

# High Strength Marine Grade Fasteners

Status: Transitioned

## PROBLEM / OBJECTIVE

Surface ship and submarine components face unique challenges caused by their exposure to harsh marine environments. Of particular concern are the large diameter fasteners used to attach various components on the Seawolf (SSN-21) and Virginia (SSN-774) Class Submarines. Corrosion concerns require that the existing fasteners be replaced at periodic intervals to preclude catastrophic failure. The objective of this project was to identify a solution that would increase the reliability and strength of these fasteners, while reducing life-cycle costs.

## ACCOMPLISHMENTS / PAYOFF

### **Process Improvement:**

A wide variety of materials was evaluated for strength and corrosion resistance before the cobalt-nickel alloy MP98T was selected as the best candidate material. The material manufacturing process was then adjusted to obtain the required strength and toughness levels and to ensure that the fasteners could be produced from MP98T without extraordinary measures or a deterioration of the material properties. Smaller diameter MP98T fasteners were fabricated to test the material properties, including corrosion resistance. Once satisfactory test results were achieved, a large diameter (3.5 inch) hex-head fastener was fabricated. (The hexagonal shape was selected for the proof-of-concept fasteners because it was deemed the most difficult head geometry to fabricate.) Material testing conducted on the finished, large diameter fasteners confirmed that the desired material properties were not adversely affected by the fabrication processes. The data from this project will be used to create a new fastener material specification for MP98T.

### **Implementation and Technology Transfer:**

The MP98T fasteners are expected to last for the life of the submarine without mechanical or corrosion failure. Smaller diameter MP98T fasteners have been authorized for use for the pad eyes of the Advanced SEAL Delivery Systems used on the SSN-21 Seawolf, SSN-22 Connecticut, SSN-23 Jimmy Carter, USS Virginia and the USS Texas submarines.



A large-diameter (3.5 inch) MP98T marine grade fastener.

### **Expected Benefits:**

- Total cost avoidance of \$1.1M per fielded submarine per year
- Reduced life-cycle costs of \$220,000 per each of five applications, per year, per submarine
  - propulsor, Advanced SEAL Delivery System, dry deck shelter, high frequency sail array and wide aperture array
- Improved reliability; to date no corrosion has been reported
- The potential for reduced weight through submarine component redesign afforded by MP98T's higher strength

## TIME LINE / MILESTONE

Start Date: January 2002

End Date: January 2005

## FUNDING

Total ManTech Investment: \$0.73M

Cost Share: None

## PARTICIPANTS

- National Center for Excellence in Metalworking Technology (now the Navy Metalworking Center)
- NAVSEA
- Carderock Division, Naval Surface Warfare Center
- Timken Latrobe Steel
- SPS Technologies
- Wodin, Inc.
- General Dynamics Electric Boat.