NSMRL

Naval Submarine Medical Research Laboratory

Approved for public release, distribution unlimited

November 2022

MISSION

To sustain the readiness and superiority of our undersea warriors through innovative health and performance research.

VISION

To lead the world in delivering science solutions to ensure undersea warrior dominance.

The Naval Submarine Medical Research Laboratory (NSMRL) delivers research solutions to promote the health, welfare, and performance of undersea warfighters. Located onboard Naval Submarine Base New London, NSMRL scientists have local access to Submarine Squadrons 4 and 12, the Naval Submarine School, the Submarine Learning Center, Submarine Readiness Squadron 32, the Naval Undersea Medical Institute, the Undersea Warfighting Development Center, and submarine design and construction company: General Dynamics Electric Boat.

Staffed by a diverse group of psychologists, audiologists, physicians, physiologists, and engineers, NSMRL's research areas include: health and performance; submariner psychological fitness and resilience; human systems integration; submarine atmospheric monitoring; bioeffects of underwater sound and blast; hearing conservation; diving and hyperbaric research; disabled submarine survival, escape, and rescue; and submariner- and diver- focused epidemiology.

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Working with NSMRL:
A sample of our Partners and Collaborators

We engage in strategic partnerships and collaborations with multiple military, public, and private institutions. The distinct strengths of these partners, combined with NSMRL's unique capabilities, enhances the Navy's ability to advance the health, performance, and readiness of its undersea warfighters.

Naval Information Warfare Center

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LEADERSHIP

REAR ADMIRAL
GUIDO VALDES, MC, USN
COMMANDER, NMFP

Rear Adm. Guido F. Valdes is a native of San Juan, Puerto Rico. He holds a Bachelor of Science Degree in Biology from the University of Miami, Florida. He earned his Doctor of Medicine degree from the University of Miami School of Medicine in 1992 as a Navy Health Professions Scholarship recipient and upon graduation reported for active duty.

Valdes' professional training includes transitional internship at the National Naval Medical Center and emergency medicine residency at Naval Medical Center Portsmouth. He is board certified by the American Board of Emergency Medicine.

He has served in various positions throughout Navy Medicine to include General Medical Officer, Branch Health Clinic Gaeta, Italy; Staff Emergency Physician, U.S. Naval Hospital Naples, Italy; U.S. Naval Hospital Rota, Spain; and Naval Medical Center Portsmouth; Executive Officer, Naval Hospital Pensacola; Commanding Officer, Naval Health Clinic Corpus Christi; and Deputy Commander, Naval Medical Forces Atlantic.

Operationally, he served as Officer In Charge of the Shock Trauma Platoon/Forward Resuscitative Surgical Site at Camp Korean Village in Al-Anbar province, Iraq during Operation Iraqi Freedom; Officer In Charge, Fleet Surgical Team Six; Force Surgeon, Riverine Group One; Executive Officer, Role 3 Multinational Medical Unit, Kandahar, Afghanistan during Operation Enduring Freedom; and Force Surgeon, U.S. Naval Forces Central Command/Fifth Fleet. RDML Valdes assumed duties as Commander, Naval Medical Forces Pacific, May 20, 2022. He has oversight of 10 Navy Medicine Readiness and Training Commands on the West Coast and Pacific Rim that train, man, and equip medical forces, primarily in military treatment facilities, as well as Navy Medicine's eight global research labs. Valdes also serves under the Defense Health Agency as the director of the San Diego Medical Market where he oversees the delivery and integration of healthcare for beneficiaries seen at Naval Medical Center San Diego and Naval Hospital Camp Pendleton.

RDML Valdes is qualified as a Fleet Marine Force Warfare Officer. His personal decorations include the Legion of Merit (two awards), Meritorious Service Medal (four awards), Navy Commendation Medal (two awards), Navy Achievement Medal and various other unit and campaign awards.

CAPTAIN
WILLIAM DENISTON, MSC, USN
COMMANDER, NMRC

CAPT Deniston is a native of Carbondale, Illinois and graduated from Southern Illinois University – Carbondale (SIU-C) in 1989 with a BA in Psychology, an MA in 1993, and his Ph.D. in 1997 in experimental psychology. He was commissioned in December of 1996 as a Naval Officer in the Medical Service Corps as a Research Psychologist.

Following Officer Indoctrination School, he reported to his first duty station at the Naval Health Research Center (NHRC) in San Diego, California, where he focused on operationally relevant medical research and conducted test and evaluation of medical technologies. In January 2000 he became the first Program Manager for the Field Medical Technologies department, the only LT to hold the title.

CAPT Deniston reported to Space and Naval Warfare Systems Center – San Diego in September 2001 as a project manager on the medical data surveillance system (MDSS) and he was selected as Head of Performance Improvement for a 540 person department and as a co-lead for performance improvement and strategic planning for the command.

In October 2004,he reported to the Office of Naval Research (ONR) as the Deputy Director of the Neural, Cognitive, and Social Science & Technology Division. In January 2005, he was selected as the Deputy of the Department of the Navy (DON) Human Research Protections Program Working Group and in September 2005 he was selected as the Deputy Director of a new Research Protections Division at ONR.

In September 2007 CAPT Deniston reported to the Bureau of Medicine and Surgery (BUMED), hand selected to be the first Deputy Director of the newly established DON Human Research Protection Program (DON HRPP). DON HRPP provides oversight and monitoring of human subject research which allows the Navy to continue over 1600 research protocols. In January 2010, he reported to the Office of the Naval Inspector General as Assistant Inspector General for Command Climate Evaluation. His work there was instrumental in assessing the readiness and quality of life for military service members, navy civilian employees, and their families, information that was provided to the Secretary of the Navy and Chief of Naval Operations for decision.

CAPT Deniston reported to BUMED as the Program Manager for Deployment Mental Health Research in the Wounded Ill and Injured (WII–M9) in December 2012. In May of 2013 he was appointed as Strategic Integration for WII/M9 and where he later served as Acting Director, DON HRPP, concurrently with his WII/M9 responsibilities. In December 2013 he was appointed as Director, DON HRPP, responsible for the oversight and monitoring of all human subject research in the Navy and Marine Corps and DON sponsored extramural institutions.

CAPT Deniston served as the Executive Officer, Naval Medical Research Center (NMRC) from May 2017 to June 2019. From June 2019 to May 2021, he served as the Commanding Officer, NHRC. In June 2021 he assumed the duties as Commander, NMRC.

CAPTAIN
MATTHEW H. JAMERSON, MSC, USN
COMMANDING OFFICER, NSMRL

Captain Matthew Hunter Jamerson, a native Marylander, graduated Summa Cum Laude from Drexel University in 1995 with a Bachelor of Science in Biological Sciences. In 2003, he earned his Ph.D. in Tumor Biology, an interdisciplinary program encompassing Biochemistry and Molecular Biology, from Georgetown University. His dissertation focused on the role of genes in the development and natural history of breast cancer using genetically-engineered mice as tumor models. Prior to joining the Navy, his work experiences included serving as an Acoustical Engineering Aide in the Sonar Self-Noise Group at the former David Taylor Naval Research Center in West Bethesda, Maryland, and serving as a Research Assistant Scientist in the Reproductive Toxicology Group at the former SmithKline Beecham Pharmaceuticals in Swedeland, Pennsylvania. In October 2003, he was commissioned a Lieutenant in the Medical Service Corps as a Biochemist.

