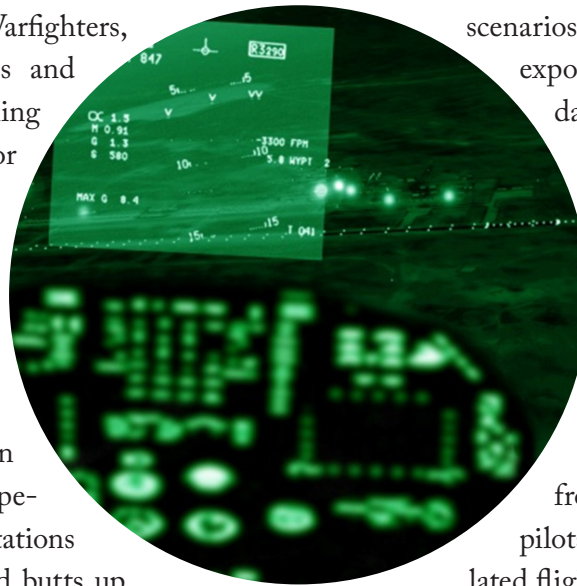# FLYING BY NIGHT

SBIR Support helps bring real-time
geo-spatial simulation to night vision goggles

Among America's Warfighters, across service branches and specializations, one thing remains constant: the need for training. No matter your specialty or area of expertise, consistent training is necessary to maintain an expected standard of excellence.

Perhaps nowhere is that necessity more urgent than among military pilots. These specialists need to exceed expectations at every turn. And yet that need butts up against certain limitations. Fifteen years ago, one of those limitations related to the use of night vision goggles (NVG).

At the time, most of the training pilots received with NVG was in real-world aircraft. Because of safety concerns and the limitations of real-world training scenarios, however, pilots were neither exposed to nor trained for the most dangerous conditions.

The only other method used for training pilots for night missions was a cumbersome scenario in which pilots donned goggles and sat in a room outfitted with a physical model of possible terrain. Instructors would turn on small glass lights to represent light from the moon, stars, and land while pilots navigated through their simulated flight operations and mission goals. It was a very limited and static physical model.

In the wake of 9/11, the U.S. Department of Defense identified the need for digital simulation technology for training and night mission rehearsal. And in 2004 and 2005, Aechelon Technology, a nascent digital engineering company based in San Francisco, California,

received Phase I and Phase II Small Business Innovation Research (SBIR) contracts from the U.S. Navy to produce a computer-driven simulation technology that could be used for NVG pilot training and mission rehearsal.

Over the course of a few years, Aechelon developed a digital system of interacting computers, software, and goggles that pilots could use to practice flying in low-light night missions. "We were able to replace all those model boards with our computer," Castellar said. "With the computer, they could fly. You could expose them to different terrain, different settings in the world. It was a great change for them."

By the time of the night raid on Osama bin Laden's compound in Pakistan in 2011, military pilots were training and rehearsing for demanding missions using NVGs and simulation technology. It was a long leap in a relatively short time.

Aechelon received the Phase II SBIR contract in 2005 to develop a prototype of its technology. Under this SBIR, and in order to virtually model and simulate a terrain, Aechelon needed to digitally map a given area. Co-founder Javier Castellar and two other Aechelon employees began creating a digital model of the terrain around Yuma, Arizona, using satellite-generated images. The geo-spatial visual data was digitally integrated into a model that also simulated moon position, weather, and light conditions.

Aechelon's system begins with an image generator that replicates reality in 60 to 120 frames per second. The system projects near-infrared energy on a screen, creating a virtual "flying window" for the pilot, simulating a war terrain that's realistic in its moon and stars positioning, land forms, and

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the weather conditions of the day, along with simulated enemy movement, friendly vehicles, fires, explosions, and smoke.

"The student pilots can use their night vision goggles and experience firsthand all the dangerous scenarios in training before they even board an aircraft," Castellar said.

Mike Merritt, acquisition director for the Naval Aviation Warfare Training Systems Division, has followed this technology from the early days. He remembers the limits of the physical terrain boards. "How you do simulation, basic training, mission rehearsal—this technology is woven into all those technologies," Merritt said. "The pilots can fly the exact route and rehearse that mission—that is why I call it a fundamental technology. It does change the way we do mission rehearsal and flight."

Aechelon's technology is now in use by all branches of the military, including Special Operations Command and the U.S. Coast Guard. "All the services have a basic need to do this training. All have different needs and all are leveraging [the technology]," Merritt said.

The core technology developed under the SBIRs continues to be refined. Military pilots today have many hours of virtual flight before they go on a mission. "These days you can be more prepared for the mission for a specific area and fly the mission before you get in the aircraft," Castellar said. "It is very, very similar to the real mission. It's now standard."

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