

THE MAGIC OF MERLIN

SBIR-POWERED ROUTING SYSTEM PROVIDES LIGHTNING QUICK PATHS FOR PILOTS

In 2010, the U.S. Navy began looking for an improved way for its pilots to plan their flight routes. Up until that point, most route planning was done manually, which was unduly cumbersome, and took too much time and manpower. They also rarely could create routes with built-in time-lines—an important element in any planned route that dictated when certain moves or deviations will occur. But a Navy Small Business Innovation Research (SBIR) solicitation issued that year (Algorithms for Dynamic 4D (3D space with time) Volumetric Calculations and Analysis) aimed to tackle those shortcomings, providing an overall safer experience for the warfighter.

Maryland-based Chesapeake Technology International (CTI) secured the SBIR award. CTI, which focuses on military aircraft software, was familiar with the program through its securing of an earlier Navy SBIR award for a haptic feedback system for pilots that helped improve performance in brown-out and white-out conditions.

The company set out to build a routing system that could use a complex algorithmic model to automatically replicate the process pilots had been doing by hand. The first iteration of the software was a “great success,” according to CEO Dustan Hellwig, one of CTI’s four founders. The program, developed with help from collaborators Matthew Goldsbury and Tommy Tucker, could route a path for an



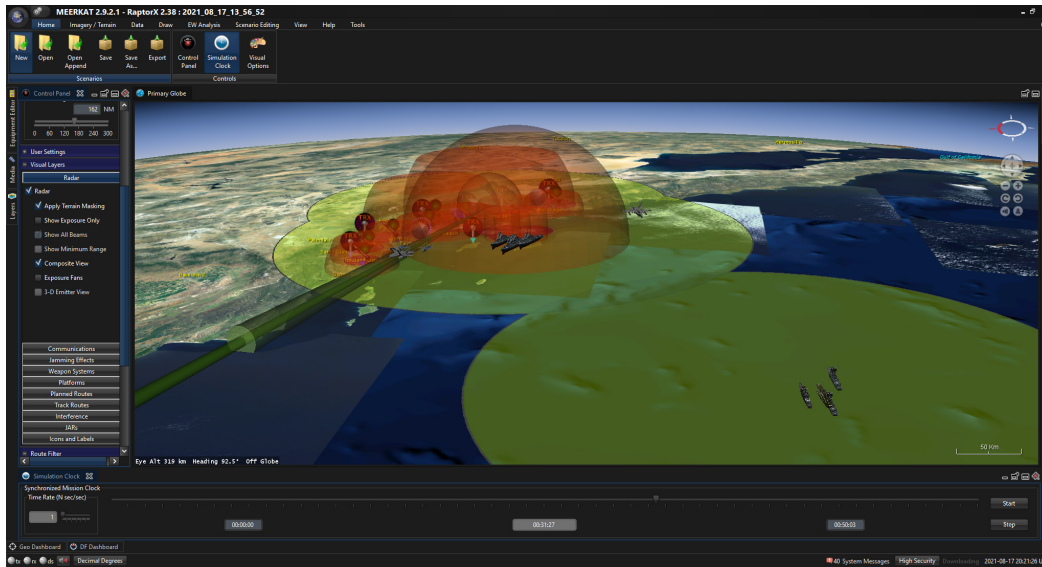
EA-6B Prowler or EA-18G Growler in 10 seconds, while factoring as many as 1,000 outside threats—a task that would normally take hours for a human to complete. The key behind the program was a cutting-edge heuristic network, based in part on a Navy-patented algorithm, that only allowed for acceptable outcomes (e.g. flight safety and logistical limitations such as aircraft range).

However, the final dimension—time—is what truly sets the technology apart, according to Hellwig, allowing for components such as reaction timelines and route replay. This functionality consequently increases mission preparedness as well as success and performance.

“We construct a decision network based on acceptability regions and capability regions. We plot all those points against all those threats and then constrain that with what’s logistically possible. We then carve out that decision network which only contains valid opportunity points,” Hellwig explained. “That’s why we’re able to solve it very quickly.”

The company secured a patent on the technology on the heels of its initial success. A Phase 2 SBIR contract then allowed them to build out a working prototype, and finally a Phase 3 contract brought the software into production. Called





The SBIR-supported Merlin software package streamlines aircraft mission planning, among other applications, and has transitioned to use in a number of military programs.

Merlin—given the magical speed at which it operates—the auto-routing software was slowly implemented into Naval aircraft mission planning, beginning at Point Mugu in California, where it remains in use to this day. It has also been used in battle planning scenarios and advanced threat analysis, and is used by many military programs, among them the Airborne Electronic Attack Unique Planning Component, Marine Air-Ground Task Force Electromagnetic Warfare, Joint Electromagnetic Preparedness for Advanced Combat, Joint Navigation Warfare Center, Joint Electromagnetic Warfare Center, Warfighter Lab Incentive Fund, EA-6B ICAP-III flight simulators, and other classified programs.

Perhaps more importantly, the tech’s results have been validated numerous times over the years by pilots, including experts at Top Gun Naval Fighter Weapons School.

“The best validation is having the human look at it,” Hellwig said. “We’re informing the way we build the solution out based on how the experts would do it.”


Scott Burkholder, a former EA-6B aviator and an engineer at the Naval Air Warfare Center and technical point of contact for one of CTT’s SBIR contracts, was among those to validate the auto-routing software.

Burkholder, who spent more than 30 years in the Navy and worked with numerous SBIR contracts, said he was blown away when he first tested Merlin.

“I can’t believe how fast it is,” Burkholder said. “Before, it was taking hours to do anything. An hour for training for line of sight, for example. CTT’s technology is the best auto-routing program I’ve ever seen, where it does it live, and on the fly.”

The temporal aspect made it that much more impressive, Burkholder said, allowing pilots to input a destination and come out with a route, as well as the exact timing. “Auto-routing with temporal timelines with Jammer Acceptability Regions is not an easy subject. That’s where this program came into its own, doing all that at once,” he said.

Hellwig said he believes the technology has further applications still, including for electronic warfare missions, as well as in the world under the Joint All-Domain Command & Control (JADC2) initiative of the Department of Defense. But none of this would be possible, he added, without the initial boost the SBIR program provided the company.

“Overall, the SBIR program has given us the ability to get these advanced capabilities into deployed systems in the force,” Hellwig said. 



Chesapeake Technology International Corp.

California, MD

Modernization Priorities: Cyber, Artificial Intelligence (AI), Autonomy

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Volumetric Calculations and Analysis

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