Following Officer Indoctrination School, then LT Jamerson was assigned to the Navy Drug Screening Laboratory (NDSL) in Great Lakes, Illinois, where he served as the Quality Control Department Head, the Assistant Technical Director, and the Operations Officer. In December 2006, LT Jamerson reported to the Division of Forensic Toxicology, Armed Forced Medical Examiner System (AFMES), in Rockville, Maryland, where he served as the Chief of Technical Services and Chief of Quality Assurance. In August 2009, LT Jamerson reported to NDSL Jacksonville as the Executive Officer. In August 2012, LCDR Jamerson reported to NDSL San Diego as the Executive Officer. Following successful command screening, LCDR Jamerson assumed command of NDSL San Diego in September 2014 through that command's dis-establishment on 1 February 2017 and then served as the Senior Officer for that command's decommissioning completed in October 2017.

In October 2017, CDR Jamerson reported to the Navy and Marine Corps Public Health Center (NMCPHC) as Director for Laboratory Services (with oversight for both the Navy Bloodborne Infection Management Center and the Naval Dosimetry Center) and as the DON Drug Testing Program Manager (overseeing two remaining NDSLs).

In June 2020, CDR Jamerson reported to the Naval Health Research Center, the DoD's deployment health research hub, as the Executive Officer, and in September 2021, he was promoted to the rank of Captain.

In July 2022, CAPT Jamerson assumed command of the Naval Submarine Medical Research Laboratory (NSMRL).

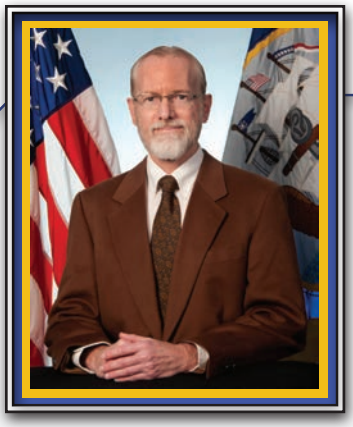
CAPTAIN
JENNIFER BUECHEL, NC, USN
EXECUTIVE OFFICER, NSMRL

CAPT Jennifer Buechel, a native of Woodhaven, Michigan (MI), received a Bachelor of Science in Nursing from Wayne State University in 1997, a Master of Science from San Diego State University in 2008, and a Doctor of Philosophy in Nursing from the University of San Diego in 2016. CAPT Buechel began her career as a Medical Surgical Nurse and Critical Care Nurse at Henry Ford Hospital in Detroit, MI. In 1998, she joined the Navy Reserves with Fleet Hospital Nine (Great Lakes) through the Direct Commission Officer program. In 1999, she volunteered for active duty, and attended Officer Indoctrination School in Newport, Rhode Island and transferred to Naval Medical Center Bethesda as a Staff Critical Care Nurse with an operational platform aboard the USNS COMFORT.

In 2001, CAPT Buechel transferred to Naval Hospital Sigonella, Italy to serve as a Staff Emergency Room (ER) Nurse. In 2002, she was assigned to Naval Hospital Camp Pendleton and served as the Intensive Care Unit (ICU) Division Officer and Staff Critical Care Nurse. In 2006, she was accepted to her first Duty Under Instruction (DUINS) for an Adult Geriatric Nurse Practitioner (ANP) and Critical Care Clinical Nurse Specialist (CNS) program. In 2008, she transferred to Naval Hospital Guam as the ICU Division Officer, ICU CNS, Staff ER Nurse, and ANP. Following that, she was assigned as the Ship's Nurse and Medical Training Team Leader aboard USS HARRY S. TRUMAN where she earned her Surface Warfare Medical Department Officer warfare qualification. In 2012, she was accepted for a second DUINS, and completed her PhD in Nursing with honors (Magna Cum Laude).

After earning her PhD, CAPT Buechel was assigned as a Nurse Scientist at Naval Medical Center San Diego (NMCSD) and served as the Associate Director for Professional Education and Clinical Investigations Department Head. Throughout, she maintained her operational skill set by working in the ICU, teaching trauma/resuscitative courses, and training as a Critical Care Nurse for Expeditionary Medical Facility Bravo. In addition, she was the Navy Medicine Pacific Research Manager, responsible for the approval, oversight, and support for over 450 human and animal research protocols for 13 military treatment facilities and dental centers including six directly in support of the fight against COVID -19 pandemic. In May 2021, she transferred to as Executive Officer NSMRL to serve as Executive Officer.

CAPT Buechel is the Navy Lead for the Tri-Service Nursing Research Program's Women Health Research Interest Group, a Department of Defense Women's Health Consortium Member, is certified/licensed as a Nurse Practitioner, a CNS, a Critical Care Registered Nurse, Certified Emergency Nurse, Advanced Cardiac Life Support Instructor, and Trauma Nursing Core Course Instructor.



Ben Lawson, PhD
Technical Director

- *Orientation*
- *Motion Maladaptation*
- *Cognition*
- *Human Factors*

Ben Lawson has 27 years of experience in Navy and Army laboratories. He is an expert on spatial orientation, especially vestibular-tactile psychophysics, illusions of self-motion, motion/simulator sickness, and motion-induced drowsiness. He also has published on psychomotor coordination, situation awareness, auditory perception, cognitive performance, mishap analysis, human factors, pharmacological countermeasures, survey scales, teamwork, and technology transition. In addition to his research, he has transitioned materiel products and military standards. Dr. Lawson has served on military executive steering boards, program review panels, and international committees. He has chaired a multi-lab research portfolio, an IRB, and an SRB. He has served as an Adjunct Professor of Psychology, Human Factors, and Military Medicine, and on editorial and advisory boards for books, symposia, and journals. Dr. Lawson's honors include the Navy's Meritorious Civilian Service medal and the Army's Superior Civilian Service medal.

David Fothergill, PhD
Scientific Director

- *Diving & Hyperbaric Physiology*
- *Human Physiology in Extreme Environments*
- *Submarine Escape, Rescue, & Survivability*
- *Atmosphere Contaminant Monitoring*

David Fothergill is the Scientific Director and former Submarine Medicine and Survival Systems Department Head at NSMRL. He is a qualified U.S. Navy trained diver and has, for the past 28 years, conducted research to support undersea warfighter health, readiness, and performance at the Naval Medical Research Institute and NSMRL. Dr. Fothergill served as Senior Research Scientist at the Center for Research and Education in Special Environments, State University of New York at Buffalo. His research interests and scientific publications cover a wide range of topics including: inert gas narcosis, CO_2 toxicity, pulmonary O_2 toxicity, nitric oxide physiology in extreme environments, underwater breathing apparatus design and evaluation, bioeffects of underwater sound, submarine escape and rescue, biomechanics of human strength, human thermal physiology, and environmental exposure monitoring.

