News, features and analysis for immersive tech and enterprise

magazine
Virtual Reality
WORLD TECH

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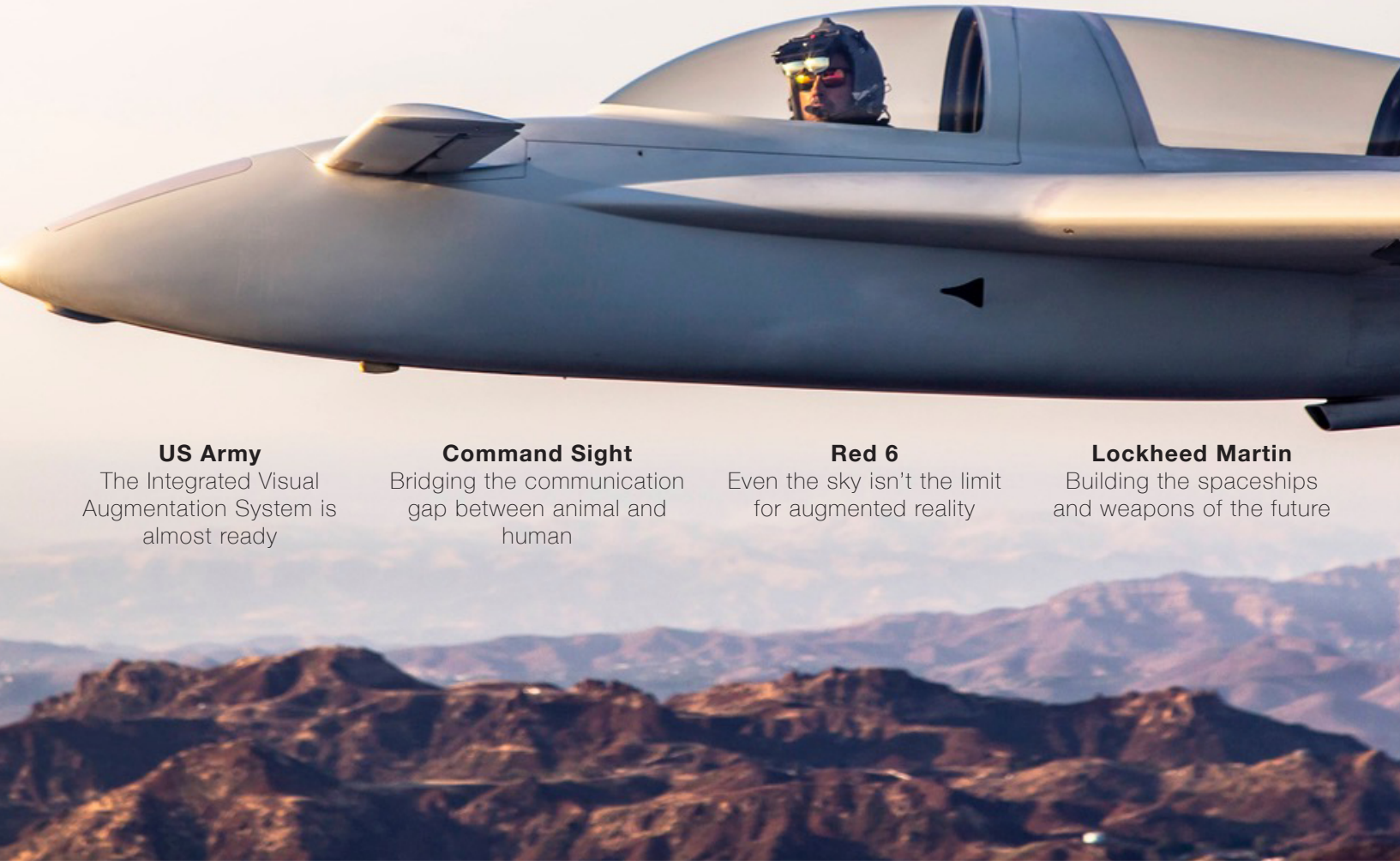
Military-precision potential

Public and private unite to transform immersive technology

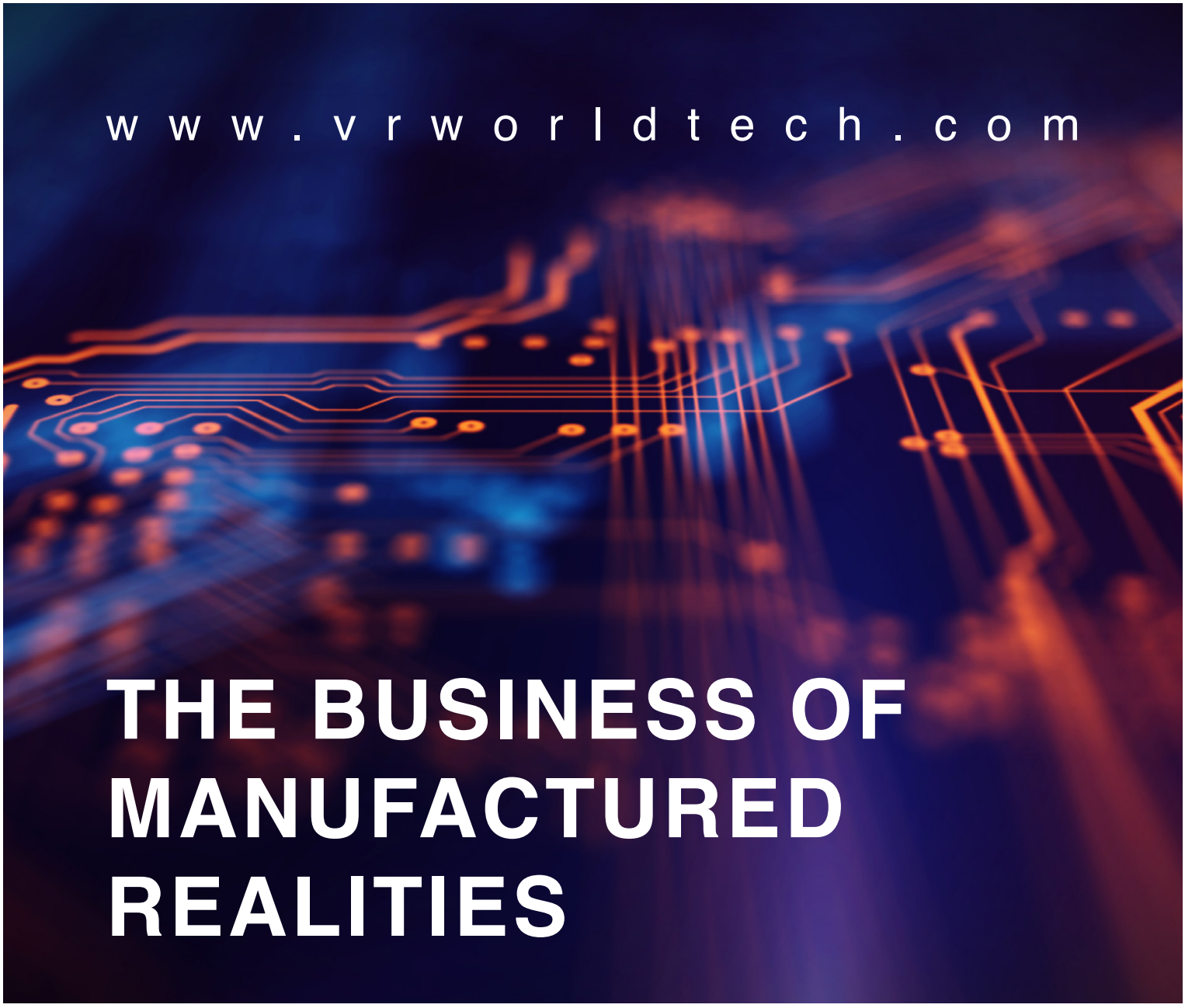


US Army
The Integrated Visual Augmentation System is almost ready

Command Sight
Bridging the communication gap between animal and human

Red 6
Even the sky isn't the limit for augmented reality

Lockheed Martin
Building the spaceships and weapons of the future



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THE BUSINESS OF MANUFACTURED REALITIES

Dedicated to the business of virtual reality, augmented reality, mixed reality, audio sensory experiences and other upcoming innovations within immersive technology, VRWorldTech keeps business leaders and professionals updated with daily news and regular features from across the globe.

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Change in MOTION

2021 beckons

My previous editor's note called for change and that's again a theme for this issue, but this time it's very much in motion.

Since we last met, voters have spoken, vaccines have been developed and immersive technology has moved toward the mainstream. That's in part thanks to the likes of Oculus Quest 2 and sharp drops in hardware costs, a rise in available software and an increasing need for digital solutions, but also because the word has spread and enterprises are opening up about why and how they've adopted virtual, augmented or mixed reality, or a host of other immersive technologies. That's a big change—and one the team at VRWorldTech is proud to have played a part in.

This has been acutely apparent in military and defence, where this issue of VRWorldTech Magazine focuses, with the US military surprisingly vocal about its motivations, plans and efforts in technology modernisation.

We hear from the US Army on the Integrated Visual Augmentation System and how it's set to enter the field in 2021, as well as Command Sight and the work being done to develop augmented reality goggles for military working dogs. Both are bold projects, so it's refreshing to be able to learn about them in detail and find out how immersive technology is being put to work in this context.

Immersive technology company Red 6 and defence and aerospace giant Lockheed Martin also feature in our military and defence focus, capping off an in-depth look at the cutting-edge work being done in this exciting space.

You'll notice that this issue is somewhat slimmer than previous editions. This, too, reflects a theme of change in motion. Next year, VRWorldTech Magazine will become a bimonthly publication, meaning we'll have more opportunities to show you the advances being made in immersive technology for enterprise.

Editor's Note

Each issue will carry the usual focus, made up of a series of profiles and articles, bookended by The Reality Wire and a Meet feature introducing a developer.

