unity eBook

The Incredible Impact of Enterprise AR and VR

How industry leaders in automotive, transportation, and manufacturing drive measurable outcomes from mixed reality

Executive summary

As augmented and virtual reality (AR and VR – collectively mixed reality, or XR) technology and hardware continue to evolve and become more accessible, enterprises are expanding the range of use cases for XR across their organizations. What used to be seen as merely a marketing "gimmick" has evolved to now measurably impact the entire product lifecycle and customer experience.

Here are three critical areas where industry leaders in automotive, transportation, manufacturing, and more are seeing real ROI from interactive, immersive experiences:

More cost-effective and collaborative product design and development

— Since implementing its Collaborative Human Immersive Lab VR solution, **Lockheed Martin** has seen a tenfold ROI by building products virtually versus physical builds and testing, saving more than $10 million in costs last year with VR-assisted validation.

More efficient and effective maintenance and training

— Taqtile's Manifest AR solution helped the **U.S. Air Force** dramatically reduce the number of errors made by its recruits on aircraft maintenance tasks to virtually zero.

— In a specific VR training pilot for the T6 Multivan, **Volkswagen Nutzfahrzeuge (Volkswagen Commercial Vehicles)** found the potential of reducing training time by 50 percent over conventional on-the-job training. The pilot also revealed that applying VR can save as much as one third of the training cost.

More engaging sales and marketing

— A real-time 3D activation by Visionaries 777 for **INFINITI** increased tradeshow booth leads and retail engagement by 35 percent.

Mike Boland
Founder of ARtillery Intelligence

"The benefit of AR and VR is that they are so broadly applicable. It goes all the way back to manufacturing and design, and then all the way down to the consumer level and the dealer level."

Real-time 3D: Powering immersive XR experiences

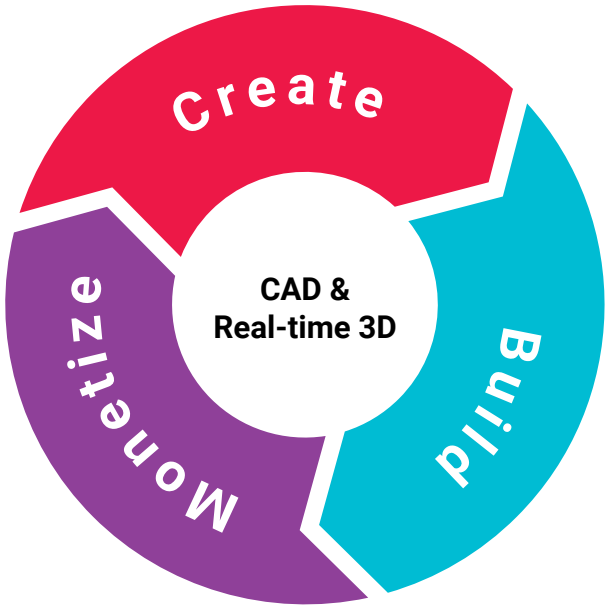
Every manufacturer across the automotive and transportation, consumer products, and industrial equipment industries needs to design, engineer, produce, sell, service, and maintain products. Many processes and technologies, such as Product Lifecycle Management (PLM) and 3D design software, have helped streamline these workflows.

Until recently, real-time 3D – technology for creating interactive and immersive visualizations for AR, VR, and other platforms in which virtual objects look and behave like reality – was largely deployed for siloed visualization use cases, often peripheral to core product development. Most companies felt that 3D design and engineering tools sufficed for visualization, especially since preparing CAD data for real-time 3D required many cumbersome steps for data conversion and adjustments.

All that has changed as real-time 3D technology has become significantly easier to use. This can be attributed to multiple factors: Data preparation is now almost fully automated; integrations with 3D design tools have improved; visual scripting tools were introduced to reduce the need for programming experience; millions of assets are now available for download to speed up development; and more professionals are trained in this technology.

Now, we've crossed the tipping point for scaling real-time 3D. Most automotive OEMs and many manufacturers have started deploying real-time 3D for AR and VR in a more integrated way across their workflows and value chain – for not one, but hundreds of use cases.

