FACEPLATE

The Official Newsletter for the Divers and Salvors of the United States Navy
Volume 28, No. 2 / December 2024

In This Issue...

Francis Scott Key Bridge Salvage
ONR/NAVSEA Undersea Medicine Projects
SEALAB 60th Anniversary Reunion
The Rat Race, When Preparation Pays Off

FACEPLATE is published by the Supervisor of Salvage and Diving to make the latest and most informative news available to the Navy diving and salvage community. Discussions or illustrations of commercial products do not imply endorsement by the Supervisor of Salvage and Diving or the U.S.Navy.

Articles, letters, queries and comments should be directed to the Commander, Naval Sea Systems Command, NAVSEA 00C, 1333 Isaac Hull Ave. SE Stop 1070, Washington Navy Yard, DC 20376-1070. (Attn: FACEPLATE). Visit our website at **http://www.navsea.navy.mil/Home/SUPSALV/00C3-Diving/Faceplate-Magazine/** to view/print Faceplate.

Editorial Staff

In This Issue

SUPSALV Sends 3
The Rat Race, When Preparation Pays Off 4
Francis Scott Key Bridge Salvage 7
A Look at the Hazards of Diving Near Active Sea Suctions 10
The Man in the Sea Museum's MKV Scholarship Program 12
ONR/NAVSEA Undersea Medicine Projects 13
SEALAB 60th Anniversary Reunion 17
Underwater NDT (Not Just for Small Areas): A Case in Point 19
This Day in Diving History: The Brooklyn Bridge Construction 20
SUPDIVE Sends 22
Diving Advisories 23
Faceplate Mailing List 23

Cover

Wreckage removal and survey operations in support of the Francis Scott Key Bridge Salvage.

SUPSALV SENDS...CAPT Sal Suarez

And, just like that, over two years in this seat have passed! I cannot believe it has flown by so quickly...even as I type this, there is so much going on across the Navy and I couldn't be more proud of the men and women that make up the diving and salvage force.

Unfortunately, starting on a bit of a somber note, CAPT John "Jack" Ringelberg passed away this last August. He was the first CO of NEDU after it was moved to Panama City Beach, FL. Among his many accomplishments during and after active duty, he oversaw the construction of the Ocean Simulation Facility (OSF) and conduct of saturation diving operations down to 1,800 fsw. To say that CAPT Ringelberg was an accomplished man is an understatement, and he personally gave back to each community he called home. Rest in peace, Jack.

This past spring, my office was heavily involved with the Francis Scott Key (FSK) bridge collapse due to the allision by the M/V Dali, which resulted in the complete collapse of the steel truss portion of the bridge. There's another article later in this copy of Faceplate, but a quick synopsis is this allision dropped approximately 16,000 tons of steel and 10,000 tons of roadbed material into the river. Eight people were on the bridge when it went down – two were rescued, but sadly, six lost their lives. My office was immediately pulled into the Unified Command (UC) established under the Incident Command System (ICS) structure as the Salvage Operations lead, and we immediately activated one of our salvage contractors to begin salvage operations. At the busiest portion of the operation, there were dozens of vessels supporting in a relatively small area, so space and prioritized tasking was key to managing an effective and efficient response. Eventually, over 50,000 tons of steel, wreckage, and mud were removed from the channel via various methods and specialized salvage equipment, including a salvage grab with 1,000 ton capacity, dredges, tugs, work boats, personnel transfer boats, and floating cranes. Due to visibility in the 1 to 3 foot range, we also employed a Coda Octopus 3-D volumetric sonar system we keep in the ESSM inventory, which played a huge part in building and validating a successful operation. Full channel restoration (50ft deep by 700ft wide) was achieved in 77 days without a single safety incident! That last fact is a testimony to the entire team's expertise and professionalism.

We also have the Salvage Executive Steering Community (S-ESC) coming back around. Under my push to re-organize the S-ESC meetings to more efficiently bring key topics to all Flag leadership who have a stake in salvage operations, my team is planning the first Captain's Working Group. This is modeled after the recent Diving ESC, and designed to assess issues raised by the various Action Officers before bringing them to the Flag leadership for a decision, guidance, and/or awareness. Again, my goal is to ensure all major movements that impact organic salvage force capability or readiness is adequately relayed to all salvage stakeholders to ensure the overall Navy capability can adequately compensate for changes in posture. The S-ESC outbrief to Flag leadership is targeted for April 2025.

The Underwater Ship's Husbandry lockers continue to perform feats of strength and wonder, a daily reminder to me of a large portion of the Navy diving background and history, and current leadership expectations. I'm lucky I get exposure to a portion of what they do, but not nearly as lucky as those that get to deliver performance to the fleet. Additionally, their part in keeping our platforms fit to fight continually garners admiration of senior leadership, so I hope that word is making it down into the lockers for our Sailors and civilians to hear!

Although the BDA-R exercise planned during Atlantic Thunder 24 was cancelled due to extenuating circumstances, I continue to advocate for, and look forward to involvement with fleet exercises in 2025. As always, the goal of participation in fleet exercises is that we will continue to grow capability and develop additional instinctive muscle movements when called upon. Hooyah, Deep Sea!

The Rat Race, When Preparation Pays Off

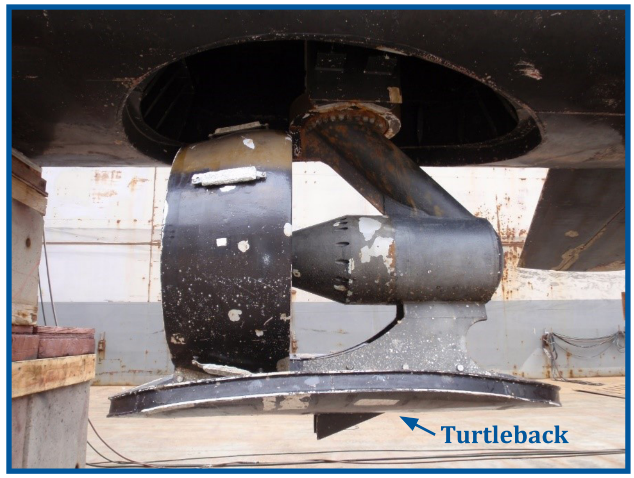
By: T.J. Guthrie

SUPSALV's Underwater Husbandry group prides itself on working with program offices to forecast repairs that could present themselves in the future, and having the required repair procedures and supporting equipment readily available when called upon. One such repair was discussed in the January 2016 issue of Faceplate for LCS. This UWSH Procedural Development was targeted to the LCS Independence Class Retractable Azimuth Thruster (RAT); the initial leg work paid dividends.

In May of 2023, Southwest Regional Maintenance Center (SWRMC) notified 00C5 that the hydraulic propulsion motor on the RAT of the USS KANSAS CITY had failed and wanted to know if conducting a waterborne replacement was even an option during an upcoming availability (MAY 2024). SEA 00C5 informed SWRMC that it was not feasible to change out the hydraulic motor in the water; the best Course of Action (COA) was to remove the entire unit and perform repairs topside. There were two COAs that could be taken to repair the RAT topside: replacing just the hydraulic motor, or performing a complete swap out of the RAT Lower Outdrive. Replacing the hydraulic motor would require removal and reinstallation of the propeller, adding a level of risk with a limited availability. Performing the complete swap out of the RAT Lower Outdrive would require transferring the old fairing plate (Turtleback) to the new unit, which also had some level of risk if there was a misalignment from the transfer. This appeared to be the best option with the least amount of additional effort, or so we thought.

The repair team had the support equipment and the procedures but had more parts than were needed. The Lower Outdrive was all that was required to complete the repair, but this was a subcomponent of the battle spare assembly and would need to be removed by others prior to beginning the removal of the failed unit on the KANSAS CITY. To add an additional level of complexity, the new Lower Outdrive would need to be painted after the Turtleback was transferred from the old unit to the new. There was limited ability to conduct these tasks concurrently to minimize delay, this would need to be made up on the back end by the repair team.

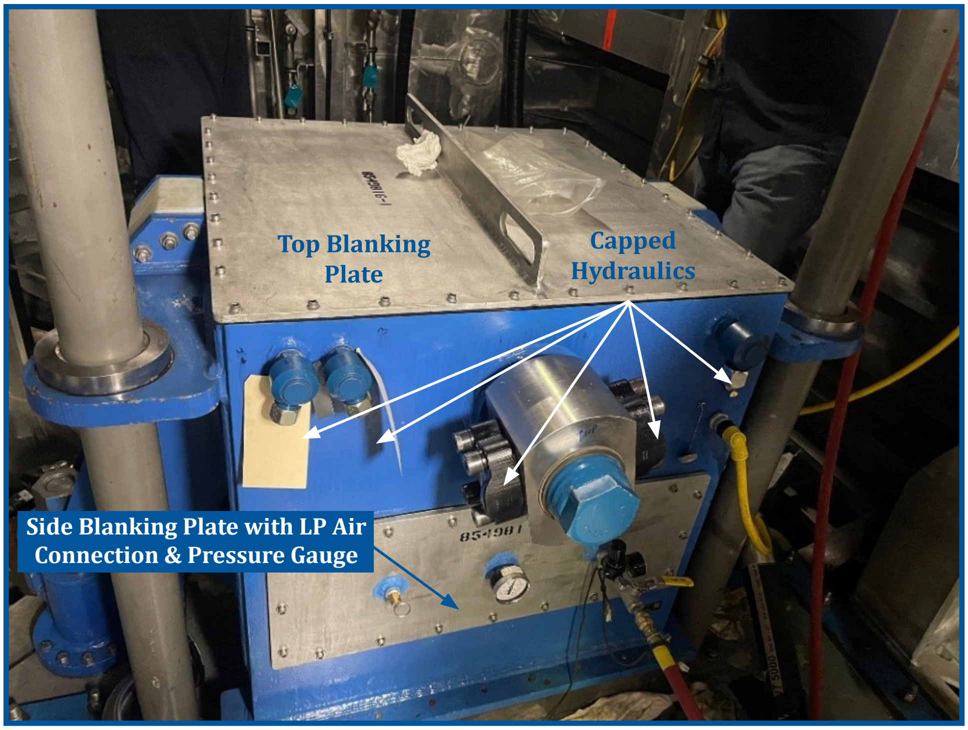
Once the Lower Outdrive was removed from the battle spare, the team hung red tags and went to work removing the failed Lower Outdrive. Inside the ship, the RAT's hydraulic propulsion system was disconnected, all hoses and fittings capped and plugged, blanking plates installed on the Upper Assembly, and a pressure test conducted to ensure watertight integrity once the Lower Outdrive End



Retractable Azimuth Thruster (Lowered Position)

Battle Spare Received

RAT Lower Outdrive (without Turtleback)



Upper Assembly in Thruster Room (Lowered Position)

Cover was removed. The follow-on in water efforts took several days that led into nights and multiple pier side modification of tools that would assist in disconnecting and reconnecting of hydraulic hoses from the motor in the tight confines of the housing. The ingenuity of the SWRMC Divers Foxtrot Team to find ways to break bolts and hose connections free in such a limited space was an impressive thing to see.