We encourage you to submit press releases for the former, the majority of which will feature online at VRWorldTech.com and the best of which will appear in an upcoming issue, and to express an interest in being interviewed for the latter. The magazine's Meet feature is reserved for stories we deem particularly interesting for readers, but the website is a limitless space and we will strive to include you.

Six slimmer issues of VRWorldTech Magazine will also bring the added benefit of making it cheaper to print, so look out for the link to where you can order your copies. Stay tuned for the 2021 editorial calendar and where we'll be turning our attention to next.

That's all from me. Have a very Merry Christmas and restful New Year, when we can't wait to see what you come up with next in immersive technology.

Over the break I'll be putting my Oculus Quest 2 to work and writing a belated review. I'll say this: the headset is a massive improvement on its accomplished predecessor, which is a fantastic achievement for the team at Oculus and Facebook. But is the headset everything enterprises had hoped for? We shall see.

Mark has been a business-to-business journalist for a decade. He has edited and written for websites within financial services and law, primarily intellectual property, for which he also has a keen interest. He graduated from the University of Leeds with a BA in creative writing. He is an avid reader, particularly of science fiction and fantasy.

Mark Dugdale
Editor
VRWorldTech

Image by Fotos nuclear_lily via Adobe Stock

VirtualReality WORLD TECH

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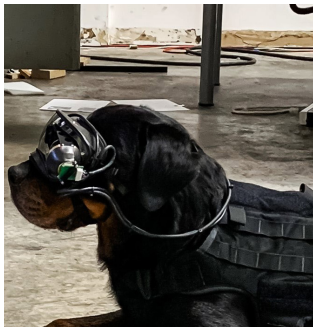

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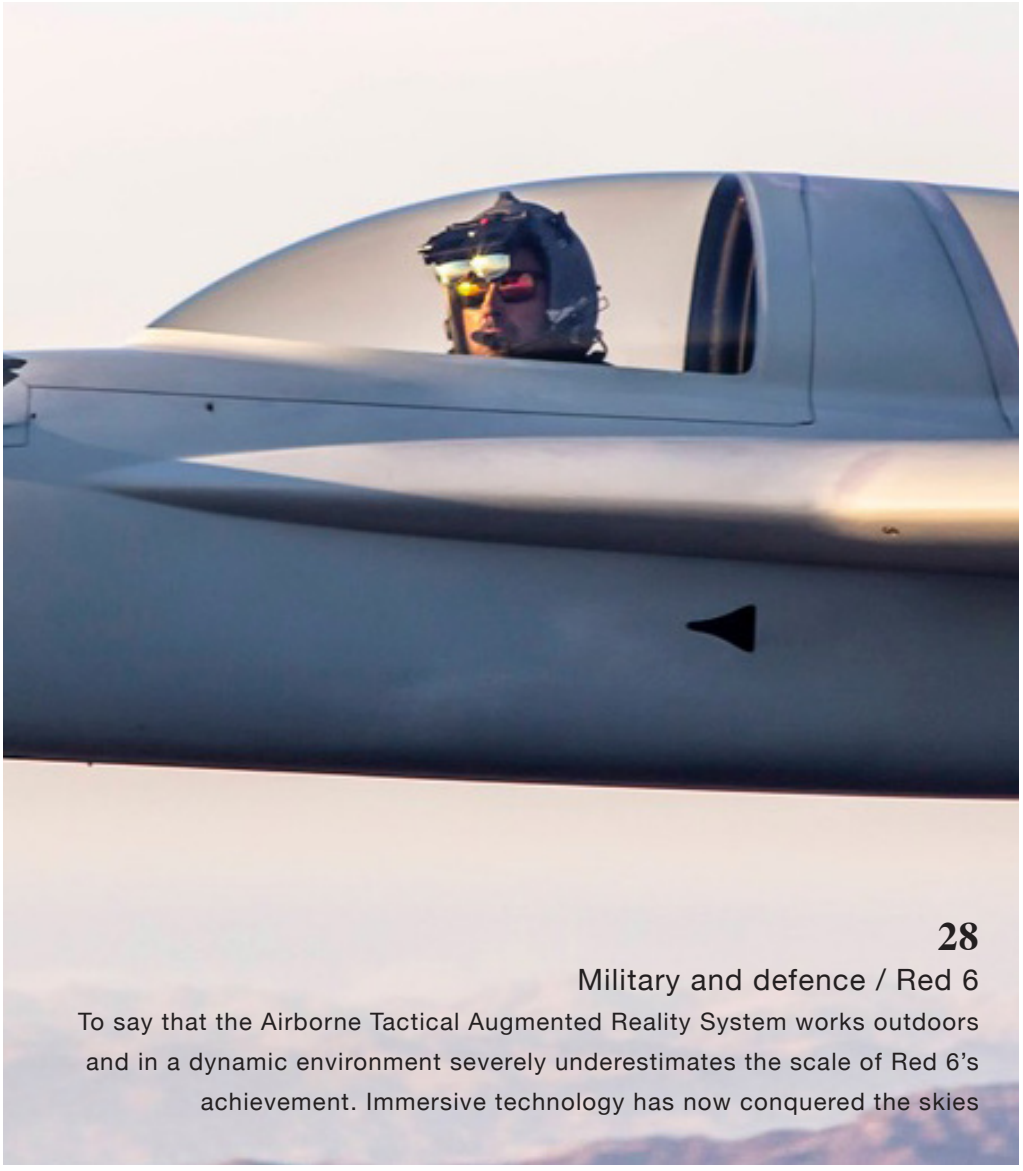

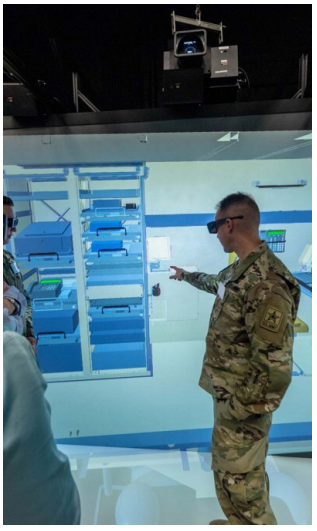

Meet: Ellinogermaniki Agogi

VirtualReality WORLD TECH

VRWorldTech is a must-read resource if you want to stay up-to-date on progress within immersive technology. Our content sits between the technology's creators and developers and the business leaders who can benefit from its use and application. We cover the stories that make immersive technology a reality.

THE REALITY WIRE

A round up of the biggest stories tracked in The Reality Wire over the past two months.

KRATOS®
PUBLIC SAFETY & SECURITY SOLUTIONS, INC.

Kratos brings realistic mixed reality to aircrew training

Kratos Defense & Security Solutions is rolling out its Aircrew Combat Mission Training (ACMT) system that utilises advanced immersive training technology to allow teams to train together in highly realistic, mixed reality combat scenarios. Offered as a turnkey solution, the system includes a mixed reality Multi-Position – Aircrew Virtual Environment Trainer (MP-AVET) integrated with a mixed reality Ground Party Simulator (GPS).

The system is based on the Kratos Immersive Technology Platform that unites best-in-class commercial products with the latest immersive technologies.

The Kratos Immersive Technology Platform enables Kratos to create highly realistic training environments that seamlessly combine real and virtual components in immersive environment scenarios that go beyond augmented or virtual reality experiences in actual mission fidelity.

Based on industry standards and using pre-integrated technologies, solutions built on the Kratos platform are highly realistic, cost-effective and built to be easily transported to the customer's point of need.

For example, in the MP-AVET, an actual rotorcraft fuselage is surrounded by a Kratos immersive holodeck. The aircrew performs their assigned duties in the physical aircraft outfitted with seat-shaker technology, weapon recoil and windloading to mimic vibration and forces of aerial weapons employment during flight.

The entire aircrew performs highly realistic virtual air interdiction, air assault and close air support mission scenarios.

Simultaneously, the helicopter flight engineers work physical weapons

>>

while firing at virtual air and ground targets.

The MP-AVET works in tandem with Kratos's GPS, allowing ground personnel to collectively train with their aircrew as they would engage with them in live fire situations.

In this mixed reality environment, the aircrew and ground party train together, experiencing the sights, sounds and haptics of simulated combat missions, while saving the cost of flight time, fuel and ammunition.

Currently offered as a turnkey service, Kratos's ACMT can accommodate different aircraft platforms, including the H-1 and the H-60 helicopters.

When configured for the H-1, ACMT can simultaneously train up to two pilots and two flight engineers at their crew positions in the same immersive environment.

Once it's coupled with the physical aircraft and weapons, the system increases combat mission training effectiveness and enhances the aircrew's ability to anticipate, recognise and react to threats in a fully immersive, simulated tactical environment.

In discussing the capability, Wade Koch, vice president of business development at Kratos Training Solutions, said: "For the first time, helicopter aircrews can train together in a completely immersive, collective, training environment."

"The immersive environment supports initial, continuation and mission rehearsal training using a real aircraft fuselage, flight deck, flight controls, cabin and simulated weapons."

"Depending on customer requirements, the turnkey service includes logistics support, courseware development support and ground-based academics/ mission instruction." ■

Realize MEDICAL

Realize Medical adds remote collaboration to Elucis medical VR platform

Realize Medical is now offering fully integrated remote networked collaboration through its medical virtual reality platform, Elucis.

Users of the platform can now safely 'meet' with their peers in a secure, collaborative virtual reality environment—the perfect solution for communicating 3D content in healthcare and education, especially while options for physical gatherings are limited.

Internal remote collaborations are facilitated with a single click by storing a project database on a network drive or institutionally approved cloud storage drive of one's choice. If users want to collaborate externally, they can export an Elucis project and share it with their collaborators through secure means of their choosing.

To maximise security of information, the telemetry facilitating the remote interactions never contains image or 3D structure data, and voice communication is always encrypted.

Personal health information and image data are maintained entirely within the custody of users at all times.

Justin Sutherland, chief executive officer and co-founder of Realize Medical, said: "It's widely recognised that exceptional healthcare is facilitated by a collaborative approach and the pandemic has forced us to get creative about how we communicate and share content with one another." >>

"Creating 3D models of patient anatomy in Elucis has the potential to enhance patient care but only if that high-quality content can be safely and easily shared with the entire surgical planning team in a meaningful way. With VR collaborative environments, the possibilities are vast. The medium really is the message."

