

US NAVY
DEEP SUBMERGENCE SYSTEMS PROGRAM



DEEP SUBMERSIBLES



SUBMARINE RESCUE



SEALAB PROGRAM

21st ANNUAL
SUBMARINE
SYMPOSIUM



2024



International Workboat Show, Nov 12 - 14th, New Orleans, LA USA



2024 Annual Submarine Symposium

at International Workboat Show, New Orleans, USA



TUE NOV-12-2024

ROOM 338

No	Session	Speaker	Company	Presentation Title
1	8:30 - 9:00	William Kohnen Submarine Cmte Chair	MTS - Submarine Committee	Yearly Overview: State of Submarine Industry 2023
2	9:00 - 9:30			
3	9:30 to 10:00	Bruce Strickrott DSV ALVIN - Group Manager	WHOI - Woods Hole Oceanographic Institution USA	Alvin's '23-24 operational year and 60th anniversary
4	10:00 to 10:30	COFFEE BREAK		
5	10:30 to 11:00	Kaitlyn Tradd DSV ALVIN - Lead Engineer	WHOI - Woods Hole Oceanographic Institution USA	2024 Review of DSV Alvin Emergency Response Plan and Alvin's companion Observation Vehicle
6	11:00 to 11:30	Itaru Kawama Director, Fleet Maintenance and Engineering Dept	JAMSTEC - Japan Agency for Marine- Earth Science and Technology JAPAN	Safety measures of SHINKAI 6500
7	11:30 to 12:00	Charles Kohnen Co-founder, Chairman	SEAmagine Hydrospace Corp USA	SEAmagine's Latest 1300m Submersible: A New Tool for Scientific Exploration in the Tropical Pacific
8	12:00 to 12:30	LUNCH		
9	12:30 to 1:00			
10	1:00 to 1:30			
11	1:30 to 2:00	Greg Cotten, PhD Technical & Operational Authority	JFD Ltd. UNITED KINGDOM	The History of United States Submarine Rescue
12	2:00 to 2:30	William Kohnen President/CEO	HYDROSPACE Group Inc USA	UW Habitats - History SEALAB Program 60th Anniversary
13	2:30 to 3:00	Alexander Petri Market Segment Manager	POLYVANTIS GmbH GERMANY	The milestones of PLEXIGLAS(R) - a History of Acrylic
14	3:00 to 3:30	COFFEE BREAK		
15	3:30 to 4:00	Sarah Frias-Torres Research Associate	SMITHSONIAN INSTITUTE USA	All The Corals We Cannot See
16	4:00 to 4:30	Jay Wade Chairman	International SeaKeepers Society USA	Unlocking the Depths: Opportunities for Submersibles in the Yachting Industry
17	4:30 to 5:00			
18	6:00 to 9:00	<i>Marine Technology Society</i>	<i>MTS/Blue Robotics Happy Hour Reception</i>	Brewery St. X 734 Loyola Ave, New Orleans, LA 70113

WED NOV-13-2024

ROOM 338

No	Session	Speaker	Company	Presentation Title
1	8:30 - 9:00	Curt Cunningham Assistant Program Manager	US NAVY - NAVSEA PMS390 Undersea Special Mission Systems USA	U.S. Submarine Rescue System Recertification and Capability Gaps for Modernization
2	9:00 to 9:30	Liz Hunter MOSHIP Surveyor	OCEANEERING Int'l Inc USA	Navy Submarine Rescue
3	9:30 to 10:00	Chris Haugen Bus. Dev. Manager N.A.	FORCYS Inc. USA	Rapidly Deployable Undersea Survey System in a box
4	10:00 to 10:30	COFFEE BREAK		
5	10:30 to 11:00	Jarl Stromer Compliance Manager	Triton Submarines LLC USA	Practical Depth Limit of a Two-Occupant Transparent Acrylic Sphere Submersible Vehicle
6	11:00 to 11:30	Kyle Robinson Senior Research Engineer	SWRI - Southwest Research Institute USA	Alvin Hull Post-Weld Heat Treatment
7	11:30 to 12:00	Jakob Sixl CEO	Heinz-Fritz GmbH GERMANY	Chemicals an often underestimated danger to acrylic
8	12:00 to 1:30	LUNCH		
9	1:30 to 2:00	Roy Thomas Sr. Principal Engineer	ABS - American Bureau Shipping USA	Overview of the ABS Underwater Rule Change Proposals (Annual Industry Meeting)
10	2:00 to 2:30	Ben Sharples Managing Director	SMP Ltd UNITED KINGDOM	Launch and Recovery - the real safety threat to manned submersibles
11	2:30 to 3:00	CAPT Gard Clark, USN (Ret) Principal	CPMQ Consulting LLC USA	"Collapse Under Pressure" Being Ready to Take Personal Risk to Prevent Undersea Fatalities: Lessons from the US Navy to the Titan Submersible
12	3:00 to 3:30	COFFEE BREAK		
13	3:30 to 4:00	Jonathan Struwe Head of Section - UW Technology	DNV - Det Norske Veritas GERMANY	DNV Classification Rules for Underwater Habitats
14	4:00 to 4:30	W. Kohnen G. Clark G. Cotten	WORLD SUBMARINE ORGANIZATION	Submersible Operations Safety
15	4:30 to 5:00			A Collective Consensus Standard based on Industry Best Practices

THUR NOV-14-2024

ROOM 338

No	Session	Speaker	Company	Presentation Title
1	8:30 - 9:00			
2	9:00 to 9:30	Bart Kemper Principal Engineer P.E., CPEng	Kemper Engineering Services USA	Establishing design limits for Design By Analysis for Glassy Polymers
3	9:30 to 10:00	Mike Zintel Principal	W. Michael Zintel Consulting USA	Thoughts on a Modular Software Architecture for Deep Sea Submersibles
4	10:00 to 10:30	USA		
5	10:30 to 11:00	Carme Parareda COO	ICTINEU Submarins SL SPAIN	ICTINEU new generation li-po batteries with increased capacity and voltage, case studies.
6	11:00 to 11:30	Leon Adams VP, Sales & Marketing	Southwest Electronic Energy Corp USA	Condition Based Monitoring with a Subsea Battery's Battery Management System
7	11:30 to 12:00	William Kohnen President	HYDROSPACE Group Inc USA	ASME PVHO Acrylic Windows – Overview of the 2023 Standard
8	12:00 to 1:30	LUNCH		
9	1:30 to 2:00	William Kohnen Submarine Cmtee, chair	MTS Submarine Cmtee	ANNUAL MTS Submarine Committee Meeting
10	2:00 to 2:30			



Welcome to the 21st Annual Submarine Symposium!

