

Nondestructive Evaluation and Underwater Repair of Composite Structures

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Composite materials are gaining popularity in U.S. Naval applications because of their unparalleled strength, stiffness, and manufacturing simplicity. A better understanding of the structural integrity of these materials has the potential to reduce overdesign, decrease manufacturing cost, and simplify repairs.

Though underwater nondestructive evaluation of composites has not been well documented, this thesis illustrates the available technologies for underwater evaluation and repair of laminated composite structures, similar to those currently used in marine applications. Dependent on accuracy and reliability of underwater evaluation, the decision to pursue temporary or permanent repairs may be made based on available information regarding the structural integrity of the effected repairs.

Discussion of the environmental effects on composite laminates and their repairs is included to provide insight into the detrimental effects of contaminants such as saltwater and petroleum products. The effect of the environment has a profound impact on the quality of composite repairs using currently available repair materials.

Underwater repairs, whether permanent or temporary, are suggested for future U.S. Navy components such as the DDG-1000 composite twisted rudder. Furthermore, a suggestion is made to eliminate the use of cofferdams on U.S. Navy shaft covering repairs in order to reduce both cost and the risk of injury associated with a cofferdam.