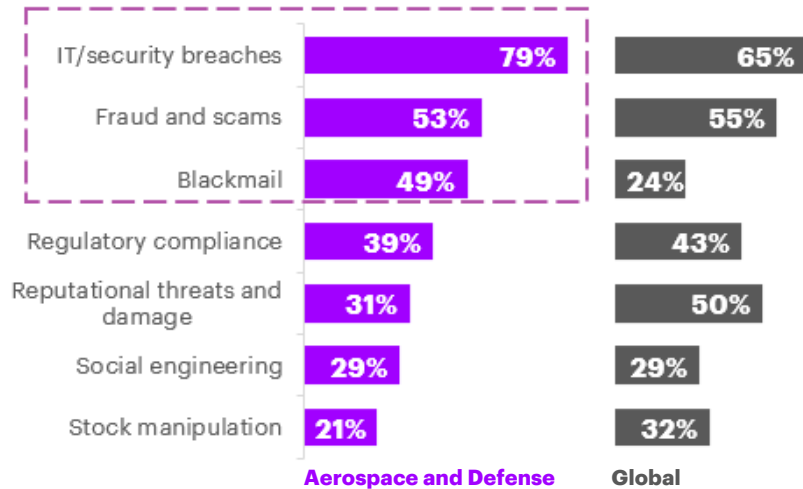
100%

of aerospace and defense executives report that their organizations are committed to authenticating the origin of their data and genuine use of AI.

89%

of aerospace and defense executives report that blockchain is going to be critical to their organization's ability to verify the origin of digital content.

Figure 3: Security concerns amongst organizations due to the risk of malicious AI



4. Computing the Impossible

New Machines, New Possibilities

We are on the precipice of resetting the boundaries of traditional industries as we begin Computing the Impossible. The outer limit of what is computationally possible is being disrupted as a new class of machines emerges. Quantum, biologically inspired, and high-performance computers (HPC) are each allowing companies to tackle grand challenges that once defined and shaped the very core of their industries. As problems once considered impossible become ever more solvable, business leaders will be pushed to reimagine some of the most basic assumptions about their enterprise.

As the next generation of computing becomes increasingly viable, it's bringing faster and more efficient ways to address larger and more complex problems. That could be HPC tackling hyper-specific problems with giant amounts of data or quantum partnerships solving problems that have constantly shifting parameters. Bio-inspired computing can draw from the natural world to solve problems in entirely new ways. Accordingly, enterprises have a lot to gain from next generation computing partnerships and consortia.

A significant talent shortage, that is getting more severe, means that partnerships may be critical to access needed hardware and expertise. Additionally, many of the problems that next generation computers will solve are large, systemic challenges that require collaboration, meaning that the alliances forming today are where the lines of industry are starting to be redrawn.

To solve seemingly intractable problems with next generation computing, organizations' plans include partnering with others and investing in technology or startups over the next three years. (Figure 4) For example, in 2021, Honeywell launched the largest quantum computing company in the world – a new venture with Cambridge Quantum called Quantinuum. Now the incubation effort is being spun out into an independent enterprise in which Honeywell maintains a controlling interest. Quantum computing could evolve into a full-stack technology that would ultimately be needed by almost all customers of Honeywell's various business units that included aerospace, building technology, performance materials, safety, and productivity solutions.⁷

79%

of aerospace and defense executives say quantum computing will have a breakthrough or transformational positive impact on their organizations in the future