RESEARCH PROGRAMS AND CAPABILITIES

Undersea Warfighter Health & Performance

The submarine is one of the most physically and mentally challenging platforms in the U.S. Navy, where submariners work, sleep, and eat in the same environment for extended periods. Lack of natural sunlight, disrupted circadian rhythms, challenging watch schedules, limited access to physical exercise, and reduced availability of fresh produce are some of the factors that may affect submariner health and performance during long deployments. NSMRL has initiated multiple efforts to understand how the undersea environment affects Sailor health and performance. These efforts include: the creation of the Unobtrusive Performance Measures Lab to measure human performance in real-time and under various conditions without the interference of intrusive technology, development of a team task simulation bridge to assess real-time team dynamics during virtually created bridge operations, and implementation of studies on the effects of the submarine environment and lifestyle on submariner performance and physiology.

Research Activities

- Understanding microbiome changes in submariners after prolonged submarine deployment and evaluation of those changes in relation to alterations in crew health and performance
- Evaluation of the effects of underwater exercise on cognitive function
- Evaluation of commercial off-the-shelf technologies to test the impact of diving on vestibular reflex function and monitor and predict effects on performance
- Evaluation of personal light treatment devices as a countermeasure for fatigue and circadian misalignment in a submarine environment
- Assessment of submariners' sleep needs during a straight-8s, 24-hour watchbill
- Development of objective and unobtrusive measures of warfighter performance (eye-tracking, galvanic skin response, heart rate variability, electroencephalography) to provide real-time indications of Sailors' degraded performance
- Characterization of caffeine use on submarines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Submarine Atmospheric Monitoring

Submarine atmospheric monitoring research at NSMRL is composed of both the Submarine Atmosphere Health Assessment Program (SAHAP) Program of Record, which provides ongoing atmospheric monitoring support, and independent research on developing new monitoring technologies. During underway periods, submariners are in a closed environment, requiring close monitoring of the atmosphere to ensure that it does not pose a hazard to the crew. While automated systems continuously measure levels of the most critical gases, including O_2 and CO_2, other possible contaminants, such as oil particulates or organic compounds produced by machinery, must also be monitored on a long-term basis.

As one of the Navy's primary resources to ensure the safety of the submarine atmosphere, SAHAP provides long-term, passive monitoring for defined atmospheric compounds of concern while underway. The program also provides guidance on the effects of evolving technology that could affect the submarine environment, such as the emittance of nano-particles from 3D printers. Additional NSMRL research related to atmosphere monitoring is focused on exploring the use of personally worn passive dosimeters to determine individual exposures to environmental contaminates in the submarine atmosphere while underway.

Research Activities

- Management of ongoing monitoring of submarine atmospheric constituents
- Provision of expertise in sampling enclosed spaces for long periods of time
- Development of wearable submarine atmosphere contaminant monitors
- Evaluation of Commercial off the Shelf instruments to develop hand-held, real-time monitoring of contaminants expected during a disabled submarine (DISSUB) event
- Development of Passive Personalized Atmospheric Monitors

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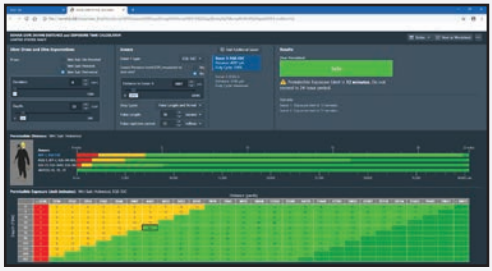
Bioeffects of Underwater Sound & Blast

Divers are among the most highly trained, highly skilled Navy Sailors, and are critical for the protection, safety, and success of our submarine and surface fleets. While the divers work to protect us, NSMRL's underwater bioeffects team works to protect them. The team conducts human effects research and provides guidance to the fleet on how underwater sound and blast from sources such as sonar, tools and equipment, and impulse sound affect human divers. Their work on underwater sound detection and localization and hearing in hyperbaric conditions has led to advancements in our understanding of the underwater hearing abilities of humans, with NSMRL researchers being the first to document that humans can detect underwater sounds as high as 190 kHz. NSMRL translates research findings into evidence-based guidance for diver exposure to underwater sound and blast. Research focuses include: physiological mechanisms for underwater sound perception, diver protection from underwater sound and blast, the use and effectiveness of underwater sound in nonlethal diver deterrence systems, creation of physical and computational models of physiological response to underwater sound, and development of tools and guidance for underwater hearing conservation.

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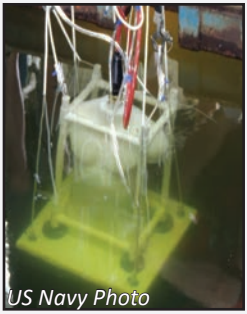
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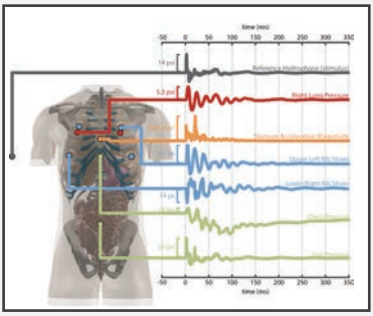

Research Activities

- Provision of updated and expanded tables for underwater explosive safe standoff distances in the EOD 60-series publication, used across the U.S. and allied international armed forces
- Development of an interactive software application to provide recommendations for human exposure limits to underwater noise
- Development of methodology to standardize the measurement of underwater acoustic signals emitted by new technologies
- Measurement of sound transmission properties of the KM-37 diving helmet to allow evaluation of noise exposure to helmeted working divers
- Development of surrogate models for studying the effects of underwater blasts, including an artificial human torso
- Development of an ingestible pill to measure internal response to blast exposure


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Submariner Psychological Fitness

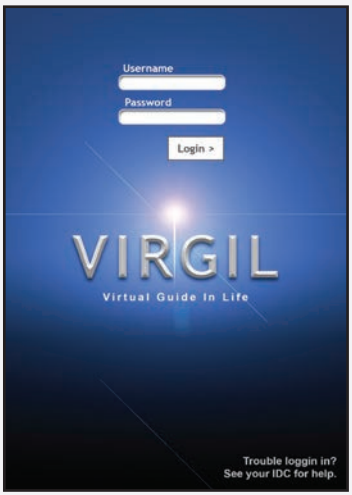
Submariners face significant stressors that are unique among the military community. The confined space and isolation of the submarine can be mentally and emotionally challenging, and yet mission success depends on optimal psychological readiness of Sailors. NSMRL's psychological screening and fitness program is dedicated to improving the psychological suitability of prospective submariners, predicting and reducing the number of unplanned losses (unexpected separation from service) from operational units, and exploring and enhancing individual and team resilience.

NSMRL has an ongoing effort to maintain, administer, and score the psychological screening assessment for prospective submariners. This assessment process, known as SUBSCREEN, seeks to identify Sailors with psychological and/or motivational factors incompatible with submarine duty.

