FACEPLATE

The Official Newsletter for the Divers and Salvors of the United States Navy

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FACEPLATE

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Editorial Staff

In This Issue

Cover

Nd3 (DSW) Ryan Farrell of SWRMC Divers Alpha Crew awaits word from the diving supervisor to leave surface for installation of the AFT OTAA on USS JEFFERSON CITY.

SUPSALV SENDS...CAPT Mark Matthews

Many if not all of you are aware that our U.S. Navy Diving Community recently completed a period of introspection and review following the tragic loss of too many of our shipmates over the past two years. Supervisor of Diving, CAPT Dan Shultz, will describe the process, findings, and many of the corrective actions from this review in his article; however, I will take a moment to provide some high level points for consideration:

I am a United States Navy Deep Sea Diver.

I traverse the dark, forbidding depths of the world's oceans, lakes, rivers, and seas where only a select few can follow. They are my battlefield. I serve across the spectrum of our nation's Military Services and with Special Operating Forces.

I honor my deep sea brethren past, present, and future; they are my Family. My personal Honor and Integrity are above reproach and compel me to do what is right regardless of the circumstances. Courage is the hallmark of my trade.

The laws governing my chosen profession are absolute and unforgiving, demonstrated and proven with the blood of many brave divers who have gone before me. Because of their courageous sacrifice, I am committed to my brothers-in-arms through relentless mental and physical preparation. My knowledge of diving, underwater techniques and systems, physics, and hyperbaric medicine must be unsurpassed.

The accomplishments of United States Navy Deep Sea Divers are the benchmarks by which the world measures man's achievements in the Sea. My specialized skills, undaunted spirit and unbreakable will enable me to succeed in an environment where there are no second chances. Excellence is my standard.

I maintain uncompromising standards personally and professionally. Accepting anything less would bring disgrace upon myself and discredit to my community. My sense of Duty to God, my Country, the United States Navy and my Teammates is steadfast and enduring.

I am a United States Deep Sea Diver.

Those words above comprise the Ethos of the Navy Diver. Those are our words, the guiding beliefs and ideals that we have chosen for our culture. Those words are the ruler by which we measure our worth, the shoes we seek to fill, the shadow we endeavor to cast.

We acknowledge that our actions and achievements shape our reputation, a reputation that was initially formed by the brave actions and contributions of all who have preceded us. Further, our reputation is the legacy that we leave, the gift we give all of the future divers yet to break the water's surface. Our professional competence, the breadth of our expertise, the manner in which we lead our divers on the dive side – all of this, forms that reputation. Our standard is Excellence. Hold that line.

Safe execution does not happen by accident. It happens through process. Be deliberate in your planning and all of the front end work required to accurately identify possible hazards and barriers to success. Dive Supes – when is the last time you did air consumption calcs before a SCUBA dive? If it has been a while, are we living up to the standards expressed in our Ethos? Keep in mind that the effort we apply in the early phase of operations will make the actual execution of the work look easy.

Another area due for a round turn is the way we communicate hazards – "The laws governing my chosen profession are absolute and unforgiving, demonstrated and proven with the blood of many brave divers who have gone before me." Instead of waiting to learn our lessons when they have been written in blood, we must identify leading indicators of problem areas. We need to broadly discuss near misses, issues that could have led to accidents but were averted through discovery early in the accident chain. On the deckplate, when these near misses occur, call them out. Report them so they can be documented, studied, and addressed. At the diving commands and the ISICs, we must embrace the open reporting, not seeing it as a deficiency, but seeing the reporting as open, healthy communication.

It will take considerable effort and time to work through all of the corrective actions from the review. Most of the corrective actions will result in changes to policies and guidance. Please embrace these changes as they are intended to reinforce our standard of Excellence, to ensure that the reputation we leave behind us is worthy of the blood and sweat contributed by the divers who served before us.

Speaking of the brave divers of the past in whose shadows we live, I am sorry to say that we have suffered a loss. Captain Walt Mazzone passed away on August 7th at the age of 96. Captain Mazzone was the project officer for the Sea Lab experiments, working with Dr. George Bond to prove the theory of saturation diving. Along with Edward Ellsberg who ran salvage operations in the Red Sea and along the northern coast of Africa in World War II, the SEA LAB team including Dr. Bond and Walt Mazzone stand at the forefront of those I think of when I reflect on the history of Navy Diving. I never had the privilege to meet the elder Captain Mazzone, but I did serve with his son Captain Bob Mazzone, a Navy Salvor who retired after serving as the Commanding Officer of the Portsmouth Naval Shipyard. Please keep the Mazzone family in your prayers as they remember the great service and sacrifices made by Walt.

In the last issue, I wished Fair Winds and Following Seas for CDR Sam Brasfield and I welcomed CAPT Dan Shultz as his relief. Now, we are bidding farewell to Dan and welcoming CDR Rob Debuse. Dan has relieved CAPT Fuzz Harrison in the diving chair at OPNAV N97. He has departed 00C, but has not gone too far.

Finally, I too must bid farewell. I have been selected to relieve RDML(s) Lorin Selby as the Program Manager for the Advanced Undersea Systems Program, working the interface of manned and unmanned systems with submarines. CAPT Gregg Baumann has been selected as my relief. It is sad to depart, but I am fortunate that I will still remain involved in submersibles and the diving Navy. As our Ethos states – I am a United States Deep Sea Diver. It has truly been an honor and a distinct privilege to serve alongside each and every one of you. Hoo-yah. Stay safe.

USS VICKSBURG (CG 69)
Port CPP Hub Cone O-Ring Replacement

By: CWO Tim Axline

Every once in a while an opportunity comes along for a "first ever" underwater repair. In February 2014, SERMC Mayport Divers found themselves in that position. In late January, the crew of USS VICKSBURG (CG 69) was testing their port shaft and noticed oil was surfacing in the area of the port propeller. The oil amount was small and quickly contained but there was obviously a problem that needed resolution. SERMC Divers were called upon to inspect the hub and propeller blades for oil leaks. Initially, no oil was found when divers inspected the blade ports and bolts but the oil had to be coming from somewhere in the hub. A closer inspection revealed that a small amount of oil was escaping from between the hub cone and hub body that is secured with 25 large bolts.

The only way to know exactly where the oil was coming from was to remove the cone cover that surrounded the hub bolts. This task has been done before in the water but it is no easy one. There were 20 tack-welded fasteners that needed to be removed. After two days of grinding and rigging, the cone cover was removed and the "smoking gun" was revealed. Oil was escaping past the O-ring that seals the hub cone to the hub body. This O-ring normally gets replaced in dry dock along with the rest of the hub but was not an option at this point so the decision to replace the O-ring in the water was made.

This is where SERMC's resident expert on CPP systems was invaluable to this task. Mr. Richard Greer of Code 200 developed a procedure to replace the O-ring, but there was a lot of speculation whether it could be done successfully. Based on the fact that the hub cone could only be backed off two inches presented the challenge of getting a diver's hand inside to remove the old O-ring and install a new one. There was also the question about the ability of the O-ring to stretch over the cone and be manipulated into the groove where it belongs. Before any work was done in the water it was agreed that doing this job on the surface would provide valuable information in determining feasibility.

Hub cone cover that was removed from USS VICKSBURG in order to access hub bolts.

A non-RFI (ready for issue) hub was obtained and the procedure was tested on dry land with perfect visibility, two luxuries the Divers would not have in the water. The non-RFI hub was also received vertically oriented, 90 degrees from the desired orientation that the divers would be working with in the water. Rigging obstacles prevented rotating the hub so the procedure was practiced in the vertical position. Code 940 personnel were called upon to manufacture the various jacking bolts and guide pins that were needed to perform this mission. MR1 Jeremiah Love and MR1 Charles Barry were the lead machinists who spent many hours fabricating these parts and directly contributed to the successful mock-up procedure on the non-RFI hub.

One of the biggest concerns on everyone's mind was the amount of oil that would escape from the hub once the cone was separated. There were varying amounts predicted to be spilled, from 20 to 2000 gallons, so the team needed a plan to collect the oil before it could enter the water. Jim Peck of the SERMC Dive Locker devised a rubber sleeve to install over the cone and NDC Thomas Shultis took that idea and created a drawing for a local vendor to fabricate. The concept was effective but efficiency was realized once ND1 Jason Young modified the oil extraction process. His idea consisted of using one of the hub bolt holes that had a mechanical plug installed. They installed a fitting that connected a hose to the containment tank on the surface. This process led to the collection of approximately 20 gallons that never touched the water. The minimal amount of oil that did enter the water was effectively cleaned up by the dive team and ship's force.

Now that the oil was contained, it was time to get to the business of replacing the O-ring. Divers removed the oil containment and had no trouble removing the existing O-ring. Anyone who knows how an O-ring works can tell you that this one was not doing its job. It was flat and brittle which was no surprise given that it was in the system for over 12 years. It was a tedious task of installing the new O-ring but nothing the divers couldn't handle. Each of the eight guide pins and jacking studs had to be individually removed and re-installed to allow for O-ring installation. The next phase consisted of maneuvering the hub cone back flush with the hub. The divers had to be careful not to allow the cone to become hung up on the guide studs while evenly working the cone back into place. Precise maneuvering ensured a smooth transition of the hub cone back into place.

Non-RFI hub that was used to practice O-ring replacement procedure.

Hub cone could only be separated two inches from hub; tight but manageable for the divers; O-ring groove is visible.

Mr. Jim Peck (left) and NDC Josh Miller working O-ring replacement procedure on Non-RFI hub.

The next step was to re-install the 25 bolts. These bolts require 2,364 ft. lbs. of torque, a job that would require the use of a hydraulic torque wrench or HYTORC as it is appropriately named. The torque sequence was formulated by Mr. Greer as this process is not simply tightening bolts to the required specification on one pass. The escalation of torque required four steps starting with 200 ft. lbs., then 500, 1,200 and finally 2,364. It took several hours but on the afternoon of the third day of this project the team was ready for a leak check on the hub. Ships force aligned their system and the initial inspection revealed no leaks from the hub, but there were still minute amounts of oil making its way to the surface. After further inspection, Divers noted oil escaping from the prairie air holes on the top blade. After the ship ran their prairie air system for a few hours to purge the remaining oil they were ready for one last inspection. At last, no leaks were found anywhere in the hub or blades. The remaining oil absorbents were collected and disposed of with no oil escaping the containment areas.

This job was a true SERMC team effort. Code 940 machine shop was vital to the production of all the jacking bolts and guide studs and they spent long hours manufacturing the required materials. The Safety department ensured the necessary oil containment materials were on hand and took the lead in getting the oily waste materials to the proper disposal area. Code 300 maintenance team worked hard to keep all personnel informed of the daily efforts and worked through multiple obstacles that stood in the way of this project. Code 910 riggers were right on time with the weight handling required to take receipt of the practice hub. And the folks in the NDT lab provided critical testing of 30 bolts that were necessary for them to be re-installed on the hub. USS VICKSBURG personnel were cautiously optimistic, along with most of the SERMC team, that the repair would be successful. Although difficult at times, the entire project was labeled a first time success for a repair of this type. With the lessons learned it is with utmost certainty that team SERMC will be ready if this repair should ever be required on another vessel.

CWO4 Tim Axline, Diving Officer at SERMC Mayport, FL. 24 years of service and completing seventh tour as a Diver in the Navy.

Joint Underwater Concrete Placement FOAL Eagle 2014

By: CEC (SCW/MDV) Terence Juergens

Fresh from the warm deep waters of Guam Seabee Divers from Underwater Construction Team (UCT) TWO arrived in Chinhae, South Korea to participate in Exercise Foal Eagle 2014 (FE14).

Over a period of 7 days UCT TWO and ROK Sea Salvage and Rescue Unit (SSU) divers worked hand in hand in support of harbor clearance/port recovery scenarios, with emphasis on the placement of underwater concrete. The Underwater Construction Team's unique ability as Underwater Seabees and vast knowledge of waterfront structures helped facilitate the first underwater concrete placement in SSU history. From the classroom to the field both nations worked long and tiring hours to complete construction of form work and successfully place over 5 cubic meters of concrete underwater.

"The SSU divers are experts in salvage, they dive the same rigs, and use the same dive manual as we do. What we're trying to do is provide them a taste of UCT capabilities," said Construction Electrician First Class (SCW/DV) Daniel Luberto, the Leading Petty Officer (LPO) for Construction Diving Detachment Charlie. "The ROK SSU divers have very little underwater construction experience, but their motivation to learn and strong work ethic helped us overcome many challenges to complete a successful training evolution."

Along with the construction of training forms to practice different techniques of underwater concrete placement, UCT TWO developed a comprehensive training plan to further the understanding of how concrete can be used to repair damaged sections of piers. Both teams worked together to use wooden and steel form work to encase a steel pier pile in concrete to enhance structural integrity. Using a surface supplied diving system and underwater hydraulic tools, divers prepped the steel pile by cleaning loose scale, rust, and marine growth. Once the pile was clean the divers took precise measurements to fabricate the necessary forms.

"The biggest barrier to training was language," said Builder Second Class (SCW/DV) Joseph Hophan, project supervisor. "But once we got in the water and started working, everything fell into place and worked out great. We were able to complete so much in such a short time and I couldn't be happier with how things unfolded."

Once all form work was complete and lowered in the water UCT divers used two topside forms to demonstrate the proper procedures of how to place underwater concrete. "There's a big difference to placing concrete on surface verses underwater," said Hophan. "The ability to rehearse and show them topside was invaluable and definitely set us up doing the same thing underwater."

With (2) Seabee divers and (2) SSU divers working together in the water, divers successfully placed over 2 cubic meters of concrete gaining valuable experience in the techniques tactics and procedures of underwater concrete placement.

While working in cold water with poor visibility safety was a main concern. UCT divers instructed the SSU divers on the proper use of personal protective equipment while constructing forms and used a large amount of Operational Risk Management to safely complete what otherwise would be a very dangerous evolution.

"At the end of the day, the ROK SSU gained indispensible insight into what the UCT's do on a daily basis," said CE1 Luberto. They realized the great importance of waterfront construction while using ingenuity and teamwork to get the job done."

UCT TWO is in South Korea during exercise FOAL Eagle on their third of 7 stops spanning 6 countries during their deployment across Pacific Fleet. They'll be conducting inspection, maintenance and repair of various underwater and waterfront facilities along with participation in 4 PACFLT exercises during their 6 month PACOM deployment.

Photos By: Equipment Operator 1st Class (SCW/DV) Manuel Terrero. Article cover photo: A Seabee Diver from Underwater Construction Team (UCT) Two guides a concrete pump during a joint underwater concrete placement with Republic of Korea (ROK) Navy Divers. Photos top to bottom: A Seabee Diver from Underwater Construction Team (UCT) Two guides a diver to shore following formwork placement in support of a joint underwater concrete placement with Republic of Korea (ROK) Navy Divers; Builder 2nd Class (SCW/DV) Joesph Hophan, from Underwater Construction Team (UCT) Two describes how to place underwater formwork before conducting a joint underwater concrete placement with Republic of Korea (ROK) Navy Divers; Seabee Divers from Underwater Construction Team (UCT) Two and Republic of Korea Navy Divers conduct a joint underwater concrete placement; Seabee Divers from Underwater Construction Team (UCT) Two and Republic of Korea Navy Divers place formwork as they prepare to conduct a joint underwater concrete placement.

USS FRANK CABLE (AS-40) Completes Three Emergent Propulsion Repairs

By: CWO3 Joe Theodorou

USS FRANK CABLE (AS 40) completed three emergent propulsion repairs on USS CHICAGO (SSN 721), USS KEY WEST (SSN 722), and USS GREENVILLE (SSN 772).

USS FRANK CABLE (AS 40) dive locker, led by CWO4 Ray Miller and NDCS (MDV) Dan Laube, safely and effectively replaced one propeller and three sets of bearings during three separate jobs totaling 28 days on USS CHICAGO (SSN 721), USS KEY WEST (SSN 722), and USS GREENEVILLE (SSN 772).

USS FRANK CABLE divers performed all functions of the repair. They cleaned equipment, conducted quality control inspections, and replaced materials needed, without the support of shops and shipyards that most lockers are accustomed too. Dive teams led by supervisors ND1 McClain, ND1 Poretti, and ND1 Demay, managed high risk lifts in excess of 90K without injury or damage to personnel, equipment, submarines. Divers amassed 591 hours of bottom time.

"Main propulsion stave bearing replacements are one of the most bottom time intensive jobs we do here on Guam at the FRANK CABLE dive locker. Averaging nine days per job start to finish with no shift work is in my opinion nothing short of outstanding", said NDCS (MDV) Dan Laube. "Our dive locker is comprised mostly of first tour Second Class Divers, a couple second termers and a few First Class Divers. With the extreme under manning of NDC's, each and every Diver has stepped up, from the newest E-4 to the most senior E-6, willingly taken on challenges and leadership roles not normally taken on by their pay grades. I personally couldn't be more proud of this dive locker, everyone here is a professional at work and strives to keep DEEPSEA alive with their work ethic and 'can do attitude'.

The closest available drydock that can support a SSN 688 Class submarine is located in Pearl Harbor, Hawaii, so having the USS FRANK CABLE divers perform these in-water repairs saves the Navy \$2.1M in dry-docking fees, transit time to and from, and roughly one additional week in drydock.

Overall, the USS FRANK CABLE dive lockers leadership, professionalism, motivation, knowledge, and work ethic returned vital assets to PACFLT mission readiness status, directly supporting PACFLTs Lines of Operation.

Hoo-yah USS FRANK CABLE (AS 40) Divers!

CWO3 Joe Theodorou is the UWSH Operations Officer/Project Manager at NAVSEA 00C.

Photo Captions: (top) USS FRANK CABLE (AS-40) stationed in Guam. (bottom) USS FRANK CABLE (AS-40) Divelocker.

SWRMC Dedicates Building to Medal of Honor Recipient

By: Rick Armstrong, Southwest Regional Maintenance Center Dive Division

Southwest Regional Maintenance Center (SWRMC) dedicated their Submarine Dive Division Building (Bldg 47) in honor of a Medal of Honor recipient during a ceremony on May 9 at Naval Base Point Loma.

Retired Lt. Thomas Eadie, was awarded the Medal of Honor for his extraordinary heroism in rescuing a fellow Navy Diver on USS S-4, which sunk as a result of a collision with a surface vessel off Provincetown, MA in Dec. 18, 1927.

"Senior and Junior Navy Divers routinely report to SWRMC to perform some of the most dangerous and technically diverse underwater repairs conducted on USN and USCG ships submarines and carriers of the Pacific Fleet during their three year tour of duty," said Rick D Armstrong, SWRMC Dive Manager. "I envisioned a newly reporting Navy Diver seeing the LT Thomas Eadie Medal of Honor display and narrative of his heroic actions. He is truly an iconic figure within the small community of Navy Deep Sea Divers and should be looked up to and honored for his superb career as a Sailor, Master Diver, and Diving Officer in the United States Navy."

Thomas Eadie was born on April 8, 1887 in Glasgow, Scotland. In 1909, he enlisted in the United States Navy, was rated as a Gunner's Mate, trained as a Navy Diver and is recognized as one of the Fleet's first working Navy Divers. He retired from active service in 1939, but returned to naval service during World War II, receiving an appointment as a Chief Gunner (Warrant Officer). He later received his commission as an Ensign and retired at the rank of Lieutenant, USN.

Thomas Eadie "Medal of Honor" Recipient. Painting by Rick Armstrong

He died November 14, 1974, in Brockton, MA, and is buried at Island Cemetery Annex in Newport, RI.

The Medal of Honor citation for Chief Gunner's Mate Thomas Eadie reads as follows:

For display of extraordinary heroism in the line of his profession above and beyond the call of duty on 18 December 1927, during the diving operations in connection with the sinking of the USS S-4 with all on board, as a result of a collision off Provincetown, MA. On this occasion when Michels, Chief Torpedoman, United States Navy, while attempting to connect an air line to the submarine at a depth of 102 feet became seriously fouled, Eadie, under the most adverse diving conditions, deliberately, knowingly and willingly took his life in his own hands by promptly descending to the rescue in response to the desperate need of his companion diver. After two hours of extremely dangerous and heartbreaking work, by his cool, calculating and skillful labors, he succeeded in his mission and brought Michels safely to the surface.

Eadie was instrumental in numerous salvage and deep sea diving operations including salvage of USS S-51 and USS S-4. He was awarded the Navy Cross for each of these arduous diving and salvage operations for his extraordinary heroism and devotion to duty under the most adverse conditions.

Eadie is a legendary figure within the United States Navy Deep Sea Diving community. A Navy Master Diver, Chief Warrant Officer and Commissioned Officer, he remains an American hero and serves as an example for active duty Navy Divers serving in the Fleet today.

Navy Teams Help Sail Districts Through Busy Dive Season

By: Rick Benoit USACE Portland District

Executing 26 dive missions at eight US Army Corp of Engineers dams in two districts, the 2014 in-water work season was one of the busiest on record for the Portland/Walla Walla Office of Dive/ROV Operations and Safety.

Additionally, the Dive Office facilitated 15 ROV (remotely operated vehicle) missions, assisted with OCONUS dives in Japan and Puerto Rico, prepared three week long classroom presentations, as well as planning execution of four upcoming dives at East Coast Army Bases, and ROV operations in the Omaha and Tulsa Districts.

"This year has been extremely busy when compared to previous years," said Portland's Deputy District Dive Coordinator Todd Manny who assists the NWW Dive Safety Office. "We'd much rather be busy than not – however, I don't think it's slowed down at all since last summer. It's been crazy busy – just how we like it!"

Providing critical assistance to the Dive Office itself in the second year of a cooperative agreement between NWP and NWW to share operational and safety expertise for all diving and ROV missions, were US Navy Dive Teams from Bangor and Keyport, WA.

Beginning in 2006 when the Navy Undersea Warfare Center (NUWC) of Keyport, WA sent a team to The Dalles Dam for an underwater spillway apron survey, the Portland District Dive Office has pioneered the use of Military Divers at USACE hydroelectric and navigation facilities.

"One of the main reasons I wanted to return to the Keyport Dive Locker from my duty station in Hawaii was because of the unique experience of diving at the various Portland and Walla Walla District projects," said Chief Jared Butler, a dive supervisor with the team.

Butler, a Navy diver for 11 of his 20 years as an enlisted sailor, has worked on 11 diving missions to the Portland District as well as on four trips to Walla Walla projects. During the 2013-2014 dive season, Butler has either led or worked on teams diving at Foster and The Dalles Dams in NWP, McNary, Little Goose, and Lower Granite in NWW.

"Our on-going relationship with the Portland District ACOE has been outstanding," said NDC William "Brett" Eversmann of the Bangor, WA Puget Sound Naval Shipyard (PSNS) Dive Locker. "The Dive Office as well as dam employees in both Portland and Walla Walla Districts have been top-notch."

Of this season's 10 Navy deployments to Portland and Walla Walla facilities, the PSNS team executed three dive missions, one at The Dalles Dam in NWP and two at NWW's Lower Granite Dam. Eversmann was the Leading Chief Petty Officer (LCPO) during his team's weeklong deployment at Lower Granite Dam where two first ever dive achievements were recorded.