Dear Members and Esteemed Delegates,

We're thrilled to welcome you to the 21st Annual Submarine Symposium, proudly hosted by the International WorkBoat Show, alongside the Marine Technology Society Submarines committee and the World Submarine Organization. This year, in the dynamic and spirited city of New Orleans, we gather to connect, learn, and inspire following a pivotal year. Our symposium unites submarine professionals from across the globe — manufacturers, operators, pilots, service providers, and regulators—all eager to drive innovation, strengthen industry standards, and uphold the highest level of safety in subsea exploration. Together, we'll explore the latest developments, exchange invaluable insights, and forge lasting connections across the subsea community.

This year we are celebrating the 60th anniversary of the US Navy Deep Submergence Systems Program, a national movement that spurred a lot of the technology we are working with today, from deep ocean submersibles, submarine rescue vehicles and underwater habitats. We invite you to join leaders from every sector, commercial, private, tourism, research, and military—for sessions that span technical analyses, industry overviews, product presentations, and hands-on networking opportunities. Stroll through the vibrant WorkBoat Show floor, where exhibitors and enthusiasts come together to showcase and explore groundbreaking technologies that are shaping our industry.

We extend our heartfelt gratitude to our dedicated speakers for sharing their expertise. A special thanks to the International WorkBoat Show for hosting us again this year. We're also grateful to Underwater Intervention for their support and the Think Tank stage, which hosts exciting talks on global subsea innovations.

Finally, we warmly invite you to join us at the MTS Reception on Tuesday night for a lively cocktail reception. Enjoy a relaxed evening of conversation, music, and New Orleans flair—a perfect opportunity to unwind and connect in a memorable setting. We're looking forward to a truly enriching symposium, where shared expertise and ideas will help us reach new depths in submarine exploration. Here's to another incredible year of collaboration, innovation, and discovery!

With warm regards,
Sincerely,

A handwritten signature in blue ink, appearing to read "William Kohnen".

William Kohnen
Submarine Committee, Chair
Marine Technology Society

2024 ANNUAL SUBMARINE SYMPOSIUM at International WorkBoat Show - USA

Day 1 - Room 338 - Tuesday, November 12

8:30 – 9:30

Yearly Overview - State of Submarine Industry 2024

By: William Kohnen,
MTS - Submarine Committee Chair, USA

A review of the state of the submarine industry in 2024. This presentation offers a report across all sectors of the industry, spanning international research, commercial endeavors, expeditions, tourism, leisure, and government/security operations. This is an opportunity to gain a worldwide view and understanding of the submarine industry's global technology landscape, expeditions and regulatory directions.



9:30 – 10:00

ALVIN's '23-24 Operational Year and 60th Anniversary

By: Bruce Strickrott
DSV ALVIN - Group Manager
Woods Hole Oceanographic Institution
United States

The presentation will share information on Alvin's 60th year of scientific operations, detailing successful voyages to the active hydrothermal vents at the Eastern Pacific Rise, Hydrothermal vents in the Gulf of California, and the deep-water methane seep communities along the Aleutian margin (to 5000m). Additionally, the presentation will highlight some of Alvin's major milestones since initial certification in 1964 and speak to the program's future goals and plans for the years to come.



10:00 – 10:30

COFFEE BREAK

10:30 – 11:00

2024 Review of DSV Alvin Emergency Response Plan and Alvin's companion Observation Vehicle

By: Kaitlyn Tradd
DSV ALVIN - Lead Engineer
Woods Hole Oceanographic Institution
United States



In late 2023, the DSV Alvin program embarked on a detailed review of the program's Emergency Response Plan (ERP), in an effort to ensure that Alvin operations are well prepared for emergencies. The presentation will include information on the ongoing ERP review and the resulting recommendations to date. Additionally, the presentation will share details on Alvin's companion "Observations Vehicle", including planned improvements and developing design of a new, and improved Alvin "OV".

11:00 – 11:30

Safety Measures of SHINKAI 6500

By: Itaru Kawama
Director, Fleet Maintenance and Engineering Dept
JAMSTEC
Japan Agency for Marine-Earth Science and Technology
JAPAN



Manned submersible SHINKAI6500 was completed in Nov. 1989, and she reached 35 years old, and has made more than 1800 dives so far. The fact that it have been able to continue operating safely without any accidents for the past 35 years is nothing but a testament to the tireless efforts and high safety awareness of the operation staff working in the forefront, as well as the sound safety philosophy and the equipment based on it. In this presentation, the safety measure of SHINKAI6500 will be described while interweaving both hardware and software aspects.

11:30 – 12:00

SEAmagine's Latest 1300m Submersible: A New Tool for Scientific Exploration in the Tropical Pacific.

By: Charles Kohnen
Co-Founder & Chairman
SEAmagine Hydrospace Corp.
United States



SEAmagine has delivered its latest 1300m depth-rated 3-person submersible, designed to enhance National Geographic's Pristine Seas 5-year scientific expedition across the tropical Pacific. The presentation showcases the submersible's technology and its crucial role in supporting the mission's efforts to explore and conserve the region's marine ecosystems.

12:00 – 1:30

LUNCH BREAK

1:30 – 2:00 The History of United States Submarine Rescue

By: Greg Cotten, PhD
 Technical & Operational Authority
 JFD Ltd.
 United Kingdom



US Submarine Rescue: A diminishing capability in an increasing threat arena. Since the dawn of submarine rescue for that United States Navy in the 1930s, non-combat submarine incidents have luckily been few and far between; however, the threat of the loss of a submarine during transit, training, and certification dives remains. The threat during transit and training is simply increased by the sheer number of submarines operating globally and the major shift from an open ocean battlespace of the Cold War to the littoral missions of today. This paper will detail the waxing and waning of the US submarine rescue capability over the last 100 years and present the current capability and capability gaps.

2:00 – 2:30 UW Habitats - History SEALAB Program 60th Anniversary

By: William Kohnen
 President/CEO
 HYDROSPACE Group Inc
 United States



This presentation explores the 60-year legacy of underwater habitats, from the US Navy's Deep Submergence Systems and SEALAB projects to Cousteau's Conshelf designs. It traces the development of these habitats, their influence on space station design, and examines certification standards, along with future concepts for underwater "space stations."

2:30 – 3:00 The milestones of PLEXIGLAS(R) - A History of Acrylic

By: Alexander Petri
 Market Segment Manager
 POLYVANTIS GmbH
 GERMANY



This presentation will take a journey to the history of PLEXIGLAS(R), today known as acrylic, and which has made such an impact on the design and operation of submersible vehicles. This talk will look at the milestones of the material in the air as well as in the deep sea. From the beginning of Otto Röhm to the state of the art.