NSMRL is also conducting studies to define the ideal psychological profile for successful service in submarines and other nuclear-powered Navy platforms and strives to support the psychological fitness of submariners by providing mental health support tools for use while underway.

Research Activities

- Modernization of SUBSCREEN by developing and testing an updated submariner psychological screening tool
- Evaluation of psychological factors that can predict the success of officers and enlisted Service Members enrolled at the Naval Nuclear Power Training Command (NNPTC)
- Identification of predictors of psychological resilience and development of a predictive model of psychological resilience indicators in submariners
- Objective assessments of anxiety-related risks and vulnerabilities in submariners
- Development of VirGIL (Virtual Reality Guide In Life): a psychology-based self help software program that provides confidential cognitive behavioral therapy content to deployed submariners



Human Systems Integration

With the emergence of new submarine technologies, Sailors are increasingly required to process complex information, make advanced decisions, and operate complicated equipment. Human Systems Integration (HSI) is a process NSMRL researchers use to provide tools to present information in an accessible manner, assist in decision making, and facilitate usability of hardware and software technologies. HSI combines our knowledge of human capabilities and limitations with systems development to make them more effective, efficient, and safe. By combining theory with an iterative feedback process with the line community, NSMRL applies an HSI approach to develop and improve submarine systems, enhance submariner performance, and increase readiness. The program also seeks to predict and mitigate degradation in performance through non-invasive monitoring of a variety of novel physiological measures.

Research Activities

- Prediction of degradation in performance with cognitive and machine learning models based on monitoring changes in physiological measures such as face and eye tracking, heart rate, and skin conduction
- Development of a computational model that mimics how humans process audio and visual cues
- Support of the creation of a software tool that provides individualized fatigue-based schedule management of submariners for optimized watchstanding schedules
- Development of a software training and knowledge transfer platform that, based on individualized learning styles, can be used to design custom performance support that optimizes (or enhances) learning for complex submarine-based tasks
- Establishment of a submarine command and control simulation lab to evaluate team performance and identify individual tasks that are most susceptible to fatigue
- Evaluation of the effectiveness of transcranial direct current stimulation on reducing the effects of time-on-task fatigue
- Tracking cognitive performance decrements in cold environments


US Navy Photo

Diving & Hyperbaric Research

NSMRL's diving and hyperbaric research program focuses on evidence-based solutions that promote the health and enhance the performance of the undersea warfighter. At the centerpiece of NSMRL's diving and hyperbaric research program is the one-of-a-kind Genesis Hypo/Hyperbaric chamber complex. NSMRL's diving mission is supported by a full Navy dive locker with SCUBA and Surface Supply capabilities, an indoor immersion test pool, and a command dive boat for open water diving operations. NSMRL's diving research program has advanced the field's understanding of saturation diving, nitrogen narcosis, CO_2 toxicity, pulmonary O_2 toxicity, decompression stress, NO physiology under ambient pressure extremes, temperature regulation, and disabled submarine escape and survival. In addition, it has provided knowledge about the environmental stress diving can have on warfighter health, cognition, and performance. A complete renovation of the chamber was initiated in 2019, with expected completion in 2023. As a result of the overhaul, NSMRL will have a fully-functional, state-of-the-art chamber facility to advance diving and hypo/hyperbaric medicine research.

Research Activities

- Evaluation of the sensitivity and reliability of exhaled NO as a non-invasive biomarker of pulmonary hyperoxic stress and pulmonary O_2 toxicity
- Investigation of undersea warfighter O_2 oxygen toxicity (genetic changes): identification of genetic markers and metabolic pathways that are altered by exposure to hyperbaric oxygen


US Navy Photo


US Navy Photo


US Navy Photo

Submarine Survival, Escape, & Rescue

In the rare event that a submarine becomes disabled (DISSUB) and is unable to return to the surface, the crew must decide whether to attempt escape from the submarine or remain onboard and await rescue. This decision rests on a complex set of factors including the condition of the crew, the status of the submarine's atmosphere, the submarine's depth, and the proximity of rescue assets. NSMRL maintains military and civilian expertise in submarine survival, escape, and rescue to provide NAVSEA 00C and SUBFOR fleet advice in case of a DISSUB incident. Areas of research focus include: DISSUB survival (e.g., survival times and survival equipment evaluation), DISSUB escape (e.g. saturation decompression drop out modeling, escape suit testing, medical hazards of escape), rescue procedures and equipment testing (e.g. test and evaluation of closed circuit O_2 rebreathers for accelerated decompression of DISSUB survivors), and science-based recommendations to modify the Guard Book, the manual that gives guidance to survivors of a submarine casualty.

Research Activities

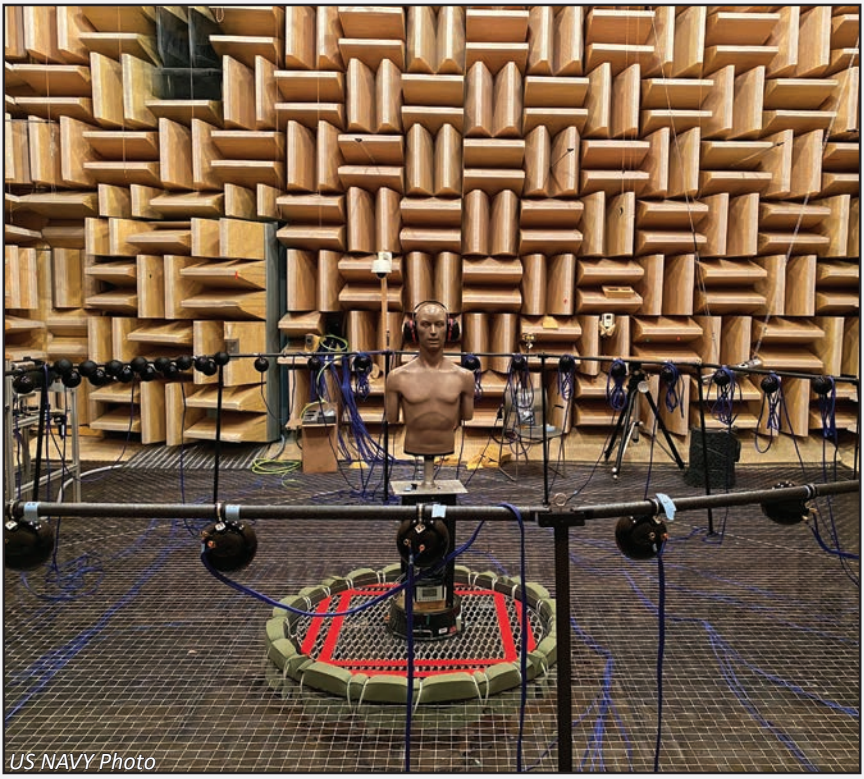
- Optimization of rescue and triage of crewmembers during a DISSUB event
- Creation of medical response strategies to optimize DISSUB escapee survival
- Provision of recommendations for modifying the Guard Book to facilitate the ability of survivors to determine escape times while under stress
- Development of the eGuard book, an electronic version of the Guard Book for use during a DISSUB scenario
- Exploration of the effects of DISSUB stressors on submariner cognition
- Development of the Submarine Rescue software application that provides decompression protocols for rescuees and rescue personnel from a disabled submarine
- Critical review of casualties from historical DISSUB incidents