With operational guidance from the Dive Office, Eversmann's team executed NWW's first ever below water metal thickness ultrasonic inspection. This task also involved the first female Diver to dive on a NWW or NWP hydroelectric dam.

"Walla Walla District presents new challenges that have been faced head on such as the first ever waterborne non-destructive testing (NDT) inspection of the RSW skin plates at Lower Granite," said Eversmann who previously led his team on a dive mission at NWP's Foster Dam in Sweet Home, Oregon. "Among other things, this allowed my Dive Team to gain firsthand experience working in cold water with little to no visibility."

Other 2014 NWP/NWW dive missions executed by the Bangor team included assisting with repair of Lower Granite's North Juvenile Fish Facility's Make-up Water Pump Trash-rack and removal of derelict fish monitoring equipment at The Dalles Dam.

"The benefits of working at USACE facilities are many. Dive supervisors are tasked with planning the job, mobilization, and selecting a qualified dive team," said Eversmann. "Divers have an opportunity to familiarize themselves with USACE in the event of an unforeseen disaster as well as gaining rigging, inspection, cutting/welding, and mobilization experience which is crucial to a junior Diver's progression in the Navy Diving Community."

Seven of the remaining 2014 NWP/NWW missions were performed by the NUWC's Keyport Dive Locker. Commercial dive companies executed 11 operations while the NWP-led USACE Rapid Response Dive Team completed five underwater missions.

Keyport's missions included time critical dives at both McNary, to work on the Washington Shore Fish Ladder Exit, and Little Goose Dams, to inspect its damaged Trash Boom, as well as a stop at Lower Granite to clear the South Juvenile Fish Facility's Make-up Water Pump trash rack.

NWP and NWW provided the dive teams more than 50 dive training and work opportunities while Keyport and Bangor executed nearly 30 days of safe, efficient, and cost effective dive operations.

"The work is exciting, it's totally out of the ordinary and challenging," said Keyport NDC/MDV Chad Leaman, a 25-year Navy veteran. "People are always amazed when I tell them we're doing work on a Columbia River dam. Because of that experience and our relationship with the Portland District we've been referred to other USACE districts."

"No other Navy dive lockers except Bangor are ever afforded an opportunity to dive on these rivers or on running Dams," said Butler. "It is exciting because you can be doing an inspection on one dive and drilling, fixing and making recommendations that might save thousands of dollars on another dive."

Determining which Navy team is used depends primarily on availability to meet mission schedule and ability to safely and efficiently complete required tasks. However, diving for USACE is considered a work-training opportunity and is a secondary and collateral duty to the team's primary mission which for both Keyport and Bangor is to support the fleet.

"This is an exceptional example of a win-win relationship for USACE and the dive teams," said Manny, himself a retired Navy Diver. "The dive teams get an exceptional training and work experience, USACE gets a job done safely and well."

Article and photos by Rick Benoit. Rick Benoit is the Program Manager and Dive Safety Officer for the US Army Corps of Engineer's Portland and Walla Walla District's Office of Dive / ROV Operations and Safety. A Navy veteran, Rick is also Program Coordinator, Dive Supervisor and Diver for the Portland-led Forward Response Dive / ROV Team.

Article Cover Photo: LT Sean Doherty (#4) and ND2 Michael Asay (#2) perform final in-water equipment checks prior to beginning their dive inspection of the Removable Spillway Weir at Lower Granite Dam.

Members of the Puget Sound Naval Shipyard (PSNS) and Intermediate Maintenance Facility (IMF) Dive Locker, Bangor, WA include (left to right - top) ND2 Casey Mrozek, ND1 Jonathan Trusty, ND3 Carter Nabors, NDC Brett Eversmann, and ND3 Reynaldo Martinez; (left to right - bottom) ND2 Michael Asay, ND3 Valerie Defreitas, and LT Sean Doherty. The team executed dive operations in support of the US Army Corps of Engineer's Walla Walla District's Lower Granite Dam 17-21 March 14.

Dive Supervisor NDC Brett Eversmann leads pre-dive briefing prior to commencing dive operations in support of Lower Granite Dam. PSNS/IMF Dive Locker members include (from left to right) ND2 Michael Asay, LT. Sean Doherty, ND3 Reynaldo Martinez, ND3 Valerie Defreitas, ND2 Casey Mrozek, ND1 Jonathan Trusty, ND3 Carter Nabors and LCPO Eversmann.

U.S. NAVY EOD DIVES KUWAIT EOD'S REBREATHER

BY: LTJG GARY MAROSY

On October 29th, Sailors from Explosive Ordnance Disposal Mobile Unit TWELVE (EODMU TWELVE), forward deployed to Kuwait Naval Base (KNB) in support of TASK FORCE FIVE SIX had a chance to dive the DC-55 Rebreather. The DC-55 is currently employed by the Kuwaiti Naval Special Unit (KNSU), Kuwait's Naval EOD unit, for use during Underwater Mine Countermeasure operations. Like the EOD Technicians of the U.S. Navy, the KNSU is responsible for conducting EOD operations on land and in the water. Since May 2013, U.S. Navy EOD Technicians have been working with KNSU as part of an ongoing partnership in order to increase interoperability and promote regional stability.

The Kuwaitis took the lead for this event. They provided and set up the equipment at the diving well on KNB for this dive. The 15' pool provided a safe and controlled atmosphere to dive the DC-55. KNSU supplied 2 DC-55's and brought along five EOD Divers and a medic. Once everything was laid out, the Kuwaiti divers went through all of the components and the functioning of the DC-55. They thoroughly explained all of the operating procedures, emergency procedures, and the proper donning of the apparatus.

KNSU Divers demonstrate donning the DC-55.

EOD2 Melendez (L) practices EP's under the close supervison of CWO Mohammad (R).

The DC-55 is manufactured by Aqua Lung and was formerly employed by French EOD forces. It is a mechanically controlled, constant fO2, semi-closed rebreather that has a low magnetic signature. It is simple to set up and operate. The U.S. EOD Technicians including LTJG Gary Marosy, EODCS Keneth Nati, EOD1 Joseph Maloney, and EOD2 Andres Melendez all got a chance to dive the DC-55 alongside their Kuwaiti counterparts. The DC-55 differs from the MK-16 MOD 1 in a number of ways, but the MK-16 qualified EOD Divers found the DC-55 simple to operate and comfortable to wear. "I really liked how quickly they were able to set up the DC-55. There were no electronics to mess with. It just worked," said EOD1 Maloney. "It's smaller than the MK-16, and much easier to swim with," added EOD2 Melendez.

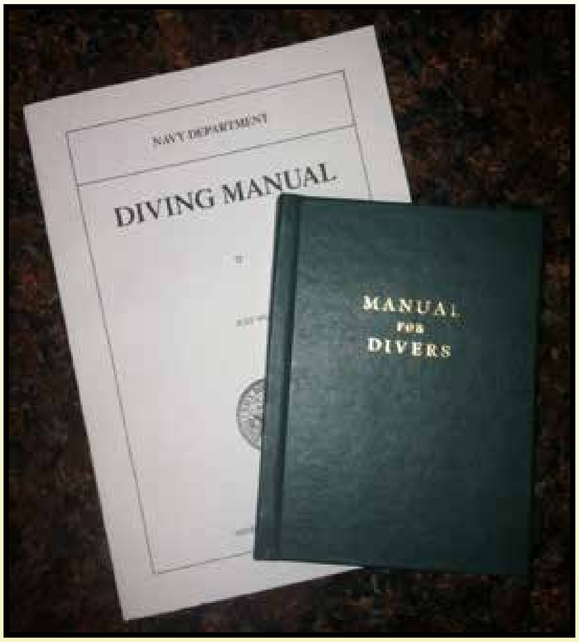
In addition the partnership aspect of the dive, the sailors of EODMU TWELVE gained valuable rebreather experience while learning about the DC-55. The pros and cons of the DC-55 were evaluated and compared to the MK-16 MOD 1, as a potential benefit to the U.S. EOD community's search for a replacement for the MK-16. An understanding of the procedures and limitations of the DC-55 benefits both units for both future partnership events and real world missions.

EODMU TWELVE trains and equips EOD Technicians to locate, identify, render safe, evaluate, and recover or dispose of all types of explosive hazards including chemical, nuclear, improvised, and underwater ordnance.

U.S. Navy EOD is the world's premier combat force for countering explosive hazards on land and in the water.

Photo top: Staff Seargent Aziz (L) and EOD2 Melendez (R)

LTJG Marosy is currently deployed as CTE 56.1.3.3, Navy EOD Det KNB.



A SHORT HISTORY OF THE U.S. NAVY DIVE MANUAL

By: MDV Cliff Morin

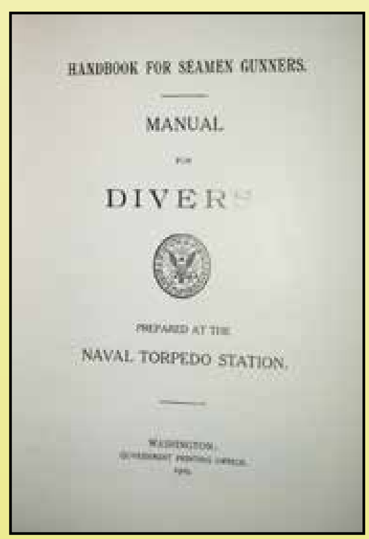
Prior to 1912 Navy Divers rarely went deeper than 60 feet of saltwater (fsw) and the only guidance available to them was the 1905 "Manual for Diver's Handbook". In 1912, Chief Gunner George D. Stillson set up a program to test Haldane's diving tables and methods of stage decompression where Navy divers reached depths of 274 fsw. At the same time, an effort to improve Navy diving equipment was undertaken that improved on earlier Morse and Schrader helmets and resulted in the development of the MK V diving dress.

In 1916, the experience gained in Stillson's program was put to use in the salvage effort of the USS F-4, which sank near Honolulu, Hawaii. The publication of the first U.S. Navy Diving Manual in 1916 and the establishment of a Navy Diving School at Newport, Rhode Island were the direct outgrowth of experience gained in the test program and the salvage of the USS F-4.

Since the publishing of the 1916 Dive Manual, hard won lessons and experience gained, often written in blood, was put into print in subsequent revisions. As those lessons were incorporated and technology advanced through research and development the dive manual grew in size. A brief summary of high points of the revisions of the U.S. Navy Dive Manual (courtesy of Mr. Tom Galloway):

1905 - Manual for Diver's - Handbook for Seamen Gunners. 66 pages.
1916 - U.S. Navy Diving Manual. 122 pages.
1959 - U.S. Navy Diving Manual. 433 pages.
1970 - U.S. Navy Diving Manual. 658 pages.
1993 - U.S. Navy Diving Manual Rev 3. Vol I and II. 749pages.
2005 - U.S. Navy Diving Manual Rev 5. Vol I – V. 966 pages.
2008 - U.S. Navy Diving Manual Rev 6. Vol I – V. 992 pages.

Since 1905 the Dive Manual has grown by 8.5 pages per year.


HANDBOOK FOR SEAMEN GUNNERS.

MANUAL

FOR

DIVERS

PREPARED AT THE

NAVAL TORPEDO STATION.

WASHINGTON:

OUR PROCESS

NAVSEA 00C3 is responsible for maintaining the U.S. Navy Dive Manual. The Master Divers assigned to 00C3, past and present, have sought to capture Fleet feedback and lessons learned in the revisions of the Dive Manual. If a diver discovers what is believed to be an error or missing information in the dive manual, or they believe a policy or procedure should be changed, they can go to the NAVSEA 00C secure website (https://secure.supsalv.org), click on the 00C3 tab and select "Dive Manual Change Database", then "Submit Change Request". A form will open. Fill out the form with as much information as possible to allow us to understand the issue and give us a recommendation of how to fix it (recommended verbiage is always appreciated). Submission of this form places the change request in our database which we review at least monthly in a panel that includes the NAVSEA Diving Warrant, 00C Master Divers, one or both 00C DMOs, SUPDIVE, and at least one representative from certification (00C4). The panel considers change requests and we give one of four statuses to the change request (which are viewable by users):

- Open – staffing in progress,
- Approved – means the change is approved. However, the approved change may not necessarily be the originally submitted change.
- Closed – change was implemented (This is an in-house status that allows us to track what was sent out as an advance change notice (ACN) or implemented into a change).
- Cancelled – The change was not approved.

We strive to contact persons submitting changes to provide a status and for clarification or justification if needed. If you have submitted a change but have not heard anything back you may contact us at the E-mail address provided on the dive manual change page (currently 00C34@supsalv.org).

On a final note about submitting change requests. All changes requests are considered. Administrative changes are easily processed. However, policy or procedure changes should be vetted by your chain of command before being submitted.

REVISION SEVEN

When a revision is undertaken, we look at the dive manual from the "30,000 foot level" to see if it makes sense and adjust accordingly. Much work has gone into this effort over the years and we owe those who have lent their time and patience to those efforts a debt of gratitude - anyone remember when diving physiology was spread out over three chapters?

Our overarching approach to Revision 7:

- Reduce rule-based decision-making by replacing "rules" with guidelines that allow the Fleet to apply analytical decision making to the problems they face. Some situations lend themselves to rule based decision making, like diving near suctions or within range of active SONAR. However, you cannot make a rule for every situation, and when you try, you get a Dive Manual that approaches 1,000 pages. By providing guidelines in place of rules, the Fleet has the latitude to accomplish its missions based on the situation, not rules.

- Consolidate information to the chapter where it properly belongs. Most of this effort involved Chapter Six (Dive Planning), Seven (SCUBA), and Eight (Surface Supplied Diving). For example, if you want to know the limits for SCUBA, you look in the SCUBA chapter, right? Not in the current version. SCUBA limits are in the Chapter Six. Made sense at some point, I'm sure. In Revision 7, rig specific information will be in its pertinent chapter and technical information will be in its operation and maintenance manual.

- Reduce the size of the manual by referring readers to appropriate technical manuals or directives where possible. Summarizing material in the dive manual that is contained elsewhere leads Divers to believe they have all the information they need. In fact, the applicable technical manual may have more current or relevant additional information. Trying to make the Dive Manual the end-all-and-be-all adds unnecessary bulk (good for weight lifters – not for manuals).

VETERANS DAY AT UDT/SEAL MUSEUM

BY: MR. IRYLL W. JONES III

The UDT/SEAL Museum hosts the Annual UDT/SEAL Muster and Music Festival every year on Veterans Day weekend. The President of the UDT/SEAL Museum (SEAL) Mr. David F. Godshall invited me to attend the festivities 5 years ago and I finally got the window of opportunity to attend last year's event held from 7-10 November 2013 in Fort Pierce, FL.

On Friday the 8th of November after arriving, touring the Museum and then meeting up with Dave on the Demo Field we sat back and watched the walk through Demonstration of the events to happen on Saturday. The demonstration was open to the public and there were quite a few parents and kids watching the event.

An informal Pre-Dedication Ceremony was held at the "Medal Of Honor Statue" and the Annual Membership Meeting Dinner-Celebrating the 70th Anniversary of WWII Scouts & Raiders, Navy Combat Demolition Units & Underwater Demolition Teams sponsored by Cooks from the Valley and USMI. The 18 piece band, F.D.O, supplied live music for the evening.

Saturday morning runners met up and checked in for the Annual "SEAL Beach Challenge 5K" which started at 0700. The Challenge 5K is held on the beach a short walking distance from the Museum and is a sand run along the beach. The SEAL Beach Challenge 5K run is open to runners of all ages, so if you like to run this may be an event for you.

The Demonstration start time was 1100 with over 20,000 people in attendance for the event. The keynote speakers were ADM William H. McRaven, Commander U.S. Special Operations Command (USSOCOM) and Congressman Patrick Murphy, with special guests H. Ross Perot, Medal of Honor Recipients Thomas R. Norris and Michael E. Thornton, and Dr. Dorothy Narvaez-Woods wife of fallen SEAL, Tyrone Woods.

All in the crowd got an up close and personal view of the SEAL Tactical Enemy Apprehension Demonstrations.

SEAL parachutist makes his approach and landing in front of the crowd.

SEAL returning to shore after completing their mission of burying at sea three fellow SEALs during the Sunday Memorial Ceremony.

The demonstration last year was different then past events due to funding cuts and Active Duty assignments, so many SEAL Reservists, SEAL Retirees, State and Local Law Enforcement Agencies, and UDT/SEAL Museum staff stepped up to make the event happen. The UDT/SEAL Museum Demonstration included a SEAL Parachuting Team, SLC K-9 Capabilities, SEAL Sniper and Tactical Enemy Apprehension demonstrations and gave recognition to all that served our great nation.

Immediately following the demonstrations was the formal dedication of the "Medal of Honor Statue", which was donated by Mr. H. Ross Perot. The guest speakers were ADM William H. McRaven (Commander USSOCOM), the two Medal of Honor Recipients depicted in the Medal Of Honor Statue Mr. Thomas R. Norris and Mr. Michael E. Thornton, Mr. Ken Reynolds (member of NCDU during the Normandy Invasion), and Mr. H Ross Perot. ADM McRaven dedicated the statue and honored Mr. Perot, as an Honorary SEAL.

The museum was open to the public for the remainder of the day with interactive events for kids to enjoy. Displays included the Maersk Alabama Lifeboat, Oil Portraits painted by (SEAL) Josh T. Hermann and located next to a tribute custom

The SEAL Trident is above three oil portraits along with the "Operation Redwing" Tribute motorcycle on display at the UDT/SEAL Museum. On the left and right are the three pictures with captions about the SEALs and used to paint the portraits by the artist.

built motorcycle for those lost during Operation REDWINGS, weapons used during different conflicts, assault vehicles, boats, and more. The SEAL Chief's after Muster Bash started with three bands - "Uproot Hootenanny", "Killbillies", and "The American Rogues", which played until late evening with plenty of good food, cold drinks, and great company.

The Sunday morning services were held on the beach near the UDT/SEAL Museum giving recognition to all SEALs who have fallen since the last UDT/SEAL Museum muster. Flags of our Country and all States were displayed by local Sea Cadets, bag pipes played as people gathered on the beach and a beautiful ceremony where the remains of some were swam out to rest in the sea as the bag pipes played. Honors were rendered and Taps was played.

After the Beach Service adjourned all of us gathered at the Navy SEAL Memorial Wall to pay tribute to all SEALs that have fallen in combat. During this event a special thanks was given to Jack Ouellette the father of Brian J. Ouellette who is listed on the memorial wall. Jack volunteers his time to maintain the wall for the museum.

If you want to do something "HooYah" with your family on vacation, or Veterans Day Weekend take a trip down and visit to the UDT/SEAL Museum located in Fort Pierce, FL. It's worth the trip.

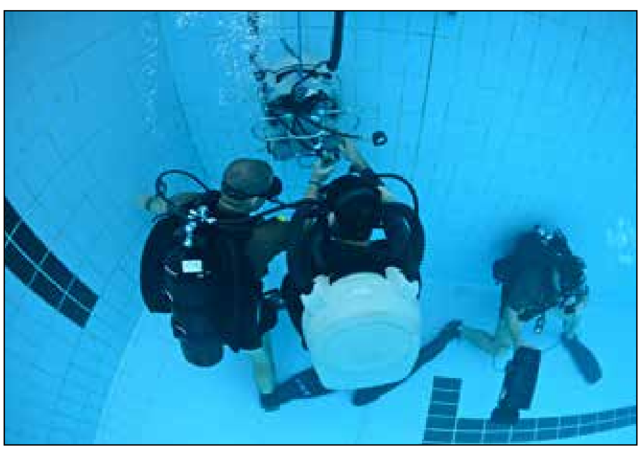
Mr. Iryll W. Jones III is a retired Navy Saturation Diver who works for Dell Services Federal Government in support PMS391 Submarine Rescue Program.

Pictures by UDT/SEAL Museum photographer Russell Gibson and Iryll Jones

www.navysealmuseum.org

MK 16 Training

Commander Task Group (CTG) 56.1



NAVAL SUPPORT ACTIVITY BAHRAIN (Jan. 8, 2013) - Explosive Ordnance Disposal Technician 1st Class Matthew Kuttenkuler, left, and Explosive Ordnance Disposal Technician 3rd Class Jamie Greene, center, both assigned to Commander, Task Group (CTG) 56.1, simulate equipment failure by breathing from a spare regulator during a re-qualification training on the MK-16 MOD 1 underwater breathing apparatus. The MK 16 MOD 1 is a re-breathable underwater system that minimizes surface bubbles during operations.

NAVAL SUPPORT ACTIVITY BAHRAIN (Jan. 8, 2013) - Sailors assigned to Commander, Task Group (CTG) 56.1 re-qualify on the MK-16 MOD 1 underwater breathing apparatus during training evolutions. The MK 16 MOD 1 is a re-breathable underwater system that minimizes surface bubbles during operations.

CTG 56.1 conducts mine countermeasures, explosive ordnance disposal, salvage diving and force protection operations throughout the 5th Fleet area of responsibility.(U.S. Navy photos by Mass Communication Specialist 2nd Class Taylor M. Smith/Released)

Current NAVSEA 00C3 R&D Projects

By: James Bullock, Program Engineer for PCCI, Inc. supporting NAVSEA 00C3

Heating System for Free Swimming Divers

Manufacturer: RINI Technologies, Inc.

Source: Data and photos from Rini Technologies, Inc.; Dr. Daniel P. Rini, President and CEO Jim Hughes

Description of Project:
It is well documented that Navy Divers who work in extreme conditions are subjected to serious health risks that may reduce physical and cognitive performance. Through a current Small Business Innovation Research (SBIR) program with NAVSEA 00C3, RINI Technologies has designed an active protection Free-Swimming Dive Heating System (FDHS) to help mitigate cold stresses for divers. The major components of the heating system are shown in Figure 1.

Figure 1. Heating system components for free-swimming divers.

Attached to the SCUBA cylinder are the following heating diving components: Diver Heating Unit (Right), Underwater Battery (Left), and auxiliary components.

Tube garment worn under the diver's dry suit.

Theory of Operation:
The FDHS has two separate closed circuit paths: a heated water loop that keeps the diver warm and a refrigerant loop that heats and reheats the water circulating to the diver. The first flow path uses potable water to fill the tubes in the tube suit. The water is then pumped through the condenser component (this is where the heat energy is transferred from the refrigerant to the water) of the heat pump housed in the Diver Heating Unit (DHU) back to the tube garment for warmth.

The second flow path uses refrigerant as its medium. The refrigerant flows through the heat pumps four major elements: compressor, condenser, expansion valve, and evaporator. The cycle starts when refrigerant enters the compressor in a low pressure-and-temperature gaseous state. The refrigerant is compressed by the compressor to a high pressure-and-temperature gaseous state. The high pressure-and-temperature gas then enters the condenser. The condenser or heat exchanger precipitates the high pressure-and-temperature gas to a high pressure liquid by transferring heat to a lower temperature medium, the water being pumped to the tube suit. The high pressure liquid then enters the expansion valve where it allows a portion of the refrigerant to enter the evaporator. In order for the higher temperature fluid to cool, the flow must be limited into the evaporator to keep the pressure low and allow expansion back into the gas phase. Once this has been accomplished, the cycle then repeats itself.