One example of this collaborative approach is at the Ottawa Hospital where physician users of Elucis connect with each other to create and collaborate in a shared virtual environment, or create a session with Realize Medical experts to be taught its powerful features in a live learning session.

The Covid-19 pandemic has also created the largest disruption of education systems in history. During this time, many educators are turning to tools like virtual reality to help them adapt and keep students engaged.

Sonya Deveau, director of sales and business development at Realize Medical, said: "Research shows we retain more information and can better apply what we have learned after participating in virtual reality exercises."

"We're excited to see how remote collaboration in Elucis will further enhance education and student engagement." ■

MANUS™

MANUS Prime II gloves now available for €1,499

MANUS, an immersive technology developer specialised in high-fidelity finger tracking, is offering its Prime II gloves at the new lower price of €1,499.

The price drop is part of its mission to deliver the best tracking experience for companies across entertainment, education, and training.

Bart Loosman, chief executive officer at MANUS, said: "We at MANUS are super excited about our new pricing, making high-end finger tracking more accessible for creators and developers."

"We felt that the market was waiting for someone to break the mold on expensive tracking hardware, and we felt that should be us."

More powerful versions of the gloves, such as the Prime Xsens, are also available. Prime Xsens gloves have recently been used in a John Legend virtual concert, tracking the performers with precision.

Due to the direct implementation of the Manus gloves inside of Xsens MVN software, there was no major change in the pipeline created for this project. The concert has since been seen by 753,350, with positive reviews of the virtual experience.

Customers can now buy the MANUS Prime II for €1,499, the Prime II Haptic for €2,499, or the Prime II Xsens (with MANUS Core) for €3,990.

Customers can also take advantage of a range of software that improves the immersive experience, such as MANUS Core, the data-handling software behind MANUS.

The software comes with four key features: glove data handling, Polygon IK-solver, FBX recorder, and multiple tracking system support.

Manus Core is available for €499 annually, or €1,499 for a perpetual licence. ■

Resonai launches augmented reality app for digital concierge services

Resonai is rolling out Vera Concierge, a groundbreaking mobile app that uses augmented reality and artificial intelligence (AI) to provide digital concierge services to visitors of retail outlets and commercial buildings.

Built on Vera, Resonai's enterprise platform that transforms any physical space into an intelligent digital environment, Vera Concierge provides personalised assistance, indoor navigation, and context-aware information through a friendly, easy-to-use augmented reality interface.

Emil Alon, chief executive officer and founder of Resonai, said: "Vera enables us to merge the digital and physical worlds so that devices and people operate seamlessly and we can create exciting new experiences for consumers and business."

"Vera Concierge is a perfect example of the type of application that not only engages end users but also delivers real value to building owners and facilities managers. Once we transform physical spaces into intelligent digital environments, the number of applications we can create is practically limitless."

Vera Concierge is part of the Vera suite of apps for use within any commercial building.

Other apps include Vera Universal Controller, which offers a way to manage and control all of a building's devices from a single, intelligent place, and Vera Maintenance Manager, which uses augmented reality and building intelligence to automate a facility's maintenance processes and improve the efficiency of its maintenance team.

The apps draw on Vera's highly accurate 3D semantic understanding of the environment and highly precise positional tracking of users within it.

Building tenants and visitors can use Vera Concierge to check in or register upon their arrival and get personalised, contactless information. The app provides turn-by-turn navigation guiding users to their destinations and offers helpful, context-aware augmented reality content along the way at just the right time and location.

In a retail environment, for example, the app can provide consumers with important product information, deliver engaging, augmented reality-based brand experiences, or simply point out where the restrooms and other facilities are located.

The app provides real-time analytics on traffic flows, user behaviours, product interactions, and other valuable data as consumers move through a store or shopping mall, enabling managers to integrate brick and mortar data with ecommerce data to map the complete buyer journey.

Vera also delivers new monetisation opportunities for building owners by creating new digital real estate that can be monetised through promotions, sponsorships and branding opportunities. ■

SimX expands US Air Force partnership

SimX is expanding its partnership with the US Air Force to develop operational medical training systems through its virtual reality medical simulation platform.

The new $1 million Virtual Advancement of Learning and Operational Readiness (VALOR) programme builds on existing collaborative efforts between SimX and innovators within the US Air Force, as military simulation training capabilities already deployed within the Department of Defense.

Recognising the urgent need for education and training to combat the global Covid-19 pandemic, this programme will also allow for military adaptation of SimX cases focused on the evaluation and management of the virus.

Currently, the civilian version of these cases can be downloaded and used free of charge by any hospital or training programme with Oculus Quest or HTC Vive devices.

This project was made possible through the Small Business Innovation Research (SBIR) Direct to Phase II programme, in collaboration with AFWERX, a team of innovation specialists within the US Air Force, and the Air Force Research Laboratory (AFRL).

AFRL and AFWERX have partnered to streamline the SBIR process in an attempt to speed up the experience, broaden the pool of potential applicants and decrease bureaucratic overhead.

SimX chief technology officer Karthik Sarma is the principal investigator for the programme and will coordinate efforts with US Air Force Colonel John R Dorsch, DO, Wing Surgeon of the 24th Special Operations Wing (SOW), and pararescue medical director.

Dorsch said: “The VALOR programme will increase overall medical capability and improve survival rates in US, Coalition, and partner force combat casualties.”

“These capabilities are critical for ensuring that the highest level of combat trauma and austere medical care are provided by the 24th SOW’s special operations ground forces.” ■

KLM Cityhopper introduces virtual reality training for pilots

KLM Cityhopper is introducing virtual reality training for pilots flying Embraer 175 and 190 aircraft.

Developed in-house, the virtual reality training courses will allow pilots to make more effective use of their training time and will also yield cost savings. KLM Cityhopper says it’s the first airline to integrate virtual reality into its pilot training for Embraer aircraft.

KLM subsidiary KLM Cityhopper has a fleet of Embraers serving European destinations. It decided to investigate the capabilities of virtual reality in an effort to respond more flexibly to pilots’ differing training needs.

Sebastian Gerkens, senior instructor for Embraer at KLM >>

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Cityhopper, said: “Virtual Reality makes training more accessible. It is on-demand and site-independent—pilots don’t have to be in a classroom or a simulator at a certain time. What’s more, it invites them to explore, something they can do safely in a virtual environment.”

“VR allows pilots to familiarise themselves with the cockpit in advance, so that they make more effective use of their simulator time.”

The new training approach will also generate cost savings, because it cuts down on the number of external suppliers and makes pilot scheduling more flexible.

The virtual reality training courses for the Embraer 175 and 190 were developed by KLM’s own experts in cooperation with KLM Cityhopper. Training consists of three applications, all part of the type rating course in which pilots learn the specific characteristics of the aircraft they are going to fly.

These applications include a virtual cockpit, a 360□ point-of-view video, and a virtual walkround the aircraft.

“These are also the three different ways to capture content used to create VR applications,” explained Werner Soeteman, manager of the VR Centre Of Excellence at KLM IT.

Soeteman continued: “The interactive virtual cockpit was created on computers entirely by our team of VR developers and 3D designers. To produce the 360-degree video and photographs, one of our VR engineers sat in the cockpit operating an advanced 360-degree camera during a flight, in close cooperation with the KLM Cityhopper pilots. Our developers haven’t the faintest idea how an Embraer works, although they’ve certainly learned a lot.”

KLM has long been interested in using virtual reality for staff training. It already has courses for maintenance engineers and KLM Cityhopper cabin crew.

KLM Cityhopper is exploring whether it can obtain European Union Aviation Safety Agency certification for these courses, which would then eventually replace some of standard training components, such as classroom instruction, the cockpit poster and textbooks. ■

TAQTILE

Taqtile Manifest augmented reality platform to help US Army modernise motor pool operations

Taqtile is the recipient of a US Army Small Business Innovation Research (SBIR) Phase 1 contract.

The SBIR award provides the opportunity for the Army to evaluate Taqtile’s Manifest augmented reality platform for its motor-pool personnel.

Through a series of workshops and hands-on demonstrations, the Army will evaluate Manifest’s ability to leverage the expertise of knowledgeable frontline personnel, empowering >>

motor-pool staff to perform complex tasks more safely, efficiently and accurately.

The Army will evaluate Taqtile's Manifest platform to address complexities, inefficiencies, and outdated paper-based processes for maintaining and repairing its extensive motor pool of military vehicles.

During the vehicle maintenance process, Army mechanics can access and follow Manifest's spatially-anchored, step-by-step instructions with embedded multimedia content to more efficiently complete complex maintenance tasks.

Kelly Malone, chief revenue officer at Taqtile, said: "Our robust Manifest solution is designed to handle the complex procedures and equipment typical in Army motor-pool maintenance."

"We expect Army personnel, from new recruits to seasoned mechanics and officers, to immediately recognise the benefits of Manifest, and to look for ways to deploy our platform to other locations and vehicles in the motor pool." ■

ECOLAB®

Ecolab completes first major equipment installation with mixed reality

As Covid-19 is reducing in-person access to energy plants around the world, Ecolab is using new digital solutions to deliver its water, energy and sanitisation solutions.

Ecolab used mixed reality to guide the installation of Purate chlorine dioxide generators at multiple facilities for one of the largest independent midstream energy infrastructure companies in the US.

These installations mark Ecolab's first use of mixed reality to install, test and deliver a chlorine dioxide generator solution for cooling tower operations at an energy plant.

Steve Kramarczyk, a corporate account manager for the global heavy division of Ecolab, said: "Due to the travel, social distancing and plant access restrictions in effect for Covid-19, a typical installation process that involves several on-site engineers was not possible for this company."

"Still, the company wanted to realise the cost and logistics savings Purate offers, so we were able to use mixed reality to safely oversee its installation."

