

NAVY SBIR TRANSITION PROGRAM

SPOTLIGHT

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Creare's sound wave protection helmet improves safety aboard carrier flight decks

By Kimberly Rouleau

“The take-off from an aircraft carrier flight deck is so loud! It shakes your teeth; it shakes your chest. It literally rattles your very existence,” said Jed Wilbur, program manager at Creare LLC. “It’s so loud from a hearing protection or hearing conservation standpoint, that if you were to fill your ear canals with concrete and completely block all the sound that gets in your ear, the sound waves that hit your head and get into your inner ear through your head are sufficiently loud enough to cause damage.”

Creare developed the Sound Wave Protection Helmet, designated the HGU-99/P. The HGU-99/P uses three layers of passive hearing protection to break through the limitations of legacy hearing protection systems. In addition to earplugs and specially designed ear cups, the HGU-99/P adds a noise-isolating helmet shell that also provides acute impact protection. Developed for aircraft squadron maintainers on carrier flight decks and for shipboard flight deck personnel, the HGU-99/P preserves auditory situational awareness and face-to-face communication for deck crew. An electronic “hear-through” technology recreates the ambient soundscape at the



U.S. Navy photo

Creare's Sound Wave Protection Helmet, the HGU-99/P, underwent fleet assessment onboard the USS Eisenhower in December 2022.

user's ears while ensuring sound at safe levels. HGU-99/P interfaces with flight deck radios, the ship's sound powered phone systems and aircraft intercommunications systems. Crew members can maintain situational awareness while protecting their hearing roughly six times better than with the existing cranial helmet. For those Sailors and Marines working in the highest noise environments throughout the fleet, Creare's HGU-99/P will soon replace the legacy flight deck cranial helmet, the HGU-25.

“The primary motivation for this technology is hearing protection. That’s where it started,” said Wilbur. “Other benefits have been worked into it, like head protection, but the primary driver was always hearing protection. There is a need for it on the flight

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deck. Sailors and Marines who maintain the aircraft and get them ready to launch are doing this in very close proximity to the aircraft they are working on. All the other aircraft on the deck are being prepared or being launched, too.

“During routine operations, the aircraft is taxied onto a catapult for launch. Once the aircraft is spotted for launch, the crew steps back 10 feet and the aircraft will take off right there. The amount of noise and sound pressure is incredible, and personnel are exposed to this environment many hours each day.”

Creare began developing its hearing protection program in 2004 under two different Navy SBIR topics and a parallel Air Force STTR topic. Initial research focused on investigating the limits of air-conducted, head-conducted, and body-conducted noise. This led to the development of a hearing protection helmet.

During subsequent Phase II awards, Creare further enhanced the helmet, including adding head protection and external communication capabilities. Creare qualified the performance specification of the

helmet, ran it through a fleet assessment event that informed the Milestone C procurement decision point in 2010–2011.

“Then, for a variety of reasons,” said Wilbur, “the Milestone C decision was not in the affirmative for us, so the project was sort of mothballed.”

Around 2014, the helmets were sold

commercially to European oil and gas companies. “A lot of operations on pipeline maintenance are absurdly loud,” explained Wilbur. “The European

regulations on hearing protection, at least for these occupations, are a little more robust than American ones, so clients there have essentially found that the helmet system is the only product they can find that gives them that level of hearing protection.”

The Navy rekindled its interest in Creare's cranial protection helmet in 2017. “We had a conversation at a networking event,” said Wilbur. “We were there for another effort. We were showing off the 2010 version of our helmet at our booth and the captain of PMA-202 was in the audience, walking



Photo courtesy of Creare LLC.

Creare's Sound Wave Protection Helmet, the HGU-99/P.

along the trade floor. He stopped, said, 'Hey, that looks familiar,' and started to chat with us. This was one of the pebbles that got the ball rolling."

By 2018, Creare was under contract again to add features to the helmet, including "hear-through" technology to address feedback related to auditory situational awareness. The helmet was requalified and run through another two fleet assessments. This time, the helmet passed the Milestone C decision point.

In October 2023, Creare finished the first round of low-rate initial production (LRIP). According to Wilbur, "On LRIP, we fabricated and delivered 582 helmets. As we wrapped up LRIP, we got under contract with the Navy for the first year of full-rate production. This is where we gear up and, instead of delivering 600 helmets, we are going to be delivering 2,000 helmets over the course of a year. We are going to be in steady state production."

