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Naval Submarine Medical Research Laboratory Groton, CT

The United States Submarine service has a long and proud tradition of developing and operating with leading edge technologies. The Naval Submarine Medical Research Laboratory (NSMRL) is a major contributor to integrating these technologies into submarine crew operations. NSMRL is DoD's Center for Undersea Biomedical Research. The laboratory's mission is to protect the health and enhance the performance of warfighters through submarine, diving and surface biomedical research solutions. Established in World War II to conduct mission critical studies in night vision, sonar sound discrimination, and personnel selection, NSMRL continues to serve the fleet by taking the lead in undersea bio-effects and human factors, sensory sciences and operational medicine.

Located on Submarine Base New London, Groton, CT, NSMRL researchers have access to submarine squadrons in Submarine Group Two; the Navy Submarine School; the Naval Submarine Support Facility; Naval Undersea Medical Institute; and the Electric Boat Division of General Dynamics, which builds the nation's submarines. The laboratory is staffed by a diverse group of psychologists, audiologists, physicians, physiologists, electrical, biomedical and nuclear engineers, divers, sonar technicians, and hospital corpsman. Several colleges and universities are located in the same area, including the US Coast Guard Academy, Connecticut College, and the University of Connecticut.

NSMRL's accomplishments continue to be many and varied, and include scientifically based recommendations for submarine rescue procedures, submarine atmosphere limits, waivers for clinical medical conditions, advanced sonar system capabilities, diver/sonar safe distances, and symbology for visual displays.

NSMRL Scientists and Divers Touched by History



A research team of scientists and divers dove into history when they collected research data as part of a preservation project for the USS ARIZONA memorial in Pearl Harbor, HI. The team worked with Mobile Diving and Salvage Unit 1 and the National Park Service, taking underwater noise measurements of a new hydraulic tool designed to remove samples of the battleship's hull for metallurgical analysis. The research team had two jobs to do, collect underwater noise levels as part of NSMRL's two-year comprehensive in-water noise survey project and determine the on-site permissible noise exposure level for the divers. Team members also performed working dives to assist in completion of the

preservation project. In the picture above, NSMRL's Diving Program Manager, Mr. Frederick Donlon (Master Diver, USN-RET) is seen coming out of the water with the hydrophone that measures in-water noise levels strapped to the top of his Mark-21 diving helmet. This is an example of Navy scientists and divers working side-by-side with working dive lockers and other government agencies to accomplish both research data collection and provide direct fleet support.

Diving and Environmental Simulation Department

- Diving and Environmental Simulation department focuses on ways to optimize the safety and performance of Navy divers by investigating diver performance for a variety of environmental factors including sound exposure, thermal stress, and breathing gas conditions. Underwater noise can impact a diver through damage to hearing and internal organs, such as the lung and brain. Applied research includes reducing workplace hazards, providing underwater noise-protection tools and developing underwater force protection. A critical part of the program is the on-going direct fleet support regarding guidelines for operational limits due to underwater noise. These guidelines are developed directly from the basic research data collected by the laboratory.

Submarine Medicine & Survival Systems Department

- Submarine Medicine researchers focus on ways to optimize the health and job performance of undersea warfighters and reduce attrition and health impact due to psychological and physical conditions. The department includes the NAVSEA-sponsored Submarine Atmosphere Health Assessment Program.
- Survival Systems researchers conduct basic and applied research and development in the biomedical and bioengineering aspects of submarine casualties by developing equipment, procedures and guidance to optimize submarine disaster survival. The researchers serve as subject-matter experts on submarine rescue and escape for the operational fleet, policy makers and industry.

Operational Sensory Department

- Hearing Conservation focuses on ways to identify the early stages of noise-induced damage to the human ear to prevent noise-induced hearing loss. Current research involves the evaluation of new methods for evoking otoacoustic emissions, an objective test that is thought to be sensitive to the early stages of noise-induced hearing loss (NIHL) and a measure of susceptibility to NIHL. The team's approach is to evaluate these methods both in the laboratory for validity, reliability, and sensitivity to temporary noise-induced changes; and in the field with noise-exposed at-risk personnel for detecting the early stages of permanent noise-induced changes.
- Information Processing and Display scientists focus on ways to optimize the quality of information presented to Navy operators (e.g., officer of the deck, fire control and submarine sonar consoles) by decreasing operator workload and improving the human-machine interface. Displays that help the operator separate desired from undesired information will increase situational awareness; reduce workload; and improve the identification, classification and tracking of signals of interest.

Achievements:

- Sea Lab I undersea habitat project
- Development of the International Orange Color (Air-Sea Rescue Red)
- Disabled Submarine Escape and Rescue project
- Saturation diving and decompression tables
- Hearing conservation in noisy environments
- Safe exposure guidance for personnel in the presence of intense low and high frequency sonars.
- Studies of nitrogen narcosis
- Effects of atmospheric constituents on health and performance in enclosed environments
- Pressurized Submarine Rescue Manual
- Data-based medical qualification policies
- Farnsworth lantern for screening color vision
- Underwater acoustic signal discrimination and classification