By wearing a mixed reality headset, a single Ecolab field representative was able to transmit on-site visuals and critical data to a team of Ecolab engineers working remotely.

Similar to a guided space mission, the engineers, whose combined experience totaled more than 50 years, were then able to guide the representative through a variety of operations at the plant.

Kramarczyk said: "Digital technologies like mixed reality will have a transformative effect in the energy sector."

"Not only will companies that embrace them be able to perform major equipment installations, they will be able to better assess risk, monitor their operations and improve their efficiency."

"Ecolab has spent decades building relationships with our customers and learning about the innerworkings of their operations. It's this intimate knowledge that enables us to leverage our digital solutions effectively for our customers." ■

Mitchell partners with Qualcomm and RealWear to develop XR solution for collision repair

Mitchell, a provider of technology, connectivity and information solutions to the property and casualty (P&C) claims and collision repair sectors, is releasing an XR hands-free solution integrated into the collision repair workflow.

Introduced last year as a proof of concept, Mitchell Intelligent Vision is expected to ship before the end of the year.

The Mitchell Intelligent Vision solution is designed to improve the speed, efficiency and accuracy of the collision repair workflow—from vehicle check in to check out. Mitchell collaborated with Qualcomm Technologies and RealWear on its delivery, leveraging the Snapdragon mobile XR platform and the RealWear HMT-1 voice-controlled headset.

"XR is transforming industries across the globe," said Brian Vogelsang, senior director of product management at Qualcomm Technologies. "With our Snapdragon technology paired with Mitchell's expertise in automotive repair, we are excited to help transform the way collision repairers work—by helping them improve productivity, meet customer expectations and address the challenges of today's complex automobiles with the new Mitchell Intelligent Vision solution."

Sanjay Jhawar, co-founder and president, RealWear, said: "RealWear's purpose-built, fully ruggedised headset was designed for environments like collision repair facilities where technicians need to streamline operations and enable hands-free access to much-needed repair procedures."

The Mitchell Intelligent Vision solution allows technicians to automate the collection of data—including consumer and vehicle information—for faster vehicle check in.

They can also use the solution to take time-stamped photos of the damage and automatically upload them to Mitchell's cloud-based ecosystem.

Voice activation and an XR field of vision provide quick access to critical procedures during teardown and repair, reducing research time.

Prior to check out, technicians can visually document the repair work with the Mitchell Intelligent Vision solution. Those images are then retained in Mitchell's software.

The Mitchell Intelligent Vision solution will be available first to US repair facilities. The company also expects to announce availability in Canada soon, having successfully completed pilot testing.

Olivier Baudoux, senior vice president of global product strategy and artificial intelligence at Mitchell, said: "Mitchell is committed to delivering innovative, cloud-based solutions that streamline workflows and support proper, safe vehicle repair. With Mitchell Intelligent Vision, we're again breaking new ground and taking a small but very significant step forward in bringing wearable technologies to the collision industry."

"Through our open ecosystem and work with industry leaders like Qualcomm Technologies and RealWear, we'll continue to advance the use of XR and XR-powered solutions to meet the needs of our customers and the market." ■

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Military-precision potential

A public-private partnership is crucial, with the military customer and defence provider working hand-in-hand to take the raw potential of immersive technology and make it useful and valuable

By Mark Dugdale

The US Department of Defense is in the middle of a massive modernisation programme designed, in the words of the strategy published last year, to preserve and expand the country's military competitive advantage in the face of near-peer competition and asymmetric threats.

The strategy identifies as key to this aim the ability to "deliver technology faster than our adversaries and the agility of our enterprise to adapt our way of fighting to the potential advantages of innovative technology".

In this edition of VRWorldTech Magazine, you'll find several examples of this modus operandi in action. Take California-headquartered immersive technology company Red 6, developer of the Airborne >>

Tactical Augmented Reality System (ATARS). This system enables pilots to engage in simulated dog fights with synthetic enemies, during real flights.

ATARS is both a product of AFWERX, a programme designed to foster a culture of innovation within the military by working with startups and circumventing the traditional barriers to entry, and an important component of the US Air Force's Live, Virtual and Constructive (LVC) programme.

AFWERX, along with the Small Business Innovation Research programme, smoothed the way for a private company in Red 6 to collaborate with the public sector giant that is the US military, while Red 6's expertise and technology enhanced an existing internal programme, LVC, which, with ATARS on board, promises to take flight training up to a new, immersive level.

The US Army's Integrated Visual Augmentation System (IVAS) is a similar story, although in this case, the military is refining existing, privately developed technology to suit its own needs, rather than nurturing development outside of its own house.

IVAS is based on the HoloLens mixed reality headset and the subject of a $479 million contract in November 2018. While using Microsoft's technology, it is very much its own device.

The Department of Defence has, here too, torn down traditional barriers to acquisition and development. A technology that would have once taken 10 to 15 years to develop is being readied for deployment in 2021. Along the way, the private sector, operators and even soldiers have had a hand in producing a system that will improve safety and enhance lethality.

The US military is also looking to the future of immersive technology with the development of augmented reality goggles for military working dogs. On the face of it, this sounds like too cool to be true, but Command Sight's technology offers the very real potential for handlers to communicate more efficiently and effectively with their dogs.

In the private sector specifically, we also check in with Lockheed Martin to hear about the aerospace and defence company's Collaborative Human Immersive Lab (CHIL).

CHIL is a canny and valuable creation for Lockheed Martin, where designers and engineers can rework and refine prototypes for some truly exciting projects, including NASA's Orion spacecraft and hypersonic weapons.

What's most impressive about this lab is its deft combination of cutting edge technology, such as a Cave Automatic Virtual Environment and motion capture studio, and commercial-off-the-shelf virtual reality devices.

Today, the lab is a multi-site, multi-user networked environment where Lockheed Martin's designers and engineers can collaboratively review 3D models and simulations in virtual reality to test a variety of studies, including ergonomic studies for product design and assembly, maintenance operations, and facility design.

This is very much a US-focused look at military and defence applications of immersive technology, but it serves as a good case study of what customers and providers such as these around the world can do with virtual, augmented and mixed reality.

The takeaways are a need to operate on reduced budgets while cutting bureaucratic red-tape that is often the anthema to technology adoption and innovation.

A public-private partnership is also crucial, with the military customer and defence provider working hand-in-hand to take the raw potential of immersive technology and make it useful and valuable.

Using immersive technology to enhance soldier lethality

Soldier-centred design and an organisational appetite for rapid development sees the US Army readying the Integrated Visual Augmentation System for deployment in the field in the latter part of 2021

The US Army's Integrated Visual Augmentation System (IVAS) is almost ready for deployment in the field after an extraordinarily rapid development period saw the device, consisting of a head-mounted display (HUD) that connects to a small computer and radio, built with the needs of soldiers at its heart. >>

Credit: US Army

Credit: US Army

IVAS is based on the HoloLens mixed reality headset and the subject of a $479 million contract in November 2018. IVAS, while using Microsoft's technology, is very much its own device.

Bridgett Siter, communications director for the US Army's Soldier Lethality Cross Functional Team, which is leading development of IVAS, says a soldier-centered design methodology was used to build the device, with user feedback influencing its design and development from day one.

Soldiers and marines have invested more than 40,000 hours into this programme in a variety of touchpoints, including user studies, field testing, feedback and assessments, according to Siter. This includes the third in a series of four comprehensive large-scale tests scheduled at pivotal junctures in the 28-month programme. During the latest event at Fort Pickett in Virginia, participants from the 82nd Airborne Division and a contingent of marines conducted company-size training exercises using the first militarised prototype of IVAS. Events included land navigation, live fire, mission planning, rapid target acquisition, trench clearing, after action review using augmented reality, and more.

Siter says the feedback received from tests such as this has been used to make important >>

Bridgett Siter
Communications director for the US Army's Soldier Lethality Cross Functional Team

> "Soldiers shaped the very design of IVAS early on, including things like the location and positioning of controls

changes to IVAS. For example, the field of view in both width and height were increased based on user feedback. She continues: "We were designing with greater distance in mind when they told us early on that the distance was more than sufficient and we needed to focus on the field of view. That's one of many examples. Soldiers shaped the very design of it early on, including things like the location and positioning of controls."

'We've been mindful of the potential for cognitive overload'

IVAS boasts night vision and can show a soldier battlefield information about the location of enemy combatants and their own unit.

The device also highlights targets, uses facial recognition software to identify others, translates various languages into English, and allows soldiers to share digital information, including map coordinates and imagery of what's happening on the battlefield.

It's the information and data sharing capability that makes IVAS "revolutionary", according to Siter.

She says: "Imagine a platoon leader being able to see the location of his soldiers in his goggles or share with them what he sees from his location, the position of the >>

adversary, a map or the layout of a room."

Through the soldier-focused design and development process, the US Army has been mindful of overburdening users with too heavy a cognitive load. Given the environments and circumstances under which IVAS will be deployed, it was important that the device was balanced and a help rather than a hindrance.

Siter says: "We are working with, primarily, a generation completely comfortable taking in various kinds of information and images simultaneously. As we've developed these technologies and incorporated them into the system, we've been mindful of the potential for cognitive overload, and we've worked with the soldiers—asking them that question every step of the way—to ensure we're locating information and presenting it in ways they find to be helpful and not intrusive. Keep in mind that the user will be able, to a great degree, tailor what information or imagery they want to see in his HUD at any given time."

Soldiers and marines who have tested IVAS so far are impressed with its capabilities.

Lieutenant Nicholas Christopher was one of the soldiers from the 501st Parachute Infantry Regiment who put IVAS to the test in the hinterlands of Fort Pickett's operationally relevant environments.

He says: "There are a lot of features on it that are futuristic, I guess you could say, including things like advanced battle tracking."

"I can see where my entire platoon is projected on a map, and for me as a platoon leader, that's amazing, because there's a lot of guesswork that goes out the window. There's a lot of verbal communication over radios that I don't have to do anymore. It's very solid I can see how this is going to make a great impact on the way we fight."