After all of the hoses were disconnected and blanked off, the Lower Outdrive was separated from the ship,

View from Inside Open Bottom Cofferdam

Open Bottom Cofferdam Installed in Place of End Cover (image from testing)

transferred to the crane, and placed into its handling cradle. From here the damaged Lower Outdrive was sent to have the Turtleback removed, transferred to the new unit, and to get a fresh coat of paint. The estimated timeline to accomplish these steps was 15 days, significantly longer than originally anticipated, leaving the team just five days to complete the installation before the end of KC's scheduled availability.

The Lower Outdrive, with Turtleback, was delivered to the pier at 1500 on Monday with paint that was still tacky, however there was still work to do before starting the install. This work included End Cover removal so that the team could install the appropriate caps and plugs onto the motor ensuring the system was not contaminated with seawater, O-ring surfaces cleaning and paint removal for adequate sealing, removal of excessive paint from bolt holes to allow for bolt installation, and paint removal from anodes to ensure contact surfaces continuity.

On Tuesday morning the RAT was craned into the water, transferred under the hull, and rigged into place while divers carefully passed the four bulky hydraulic hoses through the RAT's Lower Outdrive. After securing the RAT to the ship - 30 bolts with three torque cycles each - it was time to verify the fit up of the new Turtleback prior to connecting all the hydraulic hoses. The fit-up verification required retraction of the RAT to its home position; this presented an issue. The hydraulic system that raises

RAT Delivered to Pier In Cradle

and lowers the RAT had been drained by contractors for other work. This is where the onsite original equipment manufacturer (OEM) support from Thrustmaster proved to be invaluable. Within a couple of hours Thrustmaster and the ship had reestablished the bare minimum requirements to operate the emergency pump to allow for retracting and deploying of the RAT. The RAT was slowly retracted while divers observed for any misalignments until it was fully retracted to its home position. Clearance measurements were taken between the hull and the Turtleback, and compared to measurements taken prior to removal; the transfer was a success.

Over the course of the next two days the RAT was lowered back down, a cofferdam was installed in place of the end cover, all hydraulic hoses were reconnected, and the system pressurized to 3,000 psi with no leaks observed. The final step was to remove the cofferdam from the end of the Housing and install the end cover; it was decided to attempt this with the RAT at a partially retracted position to allow for the installation in a dry environment where no residual water would be trapped inside the RAT housing. To accomplish this the RAT was retracted to approximately 17 inches from the fully retracted "home" position. As safety and backup measures rigging was installed in the ship's Thruster Room to prevent movement in the event the hydraulic lifting system failed. Divers somehow managed to contort their bodies into the small gap between the Turtleback and the hull, removed any residual water from inside the RAT housing, applied rust preventive coatings to the interior surfaces, and reinstalled the end cover in the dry environment. With the end cover installed, there was now a barrier to the sea established and the internal blanking plates were removed from the Upper Assembly to complete the first ever RAT replacement before the end of the KANSAS CITY's availability.

Procedure validation and testing of the RAT replacement support equipment at the Thrustmaster's production facility {Jan 2016 Faceplate article} was vital in addressing obstacles ahead of time to allow for the execution of a repair that had many moving parts and participating parties. While we could not control the timeline of others, we could minimize ours to ensure that the KANSAS CITY was leaving the pier with an operational thruster. With the right tools, diver ingenuity, a winning mindset, and the highest level on integrity the TEAM (SWRMC Diver, SUPSALV UWSH Rep, our contractor Mechanic, and the OEM Re) operated safely to deliver KANSAS CITY back to the Fleet.

It is rare that OEM contractors are willing to provide information that is required to design equipment and develop procedures. Thrustmaster, however, was continually eager to offer support from providing solid models to explaining the operation of the system and testing at its facility in Houston. Fortunately, Thrustmaster is also going to be providing the APUs on the new Constellation Class frigates (FFG 62) where there is no doubt that they will provide the same level of support.

HOO YAH Navy Divers!!

T.J. Guthrie (00C53) is currently the UWSH Welding Engineer and the owner of the U.S. Navy Underwater Cutting & Welding Manual at NAVSEA 00C.

The Team & RAT

Francis Scott Key Bridge Salvage

By: Eric Brege

On March 26, 2024, at around 1:30 AM, a Singapore-flagged container ship, M/V DALI, struck pier 17 of the Francis Scott Key (FSK) Bridge near Baltimore, Maryland. The collision led to the collapse of a significant portion of the bridge, sending approximately 16,000 tons of steel and 10,000 tons of road material into the Patapsco River. Tragically, eight workers on the bridge at the time were thrown into the river, with only two surviving. The accident not only claimed six lives but also completely halted commercial shipping in the Port of Baltimore, a critical hub for U.S. imports and exports.

The immediate aftermath saw the complete closure of the channel, obstructed by massive debris, severely impacting the economy. The port, which handles over 50 million tons of cargo annually, including automotive exports and imports, faced estimated daily economic losses of $15-20 million due to the halt in operations.

Command Structure and Tasking

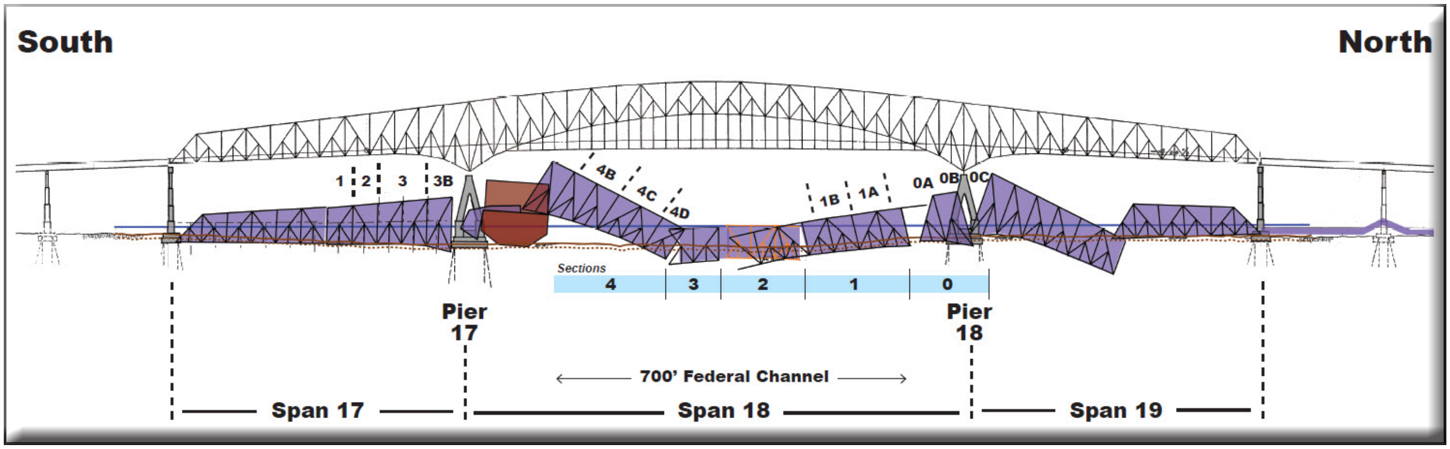
Immediately following the bridge collapse, the Unified Command was established and composed of key stakeholders, including the U.S. Coast Guard (USCG), U.S. Army Corps of Engineers (USACE), Maryland Transportation Authority (MDTA), Maryland Department of the Environment (MDE), and the vessel owner's representatives, Witt O'Brien's Ambipar. Each organization had a distinct role in the response, ensuring clear responsibilities and coordination across all agencies.

Under Title 33 of the Code of Federal Regulations, the U.S. Army Corps of Engineers (USACE) initiated the request for SUPSALV's support invoking an existing Inter-Service Support Agreement with SUPSALV. Within 24 hrs of tasking, Donjon Marine (SUPSALV Zone A Salvage Contract) and GPC (SUPSALV ESSM Contract) were mobilized to support the emergency response effort, providing cranes, vessels and equipment vital to the salvage effort.

Early in the response, the Unified Command recognized that the overall bridge response revolved around complex salvage operations. Given SUPSALV's history and expertise in large-scale salvage operations, it was agreed that SUPSALV would lead the Salvage Branch and coordinate the salvage effort under the USACE.

Salvage Operations

SUPSALV's Director of Salvage Operations, Paul Hankins, spearheaded the salvage response and provided critical leadership in coordinating three distinct salvage missions, each led by different contractors (Donjon Marine, Resolve Marine, and Skanska). Within the first 72 hours of the response Mr. Hankins aligned the planning efforts across the entire Salvage Branch and established pri-



A drawing showing M/V Dali, aground on pier 17, and an early assumption of where the truss sections lay in the three bridge central spans.

orities, schedule, and objectives to salvage the bridge and re-open the port. The planned salvage operation was a complex and collaborative effort that consisted of three distinct priorities:

- Priority 1: Clearing the federal navigation channel (Donjon Marine's responsibility)
- Priority 2: Refloating the M/V DALI (Resolve Marine)
- Priority 3: Removing non-channel debris (Skanska, contracted by the Maryland Department of Transportation)

Working with the Salvage Masters and key government stakeholders, Mr. Hankins led coordination meetings at both the start and end of each day, ensuring alignment and collaboration between all stakeholders within the Salvage Branch and across the entire Unified Command. To assist with deconflicting resources and water space, a web-based Common Operating Picture (COP) was developed and utilized through the entire operation.