Benefits of Project:

- Increases dive duration and diver comfort.
- Keeps the diver extremely warm even when the water is equal to or below 35°F.
- Physically compact and is sized for the individual.
- Electrically efficient - the FDHS delivers more than twice as much heat to the diver than the amount of electrical power consumed.
- Reduces thermal stress.
- Easily integrated into existing dive systems and can be used with a wetsuit, semi-dry, or dry-suit.
- Easy to maintain.
- Operates from portable batteries, boat, or surface power.
- No consumables, no gas venting, and no system recovery during or after operation.
- Capable of operation in contaminated and debris filled water.
- Used in temperatures down to 34°F in fresh water and 30°F in seawater at depths up to 300 fsw.

Current Status of Project:

Since the Diver Heating Unit (DHU) was designed under a previous 2010-2012 contract, the purpose of the new contract is to complete the development and testing of the full FDHS and achieve AMU certification.

The efforts for the new contract include the following:

- Underwater battery and container development
- Power and pendant cable assembly modifications
- Tube suit modifications
- Battery box cable configuration and quick change adapter

Underwater Battery and Container Development

Rini's DHU has a power draw of 135W and is rated to deliver 300W of heat in a 35°F dive water temperature. With a desired excursion run time of 3 hours, a suitable battery must be able to deliver the required power and have a total energy capacity greater than 400 W-hr. Rini Technology has proposed the use of the following battery and container.

- Battery. Two BB-XX90 series military batteries that are already part of the DoD supply system. This will increase the product delivery time by eliminating the number of dive battery certification requirements. Each of the batteries is diode protected to prevent current from flowing back into the battery through the wet-mateable connector or from the other battery. Each diode is sized to support full power draw to allow the DHU to be operated on one or two batteries. See Table 1 for the specifications of the batteries considered for the new underwater battery.

- Container. A COTS battery container that utilizes a rectangular cross section extruded aluminum box tube with ¼" thick walls, welded ends, and a bracket for mounting to a standard 80 tank. The case is capable of withstanding pressures at a depth of 450 FSW.

Table 1. Three battery configurations for dual underwater battery.

Specifications			
Batteries	BB-390/U	BB-2590/U	BB-3590/U
Chemistry	Nickel Metal Hydride	Lithium Ion	Lithium Polymer
Voltage	12V	14.4V	14.4V
Capacity	220 W-hr	426 W-hr	576 W-hr
Weight	13 lbs	11 lbs	13 lbs

Power and Pendant Cable Assembly Modifications

RINI's DHU has two electrical cables for power and control. The two connectors are distinguished by size, gender, and number of connectors. The power connector is the larger of the two; it has four powered pins and an additional clocking dowel. The second connector is for the control pendant, which is smaller and has six pins.

- Issues. Once the battery and DHU have been mounted to a diver it is difficult to see the clocking of each connector to attach the cable. This has been a problem for support staff and divers. Unscrewing the pull-out prevention sleeves has also proved difficult due to the limited clearance once the battery and DHU are mounted to a diver. The problem is more pronounced with thick wetsuit or dry suit gloves.

- Improvements. The solution is to use inline connectors with a short lead to the DHU and battery. The operator will be able to look at both connectors simultaneously to clock them correctly. It will also be easier to grasp the connector with wetsuit or drysuit gloves when it is inline. Also a new cable-penetrator assembly has an additional failsafe that if the cable is accidently cut, water will leak up the cable jacket to the penetrator but will not enter the DHU or battery. Thus no damage will be done to the DHU or battery internals and only the cable assembly will need to be replaced.

Tube suit Modifications
The tube suits have full torso, arm, and leg coverage as well as feet. The layout of the tubes has been modified compared to previous tube suits, which greatly improve mobility and flexibility without sacrificing heat transfer.

- Issues
  - Reverse zipper too high.
  - Large distribution tube across waist connects the right and left side of the manifold, which prevents the zipper from being longer.
  - No opening for relief tube.

- Improvement
  - An opening will be added to the crotch of the garment to allow a tube to conveniently exit the tube suit.
  - Add padding over exposed tubing to prevent discomfort with a tight or heavy weight belt.
  - Replace hose barb Tee's with molded and welded joints.
  - Use larger diameter tubing with spring insert to prevent kinking of main distribution lines.
  - Replace smaller return flow connector with a larger less restrictive coupling.
  - Mismatch the CPC connector sizes to ensure correct hookup.

Battery Box Cable Configuration and Quick Change Adapter Modification

Battery Box Cable Configuration
- Issues. During the diver testing it was noted that the straight bulkhead connectors on the current system were getting angular loading during diver dress-out and donning of the equipment. Since the divers were using the system with the cables pointing down, the fittings were frequently pressed into the deck or staging table causing the angular loads. The straight bulkhead fitting would also be susceptible to these angular loads, which would degrade the connector and seal.

- Improvements. A right angle connector would reduce the load based on its low profile. The connector is shielded by the solid aluminum handle on the lid. This will provide a rugged and more reliable solution.

Bulkhead Quick-change Adaptor

- Issues. The current version of the DHU has the dry suit penetrator attached directly to the DHU. Changing the length of the umbilical to the dry suit penetrator is labor intensive and not a task that can be performed easily while in the field.

- Improvements. The bulkhead quick change adaptor will allow the umbilical and dry suit penetrator to be removed from the DHU in the field and be replaced with one of the different lengths. It will also allow easy change between the dry suit penetrator and wetsuit breakaway attachment. The bulkhead quick change adaptor reduces the number of connections when compared to an inline adapter and will also protect the electrical fittings during dress out.

High Pressure Composite 30 Year Flasks

Manufacturer: Structural Composite Industries (SCI)

Source: Data and photos from PCCI, Inc.; James Bullock

Description of Project:
SCI is one of the manufactures NAVSEA 00C3 is currently using to fabricate DOT approved fully wrapped aluminum liner cylinders for their dive systems. Up to this point, SCI has only been able to manufacture cylinders with a service life of 15 years. This was based on the U.S. Department of Transportation's Pipeline and Hazardous Materials Safety Administration's (PHMSA) regulations. PHMSA is now administering a special permit that grants the holder the ability to manufacture, market, and sell 30 year fully wrapped carbon-fiber cylinders.

As a result, the Diving Program Division has contracted SCI to upgrade their existing Chamber Air and Oxygen System (CAOS) and Fly Away Dive System III (FADS III) flasks shown in Figure 2 from the existing 15 year up to the new 30 year service life. The design, testing and certification for this upgrade are based on both the special permit (DOT SP 13583) and the International Standard Organization (ISO 11119-2) requirements. In addition to this, the CAOS flasks will also be modified to operate at a working pressure of 5,000 psi.

Figure 2. Diving life support systems

CAOS Flasks

FADS III Flasks

As a comparison, Table 2 below shows the changes that were made to the FADS III cylinders for it to comply with the documents mentioned above. The aluminum liner dimensions stayed the same; however, the carbon fiber layers had to be increased to insure there was enough wrap to absorb the shock from the drop test, and to provide enough tension on the compressed aluminum to have a fatigue life greater than the number of cycles required by the special permit.

In addition to the FADS III flasks, the CAOS cylinders were redesigned to include the new extended service life and an increase in service pressure. In order for the new cylinders to comply with the documents mentioned above, the cylinders had to undergo similar modifications. Comparisons of the changes are listed below in Table 3 below. The new CAOS cylinder's aluminum liner stayed the same as its 3,000 psi predecessor. The major change was in the increased layers of carbon fiber. This was for similar reasons as the FADS III flasks mentioned above. In addition to increased carbon fiber layers, an extra material called Poron was also included in the wrapping process. This is due to the cylinder not passing its drop cycle test. After the drop test, the cylinder must complete 12,000 cycles, but after several attempts, it would only successfully pass 6,000 cycles before the compromised area on the dome of the cylinder would rupture, which resulted in loss of pressure. After several attempts to change the helical-winding angle, SCI decided to wind in the new material. Poron helps absorbs the shock forces from the drop, while the changed angle forces the failure to the center of the cylinder. The result of this modification enabled the test cylinder to complete 14,043 cycles before the failure occurred at the cylinder's sidewall.

Table 2. Comparison of the existing and new FADS III specifications.

	Existing Cylinder	**New Cylinder**
Service Pressure	5,000 psi	5,000 psi
Test Pressure	7,500 psi	7,500 psi
Minimum Burst Pressure	17,000 psi	17,000 psi
Operating Cycles	10,000 psi	12,000 psi
Minimum Volume	5,450 cu. in.	5,450 cu. in.
Maximum Outside Diameter	13.9 in	14.25 in

Maxium Overall Length	56.9 in	56.9 in
Nominal Weight	180.0 lbs	188.0 lbs
Threaded Opening	0.875-14 UNF-2B	0.875-14 UNF-2B
Maximum Service Life	15 years	30 years
Working Fluids	Compressed air, oxygen, helium/oxygen mixture, or nitrogen	Compressed air, oxygen, helium/oxygen mixture, or nitrogen
Yield Strength	41,500 psi	46,650 psi
Liner Material	AA6061-T6	AA6061-T6
Reinforcement Material	Carbon/Glass Fibers	Carbon/Glass Fibers
Resin Material	Epoxy	Epoxy
Exterior Paint	Gray NO. 16440 PER FED-STD-595	Gray NO. 16440 PER FED-STD-595

Table 3. Comparison of the existing and new CAOS cylinder design.

	Existing Cylinder	**New Cylinder**
Service Pressure	3,000 psi	5,000 psi
Test Pressure	4,500 psi	7,500 psi
Minimum Burst Pressure	10,200 psi	17,000 psi
Operating Cycles	10,000 psi	12,000 psi
Minimum Volume	1,615 cu. in.	1,615 cu. in.
Maximum Outside Diameter	13.9 in	10.65 in
Maxium Overall Length	56.9 in	30.50 in
Nominal Weight	29.5 lbs	43.0 lbs
Threaded Opening	1.3125-12UN-2B	0.875-14 UNF-2B
Maximum Service Life	15 years	30 years
Working Fluids	Compressed air, oxygen	Compressed air, oxygen
Yield Strength	35,000 psi	41,500 psi
Liner Material	AA6061-T6	AA6061-T6
Reinforcement Material	Carbon/Glass Fibers	Carbon/Glass Fibers/Poron
Resin Material	Epoxy	Epoxy
Exterior Paint	Gray NO. 16440 PER FED-STD-595	Gray NO. 16440 PER FED-STD-595

Benefits of Project:

- Both the FADS III and CAOS flasks will have an increased service life from 15 to 30 years.
- The CAOS flasks will have an increased working pressure from 3,000 psi to 5,000 psi.
- Both cylinders are DOT approved.
- Cost effective.

Current Status of Project:

FADS III Flasks

- The manufacturing process of the cylinders is complete.
- Drop Cycle Test per DOT-SP 13583 and ISO 11119: Passed
- DOT Qualification Program (wind and cured 14 cylinders):
  - Accelerated Stress Rupture Test (2 cylinders per 2,000 hours exposure to high temperatures): Passed
  - Ambient Cycle Test (2 cylinders): Passed
  - Drop Cycle Test (3 cylinders): Passed
  - Environmental Test (1 cylinder): Passed
  - Bon Fire Test (1 cylinder): Passed
  - Gun Fire Test (1 cylinder): Passed
  - Burst Test (3 cylinders): Passed
  - Flaw Test (1 cylinder): Passed
  - Liner Burst Test: Passed

CAOS Flask

- The manufacturing process of the cylinders is complete.
- Drop Cycle Test per DOT-SP 13583 and ISO 11119: Passed
- DOT Qualification Program (wind and cured 14 cylinders):
  - Accelerated Stress Rupture Test (2 cylinders per 2,000 hours exposure to high temperatures): Passed
  - Ambient Cycle Test (2 cylinders): TBD
  - Drop Cycle Test (3 cylinders): TBD
  - Environmental Test (1 cylinder): TBD
  - Bon Fire Test (1 cylinder): TBD
  - Gun Fire Test (1 cylinder): TBD
  - Burst Test (3 cylinders): TBD
  - Flaw Test (1 cylinder): TBD
  - Liner Burst Test: TBD
- Develop Qualification Test Report: TBD

Improved Portable Air Monitor System (PAMS)

Manufacturer: TBD

Source: Data and photos from NAVSEA 00C3 and PCCI, Inc.; Robyn McGinn, Justin Pollack, James Bullock

Description of Project:

Currently, the mandatory semi-annual air purity testing of diver's air is coordinated via the U.S. Navy Diver's Air Sampling Program, described in paragraph 4-4 of the U.S. Navy Diving Manual, which provides gas sampling kits to the field where gas samples are taken and then returned to a laboratory for analysis. This approach has proven to be expensive and cumbersome, especially considering the impact to expeditionary missions, where commercial breathing air sources may be the only viable resource for diver's breathing air. NAVSEA 00C3 has developed and approved the DIVEAIR 2 diving air analyzer shown in Figure 3 that is currently on the Diving Equipment Authorized for Military Use (AMU) List. This unit cannot be used as a direct substitute for the Diver's Air Sampling Program because of its inability to measure all of the constituents in the diver's compressed air breathing requirements listed in Tables 4-1 and 4-2 of the U.S. Navy Diving Manual; therefore, an OPNAV Waiver is required for its use in an expeditionary environment.

Figure 3. DIVEAIR 2 Diving Air Analyzer.

As a result, NAVSEA 00C3 is currently pursuing a portable air monitoring system that will gather credible breathing air data in the field, will not require an OPNAV waiver for use, and can be rapidly transitioned to the end user. An Improved Portable Air Monitor System Requirements Document (IPAMSRD) was drafted to define the minimum requirements for the configuration, functions, capabilities, operational environments, and other constraints for a portable air monitoring system to sample and analyze breathing air for U.S. military diving operations. The requirements outlined in this document have been derived from end users and NAVSEA 00C3. This document is intended to provide guidance for the development of a portable air monitoring system that will enhance the various domestic and expeditionary missions that require mobilization from the U.S. military diving community.

A study was then conducted to find an alternative to the existing PAMS that complies with the IPAMSRD. The manufacturers that were solicited for the task all received a copy of the document, which gave each party the opportunity to determine how their COTS product complied and what modifications were needed to make it comply. The vendors that were asked to participate in this study included Geotech, Honeywell, S.A.T. Systems, Analox, CBISS, Drager, Lawrence Factor, and RAE Systems. Due to various reasons, Geotech, Honeywell, Lawrence Factor, and RAE Systems were unable to comply and were excluded from the study. The remaining manufacturers S.A.T. System, Analox, CBISS, and Drager were then tasked to provide specifications, drawings, and a cost estimate for their modified COTS product. Currently, NAVSEA 00C3 is reviewing the information provided by the vendors to determine which prototype air sampling monitor will best fit their needs.

Benefits of Project:

- Will not require an OPNAV waiver for use.
- Meets U.S. Military Diver's Breathing Air Standards.
- Gas sensors will maintain calibration for a minimum of 30 days while operating in the field.
- The whole unit meets international flight carry-on size regulations.
- The total weight (monitor, accessories, and storage case) is less than 30 pounds.
- The PAMS can be operated from a rechargeable battery power supply that is capable of operating without charging for 8 hours, and it is equipped with a universal AC main power supply that will work with anything between 90 to 250VAC.
- Easy to maintain.

Current Status of Project:

- The Improved Portable Air Monitor System Requirements Document (IPAMSRD) was developed, reviewed, and approved by 00C3.
- Manufactures who could comply with IPAMSRD submitted cost estimates, schedules, milestones for the Alternative PAMS Study.
- Currently reviewing PAMS Study.

Multi-Occupant Flexible Hyperbaric Chamber

Contractors/Manufacturers: PCCI, Inc., SOS Hyperlite, A&P Technologies

Source: Data and photos from SOS Hyperlite and PCCI,Inc.; Paul Selby, James Bullock

Description of Project:

The SOS Hyperlite Hyperbaric Stretcher (EEHS) is the only non-metallic portable chamber that is ASME PVHO-1 compliant and has passed the U.S. Navy diving and hyperbaric system certification. The EEHS has proved itself to be an ideal solution in applications where a compact, portable and lightweight hyperbaric chamber is required. The EEHS technology utilizes the latest liquid crystal polymer fibers, which decrease the chamber's weight, packed volume, and footprint. It is currently in full operational service with the US Army, Navy, Air Force, Special Operations, Coast Guard, NOAA and the FBI. The only disadvantage to this type of system is that it does not allow hands-on under pressure medical care. A double lock, multi-occupant chamber is needed to overcome this problem.

Through a NOAA SBIR Phase I project, PCCI, SOS Hyperlite, and A&P Technologies has demonstrated the technical feasibility of extending the EEHS technology to develop a 42-inch diameter, three occupants, double lock, flexible hyperbaric chamber that is capable of pressurizing to a minimum depth of 60 feet of sea water (fsw). Due to the project's success, a NOAA SBIR Phase II project was proposed to extend the design to withstand an internal pressure of 165 fsw. This increased pressure rating will benefit the Navy Diving Program by allowing treatment of divers to U.S. Navy Table 6A applications. As illustrated in Figure 4, NAVSEA 00C3 is currently using the same contractors/manufactures to design a 48-inch diameter Multi-Occupant Flexible Recompression Chamber that can be pressurized to 165 fsw.

The Multi-Occupant Flexible Recompression Chamber will consist of the following components:

- Main flexible body
  - Bladder
  - Braid restraining layer
  - Cover
- Pre-inflation support system
- Entry door frames and braid clamp system
- Packing case/base unit sub-system
- Air and oxygen supplies
- Ancillary equipment
  - Chamber monitoring
  - BIBS system
  - Control box
  - Patient monitoring
  - Communication systems
  - Patient entry mechanism
  - Fire prevention
  - Carbon dioxide scrubber
  - First aid kit
  - Water reservoirs and urine bags

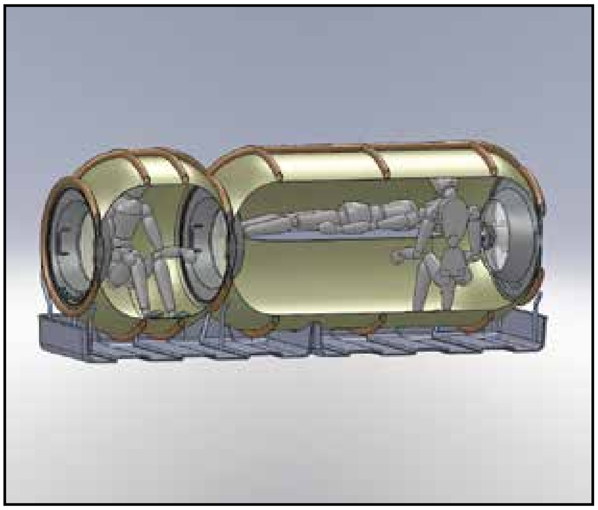


Figure 4. Flexible Hyperbaric Multi-Chamber Prototype

Benefits of Project:

- The outer lock will allow the transfer of medics in and out at any time, to perform full hands-on medical care and treatment for even the most critically ill patients, while delivering hyperbaric oxygen, the treatment of choice for pressure related injuries and introducing its many other uses to the combat zone for other traumatic battlefield injuries.
- When not in use, the chamber will take up less space allowing it to be stored on vessels where dedicated space is not available for a metallic chamber.
- The flex chamber is easier to ship and transport due to the lighter weight and smaller footprint when placed in its case.
- The flex chamber is less expensive, lighter, and more portable alternative to the current Transportable Recompression Chamber System (TRCS).

Current Status of Project:

- The System Level Design Review is complete.
- The ¼ inch scale braid is complete.
- A ½ inch scale is expected to be completed in May of 2014.
- Code Case JJ has been submitted to the PVHO Committee for Voting. The first vote is expected to be cast during the next PVHO meeting in June of 2014.
- The prototype's packing case/base has been designed and manufactured. It will be used to house the prototype frames when delivered. It will also serve as a prototype for the manufacture of the production packing case/base. The frame support interfaces are modular and can be amended if modifications are necessary to the frames. The final design modifications are still being considered.
- Design of metallic frame is still being conducted.

Diver Mask CO2 Sensor

Manufacturer: Polestar Technologies, Inc.

Source: Data and photos from Polestar Technologies, Inc.; Dr. Karen Carpenter, CEO, R. Shashidhar, Ph.D.

Description of Project:

Mixed gas closed-circuit rebreathers like the MK-16 and MK-25 are extensively used by Navy Divers. The rebreathers have a gas-tight loop from which the diver inhales (inspiration side) and then exhales into a breathing bag (expiration side). The exhaled gases are forced through a chemical scrubber which contains a chemical such as soda lime that removes the carbon dioxide from the gas mixture and leaves the oxygen and other gases available for rebreathing. If the CO_2 level exceeds 2%, due to scrubber failure or any other causes, the diver can lose consciousness.

Currently, rebreathers have the capability to monitor the partial pressure of oxygen in the breathing loop and can send that information to a microprocessor that controls the oxygen delivery system, but not the CO_2 levels. This impact's the duration of the dive mission due to how quickly the scrubber is used up. NEDU's research team has measured the scrubber's life time by monitoring the exothermic heat generated by the reaction of CO_2 with the scrubber material. A CO_2 sensor which can be inserted between the scrubber and the inhalation mask in the inspiration side of a closed-circuit rebreather would be extremely beneficial because it will enable the diver to monitor, in real time, the amount of CO_2 in the breathing loop. This in turn, will enable the diver to manage the time of his or her mission with a high degree of accuracy.

There have been several attempts to measure the CO_2 levels with electrochemical and optical/Infrared (IR)-based CO_2 sensors, but neither of these sensors has been found suitable for Navy Diver applications for the following reasons.

Issues with Infrared (IR) Spectroscopy

- The sensor's optics is very different than those used in "visible" spectroscopy. You can't use normal glass. Glass is opaque to IR radiation when below a certain energy. Chemists use cells made of potassium bromide or in some cases cesium iodide. Unfortunately, these are soluble salts and don't last too long in contact with humid air or water.
- The IR energy source is difficult to make in a low-power configuration. An IR emitter is often just a heated piece of metal or some other material, and such a resistive heating element would quickly run down a battery.
- Detectors are another challenge. IR radiation is not detected with high sensitivity by inexpensive silicon photodiodes. Instead, you need germanium, Indium Gallium Arsenide (InGaAs) detectors, or thermopiles. These are expensive, slow, require cooling, and consume a lot of energy.

Issues with Electrochemical Sensors

- Electrochemical sensors are highly sensitive and have to be compensated for temperature drift and pressure effects.
- There is a measurement lag as it takes a bit of time for the CO_2 to diffuse across the membrane.

Instead of using the sensor technologies mentioned above, Polestar has developed a CO_2 sensor system that uses a technique called time-resolved fluorescence resonance energy transfer (TR-FRET) to detect the various levels of CO_2 circulating in the inspiration side of the breathing loop.

The sensor system consists of three main components: sensor film, sensor electronics, and an in-line flow-cell as shown in Figure 5.