3:00 – 3:30

COFFEE BREAK

3:30 – 4:00

All The Corals We Cannot See

By: Sarah Frias-Torres
Research Associate
Smithsonian Marine Station
Smithsonian Institution
United States

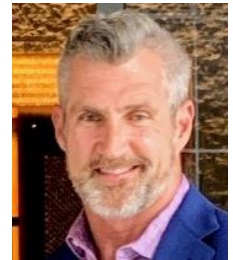


Cold-water corals (also known as deep-sea corals) form reef structures in continental margins and seamounts from polar to equatorial latitudes. Their global distribution makes them more widespread than shallow-water tropical coral reefs. Depending on species, their depth ranges from 40 m in the Arctic to over 3,000 m in seamount chains. They build habitat structures, are biodiversity hotspots, accelerate nutrient cycling, alter current flow, and sequester carbon. But we have not mapped all the locations and the extent of these unique ecosystems, due to the limited funding and resources (submersibles, and robotic solutions) allocated to ocean exploration. This lack of knowledge hinders our ability to fully understand the impact of cold-water coral ecosystems on ocean biology, fisheries, and Blue Carbon. It is an information gap we cannot ignore given ongoing pollution, deep-sea fishing, offshore wind energy infrastructure, the potential of deep-sea mining, and the climate crisis. Here, I explain briefly the critical role of cold-water coral ecosystems and how the submersible and ocean robotics community can leverage resources so that every dive becomes a science dive to advance the mapping, conservation, and restoration of these unique ocean ecosystems.

4:00 – 4:30

Unlocking the Depths: Opportunities for Submersibles in the Yachting Industry

By: Jay Wade
Chairman
International SeaKeepers Society
United States



The yachting industry is on the cusp of a new era where the integration of submersibles is transforming seafaring luxury and exploration. This presentation examines the burgeoning opportunities that submersibles offer to yacht owners, builders, and the marine industry at large. We will explore how advances in submersible technology are making underwater exploration more accessible and safer, adding unparalleled value to the yachting experience. Key topics include the latest innovations in submersible design, compatibility considerations for yacht integration, and the regulatory landscape governing private submersible use. We will also discuss the potential for submersibles to contribute to marine research and environmental conservation efforts, aligning luxury with sustainability. By embracing submersibles, the yachting community can unlock new frontiers beneath the waves, offering clients unique adventures while promoting oceanic awareness and stewardship. Attendees will gain insights into market trends, investment opportunities, and practical guidance on incorporating submersibles into yacht operations. Join us to discover how submersibles are not just an addition to yachting but a gateway to the hidden wonders of the ocean depths.

6:00 – 9:00 **MTS/Blue Robotics Happy Hour**



TUESDAY, Nov 12th
6pm – 9pm

Brewery St. X
734 Loyola Ave, New Orleans, LA 70113

COME and JOIN US – CELEBRATE with Friends!



2024 ANNUAL SUBMARINE SYMPOSIUM

Day 2 - Room 338 - Wednesday, November 13

8:30 – 9:00

U.S. Submarine Rescue System Recertification and Capability Gaps for Modernization.

By: Curt Cunningham
Assistant Program Manager
US NAVY - NAVSEA PMS390
Undersea Special Mission Systems
United States



U.S. Submarine Rescue System (SRS) certification was suspended 13 July 2021. Over the period of three years, significant efforts by the Submarine Rescue Enterprise have been made to improve material and procedural deficiencies inhibiting safe and effective maintenance and operations. Coming to a close on recertification of the U.S. SRS, efforts are being redirected to upgrading and modernizing the SRS for operations through 2043. Brief provides a high-level overview of SRS recertification and capability gaps to include driving requirements and required timeline for execution.

9:00 – 9:30

US Navy Submarine Rescue



By: Liz Hunter
MOSHIP Surveyor
OCEANEERING Int'l Inc.
United States



LT Bryan Tierney, USN
Operations Officer
Undersea Rescue Command (URC)
United States

The U.S. military maintains and operates a manned underwater vehicle (MUV), the Pressurized Rescue Module (PRM), that is used for submarine rescue response. The submarine rescue handling system is classed by the American Bureau of Shipping (ABS), part of the International Association of Classing Societies (IACS), to ensure safety standards are established and adhered to. The rescue system's concept of operations includes a capable vessel of opportunity (VOO) to serve as a Mother Ship (MOSHIP) where the PRM and its support equipment is installed on the working deck. Submarine rescue has been around since the 1930s and countries around the world still maintain and operate different rescue systems. This presentation will discuss the MOSHIP Surveyor's responsibilities at the U.S. Navy's

Undersea Rescue Command (URC) in San Diego, California. URC's Submarine Rescue Diving and Recompression System (SRDRS) includes the tethered PRM being deployed into the water column off the stern of a VOO with an A-frame that is built on the seaport's pier. The MOSHIP Surveyor assists URC to build rescue plans which include detailed VOO surveys, airfield surveys, and seaport surveys; ensuring the SRDRS can be safely transported and mobilized onto a VOO in the event of any submarine emergency around the globe.

9:30 – 10:00

Rapidly Deployable Undersea Survey System in a box

By: Chris Haugen
Business Development Manager, N. America
FORCYS Inc.
United States



In the realm of undersea rescue, Time to First Rescue (TTFR) is of the absolute essence. Sortie of rescue-capable vessels to the distressed submersible site is the long leg in assembling needed rescue resources. Once there, without actionable information on the state of play at the distressed submersible, more time is lost in assessing the situation. "Rapidly Deployable Undersea Survey System for Rescue Support" (RDUSSRS) refers to two variations of self-contained undersea survey systems. Packaged in standard ISO classified containers with additional classification as service units, RDUSSRS provides the ability to establish precise location and a profound understanding of the situation at the distressed submersible that can be used for rescue mission planning. This information can substantially decrease TTFR and improve operational safety.

RDUSSRS is a robust combination of acoustic, optical, and laser imaging sensor packages that are optimized for high-resolution seafloor surveys. As such, RDURSS would likely act first as a national or commercial asset used in a wide variety of survey and inspection tasks. It need not sit unused while awaiting a call to action. The first system, similar to one soon to be delivered to a NATO navy for a variety of survey missions, uses a high payload capacity remotely operated towed vehicle (ROTV) carried in a 20' container holding a deployment arm and winch system and includes an operator station. It can be rapidly deployed and mounted on a suitable vessel of opportunity. The highly effective sensor package is optimized for search, localization, and detailed survey.