US Navy Photo

Hearing Conservation

Noise-induced hearing loss is one of the most prevalent occupational health hazards in the military. To help protect our Service Members' hearing, NSMRL's Regional Hearing Conservation (RHC) Program of Record (POR) provides subject matter expertise on hearing conservation, psychoacoustics, audiology, and hearing protection to the Navy and Marine Corps line communities. The program also provides support to Navy audiologists, otolaryngologists, allied health professionals, audiometric technicians, and consultants across the DoD and Defense Health Agency. NSMRL houses an expansive state-of-the-art audiology test suite that includes one of the DoD's largest anechoic chambers, a large reverberant room, a Real-ear Attenuation at Threshold (REAT) facility, and multiple audiology test booths. RHC POR efforts include basic to applied research.

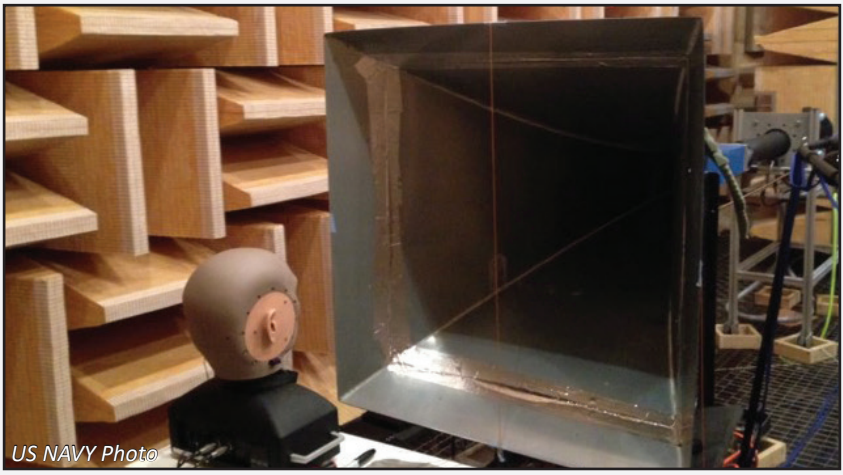
The team's principal investigator is a member on multiple American National Standards Institute (ANSI) working groups related to speech-in-noise understanding and assessing the effects of head-worn devices on human auditory localization ability.



US NAVY Photo

Research Activities

- Testing and evaluation of head-worn hearing protection devices (HPDs) for their impact on hazardous noise exposure, communication, sound localization, and attenuation of impulse (blast) noise
- Execution of large-scale shore and afloat hearing conservation field studies
- Evaluation of HPDs to determine the most effective and most appropriate forms for Sailors and Marines at accession and in positions routinely exposed to hazardous noise
- Testing and evaluation of field attenuation estimation systems' performance for enterprise-wide DoD use



Undersea Health Epidemiology Research Program

This unique program maintains an epidemiologic database that cross-references a number of Navy data sources and aids in characterizing the health effects of the submarine and diving environment. With the ability to provide rapid analyses, the program can serve as a reference source for operational planning and risk mitigation. As part of this program, NSMRL initiated the first-ever epidemiological study to evaluate the medical impacts of the submarine environment on Sailors. The program recently expanded its research to include divers to assess the impact of the undersea environment on diver health.

UHERP's main objectives are: to identify any environmental or occupational exposure risk that correlate with negative health outcomes, premature separation from military service, medical evacuations, and to improve the health and warfighting capability of the undersea warfare community by harnessing information from "big-data" platforms.

Research Activities

- Development of a centralized database linking medical and personnel data for Navy divers and submariners
- Summarization of the "who," "when," and "why" for submarine medical evacuations
- Assessment of mental health risk factors for unplanned losses
- Identification of risk factors for hearing loss and tinnitus in the submarine community, two of the most burdensome health conditions for the DoD and Veterans Affairs (VA).

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US NAVY Photo

PERSONNEL PROFILES

LT Mahamat Babagana, PhD, MSC, USN

Department Head, Warfighter Performance; Research Physiologist

- *Inflammation & Neurodegeneration*
- *Gut-Host Interactions*
- *Hypoxia & Hyperbaric Oxygen toxicity*
- *Arterial Gas Embolism/Decompression Sickness*

LT Mahamat Babagana is a research physiologist at NSMRL. LT Babagana completed his PhD research in melanoma therapeutics and hyperthermia-related cell stress at SUNY at Buffalo/Roswell Park Cancer Institute. His postdoctoral training was completed at the National Institutes of Health/National Institute on Aging where he investigated factors contributing to chronic inflammation during physiological aging and biomarkers of early Alzheimer's disease onset. LT Babagana was a NIGMS 2019 NIH PRAT Fellowship Recipient and served on the NIH Fellows Editorial Review Board. Some of LT Babagana's current interests include the effects of blast-induced trauma on CNS inflammation, gut-host interactions, & induced-hypoxia tolerance.

LT Jennifer Louie, PhD, MSC, USN

Deputy Department Head, Warfighter Performance; Research Psychologist

- *Working Memory*
- *Visual Perception*
- *Human Factors*

LT Jennifer Fung-Ming Louie is a research psychologist at NSMRL, having previously worked at the Naval Surface Warfare Center Panama City Division (NSWC PCD) as a Human Systems Integration (HSI) specialist on the Mine Counter Measures Mission Package and Multiple Vehicle Communication System aboard the Littoral Combat Ship class variants. She has assisted with studies on chemical, biological, radiological, and nuclear (CBRN) mask fit as part of an integrated command effort. As a member of the NAVSEA Inclusion and Engagement Council, she proposed an initiative to reduce civilian and military barriers to inclusion including mental health stigma. Former research projects include evaluating working memory capacity as predicting differences in distracted driving performance, the effects of attentional modulation on visual perception, and psychological testing.

Matthew Babina, MEng

Research Engineer

- *Underwater Bioeffects*
- *Acoustics & Signal Processing*
- *Psychophysics*
- *Acoustic Injury Prevention*

Matthew A. Babina is a research engineer at NSMRL in the Warfighter Performance Department. Since 2008, he has supported NSMRL's role as the Navy's primary source of expertise on the human bioeffects of underwater sound and blast, and he continues to serve as a subject matter expert in this field. In his role as a technical lead, Mr. Babina guides research to understand physiological damage mechanisms and psychological effects of underwater sound. This scientific knowledge informs guidance recommendations that aim to maximize Navy diver operational capability while minimizing risk to the diver. Some examples of these research outcomes include quantification of human ultra-high frequency perception, amendment of the underwater blast standoff tables in the EOD 60-Series publication, and measurement of noise transfer into the KM-37 diving helmet for hearing conservation standards.