Immersive experiences across the product lifecycle



Design

- Experience-based design
- Immersive collaboration for rapid iteration
- Human Machine Interface development

Simulation & engineering

- Autonomous system development
- Virtual commissioning
- System-level simulation

Production & deployment

- Digital factory
- HMI deployment
- Training and guidance

Service & usage

- Internet of Things (IoT)-based experience
- AR-assisted maintenance
- Interactive training
- Connected customer experience

Marketing & sales

- Interactive product configurators
- Cross-platform immersive consumer experiences: Dealer showroom, event XR engagement

By bringing interactivity and immersion to the entire product development lifecycle, real-time 3D experiences in VR and AR unlock synergies across departments, ultimately accelerating the product lifecycle. From initial product design and development to equipment maintenance and training, and all the way through to how consumers interact and purchase your products, real-time 3D is used to create and simulate digital twins that enable a new world of immersive visualization and simulation experiences.

For instance, with new industrial equipment or vehicles, design and engineering teams can reduce time for design review and optimization with interactive 3D models, while training and marketing teams can leverage these real-time renderings to commence their respective functions without the traditional delays of waiting for physical prototypes of static 3D models.

Many more synergies and benefits are unlocked when companies establish a real-time 3D end-to-end workflow for creating, building, and monetizing their products. These include significant cost and time savings, fewer errors, faster time to market, and increased efficiency – impacts that are only expected to grow as additional use cases and applications are realized in coming years.

Advantages of a flexible development platform for XR

With the Unity platform, companies have the flexibility to not only create custom XR solutions that fit unique industry business needs, but extend them across multiple use cases without developing new software for each individual scenario.

Mike Boland, AR industry analyst and founder of ARtillery Intelligence, notes that Unity stands out for its broad scope of use cases and cross-disciplinary approach: “Unity is one of the few democratization tools for 3D experience creation. It likely has the greatest breadth of applicability across not just individual niches, but lots of different industries and verticals.”

Visionaries 777, a developer of AR and VR software solutions, leverages Unity for automotive industry leaders like INFINITI and BMW. Their XR deliverables seamlessly extend immersive, interactive experiences across their clients’ sales, training, product design, and maintenance functions. Co-founder David Castañeda recognizes this cross-department functionality as being a key driver of AR/VR adoption and expansion across the automotive industry.

David Castañeda
Co-founder of Visionaries 777

“We chose Unity as our go-to platform because it allows us to develop something for a particular department, then deploy it in different kinds of hardware that can be reused by other departments at the same time. On other platforms, we would have to redevelop the solution for each device or hardware platform. With Unity it is a seamless deployment to over 20 platforms, which is a huge advantage for our customers.”

Product design and development

XR is revolutionizing the way products and vehicles are designed, developed, and tested, accelerating time to market and drastically cutting down on the inefficiencies and costs associated with traditional product development and research and development (R&D) methods. By replacing physical models and prototypes with virtual, interactive renderings, issues can be identified much sooner, while eliminating the need to manufacture and test multiple, costly iterations.

A user assessing a virtual product design. Courtesy of Lockheed Martin

Lockheed Martin, a global leader in aerospace and defense technology, has leveraged 3D data to assist with product design for years. As the costs and reliability of XR technology and hardware have improved, the company has made major strides in advancing the utility of its Collaborative Human Immersive Lab – or CHIL NET – VR solution.

Built on the Unity platform, CHIL NET provides a collaborative environment to support virtual simulations and modeling for product development and testing, helping Lockheed Martin to validate that engineering designs will be successful on the manufacturing floor. Simply put, it allows them to build things right the first time – a huge advantage given the sheer scale and expense of the products it is developing, from spacecraft and satellites to military aircraft.

Product design and development

Since implementing CHIL NET, Lockheed Martin has seen a tenfold ROI by building products virtually versus physical builds and testing. Last year alone, it avoided more than $10 million in costs with VR-assisted validation, allowing the discovery and resolution of issues much earlier in the development stage while dramatically lowering the risk of products incurring problems after manufacturing. The company has also saved $500,000 on travel expenses by enabling distributed employees to collaborate virtually.

