October 2026

NAVY SBIR TRANSITION PROGRAM

SPOTLIGHT

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From concept to capability: Sphere Brake Defense advances a new approach to military braking

Sphere Brake Defense, Inc. (SBD) has developed an innovative brake technology that could transform military vehicle sustainment. The technology replaces traditional disk or drum brakes with hemispherical brake pads that compress around a spherical brake surface. Sphere brake kits can be bolted on to existing wheel ends without any modifications to the axle, wheel, or hub. Compared to conventional brake systems, sphere brakes reduce weight by more than 10% per wheel, increasing both payload capacity and fuel efficiency. Most importantly, they allow brake pads to be replaced without tools or wheel removal. As a result, brake maintenance can be completed in minutes by personnel with minimal training, reducing the need to remove vehicles from service for depot level sustainment.

A 2022 Spotlight article detailed the rigorous testing process SBD's technology underwent at Aberdeen Proving Ground (APG) to qualify for use on military tactical wheeled vehicles. Since then, founder and CEO Aaron Lewis and his team have overcome a series of funding challenges while keeping their technology moving toward deployment.

As described in the 2022 Spotlight, developing and executing vehicle test plans requires careful coordination among multiple



Photo provided by U.S. Marine Corps, Amphibious Vehicle Test Branch

Sphere brake kit installed on an Amphibious Combat Vehicle.

stakeholders, including technology sponsors, Program Acquisition Executive offices, testing agencies, and vehicle manufacturers. Initial transition targets included the Army's Stryker and Family of Medium Tactical Vehicles and the Marine Corps' Amphibious Combat Vehicle (ACV). SBD was "humming right along and making significant progress," Lewis says, when congressional budget cuts suddenly threatened to derail the project.

"In late 2023, Congress started slashing budgets for tactical wheeled vehicle programs, particularly the ACV program. I was at an event in the Washington area, meeting with the program managers overseeing these tactical wheeled vehicle programs, when we were all notified that there were significant budget cuts

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to their programs," he recalls. The reduced budgets left program managers without funding for brake modernization efforts. "Everyone was scrambling. We were told that week that they would have to stop work on our contract."

With no prior experience in congressional lobbying, Lewis moved quickly to restore the funding needed for the Marine Corps, Program Manager Advanced Amphibious Assault (PM AAA), to continue advancing SBD's technology.

"I literally started knocking on congressional leader's doors, lobbying to get a congressional add for the ACV program," he says.



FMTV undergoing testing with sphere brake kit installed.

Lewis had already established a relationship with the representative from the company's congressional district, who had toured the company's facilities and was familiar with its technology, giving him a natural starting point. "It wasn't like a cold call. He already knew about me and what I was doing in his district. I went to him first and said, 'This is what's going on — if we don't do something, we're going to be shut down.'"

After that initial meeting, Lewis made monthly trips to Washington to build support from additional congressional leaders.

His efforts paid off: Congress added $2 million to the FY24 National Defense Authorization Act (NDAA). Through a collaboration agreement with the National Center for Manufacturing Sciences (NCMS), PM AAA used that funding to conduct a yearlong reliability qualification testing (RQT) effort for sphere brake pads on an ACV at Camp Pendleton from 2024 to 2025. During testing, the vehicle accumulated 2,000 mission profile miles and nearly 15 hours of ocean fording. According to Lewis, the sphere brake pads lasted more than seven times longer than the brake pads currently fielded on the vehicle.

SBD's brake technology was also cited in the FY25 NDAA House Rules Committee Report, which encouraged the Marine Corps and United States Special Operations Command to continue researching, developing and fielding the technology. In Lewis' view, strong congressional support helps "derisk" emerging technologies for program managers and acquisition personnel, giving them greater confidence to invest in their development.

By this point, SBD's technology maturation and outreach efforts had created what Lewis calls "a perfect storm," with program managers,

congressional leaders, and warfighters all eager to field SBD's brakes on the tactical wheeled vehicle fleet. Despite that momentum, overall spending on tactical wheeled vehicle programs continued to shrink. Anticipating even deeper cuts in the FY26 NDAA than those seen in FY24 and FY25, Lewis decided to hire a professional Washington lobbying firm. Although he remained actively involved in meeting with government officials, he says the lobbyists' depth of knowledge, access, and connections proved invaluable.