Luke Belval, PhD

Research Physiologist

- *Environmental Physiology*
- *Performance Optimization*

Luke Belval is a contracted research physiologist at NSMRL in the Warfighter Performance Department. His research focuses on improving safety and performance for divers and submariners, with a focus on integrative models of physiological systems. Dr. Belval's research background in environmental and exercise physiology has studied the effects of thermal stress and dehydration on safety, health and performance in military, athlete and clinical populations. He is a certified athletic trainer and certified strength and conditioning specialist. Dr. Belval received his doctorate in Exercise Science from the University of Connecticut and completed a post-doctoral fellowship in Integrative Physiology at the University of Texas Southwestern Medical Center.

Andrea Bizarro, PhD

Research Psychologist

- *Psychological Assessment & Measurement*
- *Survey Design*
- *Structured Interviews & Focus Groups*
- *Employee Retention & Attrition*

Andrea Bizarro is a contracted research psychologist at NSMRL where she leads efforts to modernize the submariner psychological screening and assessment program. Leveraging her expertise in psychometrics, employee retention, and organizational commitment, she has implemented improvements to the psychological screening program that have enhanced the efficiency of the assessment and reduced the number of false-positive psychological referrals. Before joining NSMRL, Dr. Bizarro worked in industry where she designed and led various programs supporting employee surveys, analytics, and action-planning strategies that directly contributed to the business strategy and overall vision at two Fortune 500 companies. During her graduate studies, Dr. Bizarro gained experience with quasi-experimental field research, workplace intervention design, and participatory ergonomics. She holds a graduate certificate in Occupational Health Psychology.

Jeffrey Bolkhovsky, PhD

Research Physiologist

- *Human Factors*
- *Signal Processing & Machine Learning*
- *Physiological Monitoring*
- *Sleep & Fatigue*

Jeffrey Bolkhovsky is a research physiologist at NSMRL who conducts human factors and physiological monitoring research to optimize warfighter performance. He explores non-invasive and non-disruptive monitoring tools to track physiological factors such as facial and eye movements, heart rate, and skin conductance to predict operational performance decrement due to stressors such as fatigue and cold exposure. As part of his human factors work, Dr. Bolkhovsky supported the development of a software program that creates submarine watch bills and schedules based on individualized predictions of crew member fatigue. He has also developed training tools to provide performance support for complicated onboard operations and designed submarine control room interfaces that optimize presentation of information and facilitate decision making. His work on developing models of submarine processes and watch stations allows him to connect his research directly to the operational environment.

Lia Bonacci, PhD

Research Scientist

- *Auditory & Visual Attention*
- *Signal Processing & Machine Learning*
- *Auditory Scene Analysis*
- *Human Factors Engineering*

Lia Bonacci is a contracted research scientist at NSMRL. Her doctoral research focused on characterizing neural correlates of spatial attention in complex auditory scenes using non-invasive electroencephalography. In her role as research scientist at NSMRL, she works on developing computational models of human auditory processing in order to enable autonomous systems to listen in submarine and urban environments. This work aims to enhance the ability of these systems to extract key information from their environment in order to assist human operators. In addition to her work on auditory processing, Dr. Bonacci works on various human factors engineering projects, which include modeling the submarine MEDEVAC process, predicting human performance via non-invasive physiological monitoring, and developing tools to provide performance support for various submarine tasks.

Brandon Casper, PhD

Research Physiologist

- *Underwater Bioeffects*
- *Environmental Impact*
- *Underwater Hearing*
- *Acoustic Injury Prevention*

In his role as a research physiologist, Brandon Casper is the Navy's lead on the bioeffects of underwater sound and blast on divers. His research focuses on predicting injury to divers exposed to sonar, underwater explosives, and other acoustic sources and he provides guidance recommendations to the fleet on safe standoff distances for injury prevention. He also supports research on impacts of underwater blasts on aquatic life and leads projects that advance the Navy's mobile technological capabilities, including development of software applications that streamline submarine rescue processes and house cognitive behavioral therapy to provide mental health support to submariners while underway. Dr. Casper's PhD research on hearing in sharks and stingrays marked a resurgence in that field.

Justin Handy, PhD

Research Psychologist

- *Psychological Readiness*
- *Stress & Coping*
- *Human Cognition*
- *Behavioral Neuroscience*

Justin Handy is a research psychologist at NSMRL, having joined the lab in 2018 following completion of a post-doctoral training program at the Syracuse Veterans Affairs Medical Center. His research centers on understanding the impacts of stress and motivated behavior on mental health and well-being. Dr. Handy leverages his background in cognitive psychology and behavioral neuroscience to advance the Navy's mission to maintain cognitive and psychological readiness among undersea warfighters. To this end, he supports efforts to identify behavioral and non-behavioral indices of psychological distress and resilience, directly informing psychological screening programs for submarine duty and the development of preventative, resilience-based training initiatives. In addition, he leads projects to determine the effects of environmental and physiological stress on neurocognitive function in Navy divers and other specialized operational communities.

Sylvia Guillory, PhD

Research Psychologist

- *Cognitive Performance*
- *Fatigue & Attention*
- *Human Factors*
- *Sensory Processing*

Sylvia Guillory is a contracted research psychologist at NSMRL where she provides support on projects investigating factors that impact cognitive performance and psychological readiness of naval personnel. Dr. Guillory has a background in cognitive science, training in psychophysics and neuroscience with expertise in using electroencephalography to explore neural processing. A focus of her research has been the measurement and analysis of perceptual, attentional, and working memory processes, both from a behavioral and neuroscience perspective in clinical and non-clinical populations. At NSMRL, she works to enrich our understanding of sustained attention on performance and identify interventions that combat fatigue. Outside of NSMRL, Dr. Guillory participates in outreach efforts to make psychology and neuroscience education accessible and engaging for students and increase public awareness of brain science.

Dominica Hernandez, PhD

Research Psychologist

- *Obesity Prevention & Intervention*
- *Psychological Assessment & Treatment*
- *Cardiometabolic Disorders*
- *Social Determinants of Health*

Dominica Hernandez is a contracted research psychologist at NSMRL and Adjunct Professor of psychology at the University of Connecticut. In her role as a research psychologist, Dr. Hernandez is the technical lead on projects, including the psychological screening of prospective submariners and examining contributors of obesity and cardiometabolic comorbidities among Sailors in the submarine environment. Her research focuses on assessing physical, psychological and personality correlates that may impact submarine warfighter performance and readiness. In addition to her research background, Dr. Hernandez is a trained clinical therapist with over ten years of experience in treating behavioral health disorders and has held training placements at Columbia University, UConn Health Center, and the VA Hospital. Dr. Hernandez also supports research focused on examining predictors of resilience, submariner success, and social determinants of health among Submariners.

