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Evolution Not Revolution

Insights and perspectives on the state of virtual-, augmented- and mixed-reality technology supporting maintainers' continua of learning, from diverse civil aviation training leaders. Group Editor **Marty Kauchak** reports.

The promise of the X-Realities – VR, AR, MR – has evolved for use in training and learning programs for aviation maintainers and other groups of high-skill, high-risk industries. Following on some high-profile proof-of-concept beta tests in the early life cycle of these technologies, civil aviation maintenance enterprises continue to invest in these resources at a measured and deliberate pace. As organizations in these enterprises obtain early, solid returns on investment from primarily virtual learning tools, they also appear ready to step up their spending on these products and systems – and move especially into the realms of MR and AR – to perhaps truly upend their training foundations.

Expanding Virtual Applications

Joe Tieu, Chief Product Officer at Enduvo (Peoria, Illinois, US), defines the three domains of interest thus:
- VR is entirely a digitalized visualization experience for the user and does not incorporate the real-world environment or objects;
- AR consists of digital overlays onto the real-world environment;
- MR is a subset of AR which allows for the co-existence and interaction of digital objects and information with real objects to create an interactive experience.

VR-enabled training has expanded into the different corners of our community's training enterprise, and as significant, is giving way to training in the other two domains.

In one instance, at the supplier level for aircraft materiel, Paul James, Rolls-Royce's Customer Training Manager, said his organization is "constantly looking at new, innovative technologies to complement our physical training programs." James pointed to the case of the Trent XWB, the company's largest aero engine: "It's so big that to transport it on a cargo plane it must be separated. Engineers were trained how to separate the engine when it entered service more than four years ago but required refresher training.

As this Rolls-Royce unit knew that pilots can be trained in a simulator, it wondered if the same could be done when training engineers. James continued, "We had seen virtual reality used for gaming, and decided to explore whether we could use it to teach certain engineering tasks. In this case, we found it to be a very effective tool for practicing the processes required to separate a Trent XWB."

Similar to the outcomes of other activities with these technologies, Rolls-Royce's journey with VR learning is in its very early days, but there are clear cost benefits to using this training. "Previously we would have shipped an engine out to our customer, or an engine in-service would have been used, losing valuable flying hours. It also allows us to be more flexible in when and where we offer our training," James noted.

Above
Rolls-Royce's journey with VR learning is in its very early days, but is already saving flying hours for customers.
Image credit: Rolls-Royce.

For this application, Rolls-Royce uses HTC Vive equipment, and has worked with UK-based Bloc Digital on the software.

Modest Tree (Halifax, Nova Scotia, Canada) delivered a custom 3D computer-based training system built for Jazz Aviation and its Jazz Technical Services division to simulate a detailed inspection task on the Q400 flight control system. Robert Harpelle, the Maintenance Training manager at Jazz, explained the product allows the airline's aircraft maintenance engineers to experience and implement a detailed inspection of the aileron control cables. "This system combines technical training with gaming technology, and we have found this methodology to be very appealing to our new employees," he said, adding, "The implementation of this program has seen decreases in heavy maintenance findings on this cable system, as well an increase in vigilance following task cards."

Ever-Evolving Tools

Simulation and training industry software and hardware suppliers are expanding their sales in this market space, with an important, concurrent development – their business models are changing in response to customer demands.

Stockholm, Sweden-based Virtual eTraining began as an e-learning producer in the field of virtual training environments in 2010. Patrick Sävström, the firm's managing director, recalled that in response to recommendations from their airline customers and partners, the company decided to develop a production platform, TAGGIS, that made it possible for the airlines themselves to easily create this type of education. "Through this, they made it possible for airlines to save money on creating virtual training courses themselves, and also save time by updating course content instead of by a third-party provider."

The virtual environments used when producing virtual training courses with the help of the TAGGIS software could be created using 360° photographic image material but also by using a 3D model rendered into a 360° view. Sävström added, "All TAGGIS courses are SCORM-compliant and can easily be exported from the TAGGIS platform for hosting in most LMS systems on the market."

Virtual eTraining is also using sound instructional design in its offerings, recognizing that different people learn in different ways, particularly when it comes to the generation which has grown up with technology. But more significant, the S&T provider is using VR in areas where it's appropriate – tasks that rely on set processes that can be practiced again and again. "The physical nature of the VR training also helps with learning – participants separate an engine in the virtual environment, which is incredibly realistic and mirrors the physical training," Sävström remarked.

A snapshot of Virtual eTraining's expanding customer markets around the globe includes: aircraft structure training (ACRATS); airlines (Ryanair, Norwegian, SunExpress); maintenance training (Pelesys and Pelesys Maintenance Training); as well as airport security training (Butterfly Training).