The second system, which is fully self-contained in a 40' container, provides an uncrewed surface vessel (USV) with a cylindrical ROTV. The containerized system can be delivered to the waterfront and the 26' USV put in the water. The ROTV "nests" in the specially shaped hull under the USV, which contains the deployment winch. Survey mission management software powers both systems and allows mission planning, real-time data acquisition and processing, or subsequent offline analysis supporting deep learning. An exceptionally effective multiple aperture side scan sonar provides acoustic imaging of objects on the seafloor. Precise positioning and navigation for accurate location of found objects are accomplished with an ultra-short baseline (USBL) system and a coupled inertial navigator and Doppler velocity log. Additional sensors can be included with either system to augment the mission or enhance identification and classification ability.

10:00 – 10:30

COFFEE BREAK

10:30 – 11:00

Practical Depth Limit of a Two-Occupant Transparent Acrylic Sphere Submersible Vehicle

By: Jarl Stromer
Compliance Manager
TRITON Submarines LLC
United States

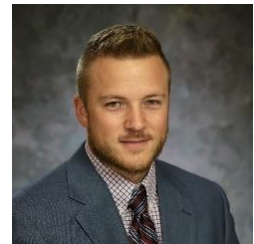


The Triton Abyssal Explorer (AE) is a two (2) occupant submersible vehicle designed and certified to operate safely, reliably, and repeatedly to a depth of 4,000 meters. Just like all Triton submersibles (with the exception of the full ocean depth rated 36000/2), the AE has a transparent acrylic pressure hull which is subject to the requirements of the ASME PVHO-1 Safety Standard. 4000 meters is the maximum depth limit of a two-occupant transparent acrylic sphere submersible vehicle using the design criteria of the PVHO-1 Safety Standard. This paper describes some of AE’s innovative design features.

11:00 – 11:30

Alvin Hull Post-Weld Heat Treatment

By: Kyle Robinson
Senior Research Engineer
SWRI - Southwest Research Institute
United States



After electron beam welding of the pressure boundary components of the Alvin titanium sphere, Southwest Research Institute staff led the post-weld stress-relieving heat treatment in 2010. This presentation recounts the decisions and process involved in one of the many risky steps in the creation of the 6,500-meter hull.

11:30 – 12:00

Chemicals an often underestimated danger to acrylic

By: Jakob Sixl
CEO
Heinz-Fritz GmbH
Germany



Acrylic components can come into contact with chemicals during their service life. Be it during cleaning, installation, operation or storage. The user is often unaware of the effects of some chemicals. Some chemicals can destroy an acrylic component within seconds, for example. The presentation is intended to sharpen the general understanding of interactions between chemicals and acrylic and thus avoid incorrect procedures and accidents.

12:00 – 1:30

LUNCH BREAK

1:30 – 2:00

**Overview of the ABS Underwater Rule Change Proposals
(Annual Industry Meeting)**

By: Roy Thomas
Sr. Principal Engineer
ABS - American Bureau of Shipping
United States



The American Bureau of Shipping (ABS) Rules for Building and Classing Underwater Vehicles, Systems and Hyperbaric Facilities, commonly known as the “Underwater Rules”, are the primary ABS Rules for classification of underwater units. These underwater units include manned submersibles, lock-out submersibles, diving systems, atmospheric diving suits, remotely operated vehicles (ROVs), autonomous underwater vehicles (AUVs), and so forth that are used for commercial, scientific, and government applications. This industry meeting gives an overview of the annual ABS Underwater Rule change proposals and provides further insight into the rationale and basis for each proposed Rule change. Following this overview, the meeting includes a question-answer session and facilitates an open dialogue with the industry on current technical issues. All active designers, fabricators, owners and operators are invited to attend and provide feedback.

2:00 – 2:30

**Launch and Recovery - the real safety threat to manned
submersibles**

By: Ben Sharples
Managing Director
SMP Ltd.
United Kingdom



Reflection on the dangers that launch and recovery poses to submersibles operations with some lessons learnt from real accidents/incidents and some thoughts on how to make launch and recovery not only safer but also more enabling.

2:30 – 3:00

“Collapse Under Pressure” Being Ready to Take Personal Risk to Prevent Undersea Fatalities: Lessons from the US Navy to the Titan Submersible

By: CAPT Gard Clark, USN (Ret)
Principal
CPMQ Consulting LLC
United States



The sea is an unforgiving environment. Sea pressure increases roughly 44 psi for every 100 feet of depth, equating to one atmosphere for every 10 meters. At the Titanic's depth, pressure reaches nearly 6,000 psi, about 400 times normal atmospheric pressure. This immense pressure challenges not only submersible vehicles but also the experts who design, maintain, and operate them. Success or failure, and indeed life or death, hinge on a strong safety culture and individuals willing to “stand in the breach” to prevent disaster.

Undersea professionals bear a unique responsibility to stop disasters. As Admiral Hyman Rickover, the father of the nuclear navy, once said: “...it is the duty of each of us to act as if the fate of the world depended on him. Admittedly, one man by himself cannot do the job. However, one man can make a difference. We must live for the future of the human race, and not for our own comfort or success.” How will you react when doing the “right thing” conflicts with your own comfort or success?

Gard Clark will share thought-provoking examples from over 40 years of experience as a naval officer, submarine captain, commercial plant manager, business executive, and current Co-Chair of the Marine Technology Society Submarine Committee and Deputy Executive Director of the World Submarine Organization.

3:00 – 3:30

COFFEE BREAK

3:30 – 4:00

DNV Classification Rules for Underwater Habitats

By: Jonathan Struwe
Head of Section
Underwater Technology, Maritime
DNV - Det Norske Veritas
Germany



The objective of the presentation will be to provide the audience with an overview of DNV's new rules on underwater habitats. It will be based on DNV Rules for design and construction of underwater systems and the Class systematics which can be applied to new building projects for ensuring that a systematic safety approach is applied over the lifetime of the habitat.

4:00 – 5:00

**Submersible Operations Safety
A Collective Consensus Standard based on Industry Best Practices**



William Kohnen
Executive Director



CAPT Gard Clark, USN (Ret)
Deputy Director



Greg Cotten, PhD
Secretary

WORLD SUBMARINE ORGANIZATION

As demonstrated over the past year, there remains a pressing need to ensure that the public, operators and port authorities, can quickly recognize and evaluate the safety credentials of submersibles. Given the technical complexities, it is essential that states take the lead in establishing a straightforward system for identifying submersibles and clarifying their safety status.

This meeting brings all industry stakeholders around the table to review critical findings from the recent U.S. Coast Guard OceanGate investigation and discuss strategies for achieving a unified, global approach to submersible identification of status.