LT Neal McNeal, PhD, MSC, USN

Department Head, Submarine Medicine and Survival Systems; Research Psychologist

- *Combat Casualty Care*
- *Psychological Health and Stressors*
- *Neurobiological Regulation of Cardiovascular Function*

LT McNeal is a Research Psychologist at NSMRL, as well as Head of the Submarine Medicine & Survival Systems Department. LT McNeal entered the U.S. Navy Medical Service Corps as a Lieutenant in September 2016 and was assigned to Naval Medical Research Unit - San Antonio. There he served as principal investigator and Head, Cellular and Immune Based Adjuncts for Casualty Care Department of the Combat Casualty Care Department. His prior research focused on improving combat casualty care in a prolonged field care setting. His diverse projects ranged from investigations of potential pain management therapeutics to real world and laboratory evaluations of a device for the treatment of penetrating injuries. He holds an appointment as Assistant Professor at the School of Medicine at Uniformed Services University of the Health Sciences. His postdoctoral and graduate training focused on the behavioral, neuroendocrine, and cardiovascular consequences of disrupting social bonds using an animal model.

LT Jacob D. Lockwood, MSC, USN

Deputy Department Head, Submarine Medicine and Survival Systems; Industrial Hygienist

- *Industrial Hygiene*
- *Safety*
- *Submarine Atmosphere Monitoring*
- *Hearing Conservation*

LT Jacob Lockwood is an industrial hygienist at NSMRL. LT Lockwood entered the U.S. Navy Medical Service Corps in October 2015 and was assigned to Naval Hospital Guam. There he served as the Industrial Hygiene Division Officer. His second tour in the Navy was as the Assistant Safety Officer on the USS Harry S. Truman (CVN-75) from November 2017 to November of 2019 where he earned his Surface Warfare Medical Department Officer (SWMDO). His third tour was as the Division Officer of the Fleet Department at the Navy Environmental Preventative Medicine Unit TWO. His Masters is in Environmental Health and Safety and he is an accredited Certified Safety Professional (CSP).

David Burnside, MPH

Program Manager

- *Submarine Atmosphere Monitoring*
- *Industrial Hygiene*

David Burnside is the manager of the Submarine Atmosphere Health Assessment Program (SAHAP) at NSMRL. He has twenty years of expertise in submarine atmosphere monitoring. In his role as SAHAP manager, Mr. Burnside is the Navy's lead on determining the presence of chemical contaminants in submarine air. His research focuses on ensuring state of the art techniques in atmosphere monitoring are employed. He has participated in and overseen multiple on board submarine atmosphere sampling evolutions. These sampling evolutions have included the development of novel techniques to sample air for multiple compounds simultaneously, a necessary component for sampling an environment as variegated as the submarine. Mr. Burnside is also the recording secretary for the Submarine Environment Advisory Board (SEAB), a CNO-chartered group devoted to advising the submarine force on environmental issues.

Surgeon Commander Joanna Halford, MFOM

Royal Navy Exchange Officer;
Consultant Occupational Physician

- *Occupational Health*
- *Injury Recovery*
- *Sports Medicine*

Surg. Cdr. Joanna Halford is a Consultant Occupational Physician in the Royal Navy, having previously served for 11 years in the British Army. Her career, to date, has been primarily in clinical roles, most recently as a Regional Occupational Health Consultant. This involved assessing fitness for work of Royal Marines and Royal Navy personnel following illness or injury, with the aim of returning them to gainful military employment, thus contributing to operational capability. Surg. Cdr. Halford is currently assigned to NSMRL as an Exchange Officer, where her research focus is on determining the impact of the gut microbiome on the health, resilience, and operational readiness of submariners. Previous research, linked to her interest in sports and sports medicine, studied the effects of anterior cruciate ligament reconstruction on fitness for service in the British Army.

Linda Hughes, MS

Statistician

- *Biostatistics*
- *Epidemiology*
- *Experimental Design*
- *Privacy*

Linda Hughes is NSMRL's statistician and program manager of the Undersea Health Epidemiology Research Program (UHERP). Since joining NSMRL in 1998, Ms. Hughes has collaborated on numerous research projects relating to warfighter health. Her contributions include work in the following areas: hearing conservation, submarine escape and rescue, women in submarines, submarine atmosphere health, test and evaluation, and epidemiology. Ms. Hughes also serves on the Institutional Review Board, the Library and Training & Professional Development committees, and is NSMRL's Health Insurance Portability and Accountability Act (HIPAA) Privacy and Security Officer.

Brian Maguire, PhD

Epidemiologist

- *Epidemiology*
- *Safety*
- *Public Health*
- *Health Promotion*

Brian Maguire is a contracted epidemiologist with the Undersea Health Epidemiology Research (UHERP) Program at NSMRL. The objective of his work is to improve health and reduce injury risks for submariners and Navy divers. Dr. Maguire and the UHERP team conduct research on medical evacuations and injuries in the Navy, publish findings, present at conferences and meetings across the country and internationally, and created a new database with 495,000 person-years of records. Dr. Maguire's other career accomplishments include being a senior Fulbright scholar, a university professor, a member of the CDC's Public Safety Council, and the author of over 70 publications, including a Cochrane Review and a systematic literature review.

Jeremy Federman, PhD

Research Audiologist

- *Hearing Conservation*
- *Audiology*
- *Psychoacoustics*

Jeremy Federman is the research audiologist who leads NSMRL's Regional Hearing Conservation Program of Record. He is an American Speech-Language and Hearing Association certified audiologist. He was named Navy Audiologist of the Year in 2014 and received the prestigious Military Audiology Association's Research Award in 2015. He completed his Masters in Audiology and PhD in Communications Sciences and Disorders at Vanderbilt University. At NSMRL, Dr. Federman uses his research and clinical training to pursue interests in hearing conservation and psychoacoustics. He is currently conducting experiments related to Hearing Protection Device (HPD) fit-testing and training, the effects of ongoing and impulse noises on HPDs and communications, and the effects of head-worn devices on auditory localization. The primary aim of his research program is to eliminate noise induced hearing loss in the Navy and Marine Corps.

Stephanie Karch, PhD, AuD

Research Audiologist

- *Hearing Conservation*
- *Auditory Function*
- *Auditory Injury*
- *Vestibular Function*

Stephanie Karch is a research audiologist at NSMRL and works on the Regional Hearing Conservation Team. In this role, she investigates the prevention of auditory injury (e.g., hearing loss, tinnitus) among Service Members. Specifically, she studies the effect of training and verification of hearing protection in the field, clinic, and laboratory; and the effect of hearing protection on auditory function (e.g., situational awareness, speech intelligibility, and localization). Dr. Karch has over five years of PhD-level experience in military medical research, having served in Navy and Army medical research laboratories. Previous to her work at NSMRL, she characterized the vestibular function of military aviators, and investigated the comorbidity of auditory injuries and mild traumatic brain injuries. In addition to her AuD and PhD in audiology, she holds the American Speech-Language-Hearing Association's Certificate of Clinical Competence in Audiology.

