Department of the Navy SBIR/STTR Transition Program

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NAVSEA #2022-0379

Topic # N192-100
Passive Cooling for Aircraft Carrier Jet Blast Deflectors (JBD)
American Maglev Technology of Florida, Inc.

WHO

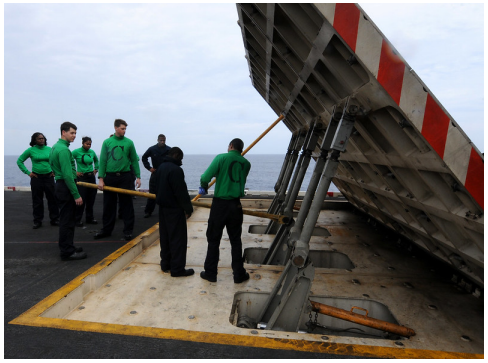
SYSCOM: NAVSEA

Sponsoring Program: Naval Air Warfare Center Aircraft Division (NAWCAD)

Transition Target: Aircraft Launch and Recovery Equipment Program Office (PMA-251)

TPOC: (540) 653-1296

Other Transition Opportunities: Navy Integrated Catapult Control Station (ICCS), Naval Supply Systems Command Weapon Systems Support's (NAVSUP WSS) P-8A Integrated Weapons Support Team (IWST)



U.S. Navy photo by Mass Communication Specialist 3rd Class Kyle Carlstrom/Released

Notes: Each of the Navy's eleven (11) aircraft carriers is equipped with four (4) jet blast deflectors (JBDs) to help manage the thermal shock of an aircraft jet engine on the deck during and after aircraft takeoff. Currently, JBDs must be actively cooled with water, presenting numerous maintenance and safety issues for Navy staff. AMT's passively cooled JBD is designed as a heat sink to absorb the jet blast and allow up to 8 to 10 sorties without the need for an active cooling mechanism. Heat is moved laterally along the surface of the deck, spreading it quickly to a much-enlarged area and enables natural convection from air moving over the deck to remove it more effectively. This technique reduces both radial thermal gradients and actual deck temperatures, reducing buckling and other thermal problems.

WHAT

Operational Need and Improvement: Aircraft carriers are currently equipped with pivotally mounted Mark 7 JBD systems that function to dissipate jet exhaust of aircraft undergoing catapult launch and are cooled by active systems that tap the fire mains to circulate seawater through water lines within the deflector panel. These systems are fraught with maintenance issues, including corrosion from the salt in the seawater, frequent leaks in the hydraulic piping system, and extremely high deck temperatures that can pose safety concerns for carrier staff.

Specifications Required: The Navy seeks a passively cooled JBD system that can reduce operating and maintenance costs by up to 40% by eliminating the seawater cooling lines and remaining capable of withstanding both the heat and pressure forces that impinge on its surface as a result of aircraft jet blasts. The replacement for the JBD system replacement must fit into the existing Flight Deck Pit cavity currently occupied by the Mark 7 system. It should allow multiple aircraft sorties without exceeding a surface temperature of 200F one minute after jet takeoff. The surface profile and inclination will be adequate to protect any aircraft located behind and in front of the JBD system.

Technology Developed: AMT has integrated two key technologies developed at Oak Ridge National Laboratory (ORNL) to create a novel method using both thermally conductive and insulative materials to effectively mitigate local deck heating at low cost, without moving parts and liquids, and in a fashion that adds no workload or complexity to ships' crews. This method utilizes a high-strength, high-conductivity, and lighter-weight aluminum-cerium (Al-Ce) alloy decking combined structurally and thermally with a highly conductive graphite foam used in conjunction with a low-conduction phase-change material (PCM) to thermally protect the flight deck.

Warfighter Value: Integration of AMT's passive JBD will result in a 50% reduction in weight over the current system. The maintenance burden will be minimized, eliminating the unreliable water lines and all related maintenance issues on the deck. Carrier operations will be enhanced, as more consecutive aircraft sorties will be enabled with a higher degree of safety and without any delays related to the current active cooling protocol.

WHEN

Contract Number: N68335-21-C-0497 **Ending on:** Jun 24, 2022

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Subscale thermal cycling tests	Medium	Temperature under 200F after 8 sorties	4	1st QTR FY23
Fabrication of full-scale thermal panel	Low	Form fitting on deck	5	3rd QTR FY23
Full-scale section thermal cycling test	Medium	Temperature under 200F after 8 sorties	6	1st QTR FY24
Full-scale JBD demonstration testing	Medium	Navy-led demonstration test of full-scale JBD	7	1st QTR FY25

HOW

Projected Business Model: After supporting the Navy in transitioning the technology for use (including test and validation to certify and qualify the system), AMT will spin out a wholly-owned, purpose-driven subsidiary that will sell JBD systems as well as further additions, modifications, and improvements by executive sales directly to U.S. Armed Forces customers.

Company Objectives: AMT's objective is to fully develop, demonstrate, and qualify a passive JBD system for delivery to the Navy for evaluation to determine its capability in meeting the defined performance goals. Through this process, AMT will demonstrate performance through subscale and full-scale prototype evaluation and testing over numerous deployment cycles to verify models, simulations, and Phase I test results.

Potential Commercial Applications: The dramatically lower operations and maintenance costs presented by AMT's design create multiple commercial opportunities in aviation and space, including new infrastructure for emerging vertical takeoff and landing (VTOL) aircraft. This technology may be tailored for use in other critical ship surface areas where cooling of the deck is required or desired, including heat sinks for weapons systems and other sources of high heating that require added efficiency, reduced maintenance costs, and increased lifespan (e.g., electromagnetic aircraft launch systems (EMALS) & other high-power electronics). Commercially, the efficiency of next-generation hot water heaters and thermal wall panels could benefit from this technology.

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