The ultimate objective should develop a practical solution that works seamlessly across international boundaries, empowering operators, owners, and stakeholders alike. This open meeting invites all to join us in discussing potential frameworks, challenges, and collaborative pathways for success.

2024 ANNUAL SUBMARINE SYMPOSIUM

Day 3 - Room 338 - Thursday, November 14

9:00 – 9:30

Establishing design limits for Design By Analysis for Glassy Polymers

By: Bart Kemper
Principal Engineer P.E., CPEng
Kemper Engineering Services
United States



The ASME task group for Design by Analysis for Glassy Polymers was formed in 2019. The intent is to develop a reliable, repeatable engineering process for using transparent glassy polymers, including acrylic, in engineering applications using modern engineering methods. The current method for plastic use in pressure vessel boundaries (hulls, windows, light pipes) is currently specified an ASME PVHO-1 and is limited to the results of 1960's empirical testing of a single polymer with a finite range of geometries. This method can be considered to be "Design By Rules" and does not allow for new shapes to be used, loads other than uniform pressure, nor does it apply material properties directly in the design the way most engineering design is done. In the current method, if the material meets the required minimums, then the resulting design is the same regardless of the actual physical properties. The Design By Analysis in current development applies the tested material properties at a given temperature in a method similar in concept to ASME Boiler and Pressure Vessel Code Section VIII, Division 2, Part 5, "Design By Analysis". This presentation proposes the method for determining the design limit for a given application for a range of glassy polymers, with subsequent implications regarding in-service evaluations and fitness-for-service.

9:30 – 10:00

Thoughts on a Modular Software Architecture for Deep Sea Submersibles

By: Mike Zintel
Principal
W. Michael Zintel Consulting
United States



I attended Underwater Intervention in 2023 and met a few of my heroes, and a large number of amazingly talented and committed people. Having a background in software, and firm belief that these days that it is not only is it wiser to buy than build, but that everything has been done before, I expected to find multiple vendors offering exactly what I describe here. I found one, on the show floor. The vendor had this, and more. Much more. They were demonstrating a rotating chair with multiple touch screens and sticks. It was cool. Unfortunately, it seems to be targeting tugboats and container ships and cruise ships and was little spendy, and a little overkill for the submersible market as I understand it today.

This patten would repeat. There are many, very (!) sophisticated solutions for topside mounted sensors and large, complex craft. These solutions were often adaptable to remote

control scenarios in the form of ROVs and AUVs, and over the horizon. Most of these assume large screens, keyboard and mouse, networks and were functional overkill for submersible pilots. There seems to be an unfilled narrow gap. The market doesn't fill it with off the shelf solutions because the volume is too low. Manufacturers either build their own, and/or try to integrate existing solutions as best they can or go without. In this paper I postulate an abstract architecture for in-cabin automation, reasons to build one, and some requirements. I do not have such an implementation today.

10:00 – 10:30

COFFEE BREAK

10:30 – 11:00

ICTINEU new generation li-po batteries with increased capacity and voltage, case studies.

By: Carme Parareda
COO
ICTINEU Submarins SL
Spain

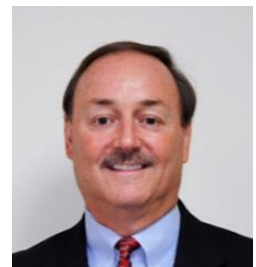


Lithium batteries are increasing in energy and increasing in voltage, offering ever greater options for submersibles, AUVs and seafloor resident systems. This presentation will offer a case study taking the step to high energy - high voltage subsea li-po batteries.

11:00 – 11:30

Condition Based Monitoring with a Subsea Battery's Battery Management System

By: Leon Adams
VP, Sales & Marketing
Southwest Electronic Energy Corp
United States



Reliability and state of power is critical information for subsea applications such as manned submarines, autonomous underwater vehicles, subsea instruments, or subsea work over control systems. A battery management system (BMS) can provide detailed feedback on demand to keep the operator well informed of battery system utilization, remaining capacity, and state of health.

Key parametric information such as Voltage, Current, temperature, remaining amp hours or watt hours capacity, and various state of health or fault codes can be monitored to get a full status condition of your subsea power system while operating subsea. An example BMS for SeaSafe subsea batteries will be demonstrated live to provide user awareness of the capability of such operation time subsea condition based monitoring available for a subsea battery system.

11:30 – 12:00

**ASME PVHO Acrylic Windows –
Overview of the 2023 Safety Standard**

By: William Kohnen
President
Hydrospace Group Inc.
United States



The ASME Safety Standards for Acrylic Windows in Pressure Vessels for Human Occupancy (ASME PVHO) possess a rich history, grounded in a unique foundation of specialized knowledge and extensive empirical testing data that is recognized as unparalleled worldwide. Its design, fabrication, testing, and certification processes are globally acknowledged, with an extensive scope and continuous updates ensuring the standard remains at the forefront of safety. Since its inception in 1977, the standard has undergone numerous revisions, with the latest version being ASME PVHO-1-2023. While the standard covers a range of applications—including submersibles, diving systems, and medical chambers—its most distinctive focus is the design of acrylic windows.

This presentation will offer a comprehensive review of the latest updates to the standard, highlighting major changes and revisiting fundamental considerations for new acrylic window installations in PVHO applications, replacement of expired windows, and ongoing maintenance as specified by the standard

12:00 – 1:30

LUNCH BREAK

1:30 – 2:30

ANNUAL MTS Submarine Committee Meeting

BIOGRAPHIES – 2024 SPEAKERS



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Leon Adams is a Vice President at Southwest Electronic Energy (SWE). He has 13+ years' experience in Lithium and Lithium Ion battery applications, product definition, applications engineering, technical customer support, and sales. With his focus on Subsea Lithium Ion battery power, Leon has authored various technical papers and articles and presented at Oceans International, Underwater Intervention, MTS SUV Symposium, and other technical conferences. Prior to SWE, Leon had 28 years' experience at Texas Instruments as a Microprocessor Systems Engineer and Product Manager, managing applications, marketing, and business in Digital Signal Processing (DSP) and embedded processing. At TI, Leon authored technical articles on DSP processors, embedded processing solutions, DSP power management, and software development tools. Leon is a member of MTS, SUT, AADE, and IEEE. He has a BS in Engineering Physics from Murray State University and an MBA from the University of Texas-Austin.