It isn't just the battlefield where IVAS will prove useful. The US Army sees IVAS being used pre- and post-mission, so to "fight, rehearse, and train, because it leverages networked information sharing and mixed and augmented reality technologies".

Siter says: "Soldiers will fight and train as they fight. They will be enabled to collectively train battle drills in a mixed reality environment against intelligent holographic opposing forces. They will conduct virtual after action reviews using recorded movements and rehearse operations using data and >>

Credit: US Army

images that are collected, mapped and preserved using the IVAS."

'A model for future technologies'

The US Army is now readying IVAS for deployment in the field in the latter part of 2021, marking the end of a rapid development process that may not have been possible in the past.

In October, defence acquisition and sustainment undersecretary Ellen Lord hailed IVAS as an example of the success of an interim policy she implemented to circumvent problems inherent to traditional military acquisitions methodologies aimed at layered governance and risk aversion.

Siter explains: "There is an urgency to resolve an erosion in combat superiority between US and near peer competitors around the world as identified in the 2018 National Defense Strategy, an erosion that resulted largely from two decades of focused efforts in the Middle East."

"Had we followed traditional and historic acquisition norms, it would take at least 10 years to develop and field this kind of capability. The need is too great. We need to ensure our soldiers are more survivable and more lethal and better able to manoeuvre on the battlefield with greater situational awareness. IVAS does that."

"The modification to the development and procurement of this technology serves as a model for future technologies that are deemed priorities by senior leadership. The Department of Defense has moved to an Adaptive Acquisition Framework to streamline programmes while reducing the time and many times the cost of lock step programmes that deliver many technologies to soldiers that are less effective due to the time normally required for a traditional programme."

"Beyond the immediate need, it's also important to demonstrate the viability of doing things in parallel with our partners that we used to do sequentially and to prove the concept of our soldier-centered design methodologies. We're seeing that it's not only feasible, it's effective, efficient and logical."

General James McConville, the US Army's chief of staff, participated in an IVAS demonstration and was equally positive about the acquisition process behind the device.

He says: "Historically, our acquisition cycle has taken a long time, ten to fifteen years. [IVAS] was just an idea two or three years ago, and we were able to bring it to fruition quickly to what we saw today working together with industry, with our operators, and also our soldiers with touch points along the way using the authorities that Congress has given us to rapidly, bring this capability to our soldiers in the field. It's safe to say that the future is here—now—and this is no longer in the realm of science fiction." ■

Credit: US Army

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VirtualReality WORLD TECH

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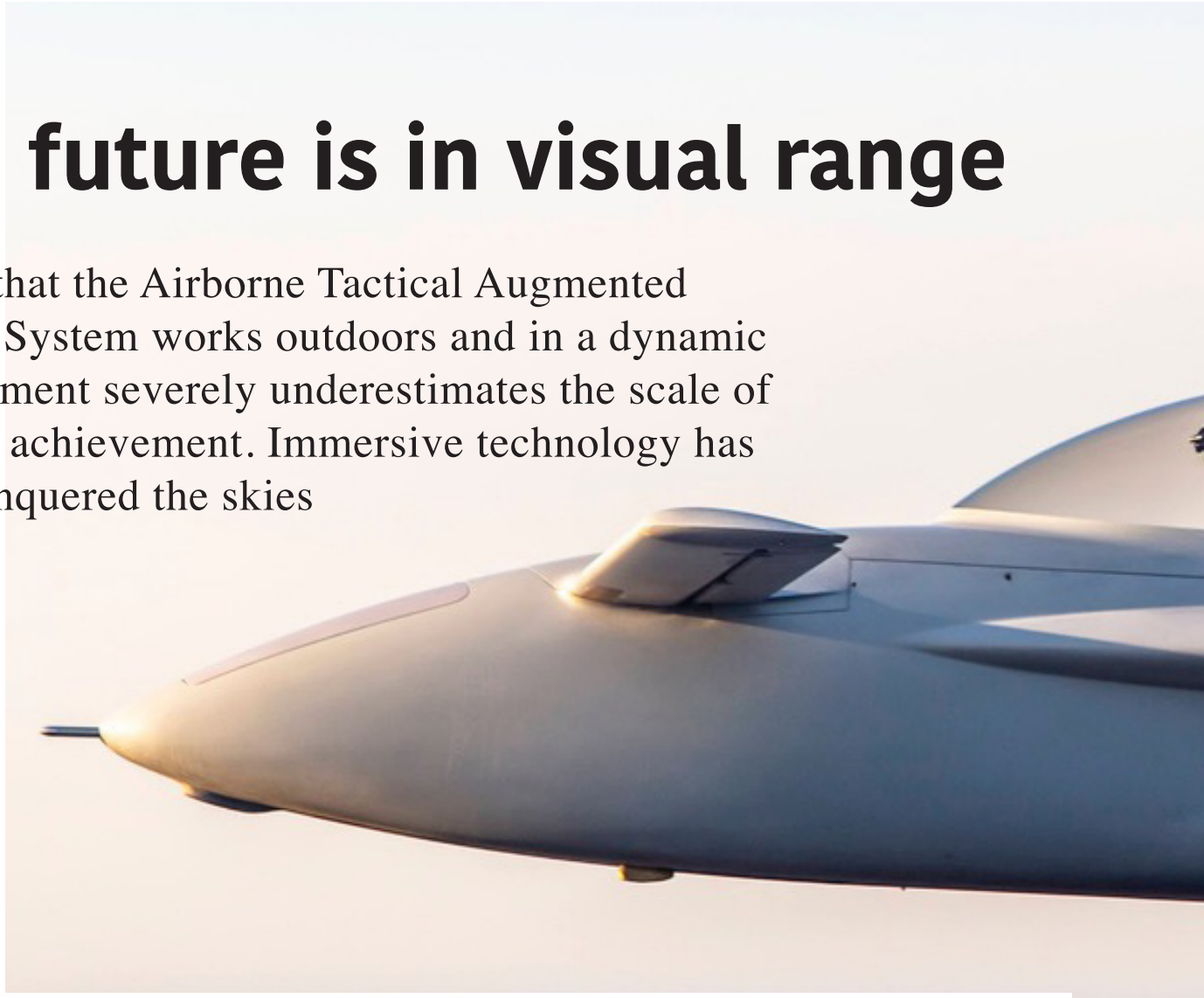
The future is in visual range

To say that the Airborne Tactical Augmented Reality System works outdoors and in a dynamic environment severely underestimates the scale of Red 6's achievement. Immersive technology has now conquered the skies



ATARS, the Airborne Tactical Augmented Reality System from California-headquartered immersive technology company Red 6, sounds like something out of science fiction.

The system enables pilots to engage in simulated dog fights with synthetic enemies, during real flights. Visor-based, remote augmented reality on this scale and of this dynamacy is unheard of, but it's an actual reality.

To understand ATARS, it's useful to weigh it against virtual reality. Daniel Robinson, founder and chief executive officer of Red 6, explains that virtual reality "has a very valid place" in training pilots on the ground for repetition-based tasks or learning. Military air forces around the world have been doing so for a long time.

But virtual reality cannot recreate the stresses and strains of real flight. Robinson explains: "Virtual reality can in no way, shape or form simulate the cognitive load, ie, >>

Credit: Mike Killian

the stresses and strains, mentally and physically, on a fighter pilot in a modern airplane. Virtual reality cannot recreate g-force, running out of fuel, getting shot at, crashing into the ground, and all of the normal stresses and strains of being in the air and as a pilot."

Pilots must be able experience these realities while training against near-peer threats, he says. ATARS takes the best of both worlds—the virtual and the real—and delivers this.

'We never had enough threats or aircraft to train against'

It's the near-peer threat point that also makes ATARS and >>

Credit: Red 6

augmented reality necessary for training military pilots.

Robinson, a pilot for the Royal Air Force (RAF) who attended the UK's equivalent to the US Navy's Top Gun training school and was the first non-American fighter pilot to fly the F-22 Raptor, saw a number of events trigger what he describes as a "massive training crisis".

The F-22 programme was meant to allow the US to dominate the skies for years to come, but budgeting constraints saw the programme cut back, as countries such as China and Russia were rapidly innovating and developing aircraft that could challenge its dominance.

And training a military pilot is a significant financial undertaking, requiring resources and crucially, equally capable aircraft to take on the role of adversary. Without a large volume of F-22 aircraft, pilots were pitted against F-18s, F-15s and F-16s, when China's answer to the F-22, the Chengdu J-20, was the real threat.

Robinson says: "It got to the point where we never had enough threats or aircraft to train against. And it was impossible to simulate those near-peer threats, so there was a massive training crisis."

It's also worth noting here that around 80% of Robinson's time as front-line pilot instructor, a job he carried out after achieving his F-22 instructor qualification, was spent playing the role of the enemy during training, which has "negative training value", he says.

These issues were the genesis of Red 6, Robinson says.

"I wanted to do something about solving that problem—to solve the training crisis and produce >>

> We could change the rules of the game—not just for military pilot training, but for augmented reality technology itself

Daniel Robinson
Founder and chief executive officer of Red 6

pilots quickly, more effectively and who are more experienced."

Before Red 6 could attempt to solve this larger training problem, Robinson and the company's co-founders, Nick Bicanic and Glenn Snyder, who he met while building his own airplane in 2017, had to deliver something that hadn't yet been done. They had to make augmented reality work outdoors and in a dynamic environment, such as the one pilots train in.

The right team was in place to achieve this feat. In 2015, Snyder enabled two race car drivers on separate tracks, both in real cars, to race each other in virtual reality, the first time this had been achieved. Snyder told Robinson this couldn't happen in augmented reality, let alone in an aircraft.

Robinson was undeterred. He says: "Once we came up with a thesis for how this could work, I realized that if we could pull this off, we could change the rules of the game—not just for military pilot training, but for augmented reality technology itself."

A successful pitch to the US Air Force saw Red 6 join AFWERX, a programme designed to foster a culture of innovation within the service by working with startups and circumventing the traditional barriers to entry.