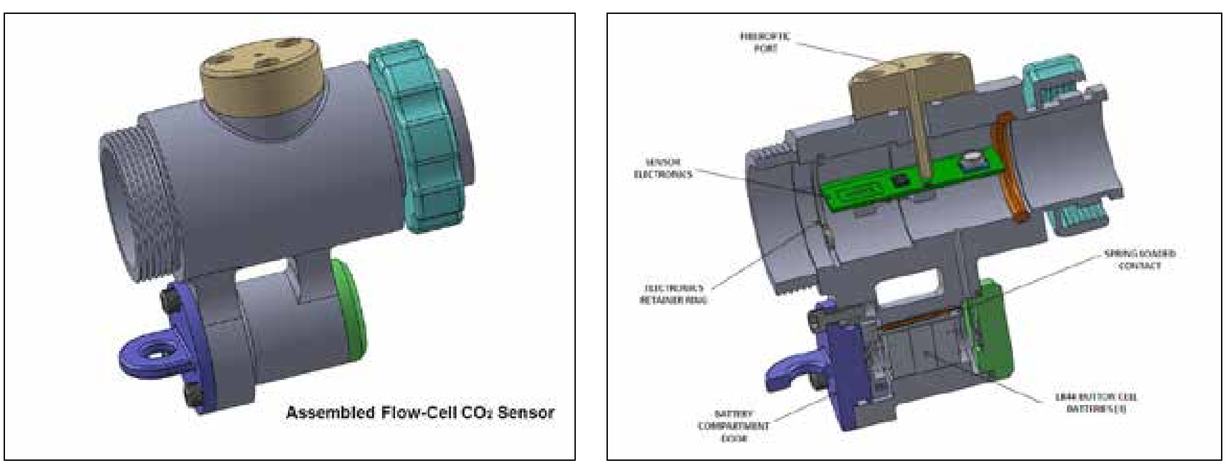


Figure 5. CO_2 sensor profile and cross section.

Sensor Film
This is the part of the sensor that uses the TR-FRET. The sensor film is based on a colorimetric CO_2 indicator salt formed from a quaternary phosphonium hydroxide and a weak acidic phenolic-type dye, which has a fast fluorescence decay that is sensitive to pH. The indicator salt is immobilized in a highly porous polymeric membrane which allows CO_2 gas to rapidly diffuse into the membrane where it interacts with water associated with the indicator salt. It then yields a molecule of carbonic acid that displaces the ammonium cation leading to protonation of the pH sensitive portion of the indicator; therefore, the spectral properties on the indicator change. The color on the indicator correlates with the concentration of CO_2 present.

Sensor Electronics
The electronics is designed to generate a flashing red light signal using a small light emitting diode (LED). The CO_2 sensing film is positioned over the red light emitting LED so that the light is only visible when the CO_2 level has shifted the indicator of the sensing film to its re-transmitting yellow form. An electronic board has been developed that includes the red LED, a 555-timer circuit, offset resistor, and temperature sensitive thermistor bead. A NTC (Negative Temperature Coefficient) thermistor bead and offset resistor are used to control the drive current of the LED, thus adjusting its output to match the temperature sensitivity of the CO_2 sensing film.

In-line flow-cell
The system electronics, sensing film, and fiber optic cable are all housed in a leak-tight flow cell designed to mate with the breathing bag and inhalation hose of the MK-16 rebreather, as shown in Figure 5.

In addition to these components, the system also uses a simple sensor that is mounted inside of the diver's mask. This allows the diver to monitor the CO_2 levels at the diver's convenience. The sensor is designed to give a visual alarm (red flashing LED) in front of the diver's eye when the CO_2 levels in the inhalation line of the rebreather exceed 1.4%.

As part of a previous program, Polestar developed a CO_2 sensor based on the colorimetric indicator approach mentioned above. Early versions of the sensor provided an output to the diver as a simple light indicator. A blinking red light appears when the CO_2 level approaches dangerously high levels. While the feasibility of the sensor had been demonstrated by integrating the sensor with a MK-16 rebreather, several key issues remain to be addressed before the sensor can be effectively transitioned to the Fleet for use by the Navy Divers in operation conditions.

The technical issues that need to be addressed include the following:

- The sensor uses only one light (a red light) that comes on when the CO_2 levels approach a dangerous level of 1.5%. This poses a problem since the field of view is black not only when the CO_2 levels are in the safe range but also when the sensor is not functioning.
- The current sensor can compensate for temperature but not pressure, so pressure compensation will be added to the sensor capabilities.
- The lithium based coin batter attached to the inhalation side of the rebreather will be attached externally to the rebreather.
- The modified sensor unit needs to be tested under all special conditions.

Based on these technical issues, a second generation prototype has evolved. The work to address these issues will be broken up into a two year program.

- Design and fabricate a new sensor module that shows a small green light to indicate that the system is functioning. A second larger light will be black for low CO_2 levels and turns red as the CO_2 level approaches a dangerous level.
- Design and fabricate a new electronic circuit board with both pressure and temperature sensors.
- Design and fabricate an external battery capability to power the sensor electronics.

The emphasis for the second year will be to conduct two or three test-modify-test cycles before the prototype design is accepted. Some of these tests will be conducted by NEDU at their facility under a separate tasking by NAVSEA 00C3. With the changes recommended by these tests, the program will be ready to move into a pre-production state. The first version of the pre-production will be designed, fabricated and tested at the independent facility.

Benefits of Project:

- Electrochemical or optical/Infrared (IR)-based CO_2 sensors are not required.
- Energy efficient, the sensor requires very little power for operation.
- The time-resolved fluorescence resonance energy transfer (TR-FRET) technique used provides a stable signal.
- Light weight and durable.
- The sensor works very well in 100% humidified conditions.

Current Status of Project:

Year 1:

- Indicator embedded in a porous polymer film that is suitable for viewing both the green and red lights.
- Sensor films that can function at 100% humidity.
- Test results of the sensor performance at different pressures and temperatures.
- Electronic board capable of both pressure and temperature compensation.

Year 2:

- Fully integrated CO_2 sensor unit embedded in a flow cell.
- Test results of the performance of the sensor unit integrated to a MK-16 rebreather.
- Sensor modules after incorporating the test results and recommendations based on the tests at NEDU.

Progress made during reporting periods of February and March:

- Functional tests were done to the breadboard electronics circuitry to test how the CPU interfaces with the color sensors. The tests confirmed the proper firing of the Green and Red LEDs used to notify sensor status and CO_2 level.
- Conducted CO_2 sensing film characterization tests, these tests were designed to examine the films sensitivity over the temperature range 41 to 95°F while generating data that will be used in the construction of calibration expressions for converting optical readings to the various CO_2 levels.
- A test plan for hydrostatic testing of the CO_2 flow-cell hardware has been drafted and is undergoing refinement. The plan will test for leak and failure testing of the critical design elements particularly the battery compartment and power feed-thru. Prototype flow-cells will be fabricated from ABS using 3D printing. The prototype designs utilizing battery compartments for both AAA and coin cell (LR44) batteries will be fabricated and tested. Design modification will be made and a second round of testing conducted if necessary based on the initial test results.
- Functional tests of the breadboard electronics circuitry and firmware control were completed verifying operational performance of the electronics and electro-optics designs per the system specifications.
- A set of prototype flow-cell housing was fabricated using the 3D printing method. The prototypes were fabricated from black ABS using the mechanical designs developed by Polestar. The prototypes were also treated with epoxy infiltration and solvent dipping. Epoxy infiltration offers an airtight and watertight seal up to 65 psi. Parts sealed by this method also withstand high temperatures and are chemically resistant. Both treatments will be evaluated. The final choice of sealing method will be based on these tests.

Manufacturer: Acentech

Source: Data and photos from Acentech; Steven A. Africk, Ph.D.

Description of Project:

Helmeted Navy Divers are exposed to very high and hazardous levels of noise generated within the helmet during respiration and by the exposure to external noise sources such as tools and sonars. This noise can interfere with communications, add stress to missions, and significantly limit their duration as the levels typically exceed the allowable daily noise level standards established by OSHA and the Navy.

According to these documents, a safe noise level for an eight hour period is 84 to 90 dBA. Exposure to noise above this level must be restricted to shorter periods. There are several rules for this in use. For example, according to the U.S. Navy standards, for each 4 dBA above 84 dBA, the permissible exposure time must be reduced by half, but noise in helmets in the majority of operational conditions exceeds this level. Time-average noise levels increase from about 89 dBA near the surface to on the order of 100 dBA or more at depths greater than 100 fsw, which means, even with these standards implemented, there's no way of completely prevent noise induced hearing loss, so the goal of Acentech's program is to find ways to reduce this noise level for helmeted Navy Divers.

Figure 6. Experimental Configuration for Dive Lab acoustic noise measurement.

Early Phases of Project

In the beginning, Acentech assembled a model of helmet respiration noise based on a series of experiments with KM-37 helmets and KM 350 Superflow regulators carried out at Kirby Morgan's Dive Lab in Panama City, Florida. Dive Lab operates an ANSTI wet breathing simulator that includes acoustic instrumentation to measure respiration noise within helmets as a function of depth pressure. Acentech's noise measurements included data from Dive Lab's system and from additional instrumentation.

Analyses were carried out to characterize the noise in terms of its level and frequency spectrum at several positions within a helmet to better understand its generation and propagation to the diver's ear. Figure 6 shows a Dive Lab measurement arrangement with a microphone located in the helmet volume outside the oral nasal mask. A second microphone was installed within the mask itself and, for example, the transmission of noise from within the mask to the helmet volume and to the diver's simulated ear was measured. This photograph also shows a pink foam outer treatment designed to reduce the transmission of external sound into the helmet generated with tool use, a secondary goal of the program.

Tests with several different configurations provided a quantitative picture of the respiration noise reaching a diver's ears. On inhalation, turbulence in the airflow generates noise within the regulator that propagates through the breathing tube into the oral nasal cavity and then through the oral nasal mask into the helmet volume and then onto the ear.

Exhalation (bubble) noise appears to be generated by the forces of bubble formation on the air within the whiskers. It then follows the same propagation path through the regulator body, breathing tube and helmet cavity to the ear. At shallow depths, exhalation is the main contributor to overall noise as measured on the dBA scale. However, with increasing depth pressure the density of the air increases and the inhalation noise becomes louder and by about 70 fsw it dominates the respiration noise. For this reason, most of the program effort to date has focused on the noise of inhalation. To continue this research, a flow noise laboratory was established at Acentech, in which a compressor is used to blow air through regulators at pressures and flow rates typical of dive operations. The resulting noise is measured in a standard reverberant room configuration.

Several noise reduction strategies were investigated. First, means to weaken the acoustic paths from the regulator including a heavier oral nasal mask, acoustic screens, and acoustic expansion chambers were evaluated. The latter two have proven the most promising. At present, methods to reduce the noise generated in the regulator by smoothing the airflow paths within it are the focus of the research.

Acoustic Screens

Figure 7 illustrates the addition of a felt-metal screen at the outlet of what Kirby Morgan refers to as the "Venturi" which is the structure in which the airflow is turned from the direction across the regulator into the direction of the oral nasal mask through the breathing tube. On the left is the standard regulator, looking into the "Venturi", and on the right is this opening with an attached screen through which inhalation air must flow. In laboratory tests, this configuration yielded 10 dBA or greater reduction in inhalation noise. Screens of this type could be readily and very inexpensively incorporated into existing regulators, as necessary. They could be removed and cleaned regularly or during regular maintenance.

Figure 7. Airflow exit from venture without and with felt metal screen

Expansion Chamber

An expansion chamber is similar to a muffler. It is simply a volume of air that provides additional acoustic compliance which reduces sound pressure. Such devices would be very inexpensive. A proof-of-principle chamber between the regulator and the helmet is shown in Figure 3. Laboratory measurements at Acentech show noise reduction of about 8 dBA. With the addition of a screen the reduction is greater than 12 dBA. The increases in bottom times will be on the same order as with the screens. This chamber was tested at Dive Lab spring 2014. It should be noted that differently shaped and less obtrusive expansion chambers could be used, as the total volume of the added air but not its shape determines effectiveness. Note also that if the exhalation whiskers are attached outside the chamber, exhalation noise would also pass through it and would be reduced by the former amount (8 dBA). The additional 4 dBA would not be achieved since exhaled air would not pass through the screen. Finally, expansion chambers could be designed to be added to a regulator on an 'as needed' basis.

Figure 8. Proof-of-principle expansion chamber

Regulator Flow Path Redesign

Figure 9. Two "venturi's" removed from KM 350 regulators illustrating their flow noise generating configuration.

Airflow noise is very readily generated by impingement of turbulent flow on a surface, so that even very slightly irregular or rough surfaces or short bend angles through which airflow is turned will generate flow noise. The air paths in current regulators are not designed with this in mind. Consider Figure 9 showing two "Venturi's" removed from KM 350 regulators and Figure 7 showing the outlet into the breathing tube of an intact "Venturi." These structures are definitely not very smooth and force the air to make two relatively sharp turns out of the inlet valve cavity into the breathing tube and helmet. Also, the lip that shows as a shiny rectangle in Figure 2 and darker one to the right in Figure 4 is a ridge over which the air must flow, a very likely source of some of the regulator noise.

Regulators also exhibit acoustic resonances (like organ pipes) due to their basic geometry that amplify the flow noise, including one in the midfrequency (500 – 600 Hz) range that contributes strongly to the overall dBA measure of noise. Reduction of this noise requires routing the airflow so that it does not excite this resonance.

A series of designs to reroute the air through the regulator during inhalation have been evaluated that attempt to smooth the airflow and reduce the abruptness of turns and bends from the inlet valve cavity into the breathing tube and helmet. The "Venturi" has been replaced with smooth ducts with one large turn. In addition, by extending the end of this new duct to the discharge end of the breathing tube, the midfrequency resonance is only weakly excited. These modifications necessitated cutting open the valve adjustment structure as shown in Figure 10 but the function of the valve adjustment rod can be restored by extending the rod through the duct. Two examples are shown in Figure10.

Figure 10. On the left illustrates an alternative copper duct replacing the "venture," and on the right shows a plastic tubing version that provided significant noise reduction.

After much trial and error, a configuration shown in Figure 10, with an intact valve adjustment rod penetrating through it successfully reduced the overall noise by about 6 dBA relative to a standard KM 350 in a laboratory test at Acentech. This demonstrates the feasibility of reducing the inhalation flow noise in a regulator by a meaningful amount and the effectiveness of the airflow smoothing approach.

Benefits of Project:
Noise in dive helmets will be reduced, making longer bottom times possible and reducing the risk for noise-induced hearing loss for divers.

Current Status of Project:
The next step in our program will be to return to Dive Lab to perform noise measurements on the expansion chamber, additional screens, and the modified flow path to confirm our theoretical and laboratory results. We will also measure the work of breathing with each modification. Given the stringent requirements on WOB it is essential that there be no significant increase due to noise modifications. Indications from previous testing have shown slight increases in WOB for screens but we shall be testing possible modifications to regulator properties that can eliminate these increases. With regard to the expansion chamber and modified airways, these WOB measurements will be the first examination of this issue for these configurations.

Kirby Morgan Thermo Exchanger

Manufacturer: Dive Lab

Source: Data and photos from Dive Lab; Mike Ward

Description of Project:

Over the past 15 years Dive Lab has been conducting cold water testing on regulators and components used for open and closed circuit SCUBA diving as well as umbilical supplied helmet and full face mask diving. Many of the basic procedures used by Dive Lab are from procedures used by the U.S. Navy, European CE test requirements, and methods employed by ANSTI Test Systems Ltd. Research and testing at Dive Lab suggests that equipment manufactures as well as agencies that dictate the use of equipment for diving in cold water including military test facilities should carefully evaluate their understanding of how and why SCUBA regulators form ice.

- How SCUBA regulators form ice. The basic root cause of regulator freezing is when the second stage demand valve starts free flowing air due to ice formation around the inlet valve mechanism that keeps the inlet valve from closing after inhalation. There is also free ice formation. This is where ice forms and builds up inside the second stage but does not cause the regulator to free flow. When this happens the diver is normally unaware that the ice is even there.
- Mechanical Effects of Ice. With most second stage SCUBA regulators, as ice forms and builds on internal second stage components such as the lever, main tube, and inlet valve, the minor free play adjustment (Gap tolerance) between the lever and fulcrum point is reduced and eventually eliminated by the ice that forms, preventing the inlet valve from fully closing during the exhalation phase of breathing. Once the valve starts free flowing, the second stage components get even colder due the refrigeration effect of the continuous flow, creating more ice and an even greater free flow making it increasingly harder to exhale. This can be very dangerous because if the diver cannot exhale, the diver cannot inhale, forcing the diver to loosen the grip on the mouthpiece and exhale around the mouth piece before being able to inhale. This entire experience can happen really fast and even for the most experienced divers, it can even prove to be fatal.
- Refrigeration Effect. When the high pressure air passes through the first stage regulator, the rapid drop from high pressure to low pressure causes a dramatic temperature drop. This pressure drop is basically how your refrigerator and air conditioner work, the temperature drop is fairly linear, the higher HP pressure the greater the drop in pressure and the colder the air gets at the second stage. Now increase the flow and it gets even colder.

The primary factors that influence second stage ice formation are the following:

- Cylinder Pressure
- Breathing/Flow Rate
- Water Temperature
- Time
- Regulator design

- Cylinder pressure and breathing/flow rate. The first and second factors are closely interrelated and if the HP cylinder pressure is 2,500 psig or higher, and the flow is great enough (50-62.5 lpm), ice will often form inside most second stage demand regulators even in water of 45-50°F.
- Water Temperature. Once the water temperature drops below 38°F there is not enough heat in the water to rewarm the cold regulator components of the second stage being chilled by the first stage and most second stage start forming ice. To understand this you need to think about how an automobile radiator works. A radiator removes the heat generated from the fuel burning engine. The hot coolant in the engine is pumped thru the radiator coils and the air that flows past the coils draws the heat away keeping the engine temperature cool and stable. A car radiator is a simple heat exchanger. If you think of the SCUBA first stage regulator as an engine that supplies air to the diver via the second stage, but in the process, supplies extreme cold air to the second stage due to the cooling effect of the air going from a high pressure to a low pressure. As the cold first stage air enters the second stage it quickly chills the second stage inlet valve components to well below freezing and as the diver exhales, the moisture in the exhaled breath instantly condenses on the cold second stage inlet components and freezes. It is the warmth from the surrounding water that keeps the second stage regulator components warm enough to prevent the diver's moist breath from freezing and forming ice.
- Time. The longer you flow gas at a high rate, the colder the regulator components will get.
- Regulator Design:
  - First Stage Regulator Design. The air coming out of the first stage is always colder than the water. There are two things that cause first stage freezing. The least common is internal freezing due to moisture in the HP air due to poor HP filter/moisture control. Most modern HP compressor filtration/moisture separators provide air at a dew point down to at least -40°F. Internal first stage freezing can happen if the moisture separators are not maintained properly. Proper compressor maintenance and regular air samples will prevent moisture in the HP system. The second and most common cause of first stage freezing is external icing from the surrounding water freezing around the outside of the first stage. This can happen in water that is below 40°F, if the flow rates

and cylinder supply pressures are high, the colder the water, the less the rewarming and the greater the chance of first stage icing. Usually the most efficient first stage designs for cold water are those that have lots of surface area and mass to allow greater heat absorption from the surrounding water (Giving up the Cold) to help keep the first stage from forming ice on the exterior of the first stage. In addition by having large exposed areas with numerous large openings can be very effective in preventing first stage icing.

- Second Stage Regulator Design. Second stage freezing can happen quickly from the moisture in the diver's exhaled breath. Second stage regulators that isolate or divert the diver's exhaled breath from coming in contact with the cold inhalation components and the area where the cold inlet gas enters will usually stand the best chance of not forming ice on the valve's critical components. How well the cold inlet air components are separated or shielded from the diver's exhaled breath, as well as the thermal transfer qualities of the second stage materials can have a significant impact on free ice formation and freezing potential. Second stage regulators that have poor sealing exhaust valves will form ice quickly. All second stage regulators can develop ice when the incoming second stage air inlet temperature averages 25°F or colder, and for this to happen, the water does not have to be any colder than 50°F.

Kirby Morgan Thermo Exchanger (TE):
The Kirby Morgan Thermo Exchanger illustrated in Figure 11 was developed to eliminate second stage SCUBA regulator freezing when diving in extremely cold fresh or salt water at temperatures down to 28°F.

Theory of Operation:
The theory of operation is based on the thermal transfer of heat from the surrounding water, which warms the air coming from the first stage regulator. The TE is a simple heat exchanger coil made of high grade stainless steel. The coil is attached to a chrome plated brass swivel block that allows for attachment of both the primary and secondary demand regulators as well as the BC inflator hose. The length of the tubing and the mass of the block is the reason why the system can warm the air from the first stage to the second stage regulator to within one to two degrees of the surrounding water. The performance of warming is based on the following technical requirements.

- Water Temperature - 28°F (-33°C)
- Breathing Rate - 62.5 lpm
- Minimum Second Stage Inlet Temperature 28°F (-2°C)
- Minimum time to 2nd stage ice formation at 62.5 rmv / 28°F (-2°C) = >10 min
- Minimum time to freeze at 62.5 rmv 32°F (0°C) = >18 min
- Minimum time to freeze time at 38 rmv = >2.5 hours (Ice development in the second stage)
- Maximum normal working pressure 350 psig
- Normal system test pressure 500 psig

Figure 11. Kirby Morgan Thermo Exchanger

The above specification relates to extreme testing. In practical use during SCUBA operations the HP air supply pressure is constantly reducing thus reducing the temperature drop as well. In addition, even an extremely fit diver could never maintain a breathing rate of 62.5 lpm at a depth of 165 fsw for more than a couple of minutes in cold water. When using the thermo exchanger, an added benefit for the diver is the reduction in thermo drain due to extremely cold gas. The TE was primarily designed and intended to eliminate second stage regulator freezing for divers diving in extreme cold water, but also provides the diver with much warmer breathing air. The TE will not significantly reduce or degrade the breathing performance of good quality high performance SCUBA regulators that currently meet the work of breathing requirements as set forth in the European CE standard EN250:2000. It is recommended that the first stage intermediate pressure be run at the upper end limit as specified by the manufacturer to minimize any pressure drop to the second stage from the volume of the TE.

Benefits of Project:
- Saves lives while diving in temperatures below 38°F.
- Prevents regulators from forming ice.

Current Status of the Project:
Dive Lab is currently working on another version of the Thermo Exchanger aimed at fitting twin cylinders with a very low profile. The new unit will be longer than the current model and is intended to mount vertically between a twin cylinder SCUBA system or vertically on a single tank. Like the current unit, the vertical unit will also be equipped with a 360 degree swivel head attachment with numerous ½"-20 and 3/8-24 straight thread ports to allow interface with the divers primary 2nd stage as well as the BC, dry suit and octopus demand second stage.

Paragon Return Surface Exhaust System

Manufacturer: Paragon Space Development Corporation

Source: Data and photos from Paragon Space Development Corporation; Christopher Linrud

Figure 14. RSE System.