Microsoft's HoloLens 2 is now on the industry's "watch list" for future development and expanded use in this sector, and with good reasons. Airbus, for example, has gained returns on investment from a partnership with Microsoft, with the aerospace and defense OEM initially reporting: "Thanks to the Microsoft HoloLens augmented reality glasses, our electrical teams can view the different parts of a virtual harness cable superimposed on top of the actual aircraft. This hands-free guidance makes things quicker, easier and more comfortable for operators, enabling a 25% quicker installation."

Fast forward to the 2019 Paris Airshow, when Airbus announced that it will begin selling off-the-shelf applications, including training, remote collaboration, and maintenance solutions that the company has built through its own experience with the HoloLens AR headset.

Airbus' Hololens launch customer is Japan Airlines, which received its first Airbus A350 XWB this June. The airline will furnish a training program that assists maintenance technicians and cabin

crew with 3D content and workflow instructions displayed in their field of view while on the job.

HoloLens' architecture has also increased its practicality and utility as a maintenance device. While it relies on Windows 10, it is completely untethered, setting it apart from current VR headsets with users typically leashed to a desktop PC.
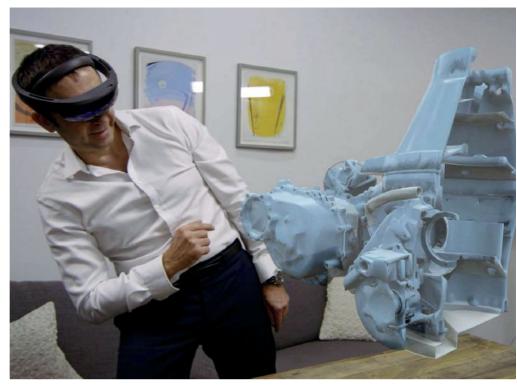
Military-Civil Cross-Pollination

Enduvo's product portfolio is expanding into the US military and adjacent public sector communities. The company recently captured attention with its efforts to help the US Air Force train and educate airman specialists, engineers and warfighters for a variety of aircraft, including fighters, strike-fighters, attack planes, and cargo transport.

Enduvo's Tieu pointed out their specialized training can encompass everything from maintenance and repair to aircraft electrical and environmental systems, munition systems, integrated avionics, and more. He emphasized, "These crucial aircraft maintenance domains for our military easily transfer to the civilian aviation sector." Indeed, a component of Enduvo's recent Small Business Innovation Research Phase I grant focused on analyzing the requirements for aircraft maintenance, a direct correlation with civil aviation maintenance training requirements.

The company executive noted that Enduvo's AR/VR technologies are gaining interest in commercial sectors because they offer a unique ability to allow people to experience learning in a real-world setting and provide the ability to practice the learning on a massive scale.

Tieu continued, "Enduvo allows for scalable distribution of standardized training through common technology platforms. Learners receive training content where and when they need it. Which is ideal for consistent training of the same aircraft across different civil aviation centers," adding, "within the civil aircraft sector, Enduvo can significantly save time and money to train aircraft engineers and mechanics. The entire training process becomes faster and more cost-effective, as companies can now train

Above
In cooperation with Japan Airlines and JAL Engineering, Airbus has developed a prototype training application for the A350 XWB, taking advantage of Microsoft HoloLens immersive mixed-reality headsets.
Image credit: Airbus.

on specific engines and models without having to have the exact engine physically available to trainees for 'hands-on' time; this allows training to be available at any place and any time. With Enduvo, instructors can teach trainees with unlimited potential situations, which may be realistically limited in real-world training due to availability of equipment and/or class duration. Support for mobile devices further boosts the portability of content developed using Enduvo."

Returns on investment? Tieu responded, "The ability to create engaging and scalable content in less than an hour." And, "Since the content exists as a digital file, existing networks can provide content distribution, and the cost of the hardware to experience this modality continues to go down." Further, organizations that rely on 3D objects, complex procedures, or multi-step processes use Enduvo's software, said to reduce costs an average of 60% and decrease content delivery time by

70% while increasing learner training competency by an average of 80% over traditional learning.

Enduvo is also collaborating with leading AR/VR hardware companies such as Dell, HP, HTC VIVE, Intel and Oculus.

Give Us More – with Caveats

Emerging technologies, such as HoloLens 2, and proven training solutions in the military and other adjacent high-risk industries, offer proven, cost-effective opportunities to further evolve this sector's training.

While the civil aviation maintenance training community remains upbeat on the potential of what additional VR/AR/MR products can bring to their training programs, these customers will carefully evaluate product offerings from simulation and training industry suppliers before buying. Indeed, Jazz's Harpelle emphasized safety is his airline's top priority and the importance of maintaining the integrity of its operation is paramount. "As the industry and its training methodologies evolve, Jazz will invest where it is safe, and when it makes financial sense to do so. Our three core values are listening, collaborating and improving; and seeking progressive solutions aligns well with our overall corporate direction." **cat**