

Retractable Bow Planes Extend/Retract System Improvements Effort Addresses Bow Plane Failures

Status: **Implemented**

PROBLEM / OBJECTIVE

The VIRGINIA Class Submarine (VCS) retractable bow plane extend/retract hydraulic cylinders are experiencing premature failures of hydraulic seals due to buildup of calcareous deposits on the rods. The focus of this project was to optimize the process for applying a selected coating and apply to a full-scale cylinder rod for system testing at General Dynamics Electric Boat (GDEB).

ACCOMPLISHMENTS / PAYOFF

Process Improvement:

During Phase I, a down-selected coating was applied to a full-scale prototype hydraulic cylinder rod for use in testing at GDEB. The test evaluated the compatibility of the coating with the seals and the ability of the coating to meet the system requirements. Phase II efforts focused on the qualification of the coating system with the cognizant technical authorities, followed by identification and certification of an appropriate vendor for fabricating the coating system. Over the course of the project, the application process for the coating was optimized for increased adhesion strength and microstructural consistency, a full-scale coated test rod was successfully tested against VCS Retractable Bow Plane system requirements (seal life and survivability under side load), and the optimized coating demonstrated that it is not susceptible to cathodic disbondment during Navy Lab testing. Additionally, a vendor qualification plan and a procurement specification were developed to impose qualification and process control requirements in excess to those specified in MIL-STD-1687 to ensure the quality of the coating as the project transitions into the production phase

Implementation and Technology Transfer:

Qualification samples meeting all requirements detailed in the Qualification Test Plan were sprayed by the coating vendor and the results were submitted to NAVSEA to support approval of the first qualified coating vendor. The first vendor was qualified by NAVSEA. The design change is with SOSG and NAVSEA for approval. The design has been advance issued by GDEB for SSN 792, 793, and 794; and is expected to be implemented on all Block IV boats.



Typical ASTM C633 Adhesion Strength Test Specimen

Expected Benefits and Warfighter Impact:

- \$9.5M/Hull overall life cycle savings
- Minimize impact on operation envelope

TIME LINE / MILESTONES

Start Date:	Aug 2013
End Date:	Aug 2015

FUNDING

Navy ManTech Investment (NSAM + iMAST):	\$1.225M
PMS 450 Investment:	\$4.9M

PARTICIPANTS

ONR Navy ManTech
PEO Submarines (PMS 450)
General Dynamics Electric Boat
Naval Shipbuilding and Advanced Manufacturing Center
Institute for Manufacturing and Sustainment Technology