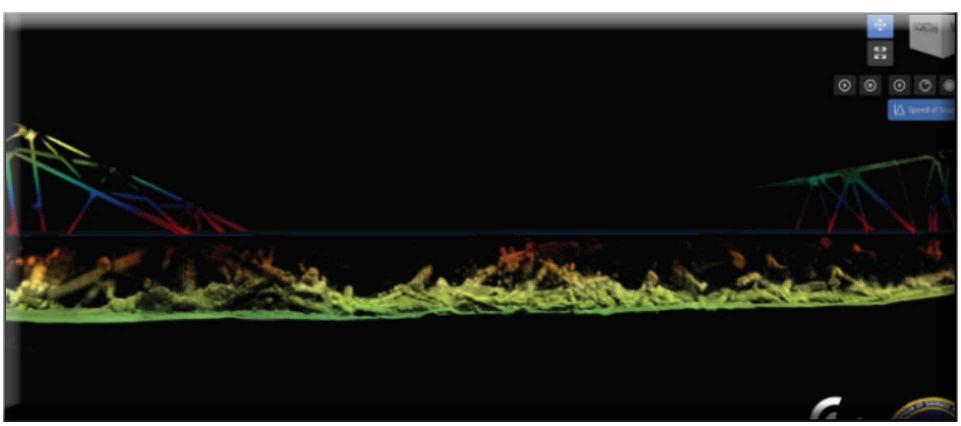
The core SUPSALV team initially consisted of CAPT Suarez; Paul Hankins, Director of Salvage Operations; Vince Jarecki, Naval Architect; Eric Brege, Project Manager; and Don Fegley, ROH. Through the course of the operation the team expanded and contracted using additional support from rotation of Engineering Duty Officer (ED) Divers and members of the SUPSALV Reserve Unit. After returning from other salvage projects, LCDR Schacht and LT Coleman led the team through the final debris removal, material processing, and demobilization phases.

Challenges for the salvage team included the sheer size of the debris, low visibility in the water, and the entanglement of bridge trusses with road materials. To assist with these challenges, SUPSALV's Coda Octopus Volumetric Sonar System was utilized to provide real-time imagery of the wrecking to assist in both planning and execution of the Salvage.

Key Operations

To accomplish the three objectives, the salvage operation involved the removal of around 50,000 tons of steel and debris from the river. Major milestones included:

1. Sectional Debris Removal: The salvage team divided the collapsed bridge truss into five damaged sections to be removed systematically. In addition to Dive Teams, the Chesapeake 1000, Columbia and Ferrell crane barges were used in conjunction with the 1000MT wreck grab, shear, and diamond wire saw were used to clear the wreckage.
2. Refloating the M/V DALI: A significant part of the operation involved clearing debris from the vessel itself, which was pinned to the riverbed by bridge sections. More than 150 containers were removed from the Dali to clear the bow and allow access for the removal of section 4. To remove section 4 from Dali, shaped charges were placed on the bridge section and the structure was cleared with explosive cutting. The ship was refloated after debris was cleared.
3. Displaced Material Removal and Processing: The debris clearing process involved collecting and transporting various materials to the Sparrows Point processing center. To ensure thorough removal, dredges removed mud and



Coda Octopus Volumetric Sonar Scans of the Bridge Wreckage.

debris down to 60 feet, reaching a solid clay layer with no bridge wreckage. The recovered mix, termed Displaced Material, required a processing solution. SUPSALV, with Maryland state officials, planned for expedited permitting and design support for holding and drying the material, with relocation handled by a third party.

4. Channel Reopening: Channel openings were established to allow port traffic to flow based on various stages and milestones of the salvage project. The following table provides the various channel opening stages:

Explosive Cutting to removing Section 4 from M/V Dali

Date	Opening size	Effort / Location	MSIB
1 April	11' depth, 264-foot horizontal clearance, and vertical clearance of 95 feet	North side of river, Sollers Point Temporary Alternate Channel	5-25
2 April	14' depth, 280-foot horizontal clearance, and a vertical clearance of 124 feet	South end of bridge, Hawkins Point Temporary Alternate Channel	6-25
25 April	**35' depth, 400-foot horizontal clearance**	**North end of nav channel after clearing section 1 and 0**	**15-24**
21 May	**50' depth, 400-foot horizontal clearance**	**Main nav channel after refloating of DALI and clearing section 2 and part of section 3**	**49-24**
10 June	**50' depth, 700-foot horizontal clearance**	**Full restoration of Fort McHenry Navigation Channel following removal of truss 4 and clearing bottom debris to depth of 50'.**	**52-24**

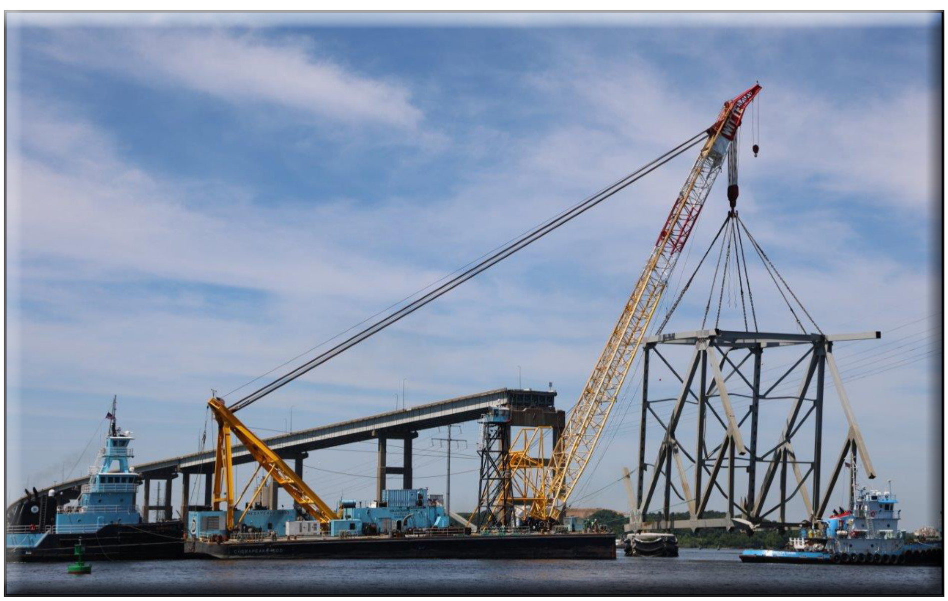
Salvage Wreck Grab and Chesapeake 1000 removing Key Bridge wreckage from the Patapsco River.

Conclusion and Impact

Despite the tragic loss of life and the initial shock of the incident, the salvage operation was a resounding success. The rapid reopening of the channel helped mitigate economic losses and restored the critical shipping routes through Baltimore. The dedication, skill, and coordination of SUPSALV and its partners ensured that what was initially estimated as a year-long project was completed in just over two months. The operation's success stands as a testament to the expertise of the salvage teams and the resilience of Baltimore's infrastructure.

Eric Brege is the ESSM Program Manager at NAVSEA 00C.

Article cover photo: M/V Dali and the Francis Scott Key Bridge Wreckage.



Chesapeake 1000 with 600 tons of truss in the hook - transiting to material processing yard.

A Look at the Hazards of Diving Near Active Sea Suctions

By: LCDR Matthew Wagner PE, with assistance from CDR Robert Carelli, CWO3 Michael Pazman, and Mr. TJ Guthrie

On the waterfront, leaders must balance the need to be safe with the drive to continue production. One constraint that I've consistently run into is the ability to dive within the vicinity of active sea suctions. For example, recently, I was working with a dive team to change out all the propeller blade seals and software on a deploying DDG. About halfway through the job, the ship's Chief Engineer came topside and asked permission from the Diving Supervisor to start a pump within 50 ft of where the divers where working. The pump was for the ship's #3 SSTG, which has a suction starboard side, about even with the starboard stern tube, but about 13 below the waterline. The dive team was working on the port propeller hub. In this case, the Dive Supervisor gave permission to start the pump in accordance with the boundary criteria laid out in the latest diving advisory. The point here is not to second guess the Diving Supervisor, but it occurred to me that there aren't really any tools available to objectively analyze the risk associated with diving next to an active suction. Do we really understand the risks associated with diving in the vicinity of active suctions? So, what began as a couple of probing questions and discussions on the dive side has grown into this "back of the envelope," analysis. Hopefully seeing my thought process will help you better understand the risks and help you make take the right ORM decisions to dive within close proximity to a suction.

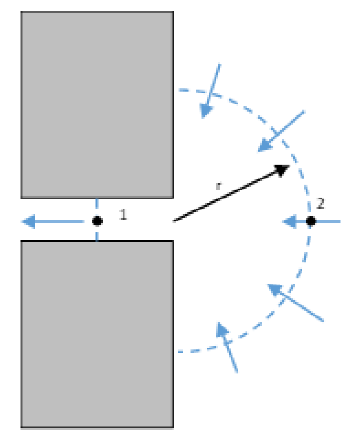


Figure 1. Pump inlet modeled as a hole in a flat plate.

There are two factors to consider when looking at the sea suction "problem." One is the water velocity in and around the suction and trying to determine whether a diver could reasonably avoid the current generated to stay out of the suction. The other is the force that is generated if a diver were to get sucked in and obstruct the flow of water generated by the suction.

Let's start with the water velocity generated around the suction. If we assume that a suction can be modeled as a hole in a flat plate and that water entering the suction enters through an imaginary half-sphere around the suction. See Figure 1. To simplify, we know that the volume of water flowing through a pipe or into a pump (in GPM) must equal the flowrate of water drawn in at the suction (i.e. Conservation of Mass). In other words, if you look at Figure 1, the volume of water flowing through the plane at point 1 must be exactly equal to the volume of water flowing through the half-sphere at point 2.

Mathematically, flowrate is simply the area of the surface in question times the velocity of the fluid, and the surface here is half of a sphere with a variable radius r. We can rewrite the flowrate equation to express the velocity at point 2 in terms of different flowrate and at various distances r. When we do this, we get the results shown in Figure 2. A line for one knot of current was added for reference. This analysis ignores the size of the pipe and any local various in velocity, but is good getting a general understanding of the underlaying physics.

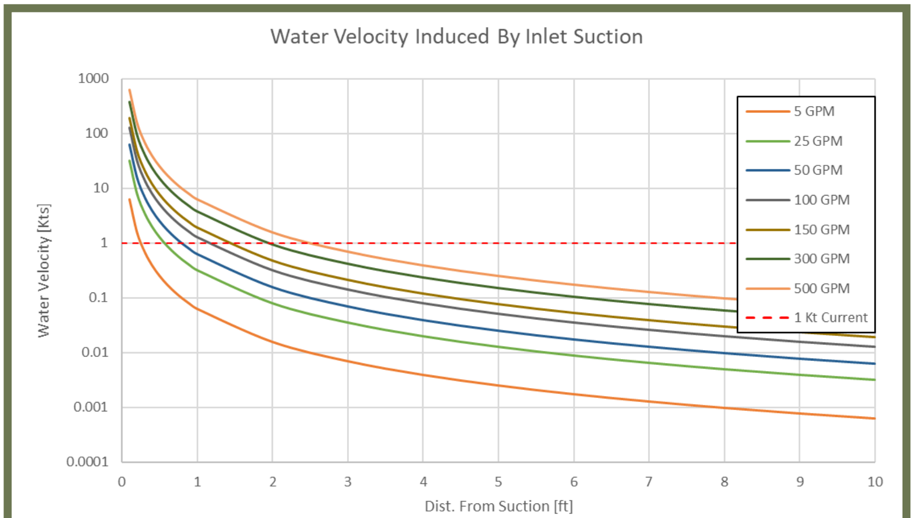


Figure 2. Water velocity induced by inlet suction.

