Dahlgren Division Engineers Capture First Live Data on Projectile and Shockwave Interaction

DAHLGREN, Va. – Naval Surface Warfare Center Dahlgren Division scientists and engineers used a M110 Howitzer modified with a 155 mm barrel to launch projectiles traveling nearly four times the speed of sound toward controlled blasts of 30 to 100 pounds of dynamite. The groundbreaking test was used to study how shockwaves affect high-speed rounds. (NSWCDD Photo)

By Kristin Davis, NSWCDD Corporate Communications, Nov. 21, 2025

DAHLGREN, Va. – Naval Surface Warfare Center Dahlgren Division recently fired high-speed projectiles into timed explosions to study how shockwaves affect high-speed rounds in

a groundbreaking test.

Over two days, a team of scientists and engineers at Dahlgren Division used a M110 Howitzer modified with a 155 mm barrel to launch projectiles traveling nearly four times the speed of sound toward controlled blasts of 30 to 100 pounds of dynamite.

“We took a high-speed projectile and did what Dahlgren does best – we shot it from a gun,” said Lyn Thomas, Distinguished Scientist for Surface Engagement Systems (Acting) at NSWCDD. “The new part was studying what happens when the projectile meets a blast wave mid-flight.”

The mission was practical: gathering data to improve computer models that simulate missile and blast behavior.

Coordinating the projectile’s flight with the explosion’s detonation required split-second accuracy.

“As we prepared for the test, there was very little question if we could get the projectile to fly where we wanted it to fly and very little question if we could get the explosive to detonate at the right time,” Thomas said. “It was really about whether we could get those two things to coincide at the right time and place.”

Because the team was using shadowgraphy, a high-speed imaging technique that makes normally invisible shockwaves visible and allows engineers to see how the blast moves around a fast-moving projectile, “we had only a tiny window where everything had to line up perfectly,” he said.

To prepare, the team conducted a series of practice firings and static detonations before the main event. During the final shots, onboard sensors and high-speed cameras recorded how the shockwave and projectile interacted – data never captured

during a live-fire event.

Everything used in the test, from the launch package to the projectile's internal electronics that collect and transmit data, was designed and built at NSWCDD, Thomas said. "We did all of it right here at Dahlgren."

The experiment took place at Pumpkin Neck, a range typically used for explosive warhead testing. Because this project required both gun firing and controlled detonations, Dahlgren Division combined two of its specialties – precision gun testing and high-explosive research – in one operation.

The team was able to conduct two to three instrumented shots per day, producing an exceptional amount of data quickly and affordably.

Though the test itself occurred over two days, safety planning took nearly a month. Engineers analyzed every possible outcome – from flight path variations to failed detonations – and designed multiple safety layers into the setup, Thomas said, "We analyze every possible failure mode and build in layers of protection. Each successful test builds confidence in our process – but nothing ever gets rubber-stamped."

For Thomas, the experiment highlights the range of talent and collaboration across NSWCDD's workforce.

"The interesting thing about Dahlgren is we're over here doing this type of testing, and across base people are doing computer programming on very complex systems and combat systems work. There is just such a variety of work going on to support the Navy and support all our activities," Thomas said. This was a test for a customer outside of the Navy, but they sought us out for our expertise, our ability to execute the test and build the projectile with onboard data to get the data they need. This is an example of Dahlgren expertise that

can be applied across the board, which I find very rewarding.”