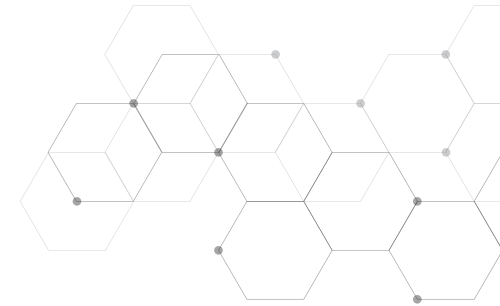
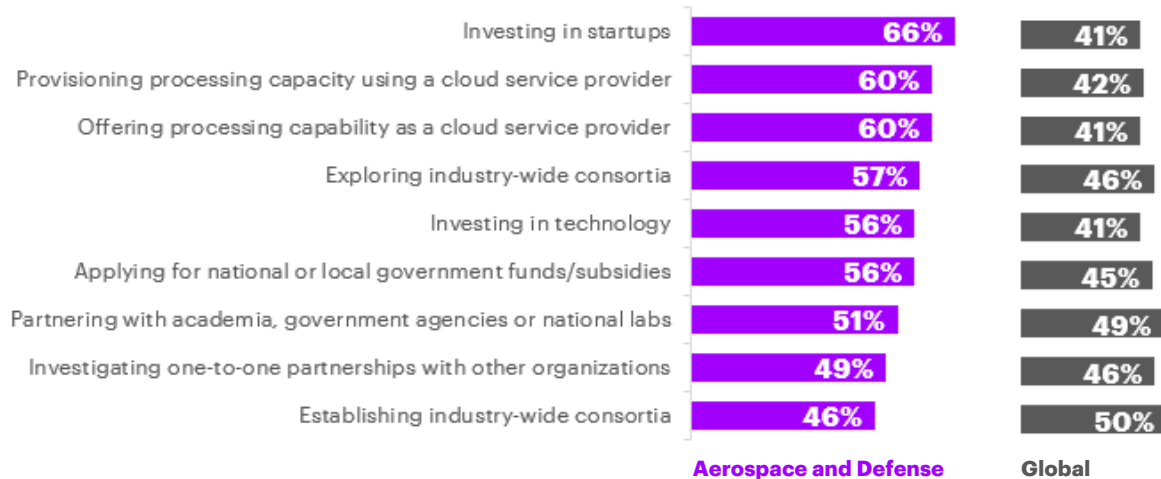
99%

of aerospace and defense executives say that next generation computing is key to long-term organizational success

91%

of aerospace and defense executives agree that next generation computing will become essential to their organization's ability to reach its sustainability goals

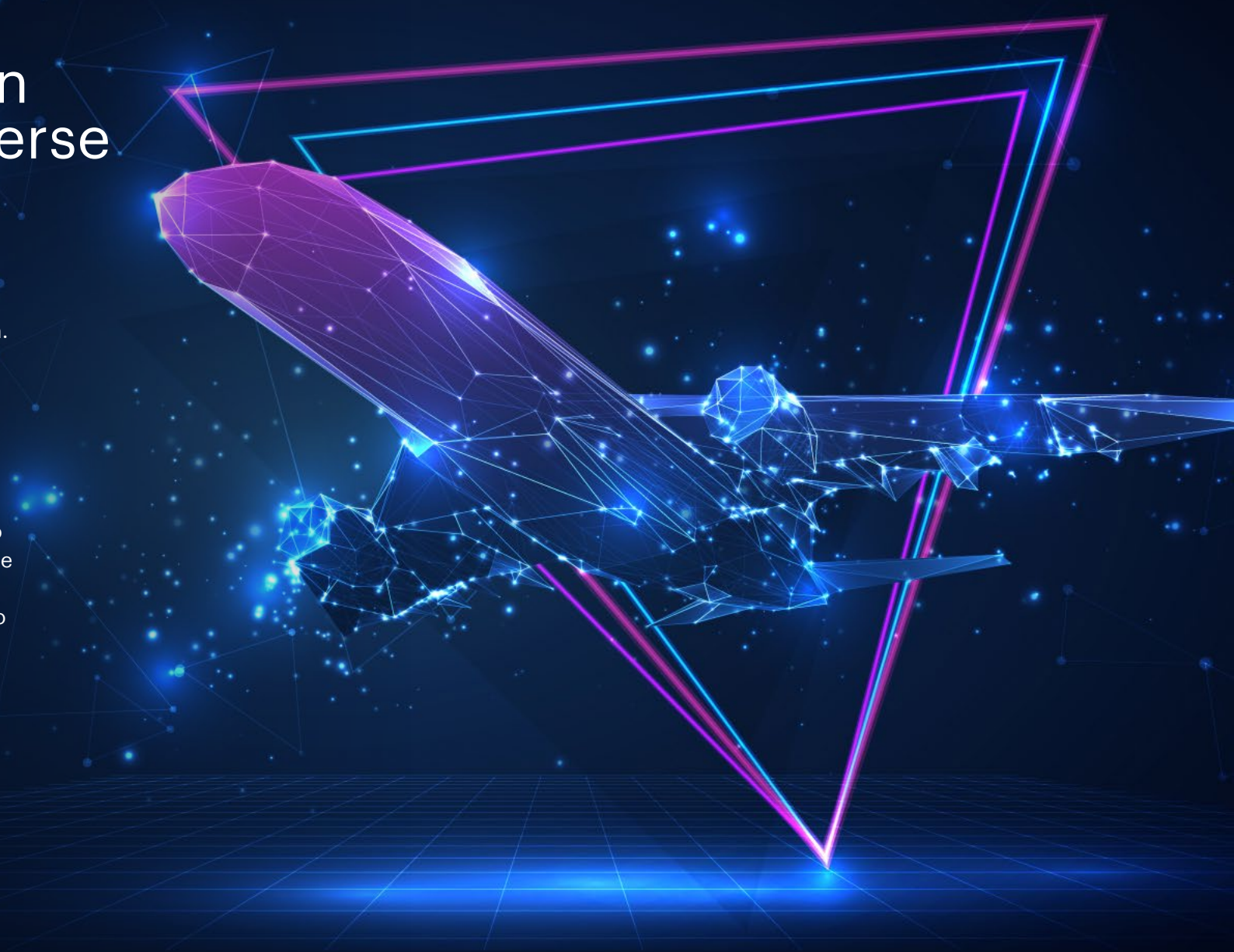
Figure 4: Actions that companies plan to take in the next 3 years to address previously unsolvable problems using next generation computing (% of executives)



