DEPARTMENT OF THE NAVY
SBIR/STTR TRANSITION PROGRAM

SUCCESS STORY

TOPIC NUMBER:
N112-137, N20A-T010

SBIR INVESTMENT:
$2,617,514

PHASE III FUNDING:
$7,910,825

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SHIP VIBRATION MITIGATION FOR ADDITIVE MANUFACTURING EQUIPMENT

Wait times for replacement parts at sea could soon be a thing of the past with the vibration mitigation system (VMS) from Advanced Technology & Research Corporation. This VMS allows Sailors to 3D print any metal part they need on demand.

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THE CHALLENGE

Naval vessels are marvels of modern engineering. Each one consists of countless components intricately assembled to deliver extraordinary capability. But that abundance of parts also creates several potential points of failure. When mission critical components on a ship break, they need to be replaced quickly. Storage space for replacement parts on board is limited, and procuring parts from shore can be costly, time-consuming, or even impossible if parts are no longer in production. To address these challenges, the Navy sought a way to produce parts necessary for repair onboard using additive manufacturing (AM).

THE TECHNOLOGY

Advanced Technology & Research Corporation (ATR) developed a vibration mitigation system (VMS) that enables effective shipboard 3D printing manufacturing. 3D printers construct three dimensional solid objects from digital models, in part through highly precise movements. That level of precision is hard to maintain in calm conditions on solid ground, and far more challenging aboard a ship at sea. Navy ships experience environmental conditions that have historically hindered onboard 3D printers' effectiveness, such as high frequency vibrations, humidity, and temperature shifts. The core of the VMS is its motion-isolation platform, which decouples the printer from shipboard motion and vibration to ensure reliable manufacturing capabilities.

THE TRANSITION

NAVSEA awarded ATR an SBIR phase II contract on September 25, 2019, to test multiple 3D printers in simulated shipboard environments and begin designing an active motion compensation platform based on the results. The SBIR abstract notes the Navy's previous attempts to install 3D printers on board ships and poor performance of those devices caused by high frequency ship vibration. Nine months later, in June of 2020, NAVSEA awarded ATR a phase I STTR contract to continue research and development of a VMS in partnership with Michigan Technological University (MTU).

By the time the phase I STTR contract expired on November 16, 2021, ATR and MTU had successfully demonstrated the feasibility of their VMS. They were subsequently awarded a Phase II cost-plus-fixed-fee contract to create a full-size prototype of the VMS and perform lab and shipboard testing. Following encouraging test results, NAVSEA awarded ATR an SBIR Phase III cost-plus-fixed-fee contract on August 10, 2022, to fully develop, mature, and transition the technology for Navy use. That contract is set to expire on August 11, 2027.

THE NAVAL BENEFIT

By enabling shipboard Sailors to print metal replacement parts on demand, ATR's VMS increases mission readiness and ship self-sufficiency while reducing procurement costs and wait times for critical replacement parts. The ability to recreate broken parts onboard as needed can reduce repair-related downtime from days to hours. Instead of storing large inventories of spare parts, Sailors will only need to store the raw materials on board to be able to print parts as needed. These benefits apply to every class of Naval vessel and offer greater value for missions in extended or remote operational environments.

THE FUTURE

NAVSEA is transitioning this technology to its AM program with plans to install it on a shipboard manufacturing lab. ATR will continue maturing the VMS technology for wider Naval deployments as well as exploring potential commercial applicability in the offshore drilling and commercial shipping industries.