

# **Optimized Design and Structural Analysis of a Non-Pressurized Manned Submersible**

**CDR Ken Shepard, USN**

<b>Dr. John Leonard</b>	<b>Prof. Mark Welsh</b>
Thesis Supervisor	Thesis Supervisor

The U.S. Navy's non-pressurized manned submersible (NPMS), the SEAL Delivery Vehicle (SDV) MK 8 Mod 1, remains the United States military's most elite and clandestine method for inserting and extracting Special Operation Forces from the maritime environment. However, in its existing configuration it is unable to meet the growing demand of future missions. A recent SDV optimization study conducted by Charles Stark Draper laboratory investigated cost-effective modifications within the existing hull to meet the new performance requirements required by Naval Special Warfare Group Three (NSWG-3). This project developed a parametric and structural analysis model of a NPMS which is based on the SDV optimization study's design concept, as an initial design tool to evaluate future NPMS designs. Based on a set of design requirements, the parametric model runs several constrained optimizations to generate a SolidWorks solid model of the hull and variable ballast tanks. ANSYS finite element software is then used to perform goal driven optimizations of the solid model to further refine the structural elements. The end product is an optimized solid model of the hull structure and variable ballast tanks that meets the specified set of design requirements. The approach combines the rapid solutions obtained from a parametric mathematical model with the more accurate, but computational intensive, finite element optimization method.

**Master of Science Naval Architecture and Marine Engineering**

**Master of Science in Mechanical Engineering**