At the time, the US Air Force was working on Live, Virtual and Constructive (LVC), which Robinson says is designed to be the future of military pilot training.

The programme places pilots in real planes and others in simulators on the ground, who are tracked by radar during training exercises. This enables pilots in the air to train against their >>

Credit: Red 6

on-the-ground colleagues, at least in beyond visual range scenarios.

Robinson says the US Air Force lacked a system for visual range training exercises. LVC was perfect for simulating a scenario in which two pilots, one on the air and another on the ground, tracked each other via radar and fired missiles.

“But those ranges can collapse in a dog fight,” Robinson explains. “Pilots are reduced to looking out of the windows of their aircraft. LVC doesn’t work in close combat because it can’t put synthetic entities into the field of view of pilots.”

Red 6 and ATARS promised to complement LVC by providing that visual range capability.

Robinson and his team have worked with the US Air Force since 2018 to develop ATARS and ready the system for large-scale use.

‘They were blown away’

The major milestone for Red 6 came in November 2019, when Robinson took ATARS to the skies above Southern California and completed the world’s first augmented reality air-to-air refueling sortie.

In Robinson’s own words: “We went up in our aircraft, wearing our ATARS gear. I flew the aircraft and shared the experience with a colleague who was in the backseat. We obtained visual contact of a synthetic target on radar and flew to intercept. We got within visual range and, lo and behold, there was a 737 airliner with an >>

air-to-air refueling boom flying around in the skies above Southern California in augmented reality."

"This was outdoors, in daylight. I was flying a real airplane. We intercepted and flew alongside the 737 airline. The tracking solution was so accurate that I was able to drive the boom of the tanker into the cockpit of my airplane."

Robinson and his team also simulated a dogfight with a Russian Sukhoi Su-57. The US Air Force was "blown away", Robinson says.

The enthusiasm of the US Air Force has been reflected in its financial commitments to Red 6. So far, the company has raised $1.6 million from Small Business Innovation Research (SBIR) phase 1 and 2 grants. With venture capital funding, other investments and a Mega Grant from Epic Games, a key collaborator in the ATARS development process, Red 6 has raised almost $6 million in total.

It's discussing a phase 3 contract, which is expected to be confirmed soon and will see Red 6 integrate ATARS into the US Air Force's T-38 Talon jet training programme.

Red 6 is also courting aerospace sector interest. Over the summer, the company received an undisclosed investment from Lockheed Martin Ventures, the strategic investment arm of Lockheed Martin, to speed up the development and commercialisation of ATARS. Robinson says: "We were actually worried that Lockheed Martin would see ATARS as a cute garage project. But their feedback was phenomenal—it was so far ahead of anything they've seen."

Going forward, Red 6 is working on developing ATARS, improving the technology and layering in new scenarios.

Robinson concludes: "With our system, all of those problems I mentioned are solved. Pilots can experience cognitive load, the real stresses and strains of flight. And this hybrid solution brings virtual simulations into the real world, so pilots can train against any near-peer threat we want." ■

Reduced cost, increased quality

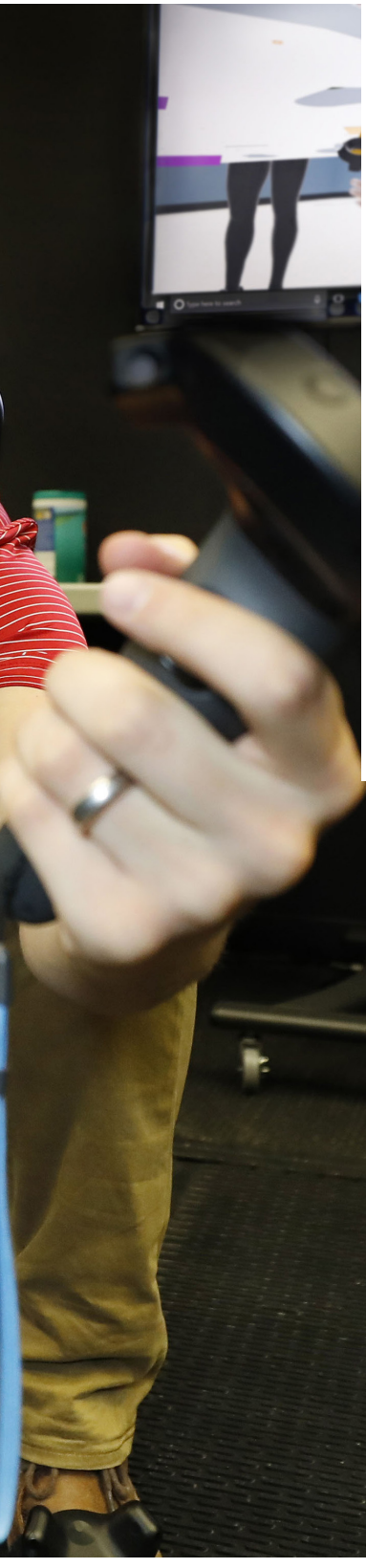
Lockheed Martin is home to the Collaborative Human Immersive Lab, where the company's engineers and designers build the spaceships and weapons of the future

Lockheed Martin's Collaborative Human Immersive Lab (CHIL) is a significant resource for the Fortune 500 aerospace and defence company, because it's able to drastically reduce the costs traditionally associated with the prototyping process behind technological achievements including NASA's Orion spacecraft and hypersonic weapons.

Set up in 2010 to bring virtual reality technology into the company's design process, CHIL consists of a Cave Automatic Virtual Environment and motion capture studio, where designers and engineers can validate their work before they take it to the production floor.

Darin Bolthouse, CHIL manager at Lockheed Martin Space, explains: "Though the industry has been changing over the past few years, the traditional prototyping process involved design work happening first and then that design being handed off to the manufacturing/assembly team to develop the product."

Credit: Lockheed Martin



> “CHIL allows users to identify and eliminate interferences and issues long before actual production on the shop floor

Darin Bolthouse
CHIL manager at Lockheed Martin’s space division

“The challenge with that approach is that sometimes there was a disconnect between design and the physical creation that could result in rework, adding time to the schedule. By using immersive technology like virtual reality in CHIL, we are able to reduce the cost 10:1.”

Bolthouse says the issue was one of scale: “The data on the computer screen is in 3D but people are still interpreting what that data looks like in full scale, and those interpretations can be incorrect which can lead to design errors.”

“In virtual reality, you can do things like practice how to assemble and install components and validate tooling and work platform designs. CHIL enables our team to do all of this in a full-scale environment as if they were looking at the real thing, allowing users to identify and eliminate mechanical interferences and ergonomic issues long before actual production on the shop floor.”

There is “no doubt” that fixing these issues in virtual reality early on in the prototyping process saves both time and money, Bolthouse says.

CHIL’s collaboration capabilities prove ‘very useful’

Despite being equipped with a CAVE and motion capture >>

Credit: Lockheed Martin

studio, it's the US-based lab's use of commercial-off-the-shelf virtual reality devices, such as HTC Vive headsets, that makes it such an impressive resource.

CHIL now serves as a multi-site, multi-user networked environment where its designers and engineers can collaboratively review 3D models and simulations in virtual reality to test ergonomic studies for product design and assembly, maintenance operations, and facility design.

"We have seen a number of benefits from the use of the interconnected digital environment and the use of commercial-off-the-shelf virtual reality devices," Bolthouse says. "For example, we have seen significant reduction in schedules on programmes."

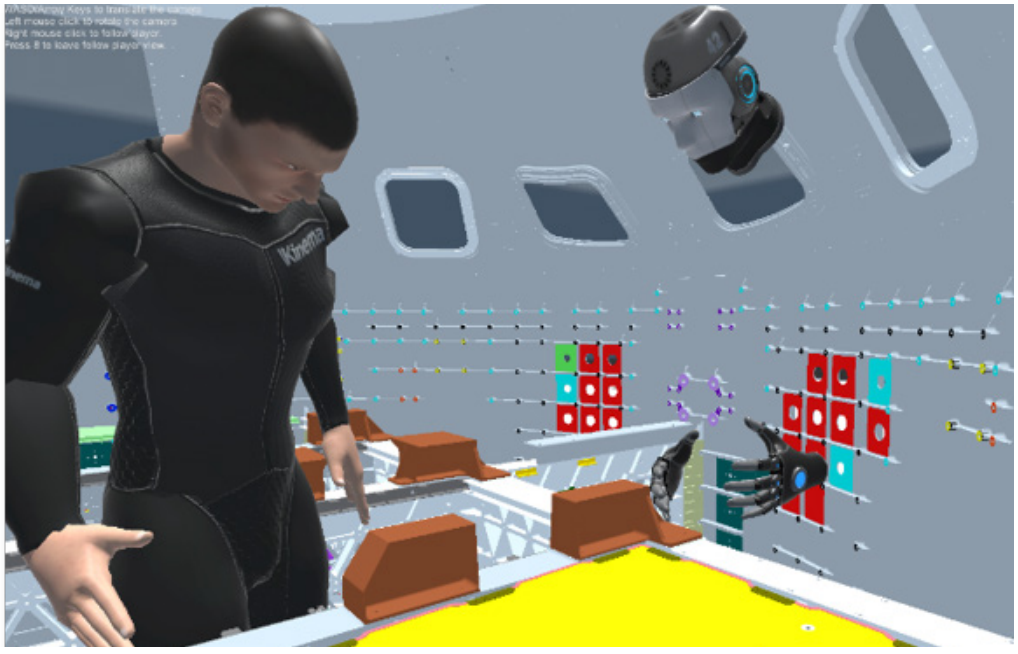
Bolthouse continues: "On the Hypersonics programmes, we are optimising the assembly process and tooling designs for production of the missiles. CHIL is also being used to solicit feedback on the equipment the soldiers will operate in the field, providing feedback that is significantly impacting the up-front engineering design."

The US Army's new prototype long-range hypersonic weapon consists of a 40-foot transporter erector launcher with missiles and a battery operations centre (BOC). The truck and trailer combination, along with the BOC, are all taken from existing US Army stock, and are in the process of being modified to create new equipment.

