

Department of the Navy SBIR/STTR Transition Program

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NAVSEA #2021-0396

Topic # N141-042

Autonomous or Remotely-Operated Maintenance of Ships Tanks
Boston Engineering Corporation

WHO

SYSCOM: NAVSEA

Sponsoring Program: CODE 1223
PNSY

Transition Target: 04T1 – Mr. Rick Anderson

TPOC:
(207) 994-4857

Other transition opportunities:
PMS555 – Mr. Mike McCarraher

Notes: The CLIMBER vehicle is shown transiting through a standard flange opening on Boston Engineering's tank mock-up.



Image Courtesy of Boston Engineering Corporation

WHAT

Operational Need and Improvement: Tank inspection and remediation are critical activities that occur within the maintenance cycle of in-service submarines and surface ships. Rapidly characterizing all conditions within a tank can have a direct impact on the scheduling and costs of shipyard maintenance, which in turn impacts overall vessel operational availability, a critical metric for the US Navy's fleet. Additionally, many ship and submarine tanks include complex, confined, and physically challenging to access regions that stress shipyard personnel and can place them at risk.

Specifications Required: Develop a system that can maneuver from one internal tank bay to another via a standard tank threshold. Ensure sufficient carrying capacity and inspection capability to execute NDT around corners, over tank bays, such that inspection systems can cover 90%+ of the tank spaces. Leverage existing shipyard user interfaces as available and work with existing ship maintenance personnel to ensure applicability to appropriate tanks.

Technology Developed: Boston Engineering has leveraged its extensive experience in ship, hull, and tank crawling robots to enhance inspection capability in a small, back-packable footprint. CLIMBER's advanced platform maneuverability allows for robotic access on all surfaces of a ship's tank and continuous operation from one tank section to another. Combined with a UMAA-compliant software structure, CLIMBER 3rd party sensing tools can be rapidly integrated on CLIMBER's available inspection arm.

Warfighter Value: CLIMBER provides a more ready and available fleet for the Navy through expedited return to service from the shipyards. This is achieved via a more rapid inspection capability, thus decreasing the total amount of time needed for vessel remediation. This decreased inspection and remediation time returns vessels to operation, increasing the US Navy's warfighting posture.

WHEN

Contract Number: N68335-20-C-0044 **Ending on:** October 31, 2022

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Initial Concept Development and Paper Study	N/A	Mathematical model feasibility analysis	3	January 2019
Demonstration of Vehicle Transit Through Oval Tank Threshold	N/A	Unsupported transit through mock-up threshold	5	May 2021
Arm and Initial Sensor Integration	Low	Sensor data reporting through CLIMBER software to remote user	6	May 2022
Full Tank Section Demonstration	Low	90%+ of tank inspection with remote operator	6	September 2022

HOW

Projected Business Model: Acquisition is planned through combined NAVSEA/Shipyard funding, with the focus of providing trial units to the major public shipyards and regional maintenance centers. Acquisition beyond intermediate NAVSEA/Shipyard funding would occur directly with the shipyards themselves, possibly executed under broader Phase III contract. The team is targeting a product available on FedMall (or similar) by 2023-2024.

Company Objectives: Boston Engineering's objective is to transition CLIMBER to support NAVSEA, the regional maintenance facilities, and both public and private shipyards. More broadly, Boston Engineering's efforts with other robotic and sensing platforms position it to be an industry leader in highly capable, highly maneuverable, in-tank data collection. This technology portfolio has received buy-in from Navy R&D and shipyard operations entities with funding in this subject area. Boston Engineering continues to look for interim funding opportunities, additional sponsors, and teammates, to decrease transition risk and overall barriers for Navy adoption.

Potential Commercial Applications: CLIMBER's remote inspection capability is magnified in value when used in confined spaces, challenging to access environments, or areas where human access is complicated by degassing and/or other operator limitations. While common in Navy vessels, these are also challenges in the commercial shipbuilding, vessel maintenance, oil and gas, and energy industries. Boston Engineering recognizes that as these industries optimize their operations, robotic platforms will become even more commonplace. CLIMBER's unique maneuverability and confined space access capability in combination with sensor modularity provides a valuable system for a suite of operations across the industries listed.

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