For companies like Lockheed Martin that innovate at light speed, the ability to react quickly and develop solutions without having to wait on third-party technology for integrations is mission critical. “That’s one of the other big advantages of a system like Unity – we can react immediately to our needs and build what we need ourselves,” says Bolthouse. “We like being able to grab assets from Unity’s Asset Store, we like the modularity of it, and we like that we can integrate other pieces of software.”

Darin Bolthouse
CHIL NET Manager at Lockheed Martin

“A big advantage of Unity is its high-level networking protocol, which allows us to distribute our VR systems across the country. Previously, it required that everyone come to the physical lab in Denver, but now we’re distributing these systems to half-a-dozen facilities and eliminating the need for travel.”

Measureable outcomes

CHIL NET saves time and money, and reduces risk!

10:1
Return on investment: greater than 10:1

$10M+
Cost avoidance 2018 due to issues discovered early

$500K+
Travel cost savings in 2018 conducting remote ergonomic studies

↘
Significant reduction in program schedules and risk

Maintenance and training

From the manufacturing floor to the sales floor, it is essential to have knowledgeable, well-trained workers. This is becoming more challenging in the industrial sector, which is dealing with a serious skills gap that could leave millions of manufacturing jobs unfilled, a rapidly retiring workforce, and a need to support increasing automation.[1] Additionally, traditional manual-based or instructor-led training can be not only extremely time-consuming, but expensive when travel costs, language translation, and machinery downtime is factored in.

XR is addressing many of these problems across multiple maintenance and training scenarios, producing time and cost savings, reducing the likelihood of errors, making it easy to capture institutional knowledge from long-tenured experts, and helping workers retain a greater amount of content through immersive learning.

Taqtile, specializing in XR solutions for manufacturing, transportation, and government, is enabling its customers to visualize processes on top of real-world equipment as both a job-aid for maintenance and operations, as well as training on equipment and processes. Its flagship solution, Manifest, is built on the Unity platform and uses AR/VR technology to capture expert knowledge on instructions and procedures that can be used to assist those without technical expertise to perform complex tasks on specialized equipment. It also allows for equipment to be worked on safely and remotely without highly skilled technicians on-site.

Dirck T. Schou Jr.
CEO at Taqtile

"Could we have built this solution without Unity? Absolutely. But it would have taken us way more work, much more time, and a lot more expense and effort to get to where we are today. It's absolutely been incredible, not only in terms of creating our product on top of Unity in itself, but we also take advantage of the various plug-ins and additional tools that are made available in the Unity ecosystem and that's been a big help for us."

1 Industry Week: How Manufacturers Will Tackle the Talent Shortage in 2019

A military subject matter expert immersed in creating a new maintenance task. Courtesy of Taqtile

Without AR	With AR
8 / of 12 M&R tasks required instructor intervention	**0 / of 12** M&R tasks required instructor intervention
3 Errors within completed tasks	**0** Errors within completed tasks

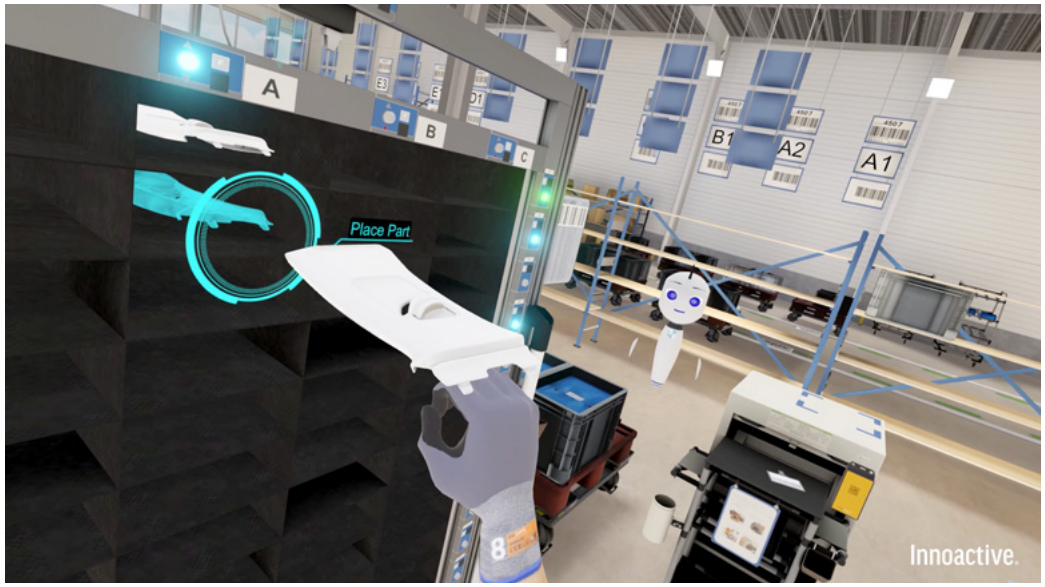
Taqtile's customers are seeing impressive results with XR, specifically in regard to execution of complex tasks and on-the-job skills training. This has led to increased speed of delivery and a dramatic reduction of errors to little or none. In particular, the U.S. Air Force has seen significant improvements in error reduction for recruits on maintenance and repair (M&R) tasks for aircraft.

