REALITY FLIGHTS

Support from DoD's SBIR program helps create aircrew virtual reality training system



The U.S. Department of Defense (DoD) training for Warfighters has long been a balancing act between traditional live exercises and alternative forms, including simulators. While live training may provide an experience that feels closest to real-life battle situations, it is also time-consuming, costly, and prone to restrictions and complex requirements. Live exercises require dedicated training sites and fixed locations, specialized equipment, and intense logistical prep work. Moreover, even these live training events, due to technological, environmental, regulatory, security, and safety constraints, cannot truly capture battlefield situations.

Since the late 1990s, when immersive virtual, augmented, and mixed reality technologies became the new frontier, DoD has been interested in creating virtual Warfighter training. DoD's specific goal was to develop more effective training solutions to support Warfighter readiness without putting soldiers through dangerous, costly, and time-consuming live exercises.

Binghamton Simulator Company (BSC), a small business in Binghamton, New York (later acquired by Kratos Technology & Training Solutions), was awarded a Small Business Innovation Research (SBIR) contract to develop immersive reality capabilities for DoD. With help from this contract, BSC produced the first U.S. Navy virtual reality device, the MH-60S Aircrew Virtual Environmental Trainer (AVET), in 2011. This device was a forerunner to much of the immersive reality technology within DoD simulation systems we see today.

A stand-alone and reconfigurable, full-motion simulator, the AVET supports aerial gunnery, search and rescue, cargo replenishment training, confined area landings, and emergency procedures training for the MH-60R Knighthawk and the MH-60S Seahawk aircrews.

BSC worked with experts from the Naval Aviation Training Systems and Ranges Program Office (PMA-205) and the Naval Air Warfare

Center, Training Systems Division, Orlando, Florida, to design and create the prototype sent to the fleet for evaluation. Instead of a large visual screen seen in most

H-60 trainers, the AVET provides each student with an individual headset to view images. Known as the helmet-mounted display (HMD) visual system, this equipment fixes directly to the student's helmet, providing a 360-degree visual of the aircraft's exterior and interior. Before BSC applied this technology for military training, dome screens were used to project a visual scene. The

AVET HMDs provided an immersive environment and removed the need for projection dome systems.

In 2011, the AVET was successfully transitioned into use by the Navy. Since then, the technology has evolved to the next generation of immersive technologies. One

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of these technologies, known as mixed reality, was adopted by the Air Force in 2020 to provide continuation and mission rehearsal training for aircrew members. ("Mixed reality" refers to 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.) The AVET simulates three aircrew stations: aerial gunnery operations, hoist operations, and

> cargo operations. The simulator also replicates two aircraft configurations, two rear doors and two windows with simulated weapons, and one cargo hatch door with a cargo hook. "The instructor can perform as a simulated pilot to assist with multiple student performance initiatives. Using the HMD, crews can rehearse with six different weapons configurations," said Rick

McKay, PMA-205 H-60 in-service integrated product team lead. "With the implementation of the AVET into the H-60 training continuum, the platform is on the cutting edge of modeling and simulation."

There are currently and commonly two sets of





A mixed reality helicopter cockpit shows the environment both with and without the augmented reality.





The mixed reality training environment developed under the SBIR program extends even to air traffic control training.

training requirements for Navy and Air Force aircrew members: initial qualification training to qualify newcomers and recurring training to recertify more experienced Warfighters. The initial qualification training primarily uses simulation technology along with live training sessions. For periodic training, the technology has now evolved far enough that it is being used to replace some of the live training requirements.

Training in simulators brings several advantages over more traditional training exercises. It enables the introduction of scenarios that would be too dangerous to include in live training exercises, leading to more comprehensive training and improving overall Warfighter readiness. It can be completed much faster than traditional training. And it provides significant cost savings over relying on live training on an aircraft. Using an aircraft may cost thousands of dollars per training hour.

BSC utilized the SBIR program for the entire evolution of the technology, from inception to finished product. The SBIR Phase I allowed BSC to conduct a feasibility study for the technology and demonstrate a

use case for aerial gunnery on Navy rotorcraft platforms. The follow-on SBIR Phase II supported a prototype, and the SBIR Phase III funded manufacturing of the final product.

Immersive technology is now impacting nearly every commercial and military sector.

This growing industry has benefited immensely from the high-risk/high-reward research and development the SBIR program fosters. Neil Oatley, Kratos' Division Marketing Vice President, explained that military needs and commercial advancements benefit each other: "The immersive training field is one of the most exciting industries worldwide. DoD needs the commercial advancements made to technology and platforms, but with special requirements and applications. This results in DoD pushing the envelope on technologies that have military appeal, which in turn incentivizes the commercial market to offer custom capabilities to DoD."

Jose Diaz, Kratos' Senior Vice President for Training Solutions, said, "The SBIR program's funding helps companies innovate products on a much faster timeline. Through the SBIR program, companies develop initial technology that can keep evolving into a greater capability set for the Department of Defense. For example, if you look at the original SBIR technology that we transitioned into Navy use, you see that we continued to evolve the project from a technology standpoint and

> expanded it to other DoD branches. Currently, there is a substantial industry for immersive technology. Still, for our company, it started with that first SBIR, and our advanced technology capabilities are based on that initial research and development." *****

Modernization Priorities: Microelectronics, Fully Networked Command, Control, and Communications (FNC3) SBIR Contract: N61339-05-C-0087 Agency: Navy • Topic: N03-190 Helicopter Operations Aircrew/Crew Chief Trainer National Defense Strategy Pillar: Force Readiness & Lethality