We can see that even for high powered suctions, the water velocity induced by the suction drops off rapidly after a few feet and becomes negligible by 10 ft, dropping to less than a tenth of a knot. Certainly by 50 ft, a diver would be unaffected by the induced velocity. However, look at what happens close to the suction inlet and remember that water velocity is plotted on a logarithmic scale. Within a few feet of even moderately power suctions, the water velocity increases rapidly. This is the real danger. By the time a diver realizes they've inadvertently swam too close to an active suction, it is too late for them to do anything about it. They become trapped in the rapidly increasing water velocity. This leads then to the second part of the problem. What happens when a diver gets stuck and obstructs the opening to the suction? What forces are generated then?

In the worst-case scenario, a diver would completely obstruct the opening to a suction (Neoprene wetsuits provide a convenient sealing material). Taking into account that by and large, the Navy uses centrifugal pumps on all sea suctions. The pump will continue to attempt to draw a suction even after the suction in obstructed. Since the water can no longer flow, the pressure in the suction piping will decrease until the pump begins to cavitate. Depending on the pump and configuration, we would expect the pressure within the suction piping to approach a perfect vacuum (0 PSIG). Note, by looking at the problem this way the capacity and flowrate of the pump doesn't matter. Ultimately, it's the size of the suction opening that will determine the suction force. Although, a larger pump would be expected to generate the suction forces shown in Table 1 much faster. At first decreasing pressure may seem like a good thing but, this creates a differential pressure across the diver. Sea pressure on one side and close to a vacuum on the other. We all learned in dive school to calculate the pressure at a given depth. Depth of water multiplied by 0.445 PSI multiplied by the cross-sectional area of the suction opening. Now you also need to factor in the pressure induced by the pump drawing a vacuum on the suction piping. Results for different size openings at different depths are shown in Table 1.

We can see that small suctions at shallow depths can be expected to create relatively small suction forces and a diver could reasonably be expected to free themselves. However, that same small suction becomes problematic at deeper depths. For example, a typical surface combatant has a keel depth around 25 feet where a two-inch suction would create a force equivalent to 81 lbs. Probably painful, but a diver should be able to work themselves free. Increase the suction size to four or six inches and a diver would certainly not be able to free themselves and the resultant force could inflict serious bodily harm. For those divers working on CVNs with a keel depth around 45 ft, a 12-inch suction would likely be fatal.

Depth (Ft)	Seachest Diameter (in)						
	2	3	4	6	12	18	24
2.5	50	112	199	447	1788	636	7154
5	53	120	213	479	1914	1272	7658
7.5	57	128	227	510	2040	1909	8162
10	60	135	241	542	2166	2545	8665
12.5	64	143	255	573	2292	3181	9169
15	67	151	269	605	2418	3817	9673
17.5	71	159	283	636	2544	4453	10177
20	74	167	297	668	2670	5089	10681
22.5	78	175	311	699	2796	5726	11184
25	81	183	325	731	2922	6362	11688
27.5	85	190	339	762	3048	6998	12192
30	88	198	353	793	3174	7634	12696
32.5	92	206	367	825	3300	8270	13199
35	95	214	381	856	3426	8906	13703
37.5	99	222	395	888	3552	9543	14207
40	102	230	409	919	3678	10179	14711
42.5	106	238	423	951	3804	10815	15215
45	109	246	437	982	3930	11451	15718

Table 1. Equivalent force [lbs] produced by various seachest sizes at varying depths.

What Table 1 does not show is the time required for the pump to build up to the listed pressure. Again, this is largely dependent on the size and capacity of the pump as well as the length of suction piping. Referring to Figure 2, as soon as a diver approaches an active suction the water velocity increases dramatically. This leads to a downward spiral where a diver gets caught in the increasing water velocity and drawn partially or completely into the suction, further increasing the suction force on the diver.

For Table 1, I limited the suction open to 24 inches in diameter. Anything larger than this I assumed a diver would have trouble obstructing the entire opening. The entire opening needs to be obstructed to generate the forces listed in Table 1. A partial obstruction could still generate forces strong enough to pin a diver, but it leaves open a flow path for water and thus the full suction force won't be felt. This was noted in NEDU studies conducted in 2004 and 2006 with respect to Main Seawater and Auxiliary Seawater suction on SSN and SSBNs. These suctions are unique in that the suction opening is so large and the pump speed so low it is impossible for a diver to cover the entire suction opening and the current induced around the suction is minimal.

I want to be clear that this analysis is a simple mathematical and engineering approach to looking at these hazards and should not taken as grounds to bypass the current 50 ft standoff guidance. There are a lot of other factors that must be considered during your ORM of a dive. In particular, this doesn't account for visibility, existing current, how susceptible new divers are to getting lost under the hull of a ship or lines/diver umbilical getting sucked into a suction. However, it should shed some light on the hazards and offer some perspective for Dive Supervisors who need to make these types of decisions on the side.

I hope that this article will generate some thoughtful discussion on the dive side, and more importantly provide the background you need to make educated and informed ORM decisions. Diving is serious business with potentially fatal consequences for even minor errors. Diving within 50-ft of an active suction should only be done with extreme caution. The slope between a minor tag-out inconvenience verses life-threatening consequences is steep and unforgiving. Perhaps the most insightful result of this analysis is to show you how quickly the forces produced by a suction can trap or fatally injure a diver. I look forward to answering questions and discussing any feedback from the waterfront. Dive safe out there and Hoo-Yah Deep Sea!

The Man in the Sea Museum's MKV Scholarship Program

By: Steve Mulholland

JAKE, believed to be Florida's most visited monument, stands proudly as a tribute to all U.S. Military diver graduates. It symbolizes the rich traditions of divers worldwide who have dedicated their lives to underwater ship maintenance, construction, salvage, combat, and covert operations.

From 2014 to 2024, 40 deserving students have been awarded scholarships ranging from $500 to $3,000. Thanks to the generosity of our donors, military diver alumni, and successful fundraising events, we are excited to announce that we will be distributing $8,000 in scholarship funds for 2024. Congratulations to the 2024 MKV Scholarship Recipients:

Reid McMurtrie of Cazenovia, NY
Margaret Duff of Wahiawa, HI
Jordyn Dodd of Lynn Haven, FL
Sarah Frey of Christchurch, New Zealand

A special thank you to this year's sponsors: The Diver Recall, Diver Gifts and Collectables, Tudor Watches, and The Steckel Family for their invaluable support.

The Man in the Sea Museum is proud to continue the legacy of Dave Sullivan, the scholarship's founder, and to play a role in supporting the next generation of scholars.

How You Can Help: We're always seeking outstanding candidates striving to achieve their academic goals. If you're interested in applying for our 2025 scholarships or would like to support one of our upcoming fundraising events, visit us at: **maninthesea.org**. And don't forget to enter our raffle for a chance to win a pair of Diver Statues for your mantel - an exclusive keepsake for our supporters!

Our 2024 Raffle:

The winner will receive a pair of statuettes.
"The MKV Monument Project" #289
"The Military Diver Memorial Project" #289

Tickets are on sale now!
https://go.rallyup.com/maninthesea

ONR/NAVSEA Undersea Medicine Projects

By: Dr. Sandra Chapman, CAPT Joy Dierks, USN, and LCDR Peter Lindhome, USNR

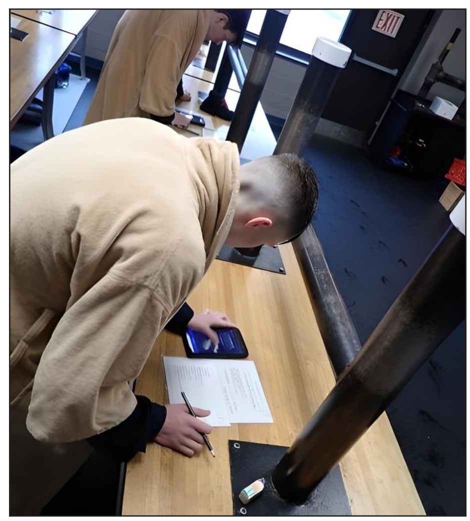
From 16-18 April 2024, the Office of Naval Research (ONR) Undersea Medicine program and Naval Sea Systems Command (NAVSEA) Deep Submergence Biomedical Development Program held a joint program review at the University of Connecticut Avery Point in Groton, CT. Scientists from 64 unique projects addressed their current investigations into various topics supporting Navy undersea medicine, including decompression illness, oxygen toxicity, human performance and disabled submarine rescue.

The U.S. Navy has approximately 8,000 qualified divers across a variety of different specialties necessary to support ship husbandry, underwater construction, special warfare, and salvage operations around the world. Scientists from U.S. Navy laboratories and from leading universities across the world collaborated for three days to address the unique physiologic challenges of diving. They shared research into solutions to make diving safer to deeper depths and for longer duration. Additionally, CAPT Evan Colbert, OPNAV N97, Deputy Director for Navy Diving, Submarine Escape and Rescue and Arctic Requirements, and CAPT James Mucciarone, Force Medical Officer, Naval Special Warfare Command shared the perspectives of the Diving and Special Operations communities needs and vision. This helps to insure understanding between those conducting research and the warfighter. Several program highlights include:

ESCAPE TIME CALCULATIONS UNDER STRESS: A COMPARISON OF PAPER GUARDBOOK AND E-GUARD METHODS

Lead Researchers: Dr. Brandon Casper, Dr. Sarah Chabal, Dr. Jeffrey Bolkhovsky, Ms. Emily Moslener, Ms. Krystina Diaz
Naval Submarine Medical Research Laboratory (NSMRL)

Description of Project: In the event of a submarine casualty, known as a DISSUB (Disabled Submarine) scenario, submariners must be able to calculate the start escape time based on the deteriorating submarine atmosphere and on-hand supplies capable of sustaining life. Currently, submariners perform these calculations using pen and paper with the DISSUB Survival Guide, or “Guard Book”. In a previous study in an unstressed environment, submariners using the Guard Book achieved an escape time accuracy of approximately 50%. This result led to the development of a tablet-based electronic Guard Book (E-Guard); a software application capable of performing these calculations following the input of critical variables. In this project, submariners were tested immediately after completing the damage control trainer, to mimic a high-stress, operational environment. The accuracy rate with the paper Guard Book fell to 33%. However, when using E-Guard, submariners demonstrated an improved accuracy of 86%.