Using traditional methods, a group of minimally experienced Level-1 maintenance engineers was unable to complete eight of twelve tasks without instructor intervention, and incurred three errors within the completed tasks. Using the Manifest solution with HoloLens headsets to provide AR-based guidance, the recruits were able to complete all tasks without assistance, incurring zero errors. In another trial, a more advanced Level-5 engineer using traditional methods completed the assigned task with eight errors, while a more novice Level-3 engineer with less training was able to complete the same task with zero errors using Manifest.

Another of Taqtile's customers, the New Zealand Army, conducted a similar trial at its trade training school to compare the effects of mixed reality training with Manifest versus traditional instructor-led training on several vehicle-related tasks. The trial concluded that Manifest reduced the occurrence of errors by 36 percent, increasing the students' overall understanding of the training materials and removing the need to ask for assistance.

Daniel Seidl
CEO of Innoactive

"Unity is a leading content creation tool for enterprises. In our experience, more companies are creating content more efficiently and effectively with Unity. By extending Unity with additional capabilities, our customers can create training modules that are more standardized and can be maintained better by multiple teams."



An AR exercise for learning commissioning of car parts. Courtesy of Innoactive

In addition to reducing errors, virtual training can produce significant time and cost savings while improving the overall productivity of your workforce. Innoactive, a provider of an extensive VR training platform for the automotive industry, helps its customers scale virtual trainings for various use cases throughout their organizations. Built on Unity, Innoactive's VR tools are enabling industry leaders like Volkswagen and Audi to create, manage and deploy VR training simulations in an integrated approach, while facilitating cooperation between departments and brands.

Innoactive's customers are not only seeing significant savings in travel expenses by bringing employees and trainers together in virtual environments, but no longer have to shut down manufacturing lines to facilitate training on the equipment – saving potentially millions of dollars in lost production.

An XR training scenario with instructor and students. Courtesy of Innoactive

Volkswagen Nutzfahrzeuge (Volkswagen Commercial Vehicles), one of Volkswagen Group's brands, conducted multiple VR training pilots, including for the front-end assembly of the T6 Multivan. In this specific case, Volkswagen found the potential of reducing training time by 50 percent, in comparison to conventional on-the-job training. The pilot also revealed that applying VR can save as much as one third of the training cost. Furthermore, 97 percent of the trainees stated that they would aspire to train new assembly contents in VR in the future.

Cost savings and speed gains are not the only benefits from using VR. When looking into logistics scenarios, VR training helps alleviate language barriers across global workforces, eliminating the need for translators and numerous iterations of multilingual training materials. With fully immersive training, logistics personnel can learn faster and better, and retain processes with a hands-on approach, helping to greatly reduce the likelihood of future mistakes. Innoactive's tools are specifically designed to reduce language barriers and enhance the hands-on simulation of workflows.

"The real KPI here is how many errors can be avoided," says Seidl. "Many logistics tasks involve, for example, scanning the right thing at the right place. If you forget just one scan, the data in the system will be wrong and can lead to longer production times. With VR training, our customers can dramatically reduce the number of these errors. Learning these procedures in VR, engineers and technicians remember everything better."

Sales and marketing

From virtual showrooms to immersive sales enablement, XR is completely changing the way that vehicles, aircraft, and vessels are marketed and sold today. Not only do virtual environments provide customers with the digital, engaging, and cutting-edge experiences they've come to expect, but they also enable manufacturers and distributors to spend less money and time making and stocking every imaginable color or configuration.

