Interphase Materials, Inc.
Guided Missile Submarine SSGN Seawater System Antifouling

Interphase Materials is a specialized engineering company that improves operational efficiency of industrial and defense cooling systems through our proprietary surface treatment technologies. We develop and apply advanced materials to deliver capability enhancements that assist warfighters operate at optimal efficiency. Our nano-coating technology creates a protective film which prevents fouling and improves heat transfer efficiency. The technology, developed for submarine heat exchanger applications, can significantly benefit heat transfer efficiency across various platforms, such as engine and HVAC systems. Interphase Materials’ environmentally-friendly surface treatment improves heat transfer by 5-10% and is easily applied to existing operating systems. Interphase is seeking DoD transition partners to demonstrate the products’ benefits across platforms that experience fouling and efficiency issues to improve their efficiency and position the technology for procurement.

Technology Category Alignment:
Propulsion and Extreme Environments
Structures and Protection

Contact:
Anna Pavlack
apavlack@interphasematerials.com
(412) 956-5500
https://interphasematerials.com/

SYSCOM: NAVSEA
Contract: N00178-18-C-8001

Room: Club Room West
Presenting: Apr 10th at 10:20 AM
Potential Surface Ship Applications for Transition of AST Technology

**WHO**

**SYS.COM:** NAVSEA

**Sponsoring Program:** SEa07

**Transition Target:** OHIO class Guided Missile Submarine (SSGN) condensers and heat exchangers

**TPOC:** (202)781-1262

**Other transition opportunities:** Virginia, Seawolf, and Los Angeles Class Submarines, surface ships' heat exchangers (HX), thermal management for avionics and directed energy systems

**Notes:** Interphase Materials' antifouling surface treatment (AST) has foreseeable impacts across propulsion and condenser systems throughout the Department of Defense (DoD). Interphase has identified a low-risk path forward for the technology that results in high-impact for the Department of Navy (DoN) and ultimately the DoD. Seawater-cooled heating, ventilation, and air-conditioning (HVAC) systems have similar biofouling issues and costly cleanings as components on submarines. In an HVAC application, the AST could provide immediate efficiency improvements, while demonstrating antifouling properties long-term. Ultimately, the similarity of condensers in HVAC will lend itself to derisk our technology for ultimate transition into surface ships and submarines in the DoN.

As shown in the image, the technology has potential impacts across various systems on a surface ship. Applications that require controlled heating and cooling are targets to transition the technology, as they will provide immediate performance enhancements, and therefore power and cost savings.

**WHEN**

**Contract Number:** N00178-18-C-8001  **Ending on:** October 4, 2019

<table>
<thead>
<tr>
<th>Milestone</th>
<th>Risk Level</th>
<th>Measure of Success</th>
<th>Ending TRL</th>
<th>Date</th>
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<tbody>
<tr>
<td>Deployment of Phase II Heat Exchanger Test Rig</td>
<td>N/A</td>
<td>Technology integrates and performs in simulated environment</td>
<td>5</td>
<td>March 2018</td>
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<tr>
<td>Confirmation of AST Performance in Simulated Environment</td>
<td>Med</td>
<td>Quantifiable performance enhancement following AST application</td>
<td>5</td>
<td>September 2018</td>
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<tr>
<td>Extended Duration Performance of AST</td>
<td>Med</td>
<td>Consistent performance enhancement by AST over test duration</td>
<td>6</td>
<td>October 2019</td>
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</tbody>
</table>

**WHAT**

**Operational Need and Improvement:** Interphase responded to the Naval Sea Systems Command’s (NAVSEA) ( NAVSEA’s ) 392 interest in seawater system antifouling methods for submarine propulsion cooling systems’ condensers and heat exchangers. Interphase proposed a unique approach by applying its AST to prevent biofouling on seawater cooled heat exchangers (HXs). Current antifouling methods employed on submarines have proven to be effective at minimizing fouling but have also proven to be costly to the DoN. Interphase Materials has developed an AST that inhibits biological growth, and therefore reduces high costs associated with ship’s force efforts to resolve fouling.

**Specifications Required:** To demonstrate success for this project, the total ownership costs associated with biofouling maintenance and removal procedures must be a reduction from existing submarine procedures. The design requires the novel solution tie into existing seawater piping systems, while (1) meeting high integrity standards (Submarine Safety Program Requirements), (2) minimizing redesign, (3) passing environmental standards for various operation areas, and (4) demonstrating cost savings compared to cleaning costs of clogged seawater systems.

**Technology Developed:** Interphase Materials has developed the AST to prevent biofouling on seawater piping systems, condensers, and HXs for OHIO Class SSGNs. The technology is a nano-layer, surface treatment that when applied to components or systems acts as a barrier layer to inhibit biological fouling. The technology is applied via a system flush, allowing the application process to integrate easily into existing systems for a seamless application process during ship availability. Contrary to traditional coating methods, the surface treatment does not require significant application time and has been shown to improve heat transfer by 5-10%.

**Warfighter Value:** Interphase Materials technology allows ship forces’ efforts and resources to be redirected to mission critical assignments. The AST technology increases duration between maintenance intervals, preventing catastrophic component failures, and increasing the operational performance of the asset. The AST has the potential to save $250K per ship annually through reduced cleaning and maintenance costs associated with hydrolancing, acid cleanings, and hazardous waste disposals as a result of biofouling.

**HOW**

**Projected Business Model:** Interphase Materials has the ability to manufacture and produce the AST in-house, as well as apply the technology to systems and components with a team of engineers. Currently, Interphase has the ability to scale the technology and to-date has successfully completed multiple commercial jobs, ranging from component to full-system applications. Interphase Materials is equipped to produce AST materials to treat a 3-megawatt power plant system. Because the AST is prepared in batches for specific jobs, the Interphase team is working towards expanding to full-production scale for future, large-scale operations.

**Company Objectives:** Interphase Materials intends to further develop and grow the technology for heating and cooling applications across the marine, HVAC, and power industries DoD-wide and commercially. Currently, Interphase Materials is seeking transition opportunities to demonstrate the AST technology on shipboard applications as a pathway to application on SSGN condensers. The company has developed a plan for an application on an HVAC system on surface ships to demonstrate heat transfer improvements. The goal of this effort is to immediately impact DoN operations through reduced energy costs, while demonstrating the long-term antifouling benefits of the AST. The team is also interested in discussing new applications for the AST, including thermal management for avionics and directed energy systems.

**Potential Commercial Applications:** Biofouling, in various forms, takes a toll on water-cooled systems. Interphase Materials has focused on transitioning the technology to applications that experience fouling, such as HVAC and power industries, to improve operational efficiency of these systems. While preventing biofouling, the AST demonstrates an improvement in heat transfer efficiency which translates to cost savings through reduced energy consumption. To date, Interphase Materials has treated multiple heating and cooling systems regionally and internationally with initial results showing significant power and cost savings.

**Contact:** Anna Pavlack, Vice President of Federal Initiatives

apavlack@interphasematerials.com  (412) 956 5500