A Sailor assigned to the Naval Submarine School at Naval Submarine Base New London conducts escape time calculations with the experimental E-Guard tablet, designed to increase the speed, reliability and accuracy of submarine escape time calculations. (U.S. Navy photo)

Theory of Operation: Changes to the existing Guard book can improve accuracy. Additionally, submariners can use the E-Guard to perform Guard Book calculations and to provide an escape time calculation with less effort.

Benefits of Project: The accuracy of escape time calculations is critical to determining if and when to abandon the submarine. By studying the mistakes made by submariners the existing written Guard Book format will be improved. Additionally, developing an electronic tool to improve calculation accuracy will result in accurate assessments of submarine escape options.

Current Status of Project: A prototype E-Guard book resulted in faster (6.8 minutes, compared to paper calculations taking 29.0 minutes), and more accurate (86.4%, compared to 33.3% on paper) results when performing escape time calculations.

Future Project Goals: NSMRL will incorporate end user feedback into future iterations of the E-Guard software to further enhance accuracy. Additionally, NSMRL will test E-Guard under simulated harsh conditions designed to mirror a DISSUB environment to validate the platform’s durability.

DEVELOPMENT OF UNDERWATER NOISE DOSIMETERS FOR CHARACTERIZING NAVY DIVER ACOUSTIC EXPOSURES

Lead Researchers: Dr. Brandon Casper
Naval Submarine Medical Research Laboratory (NSMRL)

Description of Project: Navy divers routinely face high levels of noise from various sources, yet estimating their noise exposure in the operational environment presents a challenge. Developing a wearable dosimeter would allow divers to receive real-time alerts when in danger and record acoustic exposure for future analysis. Data collected could also inform policy development for permissible exposure limits underwater. NSMRL is testing two acoustic dosimeters: a "record everything" dosimeter, and a "streamlined" dosimeter.

Theory of Operation: The "record everything" dosimeter stores all received acoustic data for future analysis. The "streamlined" dosimeter will provide immediate warning to the diver if safe exposure limits are exceeded.

Benefits of Project: Both dosimeters will inform stand-off distance and/or permissible exposure limits, equipment modification, and required personal protective equipment to mitigate the risk of hazardous noise exposures. The "streamlined" dosimeter will provide real-time awareness of hazards.

Current Status of Project: The "record everything" dosimeter has been worn by fleet divers during ship's husbandry operations. The "streamlined" dosimeter performance is currently being tested.

Future Project Goals: Update exposure limits and develop real-time warning device for divers to reduce hazardous noise exposure.

A diver from the Naval Submarine Medical Research Laboratory in New London, CT conducts an experimental dive designed to test the prototype underwater dosimeter. (U.S. Navy photo)

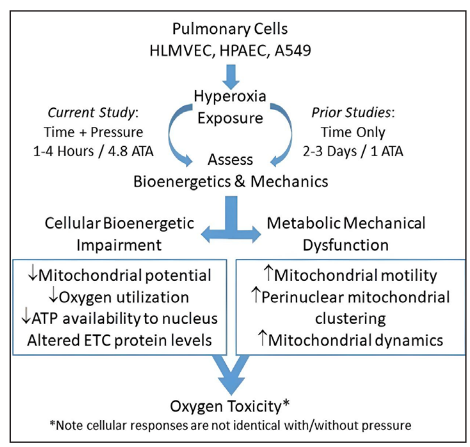
MITOCHONDRIAL DYSFUNCTION AND MOLECULAR THERAPY IN PULMONARY OXYGEN TOXICITY

Lead Researchers: Dr. David Eckmann, Dr. Tanvir Hossain, Mr. Jackson Secor

Description of Project: Pulmonary oxygen toxicity is capable of damaging multiple types of cells within the lungs. This project seeks to identify specific mechanisms of mitochondrial dysfunction and highlight relevant biochemical markers which signify oxygen toxicity in pulmonary cell lines. Additionally, investigators seek to assess the impact of potential interventions to mitigate the impact of mitochondrial dysfunction from oxygen toxicity.

Theory of Operation: Cells from human pulmonary arteries, lung microvascular endothelium and pulmonary epithelium were exposed to 3 distinct conditions: 1) ambient pressure and normoxia as a control; 2) hyperoxic conditions at ambient pressure for 24, 48, and 72 hours; or 3) hyperoxic conditions at 4.8 atmospheres for 1 and 4 hours. Several parameters specific to mitochondria were analyzed at each possible condition.

Benefits of Project: Understanding the mechanisms of oxygen toxicity at the cellular level, particularly focused on mitochondrial dysfunction will add to our understanding of the underlying cellular dysfunction caused by hyperbaric hyperoxia, which in turn will facilitate targeted mitigation therapeutic approaches.



This model of hyperoxic hyperbaric oxygen toxicity mechanisms as exhibited in pulmonary cell mitochondria provides a framework for future investigations of therapeutic modalities.

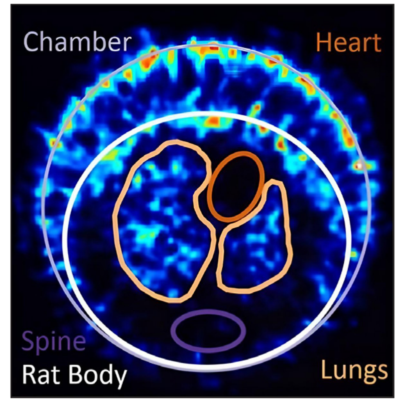
Current Status of Project: Investigators have determined that while hyperoxic experimental conditions produce oxygen toxicity in pulmonary cells in 2-3 days, hyperbaric and hyperoxic exposure produces oxygen toxicity very quickly (within 1-4 hours). Measurements of mitochondrial size, respiration, motility, and intermembrane potential in addition to specific levels of Complex I-V (critical to the generation of ATP for cellular energy) show the damage to mitochondria, providing platform for the further study of oxygen toxicity and associated mitochondrial damage.

Future Project Goals: Future work includes experiments designed to test possible therapies against mitochondrial damage, including Mito-Q (a synthetic analog of Coenzyme Q10), caffeine, and gamma aminobutyric acid (GABA).

WHERE IS THE GAS? A NEW METHOD TO STUDY NITROGEN DURING DIVING AND DECOMPRESSION

Lead Researchers: Dr. Peter Lindholm

Description of Project: Nitrogen gas, modified to emit positrons, can be inhaled at pressure by rodents (and other animals). Subsequent imaging of these animals yields direct gas location within the animal during pressure changes, directly contributing to increased knowledge of gas physiology after hyperbaric exposure.



Position emission tomography (PET) image of a rat thorax showing the uptake of nitrogen at 6 atmospheres of pressure. (Image by Dr. Peter Lindholm)

Theory of Operation: Nitrogen gas can be atomically manipulated to produce radioactive diatomic nitrogen gas which emits a positron. Positrons can be imaged using positron emission tomography (PET), providing a method for directly imaging the flow of nitrogen gas throughout the body.

Benefits of Project: PET now provides a method to image the flow of modified nitrogen gas throughout animals, allowing investigators to better understand gas distribution in vivo. Furthermore, the amount of nitrogen taken in and offgassed by various organs can now be quantified, and the changes in these parameters associated with changes in gas mixture can be studied, providing potentially valuable data for the further study of decompression sickness and gas physiology.

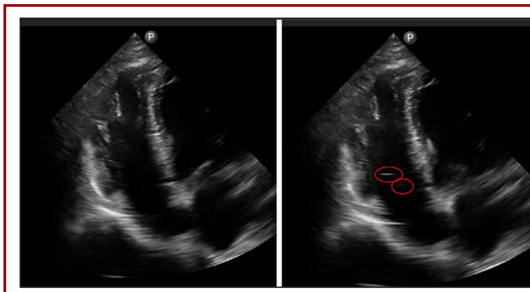
Current Status of Project: A novel method to produce the radioactive nitrogen gas was developed, as was a testing chamber with gas introduction system compatible with PET analysis. Gas uptake was measured at 6 atmospheres in a live rodent. Organ-specific analysis of gas uptake and excretion was measured at 1 atmosphere. One finding of note is that the brain absorption of gas varied much more than the other organs when normalized for organ weight.

Future Project Goals: Future project goals include testing normobaric gas uptake in 40kg pigs and then using PET to provide separation of images between venous and arterial blood, determining organ-specific gas constants for on-gassing and offgassing in pigs, and exploring the brain variability in gas uptake using rodents.

TOWARD REAL-TIME DECOMPRESSION WITH VENOUS GAS EMBOLI (VGE)

Lead Researchers: Dr. David Doolette, Dr. F. Gregory Murphy, and Dr. Alex Klemp

Description of Project: This project will evaluate variable total decompression stop times among stops in order to evaluate VGE throughout decompression. This will be used to model VGE during decompression in order to develop next generation, improved decompression models for the real-time control of decompression based on real-time VGE observations.



Ultrasound scan collected during 20 fsw stop with no VGE present. Right: Scan collected during 20 fsw stop with VGE (circled in red).

Theory of Operation: Higher-grade VGE is positively associated with higher incidence of Decompression Sickness (DCS). Two different devices capable of real-time VGE monitoring will be tested, one utilizing CMUT (capacitive micromachined ultrasonic transducer) technology and the other using piezoelectric transducers. Furthermore, this will build on the work conducted during the Navy Experimental Diving Unit (NEDU)'s Deep Stops trial, which established that the probability of developing DCS increases when decompression stops are made at lower depths.

Benefits of Project: By obtaining VGE data during diving operations and correlating them with VGE data post-dive, the decompression schedule can be optimized. Better understanding of VGE development patterns based on decompression schedule will have a great impact on diving procedures and safety.

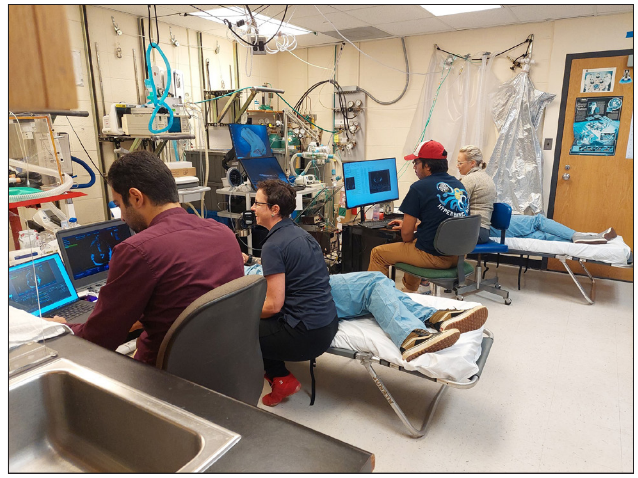
Current Status of Project: This is a new investigation, with a great deal of planned work to occur in the coming months and years. Ultrasound devices have been acquired.