Aerospace and defense companies need to regain momentum to the metaverse

The aerospace and defense industry has long recognized that information about its products is as important as the products themselves – in fact, in many cases the ultimate product *is* information. The metaverse provides an overarching paradigm to consolidate this information and interact with it, thereby making it more useful and accessible to everyone. Despite supporting the early development of many of the key metaverse building blocks such as ARPANET and helmet-mounted displays (HMDs), the legacy aerospace and defense industry has not kept pace with the accelerated adoption the metaverse has seen in other industries. However, no industry stands to benefit more from the freedom to create, simulate, analyze and operate that the metaverse provides. Innovation is the foundation of the aerospace and defense industry and the metaverse has the potential to unlock a whole new wave of innovation.

It's clear that aerospace and defense companies need to understand the urgency of this moment: they still have a chance to get ahead of the market and lead the next wave of metaverse. They need to start building new strategies today, rethinking their role in the digital world, exploring potential new products and services, and putting their technical foundation into place. Now, they must focus on identifying new growth pathways and investments.



As aerospace and defense executives look to pilot their organizations on their journey to the metaverse, they should develop a three-point approach that embraces a future powered by digital technologies.



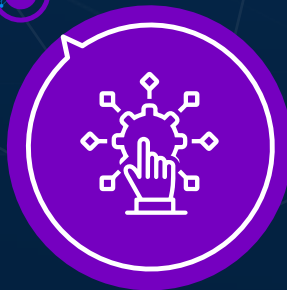
1 Set strategy

- Identify how metaverse capabilities can enhance and create entirely new products and services unlocking value and growth
- Define the roadmap, partners, and solutions required to operate in the metaverse safely and securely
- Create customer and employee journeys that are elevated through metaverse principles and technology



2 Learn and shape

- Learn about the relevant use cases that are already out there and establish an approach to continually identify new ones.
- Shape a vision to drive metaverse strategies and operating models, recognizing that creativity and evolution of this vision are critical— this is not a lift and shift of current products and services.



3 Implement and adapt

- Co-create a branded virtual world or real-world metaverse
- Engage customers and organization with 3D spaces and digital twins to unlock new ways of designing, building and supporting products and business operations
- Continually revisit and adapt the metaverse strategy, measuring results and leveraging new innovations

Aerospace and defense companies should anchor their discussions around how the metaverse could affect their core business and key customer experiences and explore opportunities to move beyond the core to metaverse services. They should rethink their approach to maximizing the value in the products and services they sell, support and operate and revisit the approach they take to their ecosystem.



Author



John Schmidt

Aerospace and Defense Global Industry Lead



Chris Tridico

Managing Director, Aerospace and Defense



Jeff Wheless

Principal Director, Aerospace and Defense
Accenture Research

Visit www.accenture.com/aero

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About the Technology Vision research

Accenture Research conducted a global survey of 6,241 business and IT executives to capture insights into the adoption of emerging technologies. The survey, fielded from December 2020 through January 2021, helped identify the key issues and priorities for technology adoption and investment. Respondents were C-level executives and directors at companies across 31 countries and 14 industries, with the majority having annual revenues greater than US\$5 billion. The survey included 99 business and IT executives across 7 countries from the Aerospace and Defense Industry.

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