Description of Project

Worldwide, water conditions have become increasingly more dangerous to both military and commercial divers due to chemical, biological, toxic industrial chemical, toxic industrial material, and potential chemical warfare agent contamination, so as part of a Department of Defense (DoD) Small Business Innovation Research (SBIR) program, Paragon has designed and built a Return Surface Exhaust System (RSE) to protect the diver from the potential ingress of contaminated water or vapor into the diving helmet, or suit, when diving in these conditions. The RSE is designed to take exhaust gasses from the helmet and the suit's dump valve and returning them to the surface, rather than exhausting directly to the water.

Illustrated in Figure 14, the RSE system consists of a modified MK-21 helmet which has had the exhaust system removed. The exhaust system is replaced with the Paragon RSE components consisting of the Oral-Nasal (O-N) exhaust manifold, Emergency Dump Valve (EDV), Demand Exhaust Regulator (DER), bypass flow fuse, return umbilical, and surface panel. Additionally, the dry suit valve is replaced with a closed system to complete the system closure. The RSE system does not modify the base helmet or the inlet system. Therefore, the helmet can be supported with existing Navy surface supply panels. The exhaust system of the base Kirby Morgan helmet is removed, including the whiskers, check valves, and Oral-Nasal attachments. The exhaust system is replaced with the Paragon RSE system which converts the helmet to a surface exhaust system. This modification closes all open pathways to the environment and routes the diver's exhaust through the return umbilical to the surface where it is exhausted to the atmosphere through the surface panel.

Oral-Nasal (O-N) Exhaust Manifold

The O-N exhaust manifold attaches to the helmet exhaust ports of the helmet. For the MK-21 helmet, this is the bottom exhaust port and the regulator exhaust port is plugged. For the KM-37 helmet, this manifold captures flow both from the bottom exhaust port as well as the exit from the inlet regulator. Tubing connects the O-N to the DER assembly.

Demand Exhaust Regulator (DER)

The Demand Exhaust Regulator (DER) controls the diver exhaust outlet during nominal diving. The helmet side is connected to the tubing from the O-N exhaust and feeds to the bottom side of the diaphragm. The diaphragm references local water pressure and when pressure helmet exceeds the local pressure, the diaphragm unseats and allows the exhaust to flow through the DER seat to the exhaust umbilical. The exhaust umbilical is at a lower pressure and will remove air pressure until it is equal to local pressure at which time the diaphragm will reseat.

Emergency Dump Valve

The Emergency Dump Valve (EDV) provides a 3rd level of redundancy for the exhaust system, should the ability to exhaust through the DER or umbilical. The EDV allows the diver to vent exhaust overboard.

Nominally the EDV remains closed with the DER or bypass operating which keeps the system closed to the surrounding environment. The EDV has 2 pressure relief settings. The first allows the EDV to vent when the pressure inside the helmet becomes too high but is low enough to not harm the diver. However, this pressure is high enough to cause fatigue in the diver so the EDV allows the 2nd setting to be actuated by the diver manually and this decreases the exhaust pressure. The EDV usage during a dive constitutes a system level failure and is intended to allow the diver to exit the water safely. It should never be used as an ongoing dive exhaust path.

Bypass Flow Fuse
The bypass flow fuse is a backup path to the exhaust umbilical in the event the DER is not functional. This is a 2 stage flow fuse which allows air to flow through the helmet to an orifice. This orifice limits the flow of the helmet inlet regulator to a rate which can be supplied. The bypass has a 2 stage setting which can allow a lower or high flow rate based on depth, and this adjusts based on flow rate and pressure automatically. The helmet will function as a flow through system rather than a demand system when the diver manually selects this path. The use of the Bypass Flow Fuse is considered off nominal and is considered a water exit mode which maintains the closed system configuration.

Exhaust Umbilical
The exhaust umbilical connects the helmet exhaust system to the surface panel. This umbilical is designed to be maintained below the diver helmet pressure. This allows the exhaust from the DER to be moved up the umbilical by the pressure difference rather than the diver exhalation effort. The umbilical is designed for pressure drop from maximum depth of 198 fsw at 90 lpm from the diver. It is also selected for chemical resistance.

Surface Panel
The surface panel has 2 components. The gas supply side feeds high pressure gas to the helmet inlet regulator through the air supply block on the helmet. The exhaust side uses a reference backpressure regulator which senses the diver depth through a pneumo-tube and holds the exhaust umbilical surface pressure at about 10 psi (this pressure is adjustable by surface attendant) below this pressure. The exhaust regulator can vent to ambient pressure when the diver is below 15 feet or can be supplemented with an exhaust vacuum pump above 15 feet.

Benefits of Project:
Protects the diver from water borne contaminants such as toxic compounds (marine diesel, jet fuel), biological compounds (bacteria, biological warfare agents) and chemical warfare agents.

Current Status of Project
- Submitted Paragon Regulated Surface Exhaust Phase I Final Report.
- Submitted Paragon Return Surface Exhaust Phase II Final Report.

SEABEE Divers from UCT TWO in Diego Garcia

By: Construction Electrician Chief (SCW/MDV) Terence Juergens

SEABEE Divers from Underwater Construction Team (UCT) 2's Construction Diving Detachment Charlie (CDD/C) spent February deployed to Naval Support Facility (NSF) Diego Garcia to inspect, maintain, and repair fleet moorings and off-shore hydro-acoustic cables in the Indian Ocean. These waterfront facilities provide vital support to U.S. and allied operations in the region.

Shortly after arriving on two C-130s with more than 40,000 pounds of diving and support equipment 12 members of CDD/C began conducting diving operations, inspecting two fleet mooring buoys in support of 6th Fleet operations in the Indian Ocean.

During inspections, divers utilized specialized tools to measure chain links identifying and documenting excessive wear.

SEABEE divers also replaced more than 150 sacrificial zinc anodes that provide cathodic (corrosion) protection to extend the life span and serviceability of fleet moorings.

In support of future fleet mooring installations members of CDD/C conducted work unique to SEABEE divers, collecting hydrographic and geotechnical survey data. They used underwater hydraulics to operate a rapid penetration test (RPT) unit to drive steel rods at measured intervals in over 80 feet of seawater (fsw). The amount of time it takes to penetrate 2-foot increments is recorded, along with torque measurements at the end of each rod. Engineers from the Naval Facilities Engineering Command will use this data to design mooring solutions based on bottom type and density.

The final task divers from UCT 2 had to complete was the inspection and repair of two Hydro-acoustic Data Acquisition System (HDAS) cables located outside of a lagoon north of the island. The cables start from the shore and extend to 110 feet of seawater until they plunge to the ocean floor 600 feet below the crystal clear water of the Indian Ocean.

"This by far is what I've been waiting for," said Equipment Operator 1st Class (SCW/DV) Manuel Terrero, assistant officer in charge of CDD/C. "The dives we get to conduct outside the lagoon are the best in the world, and we're the only ones that get to dive out there. Every dive is like watching the National Geographic Channel, or peering in to a pristine aquarium."

Battling high surf and heavy winds Divers inspected more than 3,000 feet of cable in depths up to 110 feet. Divers replaced more than 70 zinc anodes and installed 10 new stabilization points using underwater hydraulic tools.

"As a SEABEE diver, we dive all around the world, from the frigid waters of the Arctic to the tropics of the Indian Ocean. This by far is the best part of our job!" Said Steelworker 1st Class (SCW/DV) Cody Oswald, the project supervisor.

SEABEE divers begin their careers as non-diving SEABEES, learning their construction skills. This allows them to bring a unique problem solving capability to diving and underwater construction, often functioning in depths up to 190 feet of seawater.

This is the first of seven locations during Construction Diving Detachment Charlie's six-month deployment. CDD/C travels by military airlift, moving 40,000 pounds of gear more than 40,000 miles across six countries to accomplish seven missions, including four Pacific Fleet exercises. They do this without having to return to their home base for re-supply.

From the logistics of moving 20 tons of equipment by naval airlift, to life support sustainment, they're a completely autonomous unit, led by a senior enlisted officer in charge.

Following their work at Diego Garcia, CDD/C divers will travel to Guam to support fleet mooring inspections and repair in Apra Harbor.

Photos left to right: Construction Mechanic (SCW/DV) Nathan Emmett takes "go-no-go" measurements on a Fleet Mooring riser chain; Construction Electrician Chief (SCW/MDV) Terence Juergens replaces zinc anodes on Hydro-acoustic Data Acquisition (HDAS) cables; Construction Mechanic (SCW/DV) Adam Cooper removes drill steel from the seafloor after completing rapid penetration tests. (Photos by Steelworker 1st Class (SCW/DV) Cody Oswald)

SWRMC Divers Complete Emergent Pre-Deployment Repairs on USS JEFFERSON CITY (SSN 759)

NDCS (MDV/EXW/SW) Will Wittman & ND1 (DSW/SW) David Cannon

Southwest Regional Maintenance Center (SWRMC) Diving Division's (Code 360) role in providing Underwater Ship's Husbandry Support (UWSH) to the fleet is unique in that we support the underwater repair effort for three different Lead Maintenance Activities (LMA), at three different locations on the San Diego waterfront. Two of SWRMC's five dive teams are designated as "satellite" dive teams, with ALPHA team supporting aircraft carrier repair at Naval Station North Island and CHARLIE team supporting COMSUBRON ELEVEN submarines in conjunction with Portsmouth Naval Shipyard Detachment San Diego (PNS DET SD) as LMA at Naval Base Point Loma. During the 29 MAR – 02 APR timeframe, the plan was to merge ALPHA and CHARLIE as one cohesive unit to execute emergent repairs on USS Jefferson City with a very limited availability window and a firm deployment date in which to complete the repairs of both the aft starboard AN/WSQ-9 Outboard Transducer Acoustic Assembly (OTAA) as well as the AN/BQN-17 Forward Bottom Sounder. In the case of the Forward Bottom Sounder, divers would be vital to the replacement of each outboard component of this essential sonar system that required the installation of Main Ballast Tank (MBT) cofferdams to support SUBSAFE replacement of a failed Electrical Hull Fitting (EHF). As is the case with any diving operation to execute highly technical submarine repairs, significant planning was required to integrate the services of various entities, which included PNS DET SD, Ship's Force, Port Operations, NRMD, NELO-DET, and most importantly NAVSEA 00C5. The logistics support of 00C5 in providing a ready for issue (RFI) kit to execute the WSQ-9 repair and the technical expertise of Mr. Scott Posey as the 00C5 onsite representative would be vital to the success of the mission. On 28 MAR, with all pre-mission planning requirements met, equipment staged, tech reps onsite, and surface-supplied assets in place outboard of USS Jefferson City, ALPHA and CHARLIE team's Leading Chief Petty Officers, NDC Brandon "BJ" Perry and NDC Billy Goold reported that "CH-ALPHA" team was ready to go to work!

Rigging aft-lift fixture into place. Photo by NDCS (MDV) Wittman

As many within the Navy Diving community with SSN experience can affectionately attest to, commencing work on "Saturday, Sundays, and Nights" is nothing unique and was no different in this case with ND1 David Cannon briefing and deploying divers bright and early on 29 MAR from ALPHA team's surface-supplied platform, the IX Barge, to begin work on the WSQ-9 / OTAA. Simultaneously, at the forward end of USS Jefferson City, ND1 Tony Eddleman was deploying his Divers from CHARLIE team's brand-new 60' dive boat to install MBT cofferdams on MBT 3. The installation of these cofferdams would enable members of the PNS DET SD maintenance team to access MBT 3 through the topside manhole covers to complete work inside the tank, with the MBT cofferdams acting as the barrier to the sea.

From the start, the WSQ-9 repairs proved to be a challenge for ND1 Cannon and the aft dive team. One initial hurdle to overcome in guiding the first set of divers that included ND2 Nathan Gardner, ND2 Dustin Bigby and ND2 Scott Caruana through the installation of the 1,400 pound aft lifting fixture was communication. "The importance of clear communication between the Diving Supervisor, the crane crew and the other Divers is paramount to the safety of all involved as well as the equipment, we knew we were having issues initially with standard verbiage and we were able to correct the problem both topside and in the water," explained ND2 Dustin Bigby. An additional hurdle to overcome was confirmation that the aft lifting fixture on the STBD stern plane was fully seated in its

ND2 Bigby and ND2 Gardner rigging. Photo by MC1 (EXW/IDW/SW/DV) Keen

housing socket in accordance the with the depth specifications of Chapter 25 of the UWSH Manual. In order to safely function as the initial handling system for the “easing out,” and removal of the OTAA, proper installation of the aft lifting fixture was essential. Following verification and re-verification by the Divers that the measurements were not matching the specification in the procedure, the recommendation initiated by ND1 Cannon was to carefully remove the fixture using the pier crane and verify the physical depth of the socket in relation to the fixture’s shaft. Once this was completed, it was in fact confirmed that the depth of the socket was shallower than expected, but matched the length of the fixture’s shaft, thereby confirming that the fixture was fully engaged. “The procedure read one way, and with Divers reporting that the key-way was properly aligned, I knew from experience that something else was going on and it was time to step back and approach this from a new angle, one that was logical and sound in practice,” explained ND1 David Cannon.

With the difficulties encountered by the dive team working aft, the forward dive team quickly became the “winning team” as they completed the precise installation of eight individual MBT cofferdams to isolate MBT 3 in less than three hours of bottom time. “This is the fourth MBT cofferdam installation we’ve completed in five months, so we’ve pretty much got the system down,” explained ND2 Duane Altman. Despite the relative ease of accomplishing the cofferdam installation, ND1 Eddleman and his team remained on station to confirm that ship’s force was able to successfully complete the MBT venting and topside access procedure. Although initial conditions indicated that the cofferdams were holding tight in accordance with the “zero leakage rate” that is required, based on no change in list on the boat, it was determined that, as the venting process progressed, an additional dive was required to confirm the integrity of the cofferdam system that was installed on MBT 3A. So as to contribute the “night” component of the acronym SSN (Saturdays Sundays Nights), ND1 Michael Renzi and ND2 Chance Donnelly were deployed and quickly determined that one of the cofferdams on MBT 3A required being repositioned slightly, J-bolts re-tightened, and cofferdams educted to confirm zero leakage. Once these corrective actions were properly identified and acted upon by ship’s force and the dive team, the remainder of the topside venting and access procedure went off without a hitch, and the lead shop had conditions set to initiate the EHF repair.

Sunday, March 29th brought another brilliant San Diego morning to the aft dive team, which faced the next task of removing the 5/16” Allen fasteners on access covers for both the grounding strap of the high-voltage transducer and also the foundation bolts which secure the 3,500 pound transducer to the stern plane. Within a few minutes of splashing, ND1 Jason Myers reported only a few fasteners for the access covers could be broken free and that the majority were showing signs of significant over-torquing. “Usually we can get most of the bolts loose, but almost none of the bolts wanted to budge and we didn’t want to make a bad-situation worse by stripping out the Allen heads, “explained ND1 Jason Myers. This set of Divers employed all techniques at their disposal from initial shocking of the fasteners to remove paint and any debris in the threads that might cause binding to the application of every appropriate sized easy-out and Allen head extractors with little effect. Once these methods were exhausted, ND1 Cannon and NDC Goold knew that based on the Divers’ reports all options needed to be explored and a more effective tool had to be identified. A call was placed to ND1 James McInroy of SWRMC’s BRAVO team, to prepare the magnetic drill-press and MOD 9 Hydraulic Power Unit (HPU) that had been pre-positioned for an upcoming repair of USS PELELIEU’s rigging tunnel covers. Once these tools were re-deployed to SUBASE and made operationally ready to support the OTAA repair, it became clear that use of the hydraulic drill-press would be vital to efficiently drilling out the heads of the access cover fasteners and get the job back on schedule. The next two sets of divers deployed to put these specialized tools to use were ND2 Gardner, ND2 Donnavan Harper and ND2 Zachary Standley. It became readily apparent that the magnetic drill press was going to drastically speed up the tedious process of removing the access cover fasteners. By early afternoon with all access covers removed, foundation fasteners removed utilizing the hydraulic Hi-Torque and all rigging prepared for removal, ND2 Bigby, ND2 Chase McCain and ND2 Gardner were able to methodically execute the flawless removal of the existing OTAA to the surface to enable testing of the system cables and the OTAA unit itself. Testing of the OTAA unit confirmed that it was damaged, and required replacement. Once all cable testing was confirmed as "SAT" within specifications, the new unit was mated with the existing cabling and fairing plates and made ready for installation. On April 1st, the dive team, with ND1 Jameson McCrackin, ND2 David Morrell and ND2 Standley performing seamlessly together, was able to successfully rig the installation of the new OTAA unit, carefully manage the make-up of the three delicate control cables for the unit in the mud-tank and execute expert craftsmanship in reassembling the foundation bolts with the Hi-Torque, thereby completing the bulk of the re-installation in one dive.

The repairs that were executed in these four days on the aft starboard WSQ-9 and forward bottom sounder were vital on their own, but in many ways were simply the culmination of the unmatched support that SWRMC Divers provide to Pacific Fleet submarine assets on a continuous basis. In the weeks preceding these repairs, on USS JEFFERSON CITY alone, CHARLIE team had performed a Level Two inspection due to emergent CASREP tasking on the Retractable Bow Plane (RBP) system, which resulted in the development of an executable repair plan that ultimately enabled the unprecedented waterborne repair of the starboard Retractable Bow Plane (RBP), thereby avoiding very costly and time-consuming drydock repairs. Although this level of support often requires the dedication of long hours spent on the dive side versus on liberty, the end result is enhanced missions success for the fleet and tremendous "pride in ownership" for the dive team, who to a man, relish the fact that fellow sailors of the "silent service" are able to operate forward and provide their one of a kind protection of national security interests.

Special thanks to the following key contributors to the underwater repair mission on USS JEFFERSON CITY include:

CHARLIE TEAM Members

NDC (DSW/EXW/SW) William Goold
ND1 (DSW/EXW/SW) Anthony Eddleman
ND1 (DSW/EXW/SW) Michael Renzi
ND1 (DSW/EXW/SW) Julio Cerecer
ND1 (DSW) Jamison McCrackin
ND1 (DSW) Jason Myers
ND2 (DSW) John Bigby
ND2 (DSW) Duane Altman
ND2 (DSW) Gerald Gazda
ND2 (DSW/EXW) Chance Donnelly
ND2 (DSW) Donnavan Harper
ND2 (DSW) Jason Brazel
ND2 (DSW) Oscar Hopps
ND2 (DSW) Scott Caruana
ND3 (DSW) Lyle Frank

COMCAM

MC1 (EXW/IDW/SW/DV) Gary Keen
MC1 (DV) Brett Cote

ALPHA TEAM Members

NDC (DSW/EXW/SW) Brandon Perry
ND1 (DSW/SW) David Cannon
ND2 (DSW/EXW/SW) David Morrell
ND2 (DSW/EXW) Nathan Gardner
ND2 (DSW/EXW) Chase McCain
ND2 (DSW) Joshua Tomolak
ND2 (DSW/SW) Rory Fagan
ND2 (DSW/EXW) Zachary Standley
ND2 (DSW/EXW/SW) Ross Buzek
ND3 (DSW) Ryan Farrell

NAVSEA On-Site Support

Mr. Scott Posey (SEA 00C51)
Mr. Sam Carroll (ESSM Mechanic)

Authors: NDCS (MDV/EXW/SW) Will Wittman is Repair Master Diver for SWRMC Divers/ CHARLIE Team. ND1 (DSW/SW) David Cannon is Leading Petty Officer for SWRMC Divers/ALPHA Team.

State Rep. Jimmy Patronis Advances Resolution Designating "Ocean Week" in the State of Florida

Patti Butchikas

The Florida House of Representatives has adopted House Resolution 9053, sponsored by State Representative Jimmy Patronis (R-Panama City), officially recognizing the week of July 21–27, 2014 as "Ocean Week" in the State of Florida.

In 1963, the United States SEALAB program began at the Navy Mine Defense Laboratory in Panama City Beach, Florida. SEALAB I, a prototype sea base, was assembled in 1964 at the Laboratory along Alligator Bayou in Bay County. With the use of SEALAB I, the US Navy conducted a historic 11 day mission at a depth of 198 feet, which proved man could explore, live and work in the deep ocean depths for long periods of time. SEALAB I set the stage for the development of similar projects in the United States and around the world and opened new doors to undersea exploration.

"We've designated this week in July as Ocean Week to celebrate the anniversary of the historic SEALAB mission and recognize the important role Florida, and especially Bay County, played in the exploration of the world's oceans," said Representative Patronis. "It is my hope that this commemorative week will promote the wonderment of the oceans that remain unknown and encourage its continued exploration for generations to come."

MCPON Stevens Visits NSA PC

NAVAL SUPPORT ACTIVITY PANAMA CITY, FL. (Dec. 13, 2013) – Master Chief Petty Officer of the Navy (MCPON) Mike Stevens speaks with Sailors stationed at Panama City, Florida, during an all-hands call held at the Naval Diving and Salvage Training Center's (NDSTC) auditorium. The all-hands call concluded a weeklong tour of Navy Region Southeast training facilities.

U.S. Navy photos by Mass Communication Specialist 2nd Class Kevin B. Gray /Released

NAVAL SUPPORT ACTIVITY PANAMA CITY, FL. (Dec. 13, 2013) – Naval Diving and Salvage Training Center (NDSTC) Command Master Chief Steve Mulholland discusses how the Diving Simulation Facilities give students experience in the effects of nitrogen narcosis in a controlled environment at depths of 190 feet with Master Chief Petty Officer of the Navy (MCPON) Mike Stevens. MCPON Stevens toured NDSTC after holding an all-hands call for more than 200 Sailors at Naval Support Activity Panama City, concluding a weeklong tour of Navy Region Southeast training facilities.

Philippine & U.S. Navy SEABEE Divers Conduct Joint Training During Exercise Balikatan 2014

By: CEC (SCW/MDV) Terence Juergens

Sangley Point, Philippines – "Green Diver, back down the ladder until your helmet's awash" – "Make it hot", and "Switch off" were some common phrases one could hear echo from the combined Philippine and U.S. Navy dive side. During the month of May both nations partnered in support of Subject Matter Expert Exchanges involving port/harbor recovery scenarios during this year's Exercise Balikatan.

Throughout nine grueling days of high heat and periodic down pours Underwater Construction Team (UCT) TWO trained eight Philippine Navy (PN) UCT divers on topics including; surface supplied diving systems and procedures, underwater cutting and welding techniques and procedures, diving casualty management, and neurological examinations. From the makeshift classroom to underwater employment all PN Divers received immensely valuable training that goes hand in hand with the strategic goals of Balikatan 2014.

"The Filipino divers are outstanding, resourceful, and very attentive," said Builder 2nd Class (SCW/DV) Joseph Hophan, the project supervisor for UCT TWO's Construction Diving Detachment Charlie (CDD/C). "We had to take a crawl, walk, run approach to our mission here in the Philippines. Diving is already very dangerous. When you add cutting and welding to the equation your focus shifts toward safety and the steps we take to mitigate risk. They did great and learned at an impressive rate."

Seabee Divers from the Philippine and US Navy Underwater Construction Teams enter the water to conduct a joint training dive.

Steel Worker 1st Class (SCW/DV) Cody Oswald, from Underwater Construction Team Two, teaches a surface supplied diving course to the Philippine Underwater Construction Team.

