Naval Submarine Medical Research Laboratory

Fact Sheet

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 human factors, sensory sciences and operational medicine.

Located on Submarine Base New London, Groton, CT, NSMRL conducts research into Submariner Wellness, Psychological Fitness, Shipboard Health and Performance, Underwater Bioeffects, and Submarine Survival & Escape. Researchers work with many partners including the Naval Undersea Warfare Center, Naval Medical Center San Diego, NASA, NAVSEA, Navy Experimental Diving Unit, U.S. Army Research Institution of Environmental Medicine and others. NSMRL has a Memorandum of Agreement with Commander, Submarine Forces to serve as their human technology laboratory. NSMRL researchers have local access to three submarine squadrons; 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, and electrical, biomedical and nuclear engineers. Several colleges and universities are located in the same area, including the U.S. 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 engineering design for visual displays.

Research Areas

Submarine Medicine & Survival Systems Department

NSMRL conducted research and evaluation on carbon dioxide scrubbing technologies that doubled survival time in a disabled submarine scenario. Additionally NSMRL developed submarine disaster survival and escape procedures and guidance (Guardbooks). Other work includes the development of new submarine atmosphere limits for mixed gender crews and deep submersibles, disruption of submariner circadian rhythms from submarine watchstanding cycles, developing circadian phase-lock guidelines for Special Forces, monitoring of submarine atmosphere contaminants through the Submarine Atmosphere and Health Assessment Program, testing and evaluation of DoN Hearing Conservation Program efforts, and initiating the Submariner Epidemiology Research Program.

Warfighter Performance Department

NSMRL is the Navy's lead on psychological selection of submariners, gender integration into submarines, and the bioeffects of underwater sound. NSMRL is currently developing a Bioeffects Model for Underwater Sound, providing DoD guidance on various underwater sound exposures (SONAR systems, blast, pile driving, etc.). Additional efforts include development and testing of noise measurement systems, integrated periscope displays, improving diver sound localization, and underwater tool noise.

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Submariner Wellness

Submariner Wellness NSMRL conducts hearing conservation efforts from basic research to applied research, such as the ability of otoacoustic measurements to predict hearing loss, through a toolkit to assist field audiologists in hearing education, to field studies onboard the Littoral Combat Ships. Physical Health studies include Bone Density/Vitamin D studies on board submarines. NSMRL initiated the first-ever study of Submariner Epidemiology which monitors the medical impacts of the unique submarine environment.

Psychological Fitness

Psychological Fitness includes psychological screening of prospective submariners for submarine service suitability (SUBSCREEN), prediction of unplanned losses from operational units, individual and team resilience, and integration of mixed gender crews.

Shipboard Health and Performance

Shipboard Health and Performance includes submarine atmosphere effects for mixed gender crews and Submarine Atmosphere Monitoring (SAHAP) to ensure submariner health. Circadian Rhythm research to maximize performance includes evaluation of watchstanding cycles, lighting to improve vigilance, and entraining Special Forces. Assess the effects of elevated carbon dioxide exposure on submariner decision making.

Submarine Survival and Escape

Submarine Survival and Escape is a diverse set of projects that include studies of the environmental stresses encountered during submarine escape and survival, non-invasive biomarkers of pulmonary oxygen toxicity, test and evaluation of oxygen concentrators and survival hydration packs for use under environmental extremes, and development of the Submarine Rescue Manual (Guard Book) for different classes of submarine.

Underwater Bioeffects

Underwater Bioeffects includes underwater human factors research including high frequency underwater hearing and underwater sound location, assessment of nonlethal underwater bioeffects of sound and blast, diving physiology studying hyperbaric stress alleviation.

Human Systems

Human Systems covers human perception including how to display panoramic visual data and integrate audio cues as well as Command Decision-Making Processes in Submarines and evaluation of team performance.

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