Through Colorado-based CHIL and the virtual reality equipment at its disposal, participating soldiers at Fort Sill in Oklahoma were able to view the equipment from any angle, at any distance, and manipulate it as needed in order to better understand its operation and recommend improvements.

Lockheed Martin is the prime contractor building Orion, NASA's deep spacecraft. Bolthouse says CHIL is being used for engineering design and production: "In addition, Orion has a reuse strategy where sub-systems and components from returning spacecraft will be removed and reused in new spacecraft being built. Virtual reality is being used to determine the best methods for dis-assembling and reusing this equipment."

"Also, through the use of CHIL, we have seen significant >>



Credit: Lockheed Martin

savings in travel costs alone to conduct remote ergonomic studies, and that is before our current environment."

Bolthouse adds: "CHIL has been very useful to collaborate across multiple sites and geographically dispersed teams. Virtual reality, along with other collaboration tools, have proven to be very valuable to do design reviews with our customers. The ability for people to try virtual reality in the context of engineering design, and observe its benefits, definitely drives increased adoption."

'Our customers see the benefits of these tools'

Lockheed Martin's customers, both military and otherwise, are "actively adopting new smart tools and immersive technologies like virtual reality" as their benefits become increasingly apparent, says Bolthouse.

"Wide scale adoption across multiple programmes is still at the early stage, but our customers see the benefits of these tools and have actively been using tools like simulators in the past."

"The commercial availability of immersive virtual and augmented reality hardware is making not only our military customers, but the population as a whole, more familiar and comfortable with these technologies."

Bolthouse is enthusiastic about future advancements in immersive technology and how they may further improve CHIL's capabilities. He says: "Augmented reality, delivered via 5G infrastructure, is definitely the wave of the future."

"Once the holographic renderings can be delivered from the cloud via 5G, augmented reality devices will shrink to the size of sunglasses and a large number of people will be able to visualise and interact with holographic information simultaneously.

"Add some haptic feedback gloves and you would be able to touch and feel objects like they were the real thing. And if someone cannot be there in person, no problem, you can just stream in their full body hologram—just like in Star Wars!"

AR-enhanced canine units becoming a reality

Command Sight's augmented reality technology holds the potential to bridge the communication gap between animal and human in a way that will transform military and law enforcement groups that work with dogs

Augmented reality is a versatile technology that's been deployed in all kinds of ways, from navigation and advertising to video games. US-based Command Sight, the immersive technology startup of dog lover Dr AJ Peper, is working with the US Army Research Office (ARO) to use augmented reality to bridge human and animal communication.

Command Sight's device, still a prototype, uses augmented reality to serve visual indicators to the animal, delivering handler directions at range and in a variety of environments. The dog's role as 'user' >>

Credit: Command Sight

> “This potentially cuts down mission time and increases the confidence of the dog
>
> **Dr AJ Peper**
> **Founder of Command Sight**
> **With Mater**

is passive, meaning it doesn’t interact with the technology in the way a human user would.

The application of augmented reality in this way is groundbreaking, because it provides dog handlers in the military and law enforcement with an alternative to hand signals, laser pointers and walkie-talkies.

Peper, whose background is in social sciences, began investigating human and animal communication after taking up dog training sport Schutzhund and wanting to identify a better means of communicating with his own dog.

In 2017, Peper began looking at augmented reality as a solution and spoke to a number of military and law enforcement handlers. They told him that any practical application needed to be remote, so as to increase the standoff distance between handler and animal, and to be able to direct the dog with more confidence and specificity while remaining safe.

Peper says: "An augmented reality solution that worked remotely and provided specificity would solve some real fundamental mission capabilities and safety issues."

He went on to build an initial tethered prototype, with the "goal to confirm that a dog could discern and react to a digital indicator".

With this initial demonstration successfully recorded, Peper was able to show his results to several special operations groups within the US military, with potential uses including surveillance operations and scouting for possible explosive devices and hazardous materials. "A lot of the handlers were interested once they saw this technology in action," he says.

The goggles provide a means of bidirectional communication between handler and dog. A sensor platform, which includes cameras, relays data and information to the handler, who can then direct the animal with augmented reality indicators delivered via the goggles. Crucially, this provides specificity in the commands.

Peper explains: "Dogs lack our shared culture and values. When I tell a person to look left, for example, they have an innate understanding as to what I may be directing them to."

"Dogs, however, are unable to discern the specificity inherent in a command such as 'look left'. On a mission, the goggles will overcome this."

He says there are a number of "remarkable" handlers who can direct and command dogs at distance, but it's an inefficient process requiring resets and micro commands.

Peper continues: "With these augmented reality indicators, you can specify a single door in a street of 20. That potentially cuts down mission time and increases the confidence of the dog, because it now knows where it needs to go."

Command Sight has received two Small Business Innovation Research (SBIR) grants, as well as funding from the Department of Defense Rapid Reaction Technology Office, to begin developing a wireless version of the augmented reality goggles and discover the technology's true potential.

Dr Stephen Lee, a senior scientist at the ARO, which is working with Command Sight and the Navy Special Forces to build prototypes that will be tested on military dogs, says handlers are "very excited about the potential of this technology".

Lee continues: "This technology really cuts new ground and opens up possibilities that we haven't considered yet."

Peper says a wireless system is close and expects to be ready to demonstrate a prototype soon, with a view to completing this stage of the process in 18 to 24 months.

The goggles themselves are also being militarised. They are based on existing goggles from Rex Specs, which military dogs wear for protection in inclement conditions and aerial deployments.

3D scans are also being used to understand where to place optics and electrical components, specific to each dog.

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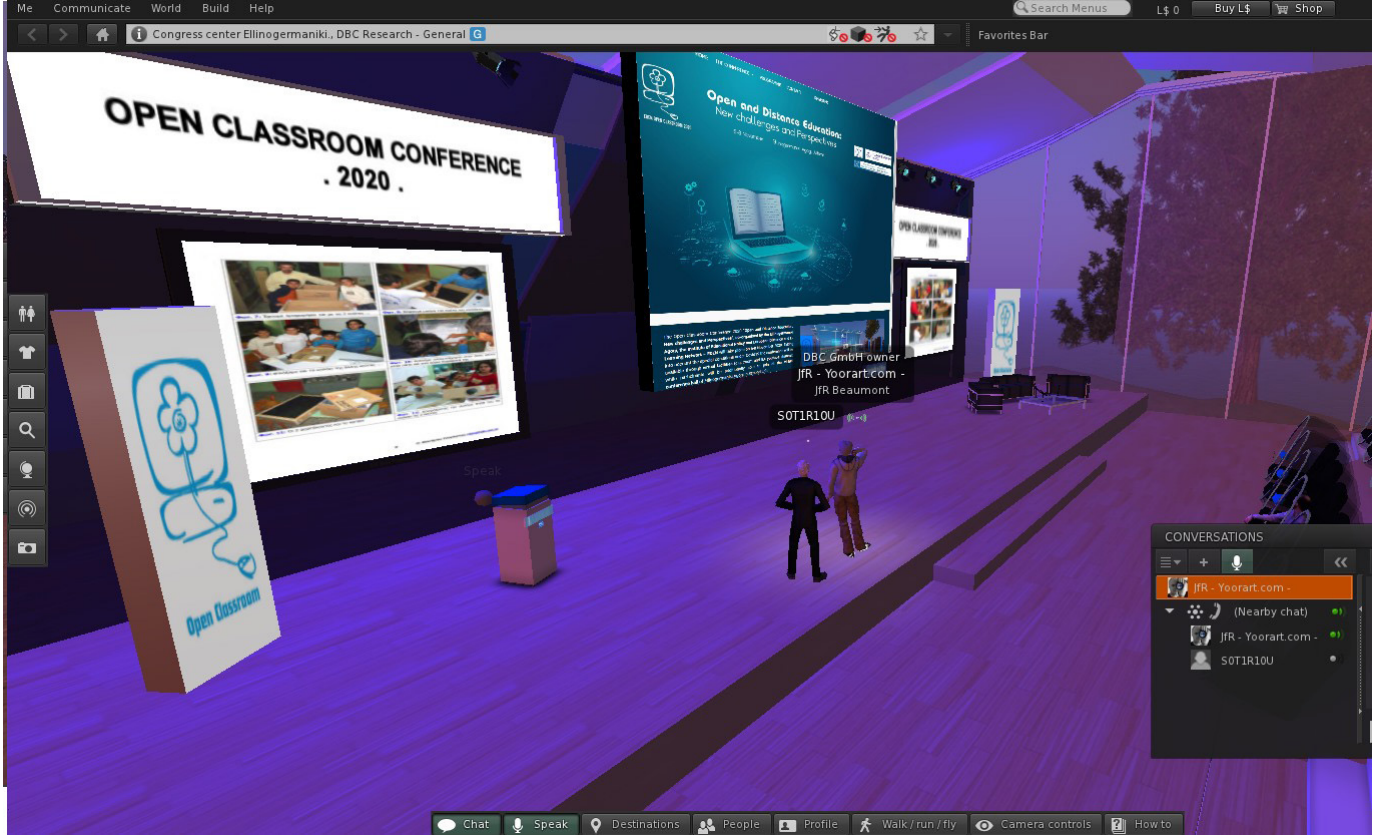

Credit: EA

Meet: Ellinogermaniki Agogi

Meet Ellinogermaniki Agogi, a school in Greece with its own research and development department doing cutting edge research in education with virtual and augmented reality technologies

What is your background?

Gregory Milopoulos: I work as a senior educational virtual and augmented reality researcher in the research and development (R&D) department of a private K-12 School in Athens, Greece, called Ellinogermaniki Agogi (EA). I am involved in large and complex projects, primarily in the field of educational >>

technologies and digital storytelling. I hold a bachelor's degree in business administration from the University of Aegean and a postgraduate degree in project management of techno-economic systems from the National Technical University of Athens (School of Mechanical Engineering).