Future Project Goals: Manned test diving conducted in the Navy Experimental Diving Unit Ocean Simulation Facility is scheduled to begin in FY25, focusing on evaluating VGE patterns during decompression and comparing real-time VGE data to post-dive VGE data. Manned diving tests are scheduled to continue into FY26, followed by data analysis. Wearable real-time venous gas embolism (VGE) monitoring may yield data capable of personalizing decompression schedules through direct analysis of available physiological data.

DEPLOYMENT OF AUTOMATED ULTRASOUND VENOUS GAS EMBOLI DETECTION IN REAL-WORLD PRACTICE

Lead Researchers: Dr. Virginie Papadopoulou, Dr. Arian Azarang, Dr. Rachel Lance, Dr. Richard Moon, Dr. Peter Lindholm, Dr. Lesley Blogg, Dr. Frauke Tillmans

Description of Project: Venous gas emboli (VGE) are a marker of decompression stress and detected in divers using ultrasound, typically as Doppler ultrasound audio (precordial or subclavian recordings) or transthoracic echocardiography (2D cardiac imaging) post-dive. Increased VGE grades are associated with a higher risk of decompression sickness (DCS). This new project led by the University of North Carolina at Chapel Hill, in collaboration with the Divers Alert Network, Duke University and the University of California at San Diego, addresses three distinct goals directly related to an automated process for identifying and grading venous gas emboli (VGE). First, automated learning models for grading VGE in Doppler recordings were refined through an expanded dataset of real recordings and will be packaged for real-time evaluation in new human dive trials. Second, the deep learning system for field VGE detection using echocardiography must be evaluated. Third, a large repository of historic Doppler ultrasound data was created and will be expanded during the course of this investigation.



Investigators perform echocardiography on test subjects to validate the reliability of a machine learning model for the detection of venous gas emboli (VGE). (Image by Dr. Virginie Papadopoulou)

Theory of Operation: By utilizing a synthetic data-supplemented deep learning approach based on analysis of historical data sets, coupled with refining newly acquired live-subject data, investigators are able to build robust algorithms that can be used for real-time assessment of VGE in both transthoracic 2-Dimensional echocardiography and Doppler audio.

Benefits of Project: Automated VGE assessment based on ultrasonic measurements will allow for continuous, real-time analysis of VGE formation during and after decompression. This analysis will also yield a large repository of data which could be used to refine VGE assessment and DCS prevention in Navy divers.

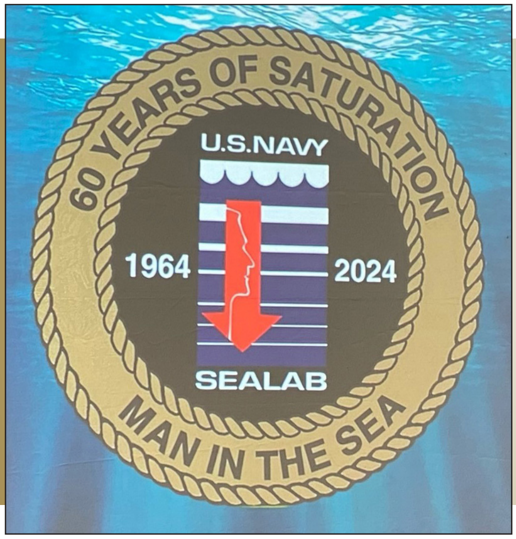
Current Status of Project: The deep learning models developed on previously acquired data in the previous phase have achieved accuracy on par with inter-rater human agreement and models were published open-source. In this new project, progress has been noted across all three domains noted above, with over 4,500 Doppler clips having been processed and integrated into the comprehensive database. The real-time echocardiography pipeline was implemented and tested in prospective human diving trials, showing compatibility with any ultrasound machine and efforts are underway to increase performance in low VGE grades. A retrospective analysis on Doppler on an expanded dataset of real data (n=2,886 vs previously published n=274) indicated substantial agreement with ground truth that remains on par with human inter-rater agreement on this expanded and largest real-world dataset to date.

Future Project Goals: Begin comprehensive evaluation of prospective Doppler analysis pipeline in human dive trials.

The ONR Undersea Medicine program, directed by Dr. Sandra Chapman, develops science and technology solutions aimed at optimizing submariner and diver health and performance and enhancing the flexibility, efficiency and safety of undersea warfighter missions.

The US Navy Deep Submergence Biomedical Development Program sponsors biomedical research aimed at improving diver health, safety, and effectiveness as well as improving the survivability of submariners in a disabled submarine (DISSUB) scenario.

Dr. Chapman is Program Officer for the Office of Naval Research, Code 342 Undersea Medicine and Marine Mammal Health.
CAPT Dierks is an Undersea Medical Officer who manages the NAVSEA Deep Submergence Biomedical Development Program.
LCDR Lindhome is a nuclear-trained Surface Warfare Officer with the Office of Naval Research, Reserve Component.



SEALAB 60th Anniversary Reunion

By: Kevin Hardy, Steve Mulholland, Brian Thompson, Man-in-the-Sea Museum

The Man-in-the-Sea Museum, Panama City Beach, Florida, planned and executed an amazing reunion celebrating the 60th Anniversary of SEALAB Program, which started in 1964. Steve Mulholland, Executive Director, and Brian Thompson, Associate Director, brainstormed, organized, worked their tail ends off, and carried off a perfect celebration. Some called it the last SEALAB Reunion, while others hoped it might not be. Seven of the surviving Aquanauts were in attendance, including Bernie Campoli, "last man standing" of SEALAB I. The celebration began Friday morning, July 19th, with a tour of the NEDU, a banquet Friday night, and ended Saturday with a series of public lectures held at the MITS Museum.

The Friday night banquet was by-invitation-only. Three hundred friends, family, and dive buddies joined in the evening's festivities.

The seven original Aquanauts took turns at the podium recalling their participation and fondest memories. First to speak was Bernie Campoli, SEALAB I, followed by SEALAB III Aquanauts Jay Myers, Fernando Lugo, Keith Moore, John Kleckner, Larry Bussey (looking fit and trim in his original SEALAB III olive drab shirt), and Martin Harrell.

Fabian Cousteau, grandson of the famed filmmaker and explorer, gave the Keynote Address, speaking eloquently of a new, permanent undersea habitat, Proteus. He made it clear that it could only be built on the shoulders of those pioneers in attendance that night, and their colleagues who came before. While only artist concept sketches of the proposed habitat were shown, and schedules were left vague, Cousteau did disclose that Oceaneering had just committed time, talent and treasure to the undersea venture, all but assuring the habitat's final design will leap from page to practice. The program concluded with a tribute video to the Aquanauts, set to the score "My Hero," professionally produced by Mariano Lorde, of Lorde Cinema. The closing video can be viewed on-line at www.youtube.com/watch?v=w9PQPEsqZDk. The images and song touched many hearts, moving some to tears.

Local attention was raised as the city placed Banners-of-the-Heroes on light posts along the main roads. Duplicate banners were also placed on and around the SEALAB I Exhibit located at the Man-in-the-Sea Museum.

Saturday's lectures were open to the general public. Fabian Cousteau, representing the Proteus Ocean Group, presented his vision of the future, "Proteus: The International Space Station of the Sea." The concept is a mixed-use habitat, half science and industry, half eco-tourist. (Go to www.proteusoceangroup.com/ for more information.)

The second lecture was Kevin Hardy, presenting his research into the truth behind the tragedy of SEALAB III in 1969, based on his article, "SEALAB III: The Divers' Story", published in the Journal of Diving History earlier this year. There was standing room only. All seven Aquanauts were there, and stood at the end to be recognized and applauded.

Three hundred guests, including seven original Aquanauts, celebrated the history making dives of SEALAB at the 60th SEALAB Anniversary banquet. (Photo by Kevin Hardy)

The boys are back in town: (left-to-right) SEALAB III Aquanaut Jay Myers, SEALAB Engineer Jim McCarthy, SEALAB III Aquanauts Martin Harrell, (Martin's friend in blue shirt), John Kleckner, Keith Moore, Larry Bussey, SEALAB I Bernie Campoli, and SEALAB III and Ivy Bells Aquanaut Fernando Lugo. Fabian Cousteau is at the podium preparing to deliver his keynote address. (Photo by Kevin Hardy)

Members of Berry Cannon's extended family were also in attendance.

The final presentation was presented by Dawn Kernagis and Kirk Krack, of DEEP.com, on another future vision habitat, "The Sentinel System". The speakers acknowledged the giant leaps made in the 1960's, and challenged themselves for a return to those halcyon days. (Go to www.DEEP.com for more information.)

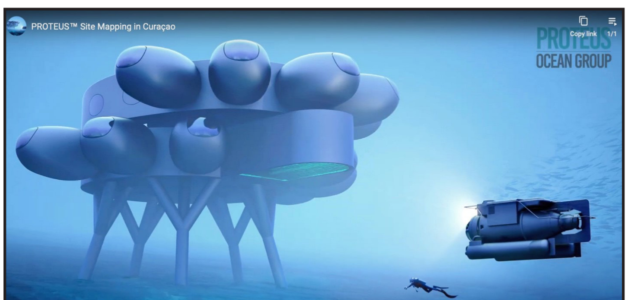
On the Sunday following the Reunion, Steve Mulholland opened the museum for Mariano Lorde, Lorde Cinema, to interview the Aquanauts. Their words and experiences are now captured on video for future generations to study and appreciate.

A number of previous Aquanaut interviews and topic videos are available on YouTube by searching "Man in the Sea Museum" and scrolling through the hits.

SEALAB Shirts and mementoes are still available at the Man in the Sea Museum online store at www.maninthesea.org.

You can also support the Museum and its valuable collections by becoming a member or buying a commemorative brick.

One exciting outgrowth of the 60th SEALAB Reunion is Mariano Lorde's personal dedication to inviting the remaining Aquanauts who were not in attendance in Panama City Beach, to sit with him for an interview. He has already traveled west to Yuma, AZ, San Diego, CA, north to Seattle, WA, back down to Ventura, CA, and soon back to Florida. His professional work is exceptional, and this series of interviews will be a rare look into the time when saturation diving was just an idea being poked at and understood.