Throughout the process, the HPU-99/P underwent thorough qualification testing. "Creare was the contractor running, testing, or hiring people to run most

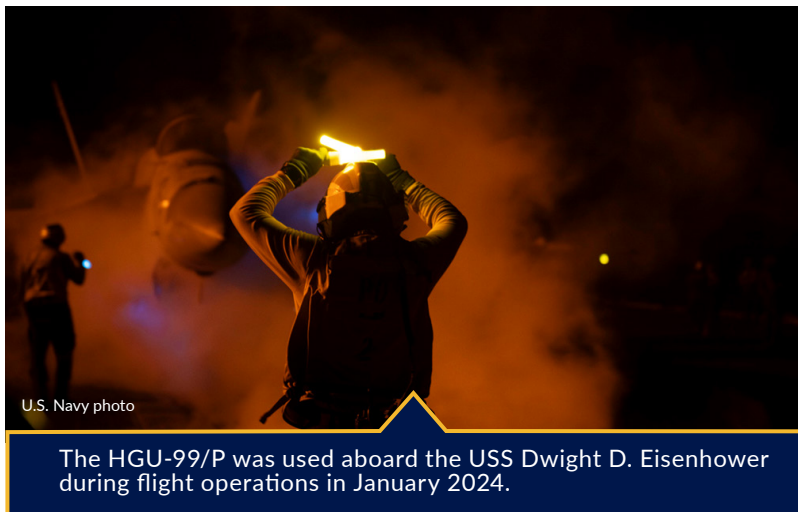
testing," said Wilbur. "The Navy ran a test where Sailors wore the helmet with life preservers and were jumping off high diving boards to simulate falling into water with the helmet on. There were events where the Navy would take a handful of helmets onto aircraft carriers, assigning them to Sailors, giving them a 20-minute lesson on how the helmets work, then

letting the sailors use them for a few weeks.

"Over the course of the program, four or five times, there have been similar events where the Navy has taken the

helmets to Naval air stations and Marine Corps air stations for personnel to try out and the Navy collected their feedback. The Navy has been a good partner in getting the helmet tested and sharing results with us to build a better product."

Creare works with two subcontractors to produce the helmets, Composite Materials Research and Development (CMR-D) in Salem, Oregon, and OTTO Engineering in Carpentersville, Illinois. CMR-D manufactures the plastic shell, the foam liners, the leather edge seal that goes around the wearer's head, and ear cups.



OTTO Engineering manufactures the wiring harness, radio interfaces, and microphones. Creare assembles, inspects and provides quality assurance on the helmets. The relationships with these subcontractors developed organically. “The program director at the time just happened to be at a conference and was showing something off. Someone walked up to him, and they started talking and he said, ‘I can build helmets.’ The next thing you know, we have a relationship with a vendor who’s trying to figure out how to build these helmets for us. It was a similar story with the electronic components. You never know who will walk up to your booth—what their background, expertise and capabilities are.”

According to Paul Movizzo, who coordinates Creare’s SBIR technology transfers, 14 of Creare’s projects have been through Navy STP. “We participate every year, and we really enjoy the opportunity to showcase what it is that we’ve done. We’re pretty selective on the Phase II project that we are going to bring forward with the goal of transition in mind. Navy STP allows us to further model or plan out what we started in Phase I. It becomes a progress check on how we are doing because we challenge our initial assumptions by creating the marketing products: the quad chart, the tech brief, the slide deck. We know these are going to be posted on the Navy STP Virtual Transition Marketplace. We can really refine what it is we are trying to say and it’s a very deliberate process. Further, STP’s market research report forces us

to examine our technical success and potentially repackage what we want to do with the technology.

“This leads to the culminating showcase event at the end of the Navy STP cycle when you are actually on the trade floor and able to exchange ideas and information about what you have. The networking environment is really valuable. All the key players are there. Navy STP does a great job of getting the DoD stakeholders, Navy stakeholders, and program managers very involved,” said Movizzo.

Creare is an engineering research and development firm located in Hanover, New Hampshire. Founded in 1961, Creare provides industrial and government clients in the medical, aerospace/defense, energy, process, and manufacturing industries with services ranging from applied research to prototype design, fabrication and testing. Creare’s core areas of expertise include fluid dynamics, heat and mass transfer, electronics and software development, sensors and control systems, and CFD/ FEA analysis. For further information, visit <https://www.creare.com/>.

