

Nano-ceramic Coatings for VCS Main Propulsion Shafts Could Create Life-cycle Savings

Status: Technical Success

PROBLEM / OBJECTIVE

The inspections of in-service Virginia class submarine (VCS) main propulsion shafts have revealed noticeable grooving of the electro-slag strip (ESS) cladding on the propulsor bearing journal. The main objectives of this ManTech project were to (1) evaluate potential solution(s) to the observed bearing journal wear issues on the VCS main propulsion shafts, and (2) identify those solutions with a high likelihood of increasing the current shaft replacement cycle from 72 to no less than 96 months.

ACCOMPLISHMENTS / PAYOFF

Process Improvement:

The Navy Metalworking Center (NMC) designed and fabricated a shaft and bearing test stand that was capable of inducing wear and grooving. NMC used this test stand to evaluate several bearing / journal material combinations. After evaluating various methods for producing the Alloy 625 journals (cast, clad and nano-ceramic clad), the project team determined that the nano-ceramic clad journals had the lowest total wear and the shallowest grooves of all journals tested. In addition, the nano-ceramic coating, when applied to the clad shaft, demonstrated very good adherence and high damage tolerance.

Implementation and Technology Transfer:

This project's results and recommendations, as well as other separate, coordinated Navy efforts, will be used by the Navy Shafting and Bearing Research and Development Integrated Product Team to formulate and execute appropriate actions to address the grooving observed on in-service VCS propulsor shafts. Results from this effort are also being leveraged by the Ohio Replacement Program.

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Alternative journal and bearing material combinations could reduce material and labor costs associated with VCS propulsion shaft replacement. NMC photo

Expected Benefits and Warfighter Impact:

While it has not been qualitatively determined that a 96-month shaft replacement can be met, the results obtained during the project justify continued work in the use of nano-ceramic coatings for shafting applications as a means of meeting this objective. With this increase in the operational life of the shaft, life-cycle savings in terms of decreased maintenance availabilities will be achieved.

TIME LINE / MILESTONE

Start Date: November 2010
End Date: May 2014

FUNDING

Navy ManTech Investment: \$2.9M
Cost Share: (PMS 450) \$20K
(PMS 397) \$900K

PARTICIPANTS

PMS 450 (VCS Program Office)
Naval Surface Warfare Center, Carderock Division
Naval Sea Systems Command
Electric Boat Corporation
NMC
ONR Navy ManTech