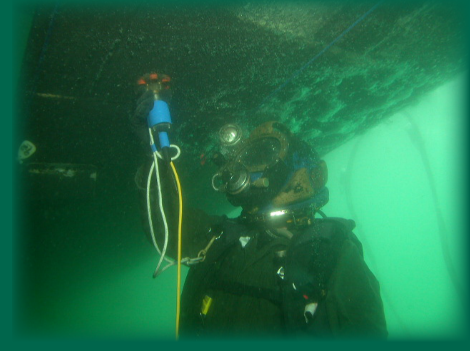


An artist's concept of Proteus, currently being considered for a site in the pristine Curacao Marine Park.
(Illustration courtesy of Proteus Ocean Group)

The modular DEEP Sentinel habitat.
(Illustration courtesy of DEEP)

Banners-of-the-Heroes were located around the main roads of Panama City Beach. (Photo by Kevin Hardy)

Underwater NDT (Not Just for Small Areas): A Case in Point



By: John Tumber; edited by UWSH Staff

Naval Sea Systems Command, Director of Ocean Engineering, Supervisor of Salvage and Diving (SEA 00C), Underwater Ship Husbandry Division (SEA 00C5) was approached by Commander Submarine Forces, Pacific to inquire into diver conducted Non-Destructive Test (NDT) support of Trident Refit Facility (TRF) for a survey of a Submarine launched almost 40 years ago. The need was to provide naval architects and structural engineers reliable and actionable information about the condition of the submarine's hull.

SEA 00C5 directed its hull cleaning contractor, Seaward Marine Services (SMS), to prepare a survey plan utilizing its NAVSEA approved NDT procedure to conduct an ultrasonic hull survey on the boat in conjunction with the boat's hull cleaning. Seaward has been performing in-water ultrasonic thickness (UT) surveys on ship's hulls since 1972; SMS employs two different techniques depending on specific needs: (i) an ROV based comprehensive hull survey (Lamp Ray®), and (ii) a diver employed technique that allows more precise hull data (Datascan). Each of these techniques of NDT complies with NAVSEA Technical Publication T9074-AS-GIB-010/271, and Underwater Ship Husbandry Manual Chapter 17 Inspections.

The need for an extremely detailed inspection drove the use of the diver-based survey (Datascan). The Datascan survey employs a grid network to precisely map out the area of the vessel to be surveyed. The grid allows the diver to know specific locations or areas of interest on a ship's hull, thus it allows future inspections to be made at precisely the same locations, which allows for defect trending.

Using this grid network establishes a uniform pattern of points (aka survey sites) at which the diver scans the hull structure at a predetermined spacing based on the inspection requirements. Typically, the survey sites are 6-9-inch diameter areas on hull at which the diver uses a UT probe to record 500 individual ultrasonic readings. These readings are compiled statistically and displayed in a detailed view of each survey site. In this recent survey of the boat, the ultrasonic hull thickness survey consisted of 5,225,000 measurements collected at 10,450 different survey sites on the underwater hull. Approximately 48,000 sqft of hull area was surveyed.

The task was performed at Naval Base Kitsap Bangor, WA, February 12-29, 2024. TRF and NAVSEA naval architects and structural engineers were on site to provide technical oversight and to validate the measurement thoroughness and results, with a goal of allowing the boat to be certified for unrestricted operation. An added benefit of the Datascan survey is that divers also visually inspect the hull surfaces, including a high-resolution color video system which further allows topside engineers to monitor the hull condition and NDT process in real time.

These in-water hull surveys can be performed worldwide which lends itself to reasonably fast deployments with tabulated results, thus avoiding the need for dry-docking and its associated cost and time, while still affording greater accessibility of underwater hull surfaces.

The professionalism and technical ability of the divers and topside team allowed a speedy and safe survey under changing conditions. Continuous feedback, verbal and report updates were provided as the survey progressed, keeping all involved fully up to speed on the progress. Teamwork and cooperation allowed divers to arrive on site, complete the survey requirements, and clear out gear and equipment in a timely manner, which enabled the vessel to stay on schedule.

The detailed final report for this operation was over three hundred pages. All the data is presented in traditional tabulated form, as well as "Data Maps" that allow quick visual interpretation of a vast quantity of data.

The unrivaled ability to mobilize contract divers worldwide and complete tasks under adverse conditions provided TRF Bangor with much needed information in an efficient manner.

L6 3.0'	L7 2.5'	L8 2'	L9 1.5'	L10 1.0'	L11 0.5"	L12 0.000	L13 0.5'	L14 1.0'	L15 1.5'	L16 2.0'	L17 2.5'	L18 3.0'	L19 3.5'	L20 4.0'	L21 4.5'	L22 5.0'
0.464																
0.474	0.469	0.470	0.464	0.468	0.470	**0.213**	0.459	0.470	0.471	0.471	0.468	0.465	0.462	0.445	0.465	
0.470	0.476	0.470	0.470	0.457	**0.240**	0.473	**0.236**	0.471	0.473	0.456	0.469	0.468	0.468	0.465	0.468	
0.459	0.460	0.468	0.473	0.471	0.468	0.465	0.450	0.470	0.473	0.459	0.468	0.468	0.469	0.468	0.450	0.468
0.391	0.442	0.465	0.469	0.473	0.463	0.459	0.471	0.465	0.468	0.465	0.469	0.468	0.454	0.468	0.470	0.462
0.465	0.443	0.465	0.465	0.445	0.470	0.468	0.470	0.463	0.459	0.463	0.468	0.468	0.469	0.469	0.468	0.468
0.463	**0.300**	**0.237**	0.467	0.462	**0.196**	0.479	0.481	0.480	0.468	0.462	0.448	0.454	0.448	0.453	0.451	0.465
0.193	0.473	0.465	0.470	0.471	0.468	**0.349**	0.476	0.474	0.386	0.479	0.481	0.476	0.479	0.473	**0.369**	0.462
0.227	0.468	0.473	0.471	**0.228**	**0.185**	**0.348**	**0.236**	**0.221**	**0.476**	**0.234**	0.465	0.423	0.459	0.462	0.476	0.471
0.454	0.468	0.473	**0.335**	0.474	0.467	0.485	0.473	0.458	**0.191**	0.474	**0.230**	0.470	0.473	0.479	0.462	0.462
0.459	0.467	0.477	0.481	0.462	**0.237**	0.473	0.499	**0.239**	0.473	0.470	0.436	0.445	0.460	0.460	0.465	0.463
0.445	0.456	0.468	0.469	0.468	0.466	0.462	0.459	0.442	0.471	0.470	0.462	0.465	0.465	0.465	0.449	0.462
0.448	0.468	0.468	0.468	**0.371**	0.465	0.462	0.462	**0.223**	**0.236**	0.465	0.422	0.465	0.468	0.465	0.462	0.465
0.174	0.470	0.468	0.465	0.465	0.465	**0.236**	**0.197**	0.456	0.470	0.470	0.468	0.462	0.476	**0.317**	0.465	0.468
0.468	0.465	0.468	0.469	0.456	0.462	0.460	0.456	0.469	**0.334**	**0.362**	0.468	0.468	0.470	0.468	0.470	
0.471	0.470	0.465	0.473	0.465	0.449	0.465	0.463	0.473	0.473	0.457	0.470	0.468	0.468	0.473	0.465	
0.334																

Typical Datascan Data Map.

Article cover photos; Left: Typical Datascan Diver Scanning Hull. Right: Diver Following Hull Grid Lines.

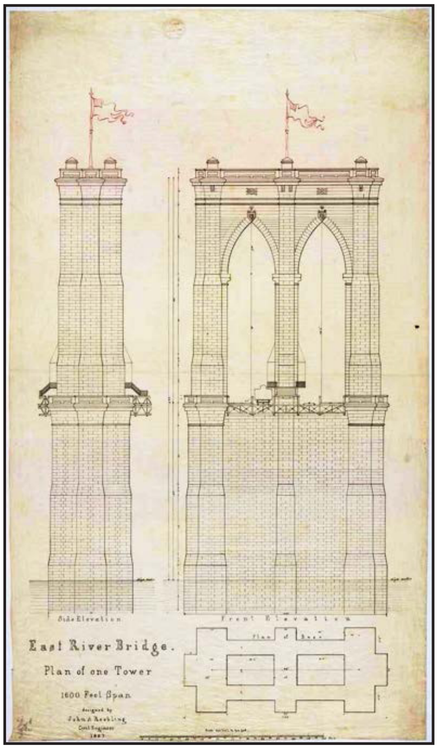
John Tumber has 24 years of NDT experience at Seward Marine Services where he is Director of the NDT department providing critical services on U.S. Navy Vessels worldwide.

This Day in Diving History

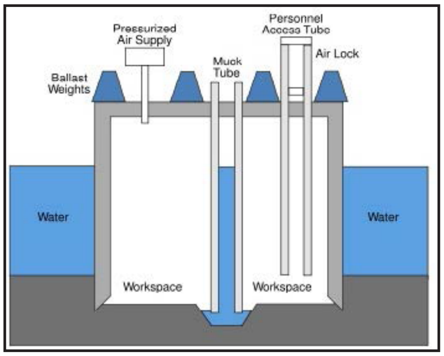
By: MDV David Gove

The Brooklyn Bridge Construction

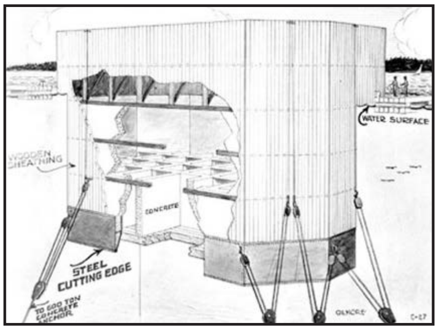
The opening day of the Brooklyn Bridge showcased it as a symbol of American ingenuity. At the time, it was the longest suspension bridge in the world, and its two towers stood as the tallest structures in New York City and the entire western hemisphere for several years. Imagine seeing such a sight if you lived in the area and how awesome it must have looked compared to anything you had seen prior. Certainly, those who had either seen the bridge or walked on it during this time period bragged about how huge and expansive it was to friends and family members. Keep in mind that the first asphalt roads were laid in the U.S. around the same time the bridge was first being constructed.



On January 3, 1870, construction of the bridge began with two granite block (Gothic-inspired) towers to serve as a base to support its massive cables. One of the towers is located on the Manhattan side, the other on the Brooklyn side of the bridge, hence the name. To anchor the towers to the East River, they were built atop caissons, which were large wooden boxes with no bottoms. These caissons resemble the large patches that Navy Divers put on ships today but were much, much larger. Each of these caissons was towed into position and sunk on the river bottom, with the top of the "patch" being flipped over to allow for excavation of any material on the bottom. Compressed air was pumped into the chambers to keep water from rushing in, and men inside dug away at the mud and bedrock at the bottom of the river. As the stone towers were built on top of the caissons, the men beneath, dubbed "sand hogs," kept digging ever deeper. Once they reached solid bedrock, the digging would stop, and the caissons were filled with concrete, thus becoming the foundation for the bridge. To expedite the descent of the caissons, dynamite was used for the first time in bridge construction. These workers were paid wages of $2.25 per day, which would be around $44.28 in today's dollars or an hour for only a 40-hour work week, which supervisors would have laughed at back then.