"I wish I had done it sooner — from day one, not eight or nine years into the life of our company. Figure out a way to have a government affairs person on your team to navigate the defense system because, as we all know, it's unpredictable and there are a lot of valleys of death to navigate."

The Marine Corps secured a $5 million funding increase in the FY26 NDAA to pursue advanced brake technology and in June 2026 SBD was awarded a new contract from NCMS and PM AAA. Running through 2028, the contract funds the certification and delivery of more than 100 Amphibious Combat Vehicle (ACV) sphere brake kits to the Marine Corps.

While lobbying Congress may seem outside the scope of a typical small technology firm's work, Lewis sees it as essential in today's defense acquisition environment. "We're going to define our destiny and do as much as we can in parallel on the procurement side while we continue to develop our technology and manufacturing."

Lewis' drive to solve military readiness challenges stems in part from his own military experience. He served as an officer in the Army National Guard, and the sphere brake concept initially occurred to him while preparing for deployment to the Middle East. Although he did not yet have a specific product or application in mind, he sketched out the idea and later patented it.

Lewis also studied furniture design at East Carolina University, where students were expected to design and build furniture on tight deadlines while sourcing their own materials and special tools. He says that experience fostered the iterative design mindset that later combined with his understanding of military vehicle readiness to shape the sphere brake concept.

"Our bootstrap days — from the time I came back from Iraq to launching the company full time in 2016 — were all about validating the concept of the sphere and making it a brake for a vehicle," he recalls. "Back then we were very scrappy. Whatever it took to make something, even if it didn't work right. All we had to do was show that it was possible and that got a lot of people excited."

That scrappy approach ultimately led Lewis and SBD to the Marine Corps and the Department of the Navy SBIR program. After launching the company in 2016, Lewis says, "I decided to do something everyone thought was crazy — a private industry day."

Using a Mack truck purchased on eBay, SBD engineered a set of sphere brakes to install on the vehicle and organized a demonstration event at Penn State. According to Lewis, Penn State's longstanding relationship with Volvo, Mack and Ben Franklin Technology

Partners, a non-profit that invests in Pennsylvania startups developing innovative new technologies, including SBD, made it an ideal location. The university's test track is also near a Navy research and development facility where the Marine Corps conducts vehicle testing. "I strategically performed this demonstration while the Marines were there so I could get them over to see our technology. It went beautifully."

The demonstration sparked Marine Corps interest, leading to writing a solicitation for the 2017 SBIR topic cycle focused on sphere brake technology. In 2018, SBD was awarded a Phase I contract, followed by Phase II contracts in 2019 and 2023.

During its first Phase II, SBD participated in the Navy SBIR Transition Program (Navy STP). "I wanted to take every opportunity to learn," Lewis says. "Navy STP provided my first exposure to how procurement works. The business consultant assigned to our company had a lot of great connections in the auto industry, which led to new relationships and great networking."

Ten years after the company's founding, SBD continues to advance toward low rate initial production (LRIP) and eventual installation of sphere brake kits on a company-sized unit of Marine Corps ACVs. While the Marine Corps has been the focus of development work so far, Lewis says the sphere brake technology can be adapted for any military or commercial wheeled vehicle. NAVAIR has even expressed interest in deploying sphere brake kits on fixed wing unmanned aerial vehicles.

"Surprisingly, not many components are different from vehicle to vehicle," Lewis explains. "What really changes is just the bolt pattern and size of the wheels. What's great about our technology is that we can scale it fast. We scaled it from heavy vehicles all the way down to fixed wing aircraft or motorcycles and maintain our same value proposition, which is changing brake pads without wheel removal or tools."

Designing their product to fit within an existing vehicle architecture can be challenging. "From day one, we've always been constrained by the vehicle that's already designed. Our kit has to match the bolt pattern, and the calipers and rotors have to fit inside the wheel without interfering. We're getting to the point, though, where the Navy is starting to bring us in early in designing their wheel specifications for new vehicles."

Based in Erie, Pennsylvania, SBD is co-located within a 100,000+ square foot machining facility. The company received ISO 9001 certification in 2024 and leverages its domestic manufacturing capabilities and secure U.S.-based supply chain to develop advanced braking systems for military and commercial vehicle applications. For more information, visit www.spherebrakedefense.com.

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