Seabee Divers from the Philippine and US Navy Underwater Construction Teams prepare to execute a joint dive during exercise Balikatan to practice underwater cutting and welding.

Each PN diver was given a project to practice various types of welds. Once they felt comfortable with what they learned during topside (dry) welding they were put to the test underwater. From proper terminology, electrode placement, and speed they were able to experience how hard it is to weld underwater. "I don't think they realized how hard it was going to be," said Construction Mechanic Second Class (SCW/EXW/DV) Nathan Emmett, lead welder, for Construction Diving Detachment Charlie. "Once you call for power it was lights out, the visibility goes to zero. I was surprised at how fast they learned."

Along with cutting and welding underwater for the first time, the PN UCT divers were able to gain valuable knowledge on side scan sonar techniques and procedures. "We were able to use their system and train them on what they have," said Builder Second Class (SCW/DV) David Madmon, Hydrographic Survey Technician, Construction Diving Detachment Charlie. "I think it resonates more when you're able to train them on a piece of equipment they already own. When we leave they can continue to practice what we taught them."

From deployment to recovery PN UCT and UCT TWO divers surveyed over 5km of ocean floor. "At the end of the day they were able to locate, mark and measure any object that was found," said Madmon.

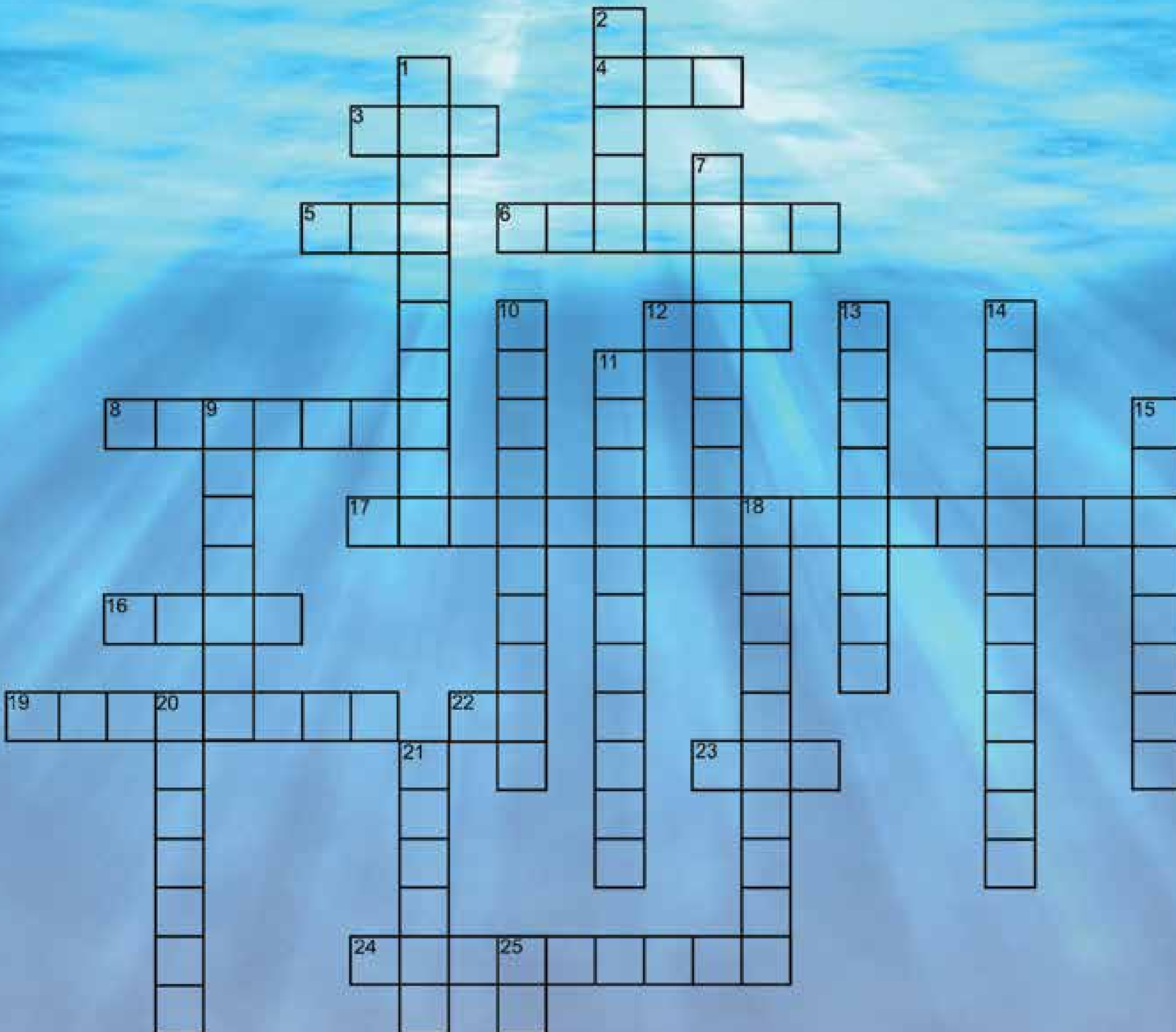
The closing ceremonies were filled with the sounds of sea stories and the sharing of local cuisine. With another Balikatan in the record books UCT TWO continues to solidify the already concrete bond between our good friends and deep sea brothers of the PN UCT's – HOOYAH SEABEE'S, HOOYAH DEEPSEA!

UCT TWO's CDD/C participated in exercise Balikatan in the Philippines on their 4th of 7 stops spanning 6 countries across the Pacific for members of Underwater Construction Team Two's Construction Dive Detachment Charlie. They'll be conducting inspection, maintenance and repair of various underwater and waterfront facilities along with participation in 4 PACFLT exercises during their 6 month PACOM deployment.

Photos by Equipment Operator 1st Class (SCW/DV) Manuel Terrero)

Article Cover Photo: Seabee Divers from the Philippine and US Navy Underwater Construction Teams practice underwater cutting techniques on surface prior to applying this skill underwater.

Crossword Puzzle



Across

3. Usually applied to carbon dioxide *(abbr.)*.
4. Produces persistent false sense of motion *(abbr.)*.
5. 79/21.
6. Capable of being dissolved.
8. Small and expandable sacs.
12. Colorless gas with an acidic taste.
16. Includes gas embolism and emphysemas.
17. Another term mediastinal emphysema.
19. Rapture of the deep.
22. Formed from incomplete combustion.
23. An anxious system *(abbr.)*.
24. Law of absorption *(two words)*.

Down

1. Bending light.
2. A volume, of the moon, and the lungs.
7. Can apply to temperature and pressure.
9. False sense of motion.
10. The way to lose a great deal of body heat.
11. A pressure equal to 14.7psi.
13. Lung capacity can affect.
14. Molecules on the move *(two words)*.
15. Water vapor.
18. Deals with gas mixtures *(two words)*.
20. One type of vertigo.
21. Very serious type II DCS.
25. Ratio of carbon dioxide produced *(abbr.)*.

Crossword answers on pg.45

SEABEE Divers Complete Deep Water Mooring Inspections

By: Construction Electrician Chief (SCW/MDV) Terence Juergens

Apra Harbor, Guam - Daily rainsqualls, howling winds, intense heat and crystal clear water. These were some of the conditions encountered by Underwater Construction Team TWO, Construction Diving Detachment CHARLIE (CDD/C) during the second stop of a 6-month deployment in the PACOM AOR.

Arriving via C-130 cargo transport 10 members of CDD/C hit the ground running. With no time to spare and half of their required gear still awaiting transport in Diego Garcia they made the long journey from Andersen Air Force Base to Apra Harbor. Their task: complete inspections and routine maintenance of 20 fleet mooring buoys, conduct Rapid Penetration Tests at (4) new mooring sites and perform (4) bathymetric surveys.

For the first two weeks UCT TWO Seabee divers utilized Self Contained Underwater Breathing Apparatus (SCUBA) gear to conduct Level I inspections of (12) fleet mooring buoys and (2) Med-Moor buoys inside the inner harbor. A typical Level I inspection consists of routine "swim by" to identify any obvious damage or defects. This is followed by collecting detailed measurements of all components and attaching hardware. Using calipers and specialized measuring devices called Go-No-Go gauges divers were able to collect vital data to ensure that all moorings are within standards to support fleet operations for the region. Once all inspections were complete, divers started the arduous task of replacing over 800 sacrificial zinc anodes. Zinc anodes protect the steel components of the mooring chain and attaching hardware by providing a sacrificial metal that corrodes at a faster rate than the underlying steel components.

After two weeks of diving and working with less than half of the equipment they normally deploy with, the second plane from Diego Garcia finally arrived. With all diving assets and personnel in Guam, UCT divers transitioned from using SCUBA to their Surface Supplied Diving System (SSDS). Using a vessel of opportunity large enough to support SSDS, Divers outfitted the craft to support diving at depths up to 170 fsw. This was no easy task. This required coordination between multiple tenant commands to load over 15,000 lbs of diving and support equipment in order to conduct deep dives that required extensive decompression. In order to limit the amount of in-water decompression divers utilized a Transportable Recompression Chamber System (TRCS) to conduct Surface Decompression dives (SUR-D). Instead of decompressing in the water on 100% oxygen divers surfaced after completing all in-water stops at 40 fsw and deeper to spend time at 50 and 40 fsw in the recompression chamber. This mode of decompression gives the diving supervisor greater control in the event a diver develops symptoms of decompression sickness (DCS) or oxygen toxicity.

Although the water in Guam is warm and for the most part crystal clear, when working underwater hydraulics all expectations go out the door. Shifting to the inner harbor following mooring inspections, divers re-configured the diving platform to support the mission of collecting Geo-Technical survey data using Rapid Penetration Tests. This entailed the use of an underwater hydraulic breaker weighing in at over 60 pounds and all support equipment to make it work.

Getting the diving craft in two-point moor was the first time-consuming task. In order to get accurate information divers had to be within 50 feet of a pre-determined location. With heavy winds and a large boat this was not easy. Constant communication and hundreds of feet of mooring line later divers were able to "go to work."

What seemed like an easy task turned in to over 4 hours of bottom time at 40 fsw. Once Divers hit the bottom they immediately sank in mud/silt sometimes extending up their chest. "It's like working in quick sand, with a blindfold on" said UT2 (SCW/DV) Erick Martin. Working completely by touch divers had to use the BR-67 (Hydraulic Breaker) to drive 2 foot steel rods. Topside personnel annotated how long it would take to drive each rod. After each rod divers used a ft-lb. torque wrench to record readings. At all (4) locations divers drove 40 feet of steel rod into the ocean floor.

The last task the Seabee divers had to complete was the inspection of mooring chains on the floating mooring dubbed "Big Blue". With only one day to complete the task the project supervisor Builder 2nd Class (SCW/DV) Joshua Knolla had to formulate a plan to simultaneously unload the SSDS dive boat and complete the inspection of over 25 mooring chains on "Big Blue." With rotating crews diving SCUBA up to 70 fsw, divers were able to get all necessary inspection data. "This was no easy task," said Knolla. "We had guys unloading the SSDS boat and packing gear for our next flight, and a full crew of guys diving."

Builder 2nd Class (SCW/DV) Joseph Hophan, from Underwater Construction Team (UCT) Two replaces zinc anodes on a deep water mooring in Apra Harbor, Guam. (Photo by Equipment Operator 1st Class (SCW/DV) Manuel Terrero)

Lieutenant Nick Brown. from NAVFAC Engineering and Expeditionary Warfare Center, cleans a deep water mooring buoy during an inspection in Apra Harbor, Guam. (Photo by Construction Electrician Chief (SCW/MDV) Terence Juergens)

Equipment Operator 1st Class SCW/DV) Manuel Torerro, from Underwater Construction Team (UCT) Two cleans a deep water mooring in Apra Harbor, Guam. (Photo by Construction Electrician Chief (SCW/MDV) Terence Juergens)

At the end of the day divers from CDD/C completed all required tasking including the last minute inspection of "Big Blue". They overcame adverse weather conditions to safely finish the project early and under budget. "These guys are true professionals," said LT Nick Brown, the Engineer in Charge from Naval Facilities Expeditionary Warfare Center (NAVFAC EXWC). "The amount of diving accomplished in the short time allotted was impressive. These guys truly embody the 'Can Do' spirit of the Seabees, with the added motivation of being Deep-sea Divers."

UCT TWO was in Guam on their second of 7 stops spanning 6 countries during their deployment across Pacific Fleet. They'll be conducting inspection, maintenance and repair of various underwater and waterfront facilities along with participation in 4 PACFLT exercises during their 6 month PACOM deployment.

Background Image: Lieutenant Nick Brown from NAVFAC Engineering and Expeditionary Warfare Center, descends along a deep water mooring buoy during an inspection in Apra Harbor, Guam. (Photo by Construction Electrician Chief (SCW/MDV) Terence Juergens)

Utilitiesman 2nd Class (SCW/DV) Erick Martin, from Underwater Construction Team (UCT) Two enters the water with a front step entry in Apra Harbor, Guam. (Photo by Construction Electrician Chief (SCW/MDV) Terence Juergens)

Rebreather Divers: Dive Longer - Safely!

By: Dan E. Warkander

Would you drive a car without a fuel gauge?

Would you dive without a pressure gauge for your gas supply?

Why should you have to dive a rebreather without a gauge for your CO_2 scrubber?

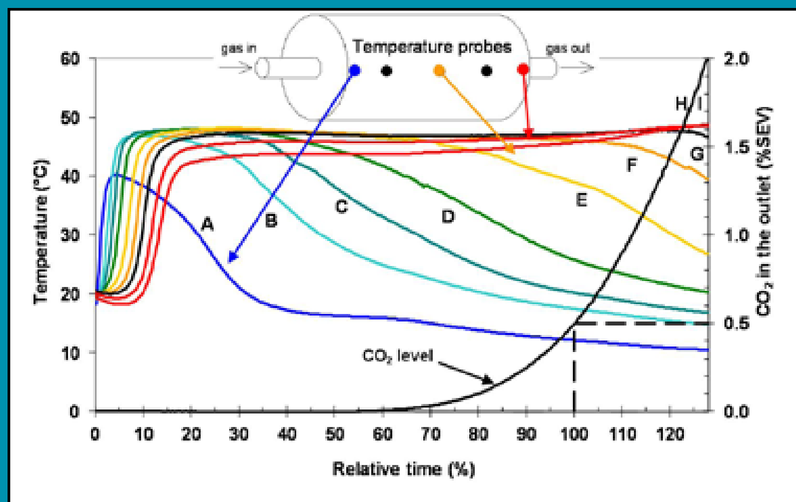


Figure 1: Nominal temperature profile and CO_2 level in the gas leaving the CO_2 scrubber. The lines labeled A through I indicate the temperature in each slice. The black line shows how the CO_2 varied during the test. A scrubber is considered spent when the CO_2 reaches 0.5% (surface equivalent), i.e. 100% relative time (interrupted line).

Today a rebreather diver is told that the scrubber will last a certain number of hours. As you well know, the fuel in your car lasts many more hours if you sit idling than if you drive on the Interstate. You see similar changes in a scrubber. The actual endurance varies with how hard you work and the water temperature. If you spend most of your dive decompressing, or otherwise not working hard, your scrubber lasts a lot longer than you think. If you knew how much, you could start another dive without having to repack the scrubber, thus saving time and money. Besides, you know that the apparatus was tight during the previous dive and opening it may cause it to leak. Wouldn't it be nice to know how much scrubber endurance you actually have left? After all, you know how much breathing gas you have.

Almost no rebreather today has a way to monitor the function of the scrubber during the dive. The solution that may seem obvious would be to put a CO_2 sensor in the gas you are about to breathe. When the CO_2 gets too high you would get an alarm. Sounds quite straightforward, except for the problems of making it work. These problems include temperature, humidity, recovery after flooding, corrosion, power consumption, varying gas density, gas composition, calibration, and price. As you can imagine from this list, it is very difficult to build a CO_2 sensor that works well in a rebreather. However, the biggest drawback is that there is no CO_2 leaving a typical scrubber until well after half the endurance time. At that point the CO_2 climbs quickly. In other words, a CO_2 sensor can really only give a warning. After all, if your display shows zero CO_2 it could mean that 90% of the absorbent is left or only 25%, you can't know which and you can't plan the rest of your dive.

What other ways of monitoring the scrubber can there be? All rebreather divers know that the CO_2 absorbent gets warm when they use the rebreather. That brings up the question of whether temperature measurements can be used to monitor the scrubber. Here at NEDU we set out to test that. We measured temperatures in several places inside the absorbent. Think of the scrubber as a loaf of sliced bread. Each slice would have a temperature sensor. When we plotted the temperatures of each slice we found a common pattern, see Figure 1. The temperatures rise quickly in all slices at the beginning of a dive. As the dive continues, the temperature in slice A (at the entrance of the scrubber) drops first, indicating that the absorbent there is getting used up. Later the temperature in slice B starts to drop. This temperature drop continues with slice after slice until the CO_2 leaving the scrubber is too high.

Figure 1 also shows how the CO_2 was absorbed by the scrubber. Up until 50% of the endurance there was no measurable CO_2 leaving the scrubber. At that point the CO_2 level started to climb fast.

We have run hundreds of tests at different water temperatures, depths, and diver workloads with different rebreathers. It was no surprise to see that the temperatures were all higher in warm water than in cold water. For a hard working diver all the changes happened faster. At greater depths the temperature increase was smaller. However, we found that the pattern of changes was consistent in all tests.

What may be easy to spot by eye is not always easy to build into a gauge. The trick was to find a method that recognizes the pattern of changes and turns it into a gauge reading in a simple, reliable way. After a lot of staring at a lot of graphs we found a very simple method. This method is so simple that it can be built using analog electronics or be very easily programmed. It turned out that nobody had found this method before and this method is now patented in the U.S. and in some other countries.

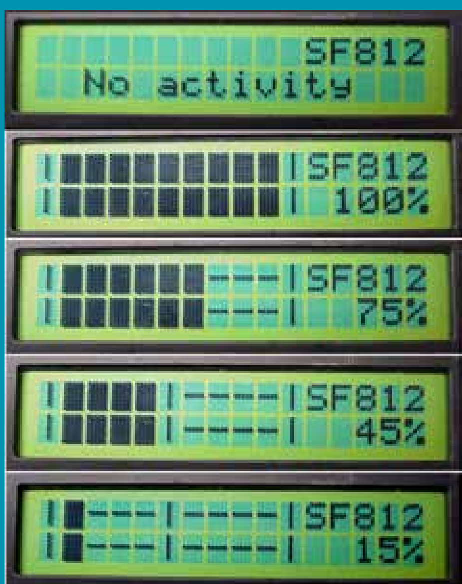


Figure 2: Proof-of-concept unit for the MK 25 oxygen rebreather. The scrubber is instrumented with temperature sensors. The readings are analyzed by the microcontroller in the upper left. The entire unit runs on a normal 9 V battery and is housed in the clear acrylic tube.

So, what will it mean to you as a rebreather diver? You won't have to just rely on tests of endurance tests run under worst case conditions. Typically, the actual endurance time is longer. A scrubber may last many, many times longer during a shallow dive with light work in warm water compared to a deep dive requiring hard work. In fact, a rebreather that lasts, say, 2 hours may actually last anywhere between ½ hour to 6 hours. With a gauge you can take advantage of all the absorbent you have already. Also, if you are working harder than expected in cold water the endurance is likely to be reduced drastically and the gauge will tell you. You will be able to monitor both your gas supply and your scrubber endurance so you can know which will limit your dive.

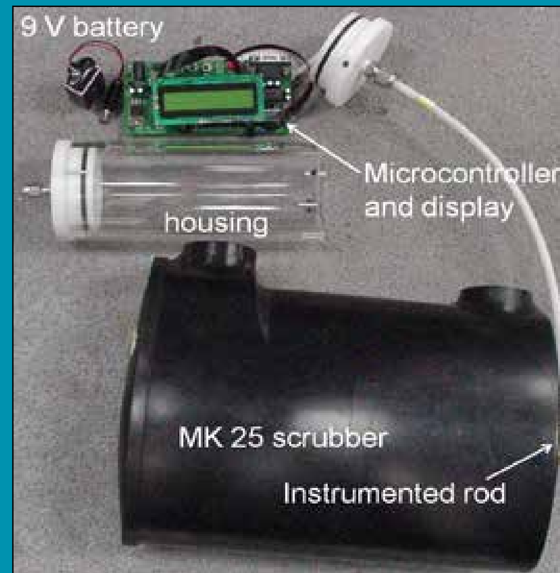


Figure 3: Information shown to the diver. When nobody is breathing on the apparatus, or if you forget to put in any absorbent, the message "No activity" will be shown. During the dive, the bar graph will shrink towards the left and remaining capacity is also displayed. The display is meant to look like a fuel gauge or pressure gauge. "SF812" indicates that the absorbent was Sofnolime 8-12.

A gauge can be retro-fitted in a rebreather in a few minutes. The gauge can be turned on and off as you wish so the battery lasts a long time. The display is even easy to understand: if you can read your car's fuel gauge or any pressure gauge you know how. Readings are independent of your workload, depth and water temperature. The gauge even works if you do repeated dives with the same absorbent. We have built and tested proof-of-concept units for the MK 25 and the MK 16 rebreathers. The MK 25 version is shown in Figure 2. The electronics and display are the same for the MK 16. The function of both units has been demonstrated with divers here at NEDU.

We are working on finding manufacturers to build gauges for the rebreathers used by the Navy. Even though NEDU is not a factory, we may be able to provide field-usable gauges for divers with special needs for endurance. Two civilian rebreather manufacturers have licensed the patent for their rebreathers and has actually had its gauge on the market for a couple of years.

In the early days of SCUBA diving there was no pressure gauge available. Nowadays, you can't buy a regulator without one. Hopefully, we will see the same thing happening with rebreather diving.

Dan E. Warkander, MSEE, Ph.D. is a Research Scientist at the Navy Experimental Diving Unit in Panama City, FL.

Crossword Puzzle Answers

ACROSS:	DOWN:
3. SEV	1. Refraction
4. IEB	2. Tidal
5. Air	7. Absolute
6. Soluble	9. Vertigo
8. Alveoli	10. Conduction
12. CO2	11. Atmospheric
16. POIS	13. Buoyancy
17. Pneumomediastinum	14. Gas Diffusion
19. Narcosis	15. Humidity
22. CO	18. Dalton's Law
23. CNS	20. Caloric
24. Henry's Law	21. Chokes
	25. RQ

Navy Divers, Sailors Awarded for MH-53E Recovery and Salvage

By: Mass Communication Specialist 2nd Class Jared Aldape

Admiral Bill Gortney, Commander, U.S. Fleet Forces Command, presented awards to Sailors and Navy Divers from Mobile Diving and Salvage Unit TWO (MDSU TWO) on February 6th for salvaging last month's downed MH-53E helicopter and recovering a missing aviator.

ADM Gortney also congratulated MDSU TWO on other recent mission highlights including salvaging a downed U.S. Air Force F-16C Falcon off the coast of Virginia in August and searching for a MQ-9 Reaper in Lake Ontario in November.