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Captain Clark is a career submariner whose undersea experience includes 31 years in the United States Navy culminating with command of the USS DALLAS (SSN-700), a fast attack nuclear powered submarine specially equipped to carry the Seal Delivery Vehicle (SDV). The SDV is a deployable MUV housed in a Dry Deck Shelter on the deck of the larger submarine and is a "wet submersible" where operators wear scuba gear and are exposed to the ocean environment. While in command, Captain Clark conducted operations with special forces using the SDV during two six-month deployments to the Middle East and Indian Ocean. Following command at sea Captain Clark served as the Major Program Manager for Naval Sea Systems Command (NAVSEA) PMS-399--Special Operations Forces Undersea Mobility Program Office. There he was responsible for sustainment and development of Dry Navy Submersibles as well as Dry Deck Shelters and other submarine Deep Submergence Systems including maintaining Scope of Certification for manned operations. Following retirement from the Navy in 2012, he joined Teledyne Brown

Engineering, Inc. where he currently serves as Senior Vice President leading the Energy and Environment Business Unit at Teledyne Brown Engineering in Huntsville, AL and also with responsibility for Teledyne Energy Systems in Hunt Valley, MD. Teledyne Brown Engineering is the designer and manufacturer of the US Navy Shallow Water Combat Submersible which is the follow-on vehicle to the SDV and also manages the Teledyne Slocum Glider in conjunction with Teledyne Marine. Teledyne Energy Systems produces undersea lithium-ion battery systems as well as the Subsea Supercharger® untethered persistent undersea electric generating fuel cell system. Captain Clark is deputy Director of the World Submarine Organization and co-chair of the Marine Technology Society's Submarine Committee.



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Dr Gregory B. Cotten graduated from the United States Naval Academy in 1987 with a B.S. in Systems Engineering. He completed 5 strategic deterrent patrols on USS JAMES MADISON (SSBN-627), ultimately as Strategic Weapons Officer. He completed his M.E. and Ph.D. in Chemical Engineering from the University of Idaho in 2000 and then served as Associate Chair and Assistant Professor of the Chemistry Department at USNA; as EXECUTIVE OFFICER, Deep Submergence Unit; DEPUTY COMMANDER for Combat Development, Naval Special Warfare Group 3; and retired in 2014 as DEPUTY COMMANDER for Undersea Rescue at Commander Submarine Squadron 11. Since 2014, he has been involved with global Submarine Escape and Rescue Systems (SERS) at JFD Ltd., in leadership positions for offshore operations, training and competence, and through-life engineering design, maintenance and certification. He is currently the SERS Technical and Operational Authority and holds a Master Mariner's Credential from the United States Coast Guard.



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Mr. Cunningham of Erie, Pennsylvania, enlisted in the United States Navy following high school in 1998 and served through 2008. He departed the Navy as a Machinist Mate 1st Class / Submarine Service. During his service, he served aboard the USS Newport News (SSN-750), the USS Hampton (SSN-767), and Mid-Atlantic Regional Maintenance Center (MARMC) Submarine Repair Shop. Mr. Cunningham is the Assistant Program Manager for Submarine Escape and Rescue Global Rescue responsible for foreign military sales and certification of Foreign Partner Navy Submarine Rescue Seats.

He has served in several roles throughout the Submarine Escape and Rescue enterprise since December 2012, most recently, as the Assistant Program Manager Acquisition and Certification leading the delivery of the United States Navy Submarine Decompression System in October 2019. He served as the Test and Evaluation Engineer for Acquisition and has had assignments throughout the In-Service Submarine Escape and Rescue Organization.

Upon departure from the United States Navy, he was a contractor providing support for Naval Sea Systems Command responsible for all Team Submarine In-Service Submarine Support Contractors at Perot Systems Government Services and Dell Services Federal Government providing engineering, test and evaluation, modernization, logistics, training development, and certification support. Mr. Cunningham has received various awards, including the Navy Meritorious Civilian Service Award, Naval Sea Systems Command Team Submarine Excellence Award, Navy Commendation Medal, and Navy Achievement Medal.



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Dr. Sarah Frias-Torres is a fieldwork-oriented biological oceanographer and marine ecologist. She finds innovative solutions to the climate crisis through biomimicry, by taking inspiration from nature to implement the actions needed to ensure the co-existence of people, wildlife, and wild places. Her research focus includes Marine Conservation, Restoration Ecology, Behavioral Ecology, and Conservation Biology of marine megafauna.

Dr. Frias-Torres is committed to making her research available to the general public through science outreach using documentary filmmaking, and social and broadcast media (TV, radio, press). In the past, she was a U.S. National Research Council Postdoctoral Fellow, a Schmidt Ocean Institute Postdoctoral Fellow, and a Chief Scientist in coral reef restoration at Nature Seychelles, Republic of Seychelles.

At present, Dr. Frias-Torres is a Research Associate with the Smithsonian National Museum of Natural History in Washington DC and the Smithsonian Marine Station in Fort Pierce, Florida, USA. She is a Fulbright Fellow.



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Chris Haugen is Forcys's business development manager for North America. He was a career submarine officer in the U.S. Navy, including command of the nuclear-powered ballistic missile submarine, the USS Nebraska (SSBN-739) (Gold).



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Liz Hunter is the Mother Ship (MOSHIP) Surveyor for the Oceaneering's Technologies (OTECH) group in San Diego, California supporting the U.S. Navy's submarine rescue mission. As MOSHIP Surveyor, Liz is responsible for surveying vessels and facilities worldwide for the feasibility of supporting unique undersea equipment.

Previously, Liz served eight years in the active-duty U.S. Coast Guard and continues to serve today as a Commander at Sector San Diego where she leads the reserve Response Department whose focus is law enforcement and oil spill response in the southern California region. Liz graduated with a BS in Civil Engineering, at the Coast Guard Academy. Following her active-duty career, Liz went back to school and received a Master of Science in Architecture from Woodbury University and a Master of Advanced Studies in Marine Biodiversity at Scripps Institution of Oceanography, University of California San Diego (UCSD). Liz grew up in Warren, Pennsylvania and is now a resident of Imperial Beach, California.



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Mr. Kawama is director of Fleet Maintenance and Engineering Department at the Japan Agency for Marine-Earth Science and Technology (JAMSTEC). His journey began as a deep submersible pilot in JAMSTEC, where he spent 15 years honing his skills in submersible operations. During this time, he not only piloted these advanced vehicles but also assumed the role of Chief Mechanic, further deepening his understanding of the intricacies of underwater systems. His career then transitioned in a role overseeing the maintenance and engineering of JAMSTEC underwater vehicles, where he spent several years dedicated to ensuring the reliability and functionality of these cutting-edge systems. With a broad perspective on marine exploration, Mr. Kawama subsequently assumed responsibility for the maintenance and engineering of research fleets, amassing over 10 years of experience in this critical domain.