While Visionaries 777 has helped INFINITI leverage VR/AR across various use cases throughout the organization, a standout scenario has been creating the auto showrooms of the future with virtual tour and visualization capabilities. Real-time 3D technology and apps, built on the Unity platform, allow customers to virtually tour cars from any angle or switch features without ever being inside, or even near, the vehicle itself.

Potential car buyers can see the engine without opening the hood. Courtesy of Visionaries 777

Visionaries 777 designed a life-size AR experience to accompany the unveiling of the INFINITI QX50. Courtesy of Visionaries 777

Sales enablement is another area where Visionaries 777 is helping INFINITI implement VR in order to accurately prepare its sales force with the product details and specifications necessary to effectively sell today's complex vehicles. Not only does this enable INFINITI to disperse the sales materials and content virtually across multiple locations and languages, but it ensures the entire global sales force is unified with the same terminology and messaging. Where ingesting large volumes of technical specifications and product options can be cumbersome and lackluster in written sales materials, VR brings the content to life, engaging sales employees and improving their retention of information needed when approaching customers.

"Traditionally, the top sales reps could all speak the same language – it was just a car with four wheels and they were very good at selling that," says Visionaries 777 Co-founder David Castañeda. "But now, every car has a different technical 'personality' inside and that's where it becomes more difficult. You can't just approach someone and expect them to buy the car – you need them to focus on your unique selling points, which are always technical advantages over other brands/models now."

Taqtile's Manifest solution has also been effective on the sales front. For situations where displaying the physical product to a customer is not feasible due to its scale or importability, Manifest is helping companies share their products and features virtually. One such company, Safe Boats International, is able to leverage Manifest to virtually showcase its 85-foot (26-meter) vessel, which cannot be easily transported and shown to customers at events and tradeshows.

What's next for enterprise XR

As the business impact of these technologies comes into clearer view, adoption in the industrial sector will follow suit. ARtillery Intelligence projects a tipping point to hit by mid-2020 for enterprise XR, followed by rapid acceleration and expansion thereafter.[2] "XR delivers a greater ROI proposition for enterprises in terms of reducing the level of errors in an industrial setting, or increasing speed of completion of a given task," says Mike Boland. "When done at scale, those gains can really add up."

Enterprise XR is projected to pass a tipping point by mid-2020

Many are looking forward to continued improvements in processing power and bandwidth to make it easier to build and access real-time 3D content, including experiencing it on mobile devices. "We are all about trying to make it friction-free for our clients to get their content into the system," says Kelly Malone, Vice President at Taqtile. "We believe that's what's going to really accelerate this technology – the more available and useful the content, and the easier it is for people to build and access that content, the faster this technology will get adopted."

Lockheed Martin is also eager to see enhancements to performance and rendering capabilities, specifically in regard to virtual maintenance environments: "The ability to readily apply textures, materials, and lighting to gain a more realistic look and feel to the scene is particularly important when you think about training someone on maintenance for an aircraft. You need it to represent what the real object would look like in the field," says Bolthouse. "There are a lot of peripheral devices coming out – like VR gloves and haptic suits – that help make the virtual world more real."

The coming years will be an exciting time as more XR use cases, applications, and hardware are realized, paving the road for even greater possibilities in the industrial market.

2 ARtillery Intelligence: Behind the Numbers: Enterprise AR's Road to $29 Billion

Contributors

About Unity

Unity is the creator of the world's most widely used real-time 3D development platform, giving developers around the world the tools to create rich, interactive 2D, 3D, VR and AR experiences across the product lifecycle. The company's technology is used by the top 10 best-selling automotive brands as well as industry leaders in transportation and manufacturing. Learn more here.

Additional resources

eBooks and whitepapers

- Top 5 ways real-time 3D is revolutionizing the automotive product lifecycle
- The value of immersive 3D automotive experiences
- Accelerating innovation in automotive design

Webinars

- From CAD to Unity
- How to produce stunningly realistic real-time images and videos
- Embedding XR & real-time 3D in the digital marketing strategies of automotive leaders
- AR & VR: How the industrial market is embracing spatial computing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