ADM Gortney presented the Navy and Marine Corps Achievement Medal to a total of 19 Sailors from MDSU TWO including the Area Search Platoon (ASP) for their efforts in locating the MH-53E that went down approximately 20 miles off the coast of Virginia January 8th and to the Navy Divers for recovering the missing aviator and salvaging 95% of the wreckage.

“Thanks for helping us find the ‘what happened’ on the helicopter, and from the family: ‘Thanks for bringing him home,’” he said.

ADM Gortney further recognized the Sailors and noted that because of their hard work, “We can find out what caused it, and put in place mechanisms to prevent it from happening again.” “You pulled up everything we need to find out what happened, so that aircrews who fly can continue to do what they need to in support of our nation. You made that happen.”

The Admiral, a naval aviator by trade, spoke of the importance of MDSU2's salvage operations. “Thank you for your work in pulling up the F-16 Falcon,” he said.

Approximately 40% of the aircraft was recovered including the flight data recorder, also known as the “black box,” and confidential avionics equipment.

VIRGINIA BEACH, VA. (Feb. 6, 2014) ADM Bill Gortney, Commander, U.S. Fleet Forces Command, awards the Navy and Marine Corps Achievement Medal to Navy Diver 1st Class Kevin Jacobs, assigned to Mobile Diving and Salvage Unit 2 (MDSU2), for his role in salvaging last month's downed MH-53E helicopter and recovering a missing aviator. MDSU TWO is an expeditionary mobile unit homeported at Joint Expeditionary Base, Little Creek-Ft. Story in Virginia Beach, VA. (U.S. Navy Photo by Mass Communication Specialist 2nd Class Jared Aldape/ Released)

In November 2013, MDSU TWO ASP deployed to Oswego, N.Y. in search of a downed, unarmed U.S. Air Force MQ-9 Reaper that crashed into Lake Ontario.

“We understand the sacrifices you make, and conditions that you operate in,” ADM Gortney said.

It has not been decided yet if the ASP will resume the search for the MQ-9 in the spring.

Both the MH-53E and F-16C salvage operations were conducted from the rescue and salvage ship USNS GRASP (T-ARS 51). GRASP, one of four Navy rescue and salvage ships owned by Military Sealift Command, is operated by 26 civil service mariners.

ADM Gortney added “I can't thank you enough for letting me come out here and talk to you. Maybe you don't think that we know how hard you work, and maybe you don't think we pay attention: we do.”

MDSU TWO is an expeditionary mobile unit homeported at Joint Expeditionary Base, Little Creek-Ft. Story in Virginia Beach, Va. They previously conducted successful salvage operations supporting TWA Flight 800, Swiss Air Flight 111, the space shuttles Challenger and Columbia, the I-35W Mississippi River Bridge collapse in Minnesota, the Civil War ironclads USS Monitor, CSS Georgia, and recovery of downed F-16Cs off the coast of Italy and Virginia.

Medal Of Honor Statue

By: Iryll W. Jones III

On Saturday, 9 November 2013 the Medal Of Honor Statue was formally dedicated at the UDT/SEAL Museum located in Ft. Pierce, Florida. The two Medal Of Honor Recipients depicted in the statue, Thomas R. Norris and Michael E. Thornton, were present. ADM William H. McRaven, Commander USSOCOM, Mr. H. Ross Perot, and Mr. Ken Reynolds, an NCDU member from the Normandy invasion, were guest speakers.

Mr. Norris and Mr. Thornton were both awarded the Medal Of Honor for their heroic actions during two separate conflicts of the Vietnam War. Mr. Thomas R. Norris was awarded the Medal Of Honor for his ground rescue of two downed pilots Lt. Col Iceal Hambelton and 1St Lt. Mark Clark deep within the heavily controlled enemy territory in Quang Tri Povince, Vietnam on April 10, 1972. Mr. Thomas Norris' actions were dramatized in the movie Bat 21. Mr. Michael E. Thornton was awarded the Medal Of Honor for saving the life of his senior officer Lieutenant Thomas R. Norris during a conflict in late 1972. Mr. Thornton heard his senior officer had been hit and believed dead, returned through a hail of fire, moved his unconscious superior officer to the water's edge, inflated his life jacket and towed him seaward for 2 hours. He was directly responsible for saving his superior officer's life and enabled the safe extraction of all patrol members.

The statue "Swim Buddies" depicts Mr. Thornton carrying his Commanding Officer, Mr. Norris during that day in 1972. The engraving on the four side of the base have inscribed names of all U.S. Navy SEALs awarded the Medal Of Honor, a description of the event depicted in 1972, History of the Navy SEAL Teams and the SEAL Ethos: FORGED BY ADVERSITY.

The funds for the Medal Of Honor Statue were made possible by the gracious donations of Mr. Perot and during the dedication ADM McRaven presented Mr. Perot a certificate as an Honorary SEAL.

Medal Of Honor Statue "Swim Buddies" depicts the event in late 1972 where Petty Officer Michael "Mike" Thornton carrying seriously wounded Lieutenant Thomas "Tommy" Norris to safety.

Photos by Mr. Russell Gibson Photographer for UDT/SEAL Muaseum and Iryll Jones

Mr. Iryll W. Jones III is a retired Navy Saturation Diver who works for Dell Services Federal Government in support PMS391 Submarine Rescue Program.

Mr. Michael E. Thornton (left) and Mr. Thomas R. Norris (right) with Mr. H. Ross Perot after the dedication and presentation of Mr. Perot as an Honorary SEAL.

Medal Of Honor Statue ceremony keynote speakers (left to right) Mr. Ken Renyolds, Admiral William H. McRaven, Mr. H. Ross Perot, Mr. Michael E. Thornton and Mr. Thomas R. Norris.

Navy Divers School NJROTC on the Deep

By: Mass Communication Specialist
3rd Class Randy Savarese

Navy Junior Reserve Officer Training Corps (NJROTC) students from David Crockett High School in Jonesborough, Tenn. learned about Navy Diving from Mobile Diving and Salvage Unit (MDSU) Two Sailors during a dive demonstration onboard Joint Expeditionary Base Little Creek-Fort Story, Oct. 1.

MDSU Two divers volunteered to demonstrate surface-supplied dives and the Seabotix unmanned underwater vehicle to 55 NJROTC students so they can get a sense of what Navy Diving is like and what it takes to get divers in and out of the water.

"I think it's great we're able to show high school students what the Navy has to offer so if any of them wanted to follow this career path they could see being a diver is an option for them," said Chief Navy Diver Rebecca Jones, leading chief petty officer assigned to MDS Co. 2-4.

Jones, who is one of seven female divers in the Navy, offered up some inspiration and advice for the female students who may be considering a career as a Navy Diver.

"The standards for women are exactly the same as they are for men, there is no special treatment for us," said Jones. "Women interested in becoming divers just need to be strong willed and be willing to work really hard, this could be a really rewarding job."

The students also learned about recent salvage operations including MDS Co. 2-4's role in the finding and salvaging of a downed F-16 aircraft off the coast of Virginia, August 6-20. The aircraft was one of two F-16 fighter jets from the 113th Wing, D.C. Air National Guard that clipped wings mid-air during a routine training mission 35 miles southeast of Chincoteague, VA on August 1st.

MDSU 2 is an expeditionary mobile unit homeported at Joint Expeditionary Base, Little Creek-Ft. Story in Virginia Beach, VA, and has successfully conducted salvage operations for TWA Flight 800, Swiss Air Flight 111, space shuttles

Challenger and Columbia, I-35W Mississippi River Bridge collapse in Minnesota, Civil War ironclad USS Monitor, and recovery of downed F-16s off the coast of Italy and Virginia.

Photos By: U.S. Navy photo by Mass Communication Specialist 3rd Class Randy Savarese/Released.

Top photo: Chief Warrant Officer John Sullivan, officer in charge of MDS Co. 2-4, awaits further dive instruction during a demonstration for Navy Junior Reserve Officer Training Corps (NJROTC) students from David Crockett High School.

Sonar Technician (Surface) 2nd Class Sarah Purvis, assigned to Area Search Platoon (ASP) 201, teaches students from Navy Junior Reserve Officer Training Corps (NJROTC) students from David Crockett High School about the SeaBotix unmanned underwater vehicle.

Capt. Walter Francis Mazzone USN (ret)

Capt. Walter Francis Mazzone USN (ret), passed away peacefully at his home in San Diego on Aug. 7, 2014 at the age of 96.

Born in San Jose, California, on January 19, 1918, to Frank and Pearl Mazzone, Walt graduated from San Jose High School in June 1936. He attended San Jose State University where he boxed and played football, graduating in June 1941. Following the attack on Pearl Harbor, Walt enlisted in the Navy in August 1942.

Walt completed two war patrols on USS PUFFER (SS 268). During his first war patrol, PUFFER survived more than 30 hours of depth charging, the longest in submarine history. Walt transferred to USS CREVALLE (SS 291), completing five more war patrols. One patrol involved a classified mission to the Island of Negros in the Philippines to retrieve documents vital to the war effort as well as the rescue of 40 individuals who had been hiding from the Japanese. For his service in World War II, Walt received the Silver Star, Bronze Star with Combat V and the Navy Commendation Medal with Combat V.

In November 1945, Walt returned to California to attend the University of Southern California, School of Pharmacy. He met and dated Lucie Margaret Oldham, a school teacher and proposed in May 1946. They were married on June 29, 1946.

Walt graduated from USC in June 1948 with his Doctor of Pharmacy degree and worked at his uncle's pharmacy in San Jose, Calif. Their only child, Robert, was born in March 1949.

Recalled to active duty in Nov. 1950, Walt was sent to Yokosuka, Japan and assigned to the Navy hospital. Upon his return to California, Walt was transferred to the Pharmacy Procurement Division, Brooklyn Navy Yard, Brooklyn, N.Y.

In 1957, Walt was transferred to the Naval Medical Research Laboratory (NMRL) in New London, Connecticut. Walt joined with DR George Bond in efforts to enhance Navy Diving capabilities. Their efforts culminated in a series of manned chamber dives which proved the theory of Saturation diving and led to the Navy's Man in the Sea Program. This program involved open ocean dives which were known as SEALAB I and SEALAB II. As Project Officer for these challenging dives, he was responsible for the divers' safety and they affectionately referred to him as "Uncle Walt." Walt was awarded two Legions of Merit for the successful accomplishment of these dives proving that man could live and work underwater.

Walt was also involved in efforts to improve escape from sunken submarines. Working closely with Lt. Harris Steinke to develop a new submarine escape device, Cmdr. Mazzone and Lt. Steinke successfully escaped from the USS BALAO (SS 285) submerged at a depth of 318 feet – a record at that time.

Walt retired from the Navy in June 1970, and returned to San Diego where he and Lucie moved into their dream home overlooking Mission Bay. Walt worked at the Ocean Systems Center in Point Loma, Calif., for the next 10 years, then left government service to work at Scientific Applications International Corporation (SAIC) as a Program Manager until his retirement in 2002 at the age of 84.

After retiring from the Navy, Walt and Lucie traveled extensively, including several cross country trips in their motor coach. They were members of the Family Motor Coach Association and Walt became well- known for parking motorhomes at these events taking special delight helping those with physical challenges.

Walt was a true Renaissance Man. He attended Harvard from 1963 to 1964 earning his Master's in Public Health. He also taught himself how to repair antique clocks, learned to play the guitar and piano, and became fluent in Japanese. However, Walt found his true passion in Stained Glass projects and his Stained Glass Submarine Dolphins and Diving Officer Insignias became legendary. While he had fun making various glass projects, his greatest joy was watching the reaction of those who received them.

Walt was preceded in death by his beloved wife, Lucie, who passed away in October 2012 after 66 years of marriage. He is survived by his son and his wife, Capt. Robert and Nancy Mazzone USN (ret), of Escondido, California, two grandchildren and their spouses, Margaret Pearl and William Clifford of North Hampton, N.H., and Michael Robert and Ashley Mazzone of Bristol, Rhode Island, and five great grandchildren – Caroline Clifford, Josephine Clifford, Annabelle Clifford, Elias Mazzone and Callen Mazzone. He is also survived by his two sisters-in-law, Mary Schaffer and Sue Anderson, both of Los Angeles, as well as numerous nieces, nephews and cousins.

Walt was a humble and quiet man who lived life to the fullest and believed that the greatest joy was achieved in helping others. He will be greatly missed.

The Old Master

Fellow Deep Sea, it's my privilege to be writing this Old Master article. I hope you will get some benefit from reading it. These are my beliefs gained through experience and this is my chance to share them with you. The first thing I'll tell you is that as a Navy Diver you have the opportunity to gain a more diverse experience than any other community in the Navy. No other rate can match our variety of assignments as outlined in our career progression and the broad view of the Navy we gain by following it. Embrace this chance to learn, both good and bad, from the different types of duty you perform as a Navy Diver. One of my beliefs, after working in a wide variety of commands is that we have the best Sailors in the Navy. Yes this is cocky, but not naive. I've worked with the other communities and I know.

NDCM(MDV) Brian Pratschner

What cements my belief that Navy Divers are better? Our long history of mission completion. Quite simply we get the job done. We are usually are called when something bad happens. Ship ran aground, jet crashed, emergent ship or submarine repair, or a diving accident requiring recompression treatment. When we are called, trying hard is never enough. We have to complete the job; and we do! This is my analogy of Navy Diving success. A three legged stool held up by time tested truths.

1st leg. Equipment Adequacy. Every critical piece of gear we use is either on the Authorized for Military Use (AMU) list or is Certified by NAVSEA 00C4. Our equipment is maintained by strictly following the 3M program and system certification guidelines of Re-Entry Control Procedures. These efforts insure that when we show up to a job we will be able to go to work and not hope our equipment is operational. The bottom line is our gear works.

2nd leg. Procedural Compliance. Adhering to established procedures separates us from any other diving force. Every diving day we follow a deliberate, planned process for preparing and completing our work. From the simple R-Check sheet and Dive Sup pre-dive checklist to often complex diving system Operating Procedures. Our discipline to follow procedures is vital to our success.

3rd leg. Training and Qualifications. This is the single most important element of our success. Without a qualified crew nothing else matters. Our focus must be on maintaining the best trained and qualified divers. Each of us is reasonably expected to be qualified to the highest watch station achievable. You should always be working on your next qual. With the exception of the Master Diver, I believe our Diving Supervisors are the most important element of any dive mission. Once you have achieved the position of Diving Supervisor you have a responsibility to those below you to insure they are properly trained and qualified.

Like a three legged stool, if you take away one leg, the stool is unstable and may fall. Take away two legs and the stool will crash. Reading diving mishap reports always reinforces this point.

The only constant in life is change. There has been a lot of change in the recent past but I believe the biggest changes for us, Navy Diving, will be in the near future. It is up to command leadership to pass the word and insure all hands understand these changes and more importantly how they will effect you. Divers have always adapted to the different missions and environments in which we work. Adapting to change is no different. Understand the environment, adjust your plan and complete the mission.

Working with the Marine Corps I picked up a belief and saying the Marines have. It goes like this, "America doesn't need the Marine Corps, we have the Army. America wants the Marine Corps because Marines do it better." This attitude, chip-on-the-shoulder belief that Marines do it better is evident when you work with them. Navy Divers need to have this attitude. We need to understand someone will do the work, it should be us. We need to be aggressive about seeking more responsibility, more jobs and always strive to expand our community. If you're not growing, you're shrinking. We should always be the first choice for any underwater operations.

Our legacy was built over generations. Embrace it, be proud but never complacent. It's our job and privilege to maintain and expand this legacy of excellence. Never fear the future or let the naysayers shake your belief in Navy Divers. As long as we stay motivated, work hard and overcome all challenges Navy Divers will be the force of choice. I know we will because that is what we have always done.

Hoo-Yah!

SUPDIVE SENDS ...CAPT Dan Shultz

As each of you are aware, Navy Diving lost several Shipmates over the past two years. Due to the number of fatalities over the past decade the CNO established the Diving Operational Assessment Integrated Project Team (DOA IPT) to take a look at how we do our business and to help ensure we are doing everything we can to be safe and to honor our covenant as leaders and Divers within each of our communities. The DOA IPT consisted of a team of 86 SMEs from across the Navy diving community, collaborating to deliver 112 findings and 90 recommended actions. The group concluded our supervisory accountability is predominately effective; however, some specific areas warrant our focused attention. These include decision-making by our command leadership and Diving Supervisors; how we assess the operational readiness of our diving commands; how we plan dive missions and manage operational risk; diving mishap and near-mishap reporting; and our application of lessons learned throughout the force.

The IPT did an excellent job characterizing where we need to improve and produced a comprehensive long-term plan that is already underway. You should begin seeing the impact of some of those changes immediately. One high priority short-term action already completed was the release of Diving Advisory 14-05 MISSION PLANNING AND ORM FOR NAVY DIVING, AIG 14-05, which emphasized Navy ORM training and readiness requirements, and provided additional interim guidance for dive planning and ORM. Since that AIG release, your positively aggressive leadership in the area of ORM, across Navy Diving, is to be commended! Well done! NAVSEA 00C is continuing development of the Mission Planning and ORM Handbook to further support you in this objective. The handbook will translate mission planning-to-ORM-to-diving, specifically hazard analysis, and provide a guide for dive-related mission analysis. When delivered, diving commands will have a valuable resource to conduct mission planning and ORM, which will help enable safer and more effective training and real-world operations.

Additionally, the revision of OPNAVINST 3150.27, Navy Diving Program, is underway in two phases; an interim change and a formal instruction change. The revision of OPNAVINST 3150.27 will address command dive bill requirements, proficiency standards, operational readiness inspections, application of lessons learned, composition of diving safety investigation boards, and the minimum duties, responsibilities, and authorities of our Diving Officers, Master Divers, and Diving Supervisors.

At the heart of every dive in the Navy lies the tactical and technical guidance and requirements of the U.S. Navy Dive Manual. Revision Seven of the Navy Diving Manual will include, among other things, revised guidance for near-mishap and mishap reporting, mission planning and ORM, breath-hold diving, and air capacity and consumption calculations. Overall, you should expect to see a reduction in direct “must-do” language and an increase in language which gives you guidance. Rules are always fundamental and key to our understanding of how to operate and train safely and successfully. However, this revision will be more “guidance-focused” with an effort to return more control, responsibility and trust to the Commanders and you, their Operators and Divers. Your mission analysis, planning, and ORM – ultimately, your critical decision-making - remains essential to mission success. This revision of the manual will place greater emphasis on you, your individual and collective leadership, and your knowledge of the craft and art of diving.

This group of Navy Diving Leaders and experts, the IPT, identified that Navy Diving must operate better as a learning organization. We need to boldly identify and analyze all of our diving near-misses to better understand our pre-accident indicators, and then apply the lessons learned to improve our processes, procedures, and training. Currently our “leading indicator” that a problem exists, potentially leading to a Class-A mishap, lags well behind our time to effectively observe and make decisions. We are operating where we are too easily potentially blind to the accident coming. We cannot afford to operate in that area where we “presume” that because everything seems to be going well that all will continue to go well. Certainly not to the point where we have already lost a Shipmate…and a Diver loses their life. We are far better leaders, managers, operators and Divers than that story would tell. We will boldly get out in front – that is the Navy way and will continue to be so. We owe it to those that lost their lives, and to their loved ones, and to each other, to foster a positive reporting culture which promotes the identification of problems and near-mishaps before a mishap occurs; without fear of reprisal or attribution. Navy diving leadership is committed to this goal – this requirement.

A pending change to OPNAVINST 5102.D, the Mishap and Safety Investigation Manual, will revise mishap and near-mishap reporting for all diving and hyperbaric operations to help maintain our place as the most capable and safest Divers in the world. This change will also bring our diving centers of excellence (Navy Supervisor of Salvage and Diving, Navy Experimental Diving Unit, Center for Explosive Ordnance Disposal and Diving, and Naval Special Warfare Center) into the reporting process to analyze mishaps and near-mishaps and better integrate lessons learned in diving doctrine, policy, training and operations. Our Divers, you, in all pillars of the Navy diving capability set, are a national asset and a national treasure. Our standard is to ensure you, the Navy Dive Team, are capable of sustainable, repeatable, safe diving with unparalleled mission success. We can go a long way to ensuring that legacy through a positive culture where safety is addressed across a broad spectrum of reporting processes with engaged leadership at all levels, from the Deckplate Sailor, to the Type and System Commanders, to the Task Force and Fleet Commanders.

We, who had the privilege to contribute directly to the Diving Operational Readiness IPT, thank you for your leadership, professionalism and courage every day out on your dive side. We are confident that you will embrace these changes and lead the charge as we continue to move out in this vitally important endeavor.