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Bart Kemper, P.E. is a Louisiana-based mechanical engineer with 30 years of engineering consulting in a wide range of industries as well as a civil engineering background through the US Army Corps of Engineers. Kemper's winding career path developed expertise in pressure vessels, marine and subsea engineering, plastic engineering, life-safety applications, medical devices, human factors, and numerical modeling. He has worked on a number of saturation diving and submarine designs, to include being the lead investigator for a technical team supporting the USCG Marine Board of Investigation regarding OceanGate and the Titan Submersible. Kemper is also a retired US Army engineer officer with a background including construction management, infrastructure assessment & development, targeting, forensic post-attack assessments, blast effects modeling, and protective structure engineering. He has over 35 professional publications, is a peer reviewer for multiple publications, and is the current Editor in Chief for the Journal of National Academy of Forensic Engineers. He is a member of multiple ASME Codes & Standards committees, including Pressure Vessels for Human Occupancy, where he is chair of the Subcommittee on Viewports and the Task Group for Design-By-Analysis For Glassy Polymers.



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Charles Kohnen, a Canadian native born to a German immigrant dairy farmer, grew up on a farm in Quebec. He built a diverse career as an engineer and manager in the offshore service industry, working across Africa and Asia with Schlumberger International. In 1995, he co-founded SEAmagine Hydrospace Corporation, a pioneering company in the design and manufacturing of one-atmosphere manned submersibles. Over the years, Charles has been instrumental in revitalizing this specialized marine sector. He served as SEAmagine’s executive vice-president from 1995 to 2010, president from 2011 to 2022, and currently holds the position of chairman. Mr. Kohnen holds a Bachelor of Electrical Engineering and Business Administration from McGill University in Canada.



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William Kohnen is president and Chief Executive Officer of HYDROSPACE Group Inc., a California company expert in manned submersibles, mission critical control systems and pressure vessels for human occupancy. Mr. Kohnen has 30 years of engineering experience in engineering, serving the space, medical and subsea industries with a primary mission to provide complete solutions to all types of high reliability applications. He is executive director of the World Submarine Organization and chairman of the Marine Technology Society (MTS) committee on Submarine Vehicles for the past 21 years. He has published many papers and articles on the state of the submarine industry. Mr. Kohnen is a member of the ASME PVHO Safety Standards Committee, a member of the ABS Special Committee on Rules for Underwater Vehicles, Industry representative for DNVGL Underwater Technology Rules review, member of the Undersea and Hyperbaric Medical Society (UHMS), and the Aerospace Medical Society. Mr. Kohnen is Co-Founder of SEAmagine Hydrospace Corp, which designs and produces manned submersibles since 1995, with multiple vehicles distributed around the globe. Kohnen was born in Germany. He has a bachelor’s and master’s degree in electrical engineering at McGill University, in Montreal, Canada.



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Carme Parareda. Co-founder, administrator and COO of ICTINEU Submarins SL. As a Surveying Engineer she worked in the service of the Cartographic Institute of Catalonia for 15 years, since 1992, in the field of geodesy, high accuracy positioning and GPS navigation techniques. In 2004 she re-oriented her career to ocean observation and underwater technology, co-founding in 2004 the Ictineu Institute, Catalan Submarine Research Centre, and in 2007 ICTINEU Submarins SL where she develops her main professional activity as chief operations manager, sales, certification procedures and pilot in training. In parallel from 2007 to 2009 she coordinated the Argo Maris Foundation activities (sea exploration and outreach) and from 2009 to 2016 she was

a board member of the Catalan Maritime Cluster. Member of the Marine Technology Society since 2009. A traveller who loves adventure sports and mountaineering, after crossing Mongolia by bike, she sailed across the Atlantic twice. She co-wrote a book l'Atlàntic a quatre mans (The Atlantic four hands).



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Mr. Petri started in 2008 as an apprenticeship at Evonik Industries as a mechanic. This was the first contact with the production site for casted blocks. After several maintenance weeks on the cast line he realized he had to study something more about polymers. In 2011 he started a "Bachelor of Plastics Engineering" in Darmstadt and went on with the Master of Plastics Engineering until 2018. Directly after University he started as a Plant Assistant Manager in the Cast Plant and felt close to where he had planned to be, namely the PLEXIGLAS(R) Block products. 2021 he took the opportunity to manage the Market Segment Specialty Glazing with all its technical finesses. To take care of the block business of Röhm, now Polyvantis, was a great decision. Meeting all the people from different industries, solving problems and developing future solutions, is the favorite part of the job.



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Kyle Robinson is a mechanical engineer from the Marine Structures & Engineering Section at Southwest Research Institute in San Antonio, Texas. Originally from Bastrop, Texas, he has been at SWRI for over 17 years, designing and analyzing manned and AUV hulls, ASME Division 2 and 3 pressure vessels, and large-article test frames. He was part of the small team that led the Alvin 6,500-meter hull development and continues to occasionally support the overall vehicle effort.



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Marine Engineer specializing in Diving and Manned Submersibles for most of his career.



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Jakob Sixl is co-owner of Heinz Fritz GmbH, a family owned company for plastic processing in the south of Germany. He started working in the company beside school since 2003. After finishing his degree as a sports equipment technologist (Science in Engineering) at FH Technikum Vienna in 2012, he started to work fulltime for Heinz Fritz GmbH. As an all-rounder, he accompanies projects from start to end. Jakob Sixl's specialties are: complex thermoforming of acrylic and CAD design. Since 2018 Heinz Fritz, his stepfather, and Jakob Sixl are sharing the ownership for Heinz Fritz GmbH. The passions for extraordinary projects link them well together and keep them motivated to find together solutions for high quality products out of acrylic.



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Jonathan Struwe is Head of Section for Underwater Technology at DNV in Hamburg, Germany. The Underwater Technology Section of DNV is primarily involved in manned submersible classification activities of DNV. Currently, he leads several manned submersible new-building classification projects. The technical experts at DNV's Underwater Technology Section are dealing with approval and analysis of a wide range of underwater systems and provide, besides approval according to the DNV Rules for Underwater Technology, technical expertise based on an engineering approach.



