LEADER FORUM
XR EMERGENCE

EXECUTIVE SUMMARY

BY ALLYSON KUKEL
HEAD OF AIRLINE ENGAGEMENT

www.halldale.com

Impact of Emerging VR/AR/MR/XR Immersive Technologies on Commercial Pilot Training

Definitions

Virtual Reality (VR) is an experience taking place within simulated and immersive environments that can be similar to or completely different from the real world.
Augmented Reality (AR) is an interactive experience of a real-world environment where the objects that reside in the real world are enhanced by computer-generated perceptual information, sometimes across multiple sensory modalities.
Mixed Reality (MR) is the merging of real and virtual worlds to produce new environments and visualizations where physical and digital objects co-exist and interact in real-time.
eXtended Reality (XR) is a catch-all term referring to real-and-virtual combined environments, where the "X" represents any current or future spatial computing technologies.

Introduction

The quality of virtual technology available today is exceptional and affordable. The visual resolution is at human eye level, eye-tracking is built-in, cameras for mixed reality are standard features. Gone are the days of cumbersome goggles, low resolution, and motion sickness. Military use of various virtual technologies spans almost a decade and airline maintenance programs were also early adopters of virtual technology for training. More recently cabin crew have begun to use virtual reality for safety and emergency equipment location training, making inroads in the civil aviation sector.

Multiple-user and mixed reality are two aspects that still require enhancement for robust pilot training. Commercial airline operations and subsequent training are based on a crew concept. Therefore, when training procedures in a virtual cockpit it is essential to perform tasks as a crew. The interim step between bringing pilots from two separate locations into the virtual cockpit is the availability of an avatar that performs the tasks of the Captain or First Officer. Mixed reality comes into play with the "feel" of the cockpit, providing the pilot with the distinct feel of the flaps, gear handles, and various knobs.

Virtual Technology Enables

Virtual technology addresses the aggravation and costs associated with crews travelling to centralized locations for training. This could be exceptionally helpful when training demand surges and there is not enough simulator capacity or when introducing a new aircraft type. It is now as simple as using a headset, a laptop and good internet connection, and crews attest to it providing far superior training than an iPad.

Cardboard cockpit mock-ups to train procedures are antiquated and, yet, are still found in most training centers worldwide. Over the last two decades, they have been supplemented with computer-based FMC familiarization and various procedures trainers. Virtual reality provides accurate 3D dimensions and location information to the user whilst providing the ability to train various scenarios.

Three points for Training Managers to consider when assessing the business case for investing in virtual training technology:

1. Crew familiarization – replacing actual aircraft visits with virtual aircraft visits. No crew movement or extra duty time, no taking aircraft off the line.

2. Training time reduction – one airline explained how they use virtual technology in the briefing room, replacing the first hour of a four-hour simulator session.

3. Aircraft training reduction – pilots train missions before flying the same task in the aircraft, reducing the time required to gain proficiency, reducing flight hours without impacting quality.

Training Methodology

Virtual reality implementation is not a simple as a simulator software, visual or motion system update and goes far beyond moving from PowerPoint course work to an integrated learning management system. Incorporating VR is a fundamental change that must encompass the entire course syllabus and in due time cover all training elements from ab initio through to command upgrade. The effective use of virtual technologies will only work in blended training which is re-designed with the pilot and instructor in mind, finding the right match and fit at the intersection of technology and user.

Specific use case examples:

- Ab initio: reduction in actual airplane time and improved results in the visual part of the flight syllabus
- Type Training: obvious application in ground school, reduction in simulator time with cockpit setups, procedures flows and eventually walkarounds undertaken using virtual technology
- Recurrent: refresher preparation done using virtual technology, reducing simulator time and or optimizing time spent in the simulator

Finally, there are two positive byproducts associated with the use of virtual technologies. The first is improved pilot confidence, through the availably and quality of the virtual technologies. The second is generating more refined data which can be analyzed for the application of evidence-based and personalized training.

Instructor Role Changes

The responsibility of the instructor is to facilitate learning in the development of competency. The role of the instructor continues to evolve alongside the technology. It could be argued that complexity has been reduced as has the workload for instructors. Yet the role and responsibility are as important as ever and instructors must embrace new skills and ways of training delivery to meet the ever-changing demands and standards of modern training.

Human Factors

Physical constraints, impact to brain function and retention after prolonged exposure, the optimal ratio between real and virtual training, and impact on instructors as their responsibilities evolve: many questions were raised regarding the impact virtual technology has on the user that must still be answered.

Communication was raised repeatedly as a consideration. Tone, nuance, and body language play a substantial role in communication, as well as culture which highly influences communication style. Most experts agree that at least 70% of communication is non-verbal; the 30% that is verbal is subject to tone and interpretation. How pilot avatars and virtual instructors communicate must also still be addressed.

Regulation

A key aim is to make all training technology-agnostic; the training requirements, for now, are the same. This will need to be revisited if training requirements are to evolve alongside new technologies. Providing quality guidance by agreeing on a minimum standard, so authorities or specialized companies could compare the equipment available from the vendor versus that standard, would be helpful, ideally with a label of conformity.

Conclusions

The use of virtual technology requires a complete rethink of training philosophy and curricula.
Human Factors consideration is key to successful implementation.
Those providing these tools must be aware, and make others aware, of the consequences of non-professional grade quality.
Virtual technologies may provide training cost reduction.
The quality of virtual technologies is rapidly improving.
Regulations are being adapted to make virtual technologies part of the training "toolbox".
Virtual technologies are paving the way for the future of training.

LEADER FORUM
XR EMERGENCE

Background

In February 2021, Halldale Group and Civil Aviation Training (CAT) magazine, in collaboration with the European Union Aviation Safety Agency (EASA), held a virtual Heads of Training (HoT) meeting to discuss critical topics facing the airline training community in Europe.

To continue these discussions, Halldale/CAT are convening a series of deep-dive workshops – the CAT Leader Forum – each with a group of selected subject experts representing airlines, training organisations, academia, regulators, and other stakeholders. The findings and recommendations of the workshops will then be presented in a public webinar by representatives of the working group for the respective issue.

Skills Decay	7th April 2021
XR Emergence	29th April 2021
EBT/CBTA	27th May 2021
Big Data	1st July 2021
UPRT	29th July 2021

The second Working Group, on XR emergence, was held in mid-April and the results presented in a webinar on the 29th of April. The recorded webinar is available online **here**.

Read the full report, including findings from the original Heads of Training working group discussion.

HOSTED BY:

www.halldale.com