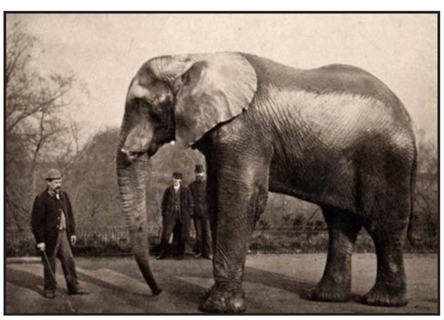
Working inside the caisson was exceedingly difficult. The atmosphere was always dirty and misty, and the caisson work occurred before Edison perfected the electric light. The only illumination was provided by gas lamps, all while working under pressure (yikes). The "sand hogs" had to pass through a series of air-locks to enter the chamber where they worked. After working for extremely long hours, workers would quickly depressurize themselves through the locks due to their shift being over. Upon surfacing, workers would experience painful symptoms in their joints and about their bodies, which was strange at the time. Such pain would cause them to limp in a manner that appeared similar to the "Grecian bend" (a dance or walk for fashionable ladies of the era). Their fellow workers would



chastise those affected with this ailment for "doing the Grecian bend." This was later shortened to simply "the bends" and is still used as a description for decompression sickness. Workers affected with the bends would experience some relief of their symptoms when they returned to work under pressure in the caisson the next day - although no one understood why at the time. Dr. Andrew Smith first utilized the term "caisson disease," describing 110 cases of reported decompression sickness (although most cases weren't reported) as the physician in charge during the construction of the Brooklyn Bridge. The project employed 600 compressed air workers. Recompression treatment was not used as it didn't exist. All in all, the foundations took three years to construct and cost 27 workers their lives.

There were so many occurrences of the disease in the caisson workers that it caused the halt of construction of the Manhattan side of the tower. This turned out to be 30 feet short of bedrock after soil tests underneath the caisson found the bedrock to be even deeper than expected. Today, the Manhattan tower rests only on the sand with concrete mixed in at a depth of 78 feet; the Brooklyn tower sits in bedrock at 44 feet of water.

Washington Roebling took over his father's work as lead supervisor of the construction after sadly passing away at the beginning of construction. Initially, Mr. Roebling went into the caissons to oversee the work but came down with a "mysterious illness," much like many other workers did during the construction. Due to being bedridden, he stayed at his house in Brooklyn Heights, giving his wife directions on the bridge's construction. There was wide speculation that his wife Emily was the actual Chief Engineer of the project until its completion. The reason this was likely hidden was due to many people's issues with women supervising anything during that period of time. The support mechanism of the bridge is also pretty impressive. If you have ever been to the bridge, think of how difficult it was to spin such large support wires into a huge cable that takes the bridge's weight on both sides of the towers in 1870.



The opening ceremony for the bridge took place on May 24, 1883. While some Irish residents took offense due to it being the birthday of Queen Victoria, it was too impressive not to see first-hand. Several thousand people attended this ceremony, and many ships were present in the East Bay for the occasion. After the opening, a rumor that the Bridge would collapse caused a stampede of people, which crushed and killed twelve individuals. As a publicity stunt and a "weight test," P. T. Barnum helped to squelch doubts about the bridge's stability-while publicizing his famous circus-when one of his most famous attractions, Jumbo, led a parade of 21 elephants over the Brooklyn Bridge.

To read more about the Brooklyn Bridge, check out "The Great Bridge" by David McCullough.

MDV David Gove, your friendly neighborhood Master Diver. Copyright David Gove, 2021.

SUPDIVE SENDS ...CDR David Scherr

Hooyah Deep Sea! It is a pleasure to introduce myself in this Fall 2024 edition of the Faceplate as your Supervisor of Diving! In my whirlwind four months onboard, I have been humbled by the professionalism and expertise of the diving community. Moreover, as I walk around the NAVSEA offices overlooking the Washington Navy Yard, I am in constant awe at the legacy of diving and salvage experience that work in the 00C offices – absolute technical experts in the community and extremely dedicated to improving technical and operational needs of the DoD. In several trips around the Fleet, I've been able to meet the members of the CWO and Senior Enlisted Advisory Teams who hail from every corner of the globe to represent the Fleet and other Services. In addition, I visited the NEDU team and was impressed by the team's diligence to solve undersea challenges and see the rich, almost 100-year history of Navy experimental diving.

In September, we gave a mighty "Fair Winds and Following Seas" to CAPT Bob Marsh as he retired after an incredible 25+ year career serving the Nation, U.S. Navy, and the EOD & Diving community. If you missed your chance to congratulate CAPT Marsh, it may be tough to reach him as he is most likely enjoying some downtime and fly-fishing in central Virginia. In July, we welcomed Master Diver Jordan Wingard to the 00C3 team, joining us from Naval Station Guam. MDV Wingard brings a wealth of knowledge from across the Diving community and we look forward to his contributions to 00C.

2024 Diving Executive Steering Committee

On 7 June 2024, a true team effort went into hosting the 1st Diving Executive Steering Committee (DiveESC) meeting in six years at Washington Navy Yard. This Flag/Senior Executive-

level DiveESC, chaired by OPNAV N97, brought together Flag-level stakeholders in Navy Diving from across TYCOMs and the Fleet to focus on sustained improvement and effectiveness of the Navy Diving Program. The highly productive meeting established action items throughout 2025 and a "State of Navy Diving" read-out to the CNO. A persistent theme of "manning challenges and aging equipment as potential sources of increased risk," was heard from stakeholders. The forum provided a renewed focus on the Lines of Effort to refine diving policy and "resourcing initiatives continue to support diving research; equipment procurement, replacement, modernization, and sustainment," including in Navy Experimental Diving Unit capabilities and the Deep Submergence Biomedical Development Program. In summary, the formal gathering of the DiveESC gives a renewed focus on the Navy Diving Program from Flag-level leadership, with messaging on the Dive program directly to the CNO.

OPNAVINST 3150.27D Revision and Dive Manual Rev 8 On-hold

With the gathering of the DiveESC in June 2024, there is momentum to rewrite the OPNAVINST 3150.27D, Navy Diving Policy and Joint Military Diving Technology and Training Program, otherwise known as THE guiding document for the Navy diving policy, operations, authorities and responsibilities. To put it mildly, the instruction has grown over the years and could stand for some refinement. The NAVSEA 00C3 office, the CWO-AT, and SEAT will be heavily involved in the 3150 rewrite throughout 2025, and we ask that the Diving community contribute as the document makes rounds for coordination. As we focus on the 3150 rewrite, we have made the decision to delay the Navy Dive Manual Rev 8, until 2026. This decision does not come lightly; we intend to ensure the 3150 is given the focus it needs and incorporate downstream effects of the 3150 into Rev 8 of the Dive Manual. To account for the deferment of Rev 8 to the right, we have re-opened Revision 8 "Change Requests".

Ongoing Efforts and Future Outlook

We have recently issued several Diving Advisories related to diving regulators, for safety concerns and equipment sundowning. With a limited number of SCUBA regulators currently on the Authorized for Navy Use (ANU) list, I recognize the challenge this puts on the Fleet for current operations, training, and long-term procurement. We are taking a renewed look at several regulators for testing and evaluation so we can ultimately have more options on the ANU list. In addition, the team recently added the AMRON MK-20 and KM-37/97 Pre-Amplified Microphone to the list, along with several other additions in the works.

We're excited to announce that the spring 2025 Military Divers Training Continuum (MDTC) will be held at the ESSM facilities at Cheatham Annex in Williamsburg, VA. Holding the MDTC at ESSM will provide a wealth of great training opportunities, along with an incredibly knowledgeable and experienced team that are on site. Additional details will be forthcoming over the next couple months.

Around the Fleet, we continue to support efforts with the development of the T-ATS Navajo Class Ocean Tug, which will provide towing, salvage, and rescue capabilities to the Fleet; human physiology and performance; and research and development on dive equipment, such as the DAVD Gen 3, LARS upgrade, FMGS modernization, Navy Dive Computers, DSEND suit, and many others.

To wrap-up, I am excited to serve the Navy Diving community as your SUPDIVE! Moreover, I'll highlight that NAVSEA 00C3 is here to serve YOU, the Navy Diver, as you operate globally. The team is available to provide technical solutions and doctrinal expertise to solve your issues. Don't hesitate to reach out to the 00C3 office or use the SUPSALV website to provide feedback.

Diving Advisories

24 - 05	ISSUANCE OF REVISED U.S. NAVY DIVING EQUIPMENT AUTHORIZED FOR NAVY USE (ANU) PROGRAM INSTRUCTION
24 - 06	ISSUANCE OF REVISED EQUIPMENT MISHAP INFORMATION SHEETST
24 - 07	ISSUANCE OF REVISED DIVERS LIFE SUPPORT SYSTEM OPERATING AND EMERGENCY PROCEDURES FOR FADS III, 0RCA, ASRA, TRCS, AND SNDL
24 - 08	POSEIDON XSTREAM DEEP 1ST STAGE REGULATOR FAILURE
24 - 09	ZEAGLE RANGER REMOTE EXHAUST SYSTEM FAILURE
24 - 10	MFR CHANGE TRANSMITTAL 1, FLY AWAY DIVE SYSTEM (FADS) III OPERATING AND EMERGENCY PROCEDURES (OP EP) (OP-2) FADS III 3000 PSI, (OP-5) FADS III 3000 PSI, (OP-5) FADS III 5000 PSI)
24 - 11	EXPANDED GUIDANCE ON POSEIDON XSTREAM 1ST STAGE REGULATOR FAILURE
24 - 12	DISCONTINUATION OF PRODUCTION AND SALE OF COMPLETE CONSHELF XIV REGULATOR ASSEMBLIES

For more information on effective diving advisories, go to **https://secure.supsalv.org/home.asp**

Faceplate Mailing List

Join the mailing list!
Users will receive an email notification when a new issue of Faceplate is released.
Submit request to Faceplate_Editor@us.navy.mil

FEEDBACK - Faceplate appreciates feedback on our entire publication. So if you want to sound off about something we have published, please do!

http://www.navsea.navy.mil/Home/SUPSALV/00C3-Diving/Faceplate-Magazine/