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Bruce Strickrott is Group Manager and Senior Pilot of the DSV Alvin at the Woods Hole Oceanographic Institution (WHOI). Alvin, and its support ship, the R/V Atlantis, are owned by the U.S. Navy and operated as part of the U.S. National Deep Submergence Facility, with principal funding from the National Science Foundation and Office of Naval Research. Bruce joined the Alvin operations team in 1996 and has logged over 356 dives for a total time of over 2400 hours (100 days) submerged. Throughout his tenure, he has travelled extensively with the submersible, supporting scientists from around the world with dives to depths of 4500 meters. He participated in several major Alvin overhaul events including the completion of the newest Alvin in 2013. Currently, Bruce has oversight of the engineering and operations groups working on new designs to complete Alvin's final systems conversion for 6500-meter depth certification. Bruce's early career was spent in the service of the U.S. Navy. He has a Bachelor of Science in Ocean Engineering from Florida Atlantic University in Boca Raton, Florida, graduating cum laude in 1996.



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Jarl manages Triton Submarine's classification, certification, and statutory compliance program. He's also a subject matter expert on acrylic pressure vessel technology. He has presided over significant advancements in the fabrication of acrylic pressure vessels for human occupancy, the quintessential feature of a Triton submersible. He's also actively working to develop rules for the design by analysis (DBA) of acrylic pressure vessels for human occupancy (PVHOs). Previously, Jarl was responsible for classification of manned submersibles at the American Bureau of Shipping (ABS) spanning the mid-1980s to the mid-1990s, a time of explosive growth in the submersible industry, particularly tourist submersibles. He served on several technical committees involved in promulgating codes and standards for manned submersibles.



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Roy Thomas works as a Senior Principal Engineer with the American Bureau of Shipping (ABS) and is based in Houston, TX. He has worked with ABS for the past 21 years. In his current role, he serves as the ABS engineering liaison to the U.S. Coast Guard, as well as the ISO/TC8 - U.S Technical Advisory Group. He also serves as the Americas technical lead for rule development, engineering equivalencies and interpretations. He has formerly served as the Manager of the Corporate Chief Engineer's Office and Managing Principal of the Underwater Systems and Lifting Appliances Group.

Mr. Thomas has extensive experience with the certification of underwater vehicles, systems and hyperbaric facilities for commercial and military applications. He has served as the lead design review engineer at ABS on numerous projects involving underwater vehicles, systems and hyperbaric facilities of every possible form and design. Over the years, he has played an active role in updating the ABS Rules for Underwater Vehicles, Systems and Hyperbaric Facilities and has authored new sections on Underwater Habitats, Diving Systems, Lock-Out Submersibles, Ambient-Pressure Submersibles, Atmospheric Diving Suits, AUVs, ROVs, Lithium Batteries, etc.

Mr. Thomas is actively involved with various industry committees and currently serves as the Chair of the ASME PVHO - Subcommittee on Diving Systems, as well as the Subcommittee on Submersibles. He also currently serves as the Chair of the SNAME T&R Panel OC-6 and is coordinating the efforts to update the SNAME textbook "Submersible Vehicle Systems Design".

Mr. Thomas holds a master's degree in Ocean and Naval Architectural Engineering from Memorial University of Newfoundland, Canada with a specialization in underwater vehicles and systems. He also holds a bachelor's degree in marine engineering from Marine Engineering and Research Institute, India.



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A native of Mound, MN, LT Tierney graduated from the University of St. Thomas (MN) in 2018 with a Bachelor of Science in Mechanical Engineering and earned his commission through Officer Candidate School that same year. He is currently enrolled at Old Dominion University for a Master of Science in Engineering Management. His Division Officer tour was in Pearl Harbor, HI, where he split tour on the USS Illinois (SSN 786) completing at Western Pacific Deployment and onboard USS Mississippi (SSN 782) where he completed an Extended Dry-docking Service Restrictive Availability (EDSRA) and a surge deployment to Perth, Australia in support of AUKUS. During his tenure in Pearl Harbor, he was recognized as the 2022 Commander, Submarine Squadron One Junior Officer of the Year.

LT Tierney is currently serving on shore tour as the Operations Officer for Undersea Rescue Command in San Diego, CA. During this time he has qualified Deep Submergence and has been recognized with the Green and Red "N" and Battle "E." His personal awards include the Navy Marine Corps Commendation Medal and the Navy Marine Corps Achievement Medal (3 Awards).

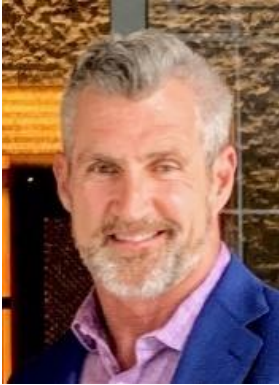


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Kaitlyn Tradd is the Mechanical Systems Lead for the Alvin HOV at Woods Hole Oceanographic Institution. She holds a degree in Mechanical and Ocean Engineering from Massachusetts Institute of Technology and has been at WHOI since 2011. One of her first projects as a newly-hired engineer was Phase 1 of the Alvin 6500m overhaul and following its completion, she served as an entrepreneurial, freelance design engineer for scientists in all academic departments at the Institution for over ten years. This allowed Kaitlyn the opportunity to design several different submersibles, both autonomous and tethered, as well as sampling systems and field support equipment, taking these technologies on research cruises worldwide. In 2023, she was offered a position in the Alvin Submersible Engineering & Operations Group and has enthusiastically fulfilled this role. Outside of her Alvin commitments, Kaitlyn still maintains a select few active research projects with science PIs who have come to rely on her experience and expertise.

Kaitlyn resides in Falmouth, MA with her husband Ben Tradd, a Jason ROV pilot and expedition leader, and their young daughter, maintaining a small family farm when their cruise schedules allow.



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Jay Wade is a seasoned entrepreneur with over three decades of experience in the technology sector. He founded his first company in 1988, developing software designed for electronic case management systems used by the U.S. Federal Court system. After successfully growing and selling that company in 1999, Jay continued to pursue business interests across various technology-related fields.

Currently, he splits his time among several ventures: Oklahoma Technology Solutions, an information technology professional services firm; Flyover Software, a developer of vertical market software; and Fresh Fit 405, a provider of fresh, ready-made meals focused on convenience and health. Residing in Oklahoma City, Jay has a passion for adventure and enjoys engaging in anything that offers a thrilling experience.



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Mike is an independent software and business strategy consultant. His first career goal was to be a famous natural history and underwater photographer. It didn't work out. He thought he retired in 2019 to pursue his post-career goal of making and posting high quality underwater video for strangers to view for free on Instagram or TikTok. And it was going OK, when he booked a trip with Undersea Hunter Group and did several dives in DeepSee at Cocos Is. After that he developed what his wife calls a "submarine problem".

Mike is retired and his last role in BigTech was Vice President of Engineering / Distinguished Engineer, Microsoft. He worked for 25 years at Microsoft and 38 years in the industry, including a stint at Motorola.

2024 Submarine Industry Directory



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