Derek Schwaller, BS

Research Engineer

- *Hearing Protection Evaluation*
- *SONAR Headset Selection*
- *Underwater Hearing*
- *Underwater Blast/Noise Injury Prevention*

Derek Schwaller is a research engineer at NSMRL. In this role, Mr. Schwaller is the lead engineer on the Regional Hearing Conservation Team. His research focuses on quantifying the effects of wearing hearing protection devices on situational awareness, protection from impulses, as well as protection from continuous noise. He also conducts research on selecting a headset for submarine SONAR operators. In Mr. Schwaller's fifteen years as a government employee at NSMRL, he has served as NSMRL's IRB Chair, Warfighter Performance Department Head, Contract Manager, and Financial Manager.

Louis Deflice

Department Head, Diving Operations;
Diving and Hyperbaric Subject Matter Expert

- *Hyperbaric Systems*
- *Diving Research*
- *Complex Diving*

Louis Deflice is the resident Diving and Hyperbaric Subject Matter Expert at NSMRL and serves as the Head for the Diving Operations Department. Mr. Deflice has an extensive background in complex diving and hyperbaric human subjects research as both a supervisor and a credentialed institutional review board member. His previous work history includes tours as Command Master Chief at the U.S. Navy Experimental Diving Unit and Command Master Diver at Naval Submarine School's high-risk submarine escape trainer. Mr. Deflice is well-versed in deep diving systems, saturation diving techniques and procedures, and quality assurance programs associated with maintaining certified diver's life support systems. Mr. Deflice finished his 30-year military career in June 2019 as a Master Chief Navy Diver (E9), qualified Master Diver, Submarine Service and Master Training Specialist.

CAPT Andrew Sellers, MC, USN

Senior Medical Officer

- *Neuroradiology*
- *Emergency Radiology*

A Maryland native, CAPT Sellers graduated from Brigham Young University in 1995 with a BS in Chemistry. He earned his medical degree in 1999 from the Uniformed Services University of the Health Sciences and was then assigned to the Naval Undersea Medical Institute, where he qualified as a Submarine Medical Officer. In 2007, Dr. Sellers graduated from residency training in Diagnostic Radiology and started work at Portsmouth Naval Hospital. During this time, he deployed as a staff radiologist aboard USNS Comfort. In 2012, Dr. Sellers was selected for a Neuroradiology fellowship at the University of Virginia, before returning to the Naval Medical Center Portsmouth as a staff neuroradiologist, with a concurrent appointment to USNS Comfort as Director for Clinical Support Services. While at Naval Medical Center Portsmouth, he served as Vice Chairman of the Department of Radiology and the Tidewater Enhanced Multi-Service Market product line leader.

LTJG Galo A. Barrezueta, MSC, USN

Department Head, Administration Department

Lieutenant Junior Grade Galo A. Barrezueta is the Head of Admistration at NSMRL. As the department head, LTJG Barrezueta manages the day-to-day operations and oversees a team of highly specialized individuals over five primary divisions that provide mission essential support to NSMRL—IT, Fiscal Management, Logistics/Material Management, Facilities, and Administration. In addition to his role supporting this diverse group and its unique needs, LTJG Barrezueta serves as the Educational Services Officer. LTJG's bachelor's degree in healthcare management and two master's degrees in health administration and business administration, along with his time as a Hospital Corpsman, have provided him with skills and knowledge of public health and administration, preparing him for his role at NSMRL. LTJG Barrezueta has been in the Navy since 2007.

US NAVY Photo

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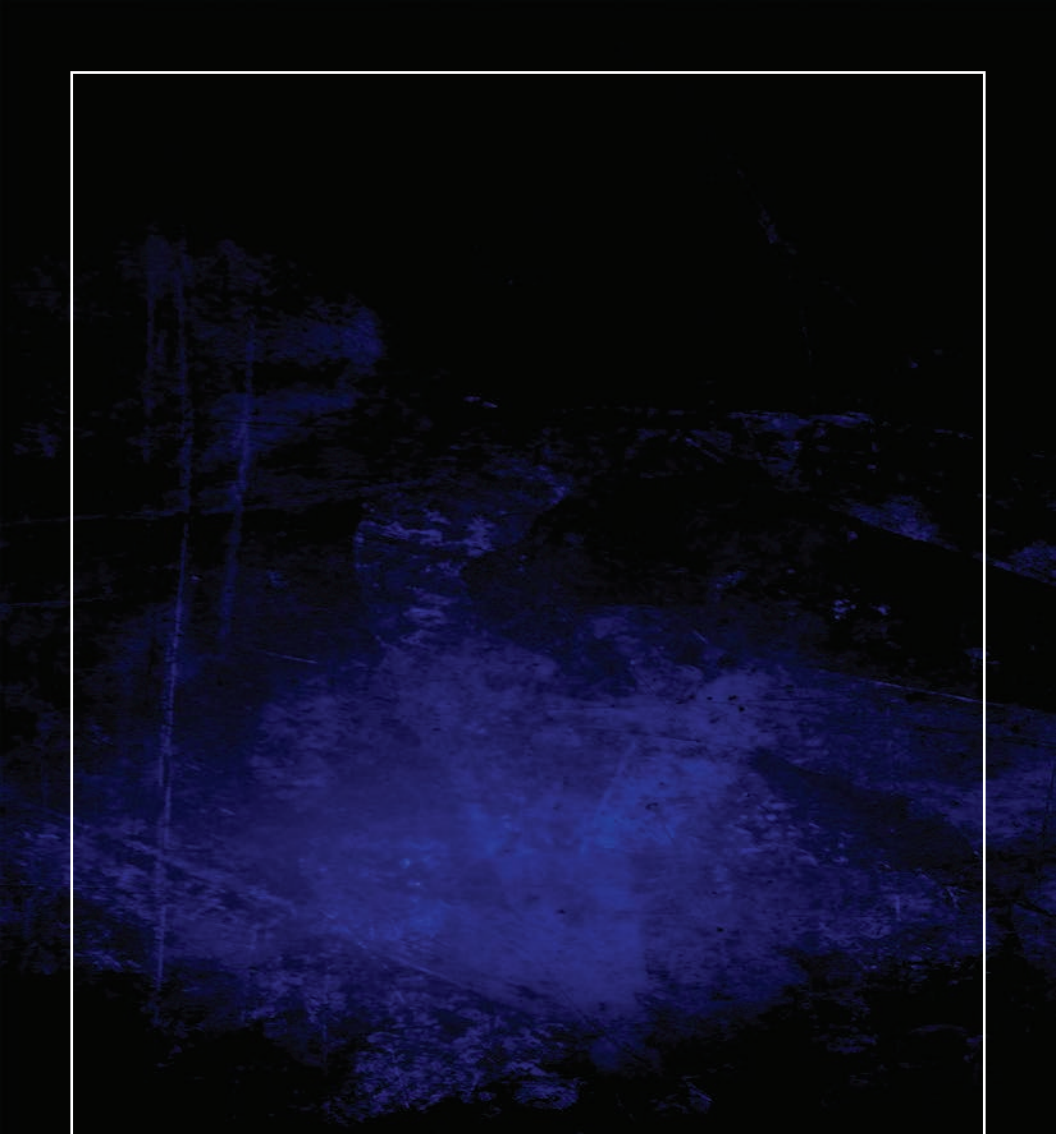

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