

**Office of Naval Research Oceanographic Research Vessels
Propulsion Thruster Reliability Improvements
Statement of Work**

Background

The US Office of Naval Research (ONR) owns six oceanographic research vessels, which are charter leased to academic institutions for operations and maintenance in support of Navy and national ocean science research objectives. Five of the six ships are mono-hull with propulsion provided by azimuthing main propulsion thrusters known as Z-drives. Z-drive equipped ships were introduced into the research fleet in 1991 upon completion of the mid-life refit of research vessels KNORR and MELVILLE, and the delivery of three ships of the THOMPSON Class beginning in 1993. Z-drives were selected for their excellent station keeping and maneuvering characteristics. Initial operations confirmed the value of this improved capability during at sea operations. Between 1993 and 2001 a problem with Z-drive lower unit gear set failures was identified and successfully resolved. Recently, a new problem with failure of shafts in the Z-drives has arisen. Possibility of fatigue failure in thruster components is of serious concern to ship operators, the funding agencies (ONR and the National Science Foundation), and to scientists who have lost and could stand to lose additional, irreplaceable research time at sea. In 2009 and 2010 almost a full ship year was lost due to thruster failures. Of note is the fact that some of the research vessel Z-drives have operated for over 88,000 hours in the past 15 years, and can be expected to operate for as many as 25 more years.

Scope/Objectives

ONR requires an effort to focus on identification of thruster components with highest potential for fatigue failure, determination of methods to identify impending failures and actions to minimize the possibility of unexpected casualties through component replacements, etc. Current inspection procedures and techniques should be reviewed, and emerging technology that has potential to improve inspections should be evaluated. Frequency of inspections and component replacements should be evaluated in view of the above failure analyses and a recommended plan developed.

Requirements/Tasks

1. Collect documentation on thruster failures since publication of Glosten Z-DRIVE RELIABILITY STUDY File No. 01038 of 25 June 2001.
2. Expand past failure history to include failures occurring since completion of referenced Glosten report.
3. Develop record of lower unit transfers between THOMPSON, REVELLE, ATLANTIS and BROWN.
4. Identify case depth and test record for each gear set currently installed in every lower unit to allow accurate future tracking and scheduling for gear replacement if needed due to reaching manufacturer's "Calculated Infinite Life". Identify gear sets still requiring upgrade to revised case depth and tooth contact specifications. Collect and review overhaul records of each upper, intermediate and lower Z-drive unit to identify any

recurring problems across the fleet. Review action taken to correct problems found during overhaul.

5. Conduct detailed study of system drawings to identify potential failure points. Specifically, examine shafts and other rotating elements for key stress points that could lead to fatigue failures. Conduct failure analysis on shafts. Determine when components will reach "Infinite Life" and develop recommendations for replacement.
6. Identify inspection procedures with ability to better identify potential developing failures. Provide recommended changes to inspection procedures.
7. Evaluate current guidance regarding frequency of Z-drive overhauls to determine if periodicity is adequate. Recommend change in guidance if warranted.
8. Review overhaul costs to determine projected maintenance costs until projected ship retirement dates with and without a mid-life refit.
9. Provide recommendations regarding enhanced Z-drive overhaul procedures including replacement of internal elements, including shafts, to ensure a 35 year reliable life.
10. Develop recommendations for replacement of current systems if sufficient reliability cannot be achieved.

Offeror's Qualifications

The successful offeror shall have extensive experience in marine engineering propulsion systems, and specifically the azimuthing main propulsion systems known as Z-drives. The successful offeror should have extensive experience with the mission, operation, maintenance and overhaul of oceanographic research vessels, and particularly understands the typical usage of the thrusters in support of specific oceanographic missions, as performed by the ONR oceanographic research vessels. The successful offeror shall have experience in analyzing thruster failures.

Deliverables

Deliverables shall consist of a Monthly Progress Report and a Final Report outlining results of requirements/tasks in accordance with the Contract Data Requirements List (CDRL), DD Form 1423, see Exhibit A.