> **We turn our ideas into projects with our partners that are able to really do the job following the standards that we set**

What's the story behind EA? Is it unusual for a school serving kindergarten- to high school-age children to have a dedicated R&D department?

Gregory Milopoulos: I have worked in European research since 2001 and I have never seen another K-12 school with a department of 15+ people dealing with educational research. If there is any, I would like to meet them! Usually, schools have one or two people to collaborate on projects that others are preparing. We turn our ideas into projects with our partners that are able to really do the job, following the standards that we set.

Gregory Milopoulos Educational VR and AR researcher at Ellinogermaniki Agogi

Since 1998, EA has had a R&D department dedicated to the design, development and implementation of the research activities in education, as well as collaboration with universities and pedagogical institutions across Europe. The department acts as an interface between pedagogical research, technological innovation and the school community.

The work of the department, which currently employs 16 full-time researchers focuses on the following areas:

- Development of methodologies and empirical research to investigate processes of learning and knowledge acquisition in various subject matter areas (such as physics, mathematics, biology and history);
- Collaboration with computer science departments and artificial intelligence (AI) labs for the development of computational models and AI learning systems;
- Collaboration with universities and private companies for the development and testing of educational software; and
- Design of technology supported learning environments.

Developer / Ellinogermaniki Agogi

Credit: EA

The R&D department has coordinated and supported the participation of EA in more than 200 European programmes and national projects. In most of them, our role has been to design the implementation of the proposed activities in real school environments

EA's R&D has a very strong vision-generated interest and rich research and development activity in the fields of inquiry-based science education (IBSE), project-based learning (PBL), and science, technology, engineering, and mathematics (STEM) education in combination with digital, online-based learning environments and tools that use virtual reality, augmented reality and story-based education.

EA is continuously modernising STEM education by promoting and creating user-driven learning environments for students and offering numerous opportunities for teachers' professional development, so that they can be prepared and thrive in the landscape of unprecedented challenges and opportunities in the 21st century.

Using this approach, EA has taken up the challenge to embed innovative pedagogical practice that effectively uses a range of technologies in STEM classrooms, as well as driving up student academic outcomes across the school.

Moreover, a large range of previous projects were focused on developing and implementing technological tools, including virtual and augmented reality authoring tools, which leverage both digital science repositories and IBSE/PBL learning. As part of this, EA has developed numerous scenarios for STEM education in which participators live their learning experience in every place.

Credit: EA

What do you hope to achieve with your work within the education sector?

Gregory Milopoulos: Virtual and augmented reality are technologies that have garnered the spotlight, especially in recent years. But while many are now familiar with the terms, this has not translated into widespread use, despite some impressive and remarkable developments.

In the field of school education, the adoption of new technologies is historically very slow. Sometimes, however, technologies are introduced whose benefits are clear and immediately recognisable. Virtual and augmented reality are technologies with these characteristics. With the necessary assistance of teachers at every stage of implementation, they are able to literally transform the way we teach and learn, at all levels, from kindergarten to vocational education.

The traditional classroom, with the teacher standing and the students sitting opposite them, will gradually transform into something more impressive for both the teacher and the student. The teacher will have in their hands a unique toolbox with which they will be able to stimulate the students' interest, to involve all their senses and to lead them to a more holistic learning experience.

Students will have the opportunity to interact with the protagonists and heroes of history, to visit every part of the Earth and other planets, to perform physics and chemistry experiments in virtual laboratories without risk and cost, and to create and share their own content, while learning to work collaboratively.

This is exactly what I hope to achieve with my work in EA, in the most unique R&D department of the world, within the educational sector!

Education projects in the EU

Q-Tales was Gregory's first virtual-reality related project in the EU. The selection of other projects listed are being undertaken at EA

Q-Tales

This project has received funding from the EU's Horizon 2020 research and innovation programme under grant agreement No 645588

Gregory Milopoulos: This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 645588. When I had my own consulting company, called Megaprojects, I was involved with the conceptualisation, proposal preparation and exploitation management of the Q-Tales Project, a funded H2020 ICT Innovation Action project that created a collaboration ecosystem enabling EU creative small- and medium-sized enterprises to exchange digital resources and create multi-plot, 2D and 3D interactive e-books for children, curated according to reader ability and educational value.

KROS (Knights for Road Safety)

This project has received funding from the EU's Erasmus+ Programme under contract No 2018-1-EL01-KA201-047946

Gregory Milopoulos: The KROS project proposes the use of innovative resources provided from different stakeholders (open content) through a project-based multidisciplinary approach (open pedagogy), that requires extended collaboration and networking between schools and different stakeholders (open collaboration) who can bring significant expertise in the design and implementation of the proposed activities.

KROS is introducing cutting edge technologies in order to accompany the retention of information regarding the subject of road safety. In particular, the project used virtual reality technologies so as to introduce attractiveness in the learning process and to improve the quality of the delivery channels of the content. Primary school students learn the rules of walking around and biking in the streets of a big city.

Developer / Ellinogermaniki Agogi

Stories of Tomorrow

This project has received funding from the EU's Horizon 2020 research and innovation programme under grant agreement No 645588

Gregory Milopoulos: By integrating the latest advances in augmented and virtual reality and 3D printing technologies, the STORIES (Stories of Tomorrow – Students Visions on the Future of Space Exploration) project is giving children the chance to develop their own 'multipath' books to express their imagination and creativity. The authoring tool we developed allows students to interconnect their stories to create extended episodes encompassing a network of hotspots and hyperlinks.

The project case study involved students creating their storyboards and flip book type animations depicting life in the first Martian community. With the help of visiting scientists and engineers, they first learned about the challenges presented by such a hostile environment. In small groups, the students created their designs using commonly found materials, such as cardboard and paper cups. They then took their creations to the next level by recreating them as a virtual 3D model. Through an easy-to-use, powerful interface which has sophisticated authoring features, students were able to convert their models into digital form, and integrate texts, animation videos and music. These can then be collated to form virtual books which can be accessed by any existing device and operating system.

Through the use of virtual reality headsets and augmented reality, the e-books created by students come to life. Students can see their own rockets being launched right through the e-book page and they can also walk around the sustainable Martian colony they have built in the previous steps.

ENVISAGE

This project has received funding from the EU's Horizon 2020 research and innovation programme under grant agreement No 731900

Gregory Milopoulos: The ENVISAGE project aims to optimise learning and teaching with the use of online virtual labs, by utilising mature game analytics knowhow in order to introduce enhanced learning analytics functionalities into the processes of using and designing them.

Developer / Ellinogermaniki Agogi

5G-Tours

This project has received funding from the EU's Horizon 2020 research and innovation programme under grant agreement No 856950

Gregory Milopoulos: Coordinated by Ericsson, with a consortium of technology giants such as Samsung, TIM, Orange, OTE, Nokia, RAI and Philips and many other acknowledged innovative companies, schools, universities and institutions, 5G-tours aims to get the European 5G vision of "5G empowering vertical industries" closer to commercial deployment with highly innovative use cases involving cross-industry partnerships. One of the use cases focuses particularly on the example of 20 to 25 students from EA travelling on a school bus to Athens International Airport (which is also a 5G-tours partner) to visit an exhibit hosted in one of its public spaces. The use of 5G-enabled augmented and virtual reality technologies enriches this school excursion with additional learning opportunities both during travel time and during the on-site visit. At the airport, they use augmented reality technologies to interact with digital content (in the form of text, images, videos and interactive 3D digital objects) blended with the exhibit and the surrounding environment.

rAn

This project has received funding from the EU's Erasmus+ programme under contract 2019-1-UK01-KA201-062018

Gregory Milopoulos: The rAn project aims to assist children in primary education with coping during emergency situations, by developing a serious game for raising their awareness about natural disasters and emergency preparedness. The main objective of the game will be for the player to survive a disaster and develop a resilient community in view of periodic geological hazards. The game will be based on a dynamic storyboard supported by interactive elements such as quizzes, puzzles and other mini-games, which can be offered in 2D or 3D and virtual and augmented reality equipment.

SECOND LIFE™

EA in Second Life!

This project has received funding from the EU's Erasmus+ programme under contract 2019-1-UK01-KA201-062018

Gregory Milopoulos: EA has created a digital twin of its campus in Second Life. Visitors are able to walk through the school's premises and even participate in classes and conferences.

iMuSCIca

This project has received funding from the EU's Horizon 2020 research and innovation programme under grant agreement No 731861

Gregory Milopoulos: iMuSciCA supports mastery of core academic content on STEM subjects (physics, geometry, mathematics and technology) for secondary school students (aged 12-16) through engagement in music activities alongside the development of their creativity and deeper learning skills. To reach this goal, iMuSciCA introduces new methodologies and innovative technologies supporting active, discovery-based, collaborative, personalised, and more engaging learning.

iMuSciCA delivers a suite of software tools and services on top of market-ready new enabling technologies integrated on a web-based platform. These include: a 3D design environment for personalised virtual musical instruments; advanced music generation and processing technologies to apply and interpret related physics and mathematics principles; gesture and pen-enabled multimodal interaction functionality for music co-creation and performance; and 3D printing for realising the actual/tangible physical instrument. The platform is complemented with a suite of interdisciplinary project/problem-based educational scenarios for STEM, integrating innovative and stimulating methods in teaching and learning.

NextLab and Go-Lab

This project has received funding from the EU's Horizon 2020 research and innovation programme under grant agreement No 731685

Gregory Milopoulos: Next-Lab intends to change the educational landscape of science and technology education in Europe on a very large scale. Continuing the legacy of Go-Lab, the project offers a unique and extensive collection of interactive online (virtual and remote) laboratories that, through a process of mixing and re-use, can be easily and efficiently combined with dedicated support tools (learning apps) and multimedia material to truly form open, cloud-based, shareable educational resources with an embedded pedagogical structure.

Next-Lab offers extensive opportunities for localisation and personalisation together with analytics facilities monitoring students' progress and achievements. Next-Lab is designed to rely on full co-creation with users in combination with rapid development and testing cycles.