DIVE SCHOOL GRADUATES 2014

14-10-DMO
LT COSTELLO, BRANDON M
LT FINNE, HUCKELBERRY A
LT FINNERN JR, MICHAEL T
LT HEAL, JARED K
LT HIGHT, MICHAEL H
LT KENNERLEY, BRIAN J
LT KINNEY, BRADLEY J
LT KOCH, ERIC J
LTJG MORI, HITOSHI
LT MOSS, NATHAN A
CPT ROLSTON, PAUL H
LT RONEY, NICHOLAS G
LT SANOU, ALIYE Z
LT STORY, SCOTT G
LT ZIMMERMAN, WADE A

14-10-MEDO (USCG)
ENS BILOTTA, MICHAELA N
ENS BYERS, PATRICK C
ENS HARSH, RILEY J
LTJG HONAN, STEPHEN G
ENS JOHNSON, MAXWELL D
ENS MALONEY, COLIN J
ENS QUADRINO, WILLIAM A
OCUI2 VIUF, JOHN S

14-10-MEDO (NAVY)
LCDR HIRSCH, CHARLES Y
LT KHESHTI, PUYAN A

13-70-CG2C
SN MCGANN, KYLE P
MK3 QUIGLEY, BRIAN R
MK3 ROBB, JESSE W
SN RUGA, ANDREW

14-20-AFCDC(CC)
A1C APPLE, JOSHUA
CAPT BEARDEN, ERIK A
A1C BENTON, ROBERT C
2LT BLASDEL, ZACHERY
2LT CLECKLER, JAMES
SSGT DAVIS, AARON
A1C DIAZ, ERICK
A1C EDWARDS, CHARLES
A1C EDWARDS, PATRICK
1LT EPSTEIN, KEVIN
SSGT HENSEN, TYLER
A1C HOUSTON, MITCHELL
A1C KAUFFMAN, MICHAEL
A1C MAUER, JEFFREY
SRA NEWTON, MATTHEW
CPL NOVAK, JARAD P
SRA SMALL, MATTHEW
A1C SMITH, JOSHUA
2LT WHITTIER, KYLE

14-30-1C
ND2 CASH, CODY M
ND1 CUCHENS, GREGORY K
ND1 DOJAQUEZ, ZACHERY D
ND1 EIDE, STEPHEN T
ND1 FOOS, SETH W
ND1 LUOMA, WADE A
ND2 REEDY, MICHAEL E
ND1 RUSSO, THOMAS J
ND2 RUSSO, ANTHONY A
ND1 VANVALKENBURG, LANDON

13-70-EOD
SN ALLEN, MATTHEW J
ENS CLARK, ANDREW R
SN JONES, JONATHAN P
SN MITCHEL II, ERIC V
ENS PATANE, STEPHEN V
SN PAZDUR, MATTHEW M
SN RICKENBAUGH, KURT A
SN RUIZ, ABRAHAM J
SA SASSMAN, CHAIM A
SN SHIELDS, BENJAMIN J
SN THOMSEN, TYLER J
SN WASARHALEY, ROBERT E
ENS FERRIS, JONATHAN C
ENS GALLUCH, DAVID L
ENS OREGAN, STEVEN F
ENS WASZ, ANDREW J

14-20-AFCDC(OC)
MD AMEDIA, SAMIEL I
A1C APPLE, JOSHUA
A1C AREVIAN, GARRETT A
CAPT BEARDEN, ERIK A
A1C BENTLEY, STEVE L
A1C BENTON, ROBERT C
2LT BLASDEL, ZACHERY
A1C BURNETT, CHRISTOPHER M
2LT CLECKER, JAMES
A1C DIAZ, ERICK
A1C EDWARDS, CHARLES
A1C EDWARDS, PATRICK
SSGT HENSEN, TYLER
A1C HOUSTON, MITCHELL
A1C HUDSON, TODD E
AB JOBE, DONALD W
A1C KAUFFMAN, MICHAEL
A1C MATHES, DAVID V
A1C MAUER, JEFFREY
SRA NEWTON, MATTHEW
CPL NOVAK, JARAD P
A1C OFFNER, ALEC
A1C SECORE, ADAM R
SRA SMALL, MATTHEW
A1C SMITH, JOSHUA
A1C SODERLUND, PATRICK E
A1C TOLDEO, JASON M
A1C VANNORSDALL, LUCAS M
A1C VINEHOUT, JAY A
2LT WHITTIER, KYLE
AB WINKLER, ANDREW
A1C ZAMBIK, JAMES M

14-10-MDV
NDC SCHAPPERT, DONALD J

14-20-MDV
NDCS COOPER, MARK E
NDCS JACKSON, DANIEL P
NDC KING, JEFFERY H
NDC MILLEN, JOHNATHAN L

14-30-MDV
NDC COOK, JASON M

14-30-AFCDC(OC)
2LT ADAGIO, NICHOLAS J
SSGT ADAMS, SCOTT
A1C BOWERS, MARK
2LT BOYD, SHAYNE J
2LT BYRNE, JAMES G
A1C COBB, MACKENZIE
AMN COX, BRIAN E
A1C DUISTERHOF, SAMUEL J
LSSN FANTAUZZI, JOSEPH A
GM2 FELICE, CARL A
2LT GAGNON, COLIN W
A1C GUEFFROY, JONATHON
A1C GUZMAN, MICHAEL
A1C HEATON, WILLIAM
A1C HERNANDEZ, JORGE
AB HILTON, HUNTER C
SRA HOINESS, NATHAN E
A1C HUNTER, JOHN M
A1C LLOYD, MATTHEW
A1C MACHESKY, CALEB
A1C MCGRIFF, MARCUS T
A1C MEADE, CHASE M
A1C OHEARN, SEAN
A1C PICKARD, AARON Z
A1C POLLOCK, TAYLOR
SRA SCHLANK, JOSEPH
A1C SULLIVAN, NATHAN
1LT THEOLOGIS, HARALAMBOS B
AMN TISCHLER, JOSHUA F
SSGT URTEAGA, JAVIER
A1C WALLACE, EVAN M
A1C YANAGIHARA, KENDALL T

14-30-AFCDC(CC)
A1C DALTON, DANIEL G
A1C FERCH, AARON R
A1C FERCH, CALEB A
A1C FERNANDEZ, JOSEPH K
2LT GOUGE, JARRETT E
A1C HILL, MICHAEL J
A1C OSTERDYK, ALSTON C
2LT PIERSON, ANDREW
A1C PLOSCHNITZNIG, JOSEPH D
SSGT TEAGUE, RYAN M
CAPT WALSH, CHRISTOPHER D
A1C WETZEL, CHRISTOPHER M

14-30-AFCDC(CC)
SSGT ADAMS, SCOTT
A1C BOWERS, MARK
A1C COBB, MACKENZIE
LSSN FANTAUZZI, JOSEPH A
GM2 FELICE, CARL A
A1C GUEFFROY, JONATHON
A1C GUZMAN, MICHAEL
A1C HEATON, WILLIAM
A1C HERNANDEZ, JORGE
A1C LLOYD, MATTHEW
A1C MACHESKY, CALEB
A1C OHEARN, SEAN
A1C POLLOCK, TAYLOR
A1C SULLIVAN, NATHAN
SSGT URTEAGA, JAVIER
A1C WALLACE, EVAN M

14-10-AFCDC(OC)
AB ALVARADO, DAVID T
A1C BENAVIDES, ANDRES I
A1C CHAVEZ, NESTOR J
A1C DALTON, DANIEL G
A1C FERCH, AARON R
A1C FERCH, CALEB A
A1C FERNANDEZ, JOSEPH K
A1C FISHER, COLIN J
2LT GALLOWAY, MITCHELL G
A1C GALVAO, STEVEN A
2LT GOUGE, JARRETT E
A1C HILL, MICHAEL J
1LT JAIME, JARED M
A1C KELLYSTRONG, JACOB R
A1C LONGNECKER, JOSHUA
A1C OSTERDYK, ALSTON C
2LT PIERSON, ANDREW
A1C PLOSCHNITZNIG, JOSEPH D
A1C POLITO, COREY
A1C POLITO, COTY
SRA ROGOWSKI, EVAN J
A1C STANTON, NICHOLAS L
AB TASKER, TYLER J
SSGT TEAGUE, RYAN M
A1C VALEICH, MICHAEL J
CAPT WALSH, CHRISTOPHER D
A1C WETZEL, CHRISTOPHER M
A1C WOLTZ, STEVEN R

14-10-1C
ND1 CARVER, KIMBERLY H
ND1 COLFORD, STEPHEN M
ND2 COLVIN, SCOTT D
ND2 DEMAY III, BOBBY G
ND1 FINKEL JR, JEFFREY M
ND1 JOHNSON, ROBERT M
ND1 LESNOCK, WILLIAM R
ND2 MARTINEZ, TIMOTHY T
ND2 SMITH, KYLE J
ND2 WALSH, TODD M

DIVE SCHOOL GRADUATES 2014

14-10-ARC
HM2 DUHAIME, JOSIAH P
HM2 FRANCOM, MICHAEL T
SA LOUD II, KEVIN R
HM2 NAKONECZNY, MICHAL P
HN PEAD, JOSEPH D

14-20-1C
ND2 ARNOLD, RYAN D
ND2 BALAVRAM, JASON S
GM2 CARTER, ALVIN T
ND2 GREEN, CHRISTOPHER R
ND2 LIGHTNER, SAMUEL R
ND2 MCCULLOUGH, WILLIAM W
ND2 MURPHY, ANDREW C
ND2 PEGLOW, JONATHAN R
ND1 SEIJA, ANTHONY G
ND2 THOMASON, JOHN M
JMTHOMASON0002
ND2 TRAUTMAN, MATTHEW R

13-80-EOD
SA ABEL, MICHAEL T
SN CONTE, MATTHEW F
SA DOVE, ANDREW M
SN FLOWERS, LANCE B
SN FRANKOVITS, EVAN W
SN GREENSPAN, ALEXANDER M
SN MCKAY, TYLER K
SA METTLER, NICHOLAS B
CTT2 MOODY, SCOTT G
ENS ROWE, SCOTT S
SN SHECTERLE, JEFFREY P
SN TARASSOV, PETER G
SN VRIENS, BRANDEN M
SN WALLACE, BRYAN G

14-10-EOD
SN AVERY, STEPHEN R
GM2 BETTS, JOSHUA M
SA DUCKER, JEREMY J
GM2 GANSMANN, JEFFREY M
SN GREY, SETH M
SN HORNER, ADRIAN E
SA JANSSENS, BLAKE A
SN KARLS, NATHAN J
SN LONG, ZACHARY T
SA MINARDI, ANDREW S
SN MINTZER, JEDIDIAH I
SN MUNIZ, ERIK R
SN NEWMAN, HILLARY V
SN OTTELE, JEFFREY S
SA RICE, TIMOTHY C
SN RODE, ALEXANDER M
SA ROHRBECK, DAVID A
SN ROY, JOSEPH R
SN SULLIVAN, MATTHEW D

14-20-EOD
SA CHIAPPERINO, DOUGLAS J
SN HURST, MATTHEW W
SN LATHROP, GARRISON N
SN MORFOGEN, JOHN F
SA NICOLETTI, BROCK D
SN STONEY, WILLIAM J
SA SYRING, JACK I

14-30-EOD
SA BERTOZZI, DANIEL D
SN FONTENOT, NICHOLAS T
SN FRANDSEN, BEAUDEAN J
SN GARBER, DYLAN R
SA GLIDDEN, MAX A
SN HOLBROOK III, CLAYTON M
SA JEZIOROWSKI, JACOB J
SN MALAK, CHRISTOPHER J
SN PAUL, LONNIE W
SN RAGSDALE, ZACHARIAH D
SA ROMAN, NICHOLAS O
SN SCALLY, SEAN D
SA WINSLOW, JUSTIN K

14-40-EOD
SA BORDERS, CODY M
SA BOX, KRISTEN N
SN BROWN, BRADLEY J
SN HAWKINS, BRANDON A
SN JACOBSEN, MATTHEW F
SA MOYNIHAN, DYLAN J
SN PATRICK, DANIEL B
SA PETERS, ANDREW J
SA RUEBEL, BROCK E
SA SANFORD, STEPHEN B
SA SHALALA, SAMUEL J
SN ULATOWSKI, RICHARD J
SN WAGAMAN, DWIGHT V
SA WEBER, WESLEY R
ENS BILOTTA, MICHAELA N
ENS BYERS, PATRICK C
ENS GRAY, GARRETT L
ENS HARSH, RILEY J
LTJG HONAN, STEPHAN G
ENS JOHNSON, MAXWELL
ENS MALONEY, COLIN J
ENS QUADRINO, WILLIAM A
ENS QUINN, DANIEL

13-70-DMT
SN JORGENSEN, THOMAS C
SN MURPHY, ROBERT C
SN PEERY, ADAM K
SA STOVER, ANDREW T

14-20-AMDV
SFC DUNHAM, JEB J
SFC FORKHAMER, JAMES J
SSG KRATSAS, CHRISTOPHER M
SFC SHULTS, ERIC J
SFC WULCZYNSKI, JOSEPH R

13-70-MCD
SGT BALDRIDGE, MICHAEL
HM2 BENNETT, JASON W
HM1 BOHAN III, JOHN E
SSGT CAMPBELL, DEMETRIUS
SSGT CARSTENSEN, JACOB A
CPL CURTIS, TYLER W
GYSGT DOWD, CHRISTOPHER J
HM2 DUHAIME, JOSIAH P
SGT FOWLER, NEVIN T
HM2 FRANCOM, MICHAEL T
SGT FRANQUEZ JR, OSCAR
SGT HALL, WILLIAM P
SSGT HARRISON, MATTHEW A
SGT HULS, WYATT D
CAPT JOHNSON, JEROMY R
LTJG KEHAYA, JAMES W
SSGT KOZLOWSKI, JAMES H
SGT KRAUSEN, JAMES M
CPL LAMBSON, CODY L
SGT LAPPIN IV, JOHN M
HN PEAD, JOSEPH D
SGT RICKSECKER, JONATHAN P
TSGT SEVY, JACOB D
SSGT SLAUGENHOUP, NATHANIEL
HM2 STEPHENS, IAN P
SGT STONER, CHRISTOPHER D
SGT TANNEY, DAVID J
SGT URSO, ROCCO A
CPL VARGAS, JONATHAN
CAPT VAUGHAN, LOGAN M
SGT WEINER, ERIC D
MAJ ZAVALA, FRANCISCO X

13-80-ARC
SN BRUSHERD, JONATHAN D
SSG CHRISTENSEN, TROY C
HN DELEEUW IV, ANDREW M
HN DIRCKS, BLAKE A
HM2 FARRELL, RORY J
HM2 NORRIS, SAMUEL C
HM2 PEREZ, JOSHUA A
HN QUINTERO, ARBEY A
SN RINTAMAKI, JEFFREY D
HM2 ROJAS, THOMAS R
SGT STULL, RICHARD W
HM2 VIENOT, LUCIEN A
SN VIPPERMAN, NICHOLAS B

14-10-MCD
HM2 ATALLAH, ROY T
HM3 BARAJAS, JORGE M
SSGT BARKER, STEPHEN A
CAPT BOGLE, JEFFREY R
A1C BOLLING, COLIN A
SGT BRADLEY, HUDSON D
SA DAPPER, BRANDON J
CPL FERNANDEZ, LUCAS R
SGT GREENE, JASON T
SSGT HARMON, JULIAN A
A1C HOOPER, AUSTIN R
SRA JENSEN, ETHAN M
SGT KNIGHT IV, JAMES C
SN MCGRATH, WILLIAM A
CPL MOUSSAVI, DARIUS J
2LT OGREN, CHARLES T
SGT PAULSON, RYAN M
CPL RING, TYLER F
CAPT RITTER, MORGAN T
1STLT ROMANS, DANIEL A
SSGT SANTOS, DANNY S
SRA SCHREINER, JOHN J
SSGT SMITH, DANIEL M
CPL THORPE, DEXTER R
CPL TOBLER, ASHTON J
SSGT WADE, JOSEPH
CPL WALKER, RYAN E
SGT WASHINGTON II, AVERY
SGT WEESE, DALTON J
CPL WRIGHT, ANDREW M

14-20-MCD
SN BALICE, JOSHUA P
A1C BROWN, DEREK D
HM3 CALLICOAT, DANIEL J
SGT CHAPMAN, TYLER D
A1C CHARTERS, LUKE P
SN DAVIS, JORDAN P
SSGT DRAHER JR, DANIEL A
SGT ERBE, CHRISTOPHER R
SA GARCIA, KEVIN X
A1C HAYNES, ALLAN M
CPL KASSINGER, ANTHONY M
LCPL KAVEL, JOSEPH E
CPL LEAPHART, TAYLOR W
CPL LIU, EVAN W
SN MANNION, LEE P
SA MESTAS, ROBERT L
SN MILLER, KYLE C
LCPL MIMS, SHAWN E
SN MITCHELL, NATHAN R
HM2 NEADING, RICHARD D
SA NOLL, BLAKE J
SGT NUNNALLY, JACOB
LCPL OH, YOUNG J
HN PATTON, CODY R
CAPT PERRY, MATTHEW T
MA2 RICE, ANSON T
HM3 RIVERA, BRICE A
LCPL ROBERTS II, ERIC R
HN ROGERS, STEVEN R
CPL RUMLEY, PHELAN M
SA SANTOS, CHRISTOPHER S
CPL SCHMITZ, STEVEN L
LCPL SIPPEL, RYAN C
SGT TANTINARAWAT, JONATHAN
CAPT WRIGHT, JEFFREY D

DIVE SCHOOL GRADUATES 2014

14-30-MCD
CPL BARBOSA, MARIANO L
CPL BEACH, TYLER R
CPL BLACK, KYLE R
SN DAVIS, KYLE A
CPL CASILIO, CHRISTOPHER M
SGT FERGUSON, ZACHARY D
CAPT FROMM, BRADLEY C
CPL GARCIA, CODY V
CAPT GILREATH, PHILIP T
CPL GRANT, MICHAEL J
PFC HANSEN, JAKE H
CAPT HOWARD, ALEXANDER D
GYSGT ISKRZYCKI, IRENEUSZ
GYSGT MORRILL, ROBERT W
LCPL NATTO, CHRISTOPHER E
SGT NEWELL, DANIEL C
SSGT PERRYMAN, ANDREW Q
SGT RITTER, KRISTIAN P
SGT SCHMITT, MARTIN E
SGT SHARP, DEREK W
LCPL TRAMMELL, CONOR C
LCPL WILKINS, SEAN M

14-20-ARC
HM2 ATALLAH, ROY T
HM3 BARAJAS, JORGE M
SA DAPPER, BRANDON J
HM3 GARDNERDEBEVILLE, LOUIS
HM2 KITCHENS, RYAN D
SN MCGRATH, WILLIAM A
SGT SIMONES, NICHOLAS P

14-30-ARC
SSGT FORD, DAVID J
SSGT SWITZER, TYE D

14-40-ARC
SSGT ALLEN, ANTHONY I
SN BALICE, JOSHUA P
SA GARCIA, KEVIN X
SN MILLER, KYLE C
SN MITCHELL, NATHAN R
HM2 NEADING, RICHARD D
SA NOLL, BLAKE J
HM3 RIVERA, BRICE A
HN ROGERS, STEVEN R

13-30-UCTB
CM2 LEMARBRE, IAN F
EA2 SAUCEDOGOMEZ, JESUS A

14-10-UCTA
CM2 BUCKETT, TREVOR A
BU2 HAWTHORNE, JOSEPH L
BU2 PROMISE, KHIARO M

13-60-2C
ND3 BOLLINGER, ZACHARY T
NDSN COUNTIE, KEVIN E
NDSN GAULT, HARMON F
ND3 GRUBB JR, MARK S
NDSN LANPHEAR, ZACHARY A
ND3 MOSS, CODY L
ND3 WARD, JAMES P

13-70-2C
NDSA BOYD III, ROBERT J
ND3 CARLSON, ANDREW M
SN HELBING, NATHAN T
ND3 HUMPHRIES, CHRISTOPHER
NDSN JOHNSON, TRACE C
SA LYDDY, MATTHEW
EM2 MORRISON, THOMAS M
ND3 SKONIESKI, CONNER L
NDSN SMIDT, PRESTON L
ND3 STIKELEATHER, CODY A
ND3 VARNER, TREVOR H

13-80-2C
SA AMBERSON, JOSHUA D
SN BENTON, DALLAS A
SN COOPER, NICHOLAS S
SN GRANTHAM, CLINT A
SA HADEN, DOUGLAS P
SN REZNOWSKI, MARCUS P
SA SHIELDS, WYLIE C
NDSA VALDEZ, ALAN M
SN WALLACE, FRANCIS L

14-20-2C
SA ADAMS, BRANDON T
SN BORGES, BLAKE W
SN GRAY, DEVIN L
SN HAMOUS, DIRK A
SN HELM, DAKOTA J
SA LINDLEY V, JAMES R
SA MARTURANO, ANTHONY P
SN ORMONDE, FRANK T
SN PETERSEN, CHRISTOPHER M
SA RYDBERG, KYLE R
SN SCHOUWEILER, GRANT S
SA TURNER, ANDREW D
SN VUILLER, IAN A

14-20-SCUBA
EM2 ARISUMI, CODY
SN CAPPOLA, MICHAEL E
ETSN DELANO II, DANIEL W
MMFN DUFFIELD, TRAVIS A
LT EUCKER IV, WILLIAM
MM1 GRIGER, EDWARD J
LSSN MALDONADO, HECTOR J
ET3 MASTERSON, JAY M
MC2 MIDNIGHT, BLAKE R
STSSN MONNIER, ANDRE J
CS3 MOTLEY, MITCHELL L
MMFN NEWMAN, JAKE V
ET3 NORTON, JOSHUA C
LTJG PELLETIER, NATHANIEL S
MM1 PENNINGTON, ZACHARY D
GS13 PIETRUSZKA, ANDREW T
STSSN SOKAL, ALEXANDER M
ET2 VINCENT, JAMES S
MM2 WEISS, IAN C

14-30-SCUBA
ENS BARNES, KENNETH R
ET3 BRODWATER, KYLE B
YNSN BRUNNER, CHRISTOPHER J
MM2 CALLAHAN, SEAN P
MC1 COTE, BRETT P
ENS CRANE, ROBERT J
CS3 DONELSON, AUSTIN B
MM2 EDRADA, DANIEL J
ETSN FOREMAN, PATRICK C
MM2 GERHARDS, MITCHELL A
ET2 JONES, CHRISTOPHER A
ENS KECK, BRYAN C
ENS LUFFEL, PAUL C
LSSN MALLORY, SHAWN P
CIV MARONDE, PETER
MM2 MORRIS, MATTHEW C
MM2 REDMOND, SHAUN M
ET2 STRINGER, ANDREW D
STS2 TOPE, DANIEL W
ENS WILKINSON, ANDREW K
BM1 ZELLA, MICHAEL R

14-40-SCUBA
MM1 BOHARSIK, MICHAEL S
CTTC BROOKS, BENJAMIN D
ET3 BYLOTAS, NICHOLAS D
ENS CARLSON, ADAM N
STS3 DAVIS, PAUL W
ENS DEMING, IAN J
LT KREUZBERGER, CHARLES M
SN MELMAN, ZACHARY S
CS2 MOSER, TREVOR C
ET2 NELSON, KYLE T
ENS NESTER, ALEXANDER D
YNSN OPITZ, ERIC D
MM2 REYNA, JASON A
MMFN SEDGHIMASOUD, KRISTOPH
MM3 SHILLINGTON, GIANCARLO
ET2 SISTO, DOMINIC J
ET1 TAPLEY, CASEY R
FT3 WARTA, IAN R
ETSN WARWICK, COLIN S
ET2 WILLIAMS, JUSTIN H

14-10-A2C
PV2 BIBLE, FRED L
PFC CONDRAC, NATHAN R
PV1 FLORIDA, KELLY D
PFC REYNOSO, CHRISTOPHER H
PFC RITZ, MICHAEL F

14-10-UCTB
CM2 DEDELVA, TRISTAN C
AOAN RODRIGUEZ, JOSEPH R

13-20-UCTA
CE2 DAILEY JR, TIMOTHY D
BU1 WEDEKIND, DONALD G

14-50-SCUBA
ENS ANDERSON, AUGUSTE W
ENS CASSIDY, PATRICK D
ET2 DELORENZO, KENNETH J
ET3 GASBARRO II, ANTHONY
FN GERBIG, CHRISTOPHERSHAN
MT3 GORMAN, TIMOTHY C
EM2 GUNNING, JENSEN J
ENS LEUTERMANN, MAXIMILIAN
LTJG MOORE, JOHN R
SN ROLSTON, DANIEL P
FN SCOTT, ZACHARY T
ETSN STOKLOSA, DEREK M
FTSN TREVINO, CHRISTOPHER
MM2 WENSON, JORDAN L

13-80-DMT
SN BRINSON, DAVID B
SN DAVIDSON, CHRISTOPHER L
HN KELLER, JOSEPH A
SA LANCASTER, LIAM P
HM2 LANIER, CHRISTOPHER L
HMC LOVING, CHRISTOPHER R
SA MADSEN, CONNOR J
SN REDIFER, DANIEL G
SN SONNTAG, ERIK M
SN TURNER, MORGAN C

14-20-DMT
SN ADKINS, COLBY C
SN KENYON, JOSHUA D
SN SCHMIDT JR, JOHN B
SA SCHOMER, LUCAS R
SN WARD, CHRISTOPHER J

13-30-A2C
PV2 AUDET, EOIN M
PV1 BANNAN, KILEY G
SPC HERRINGTON, STEPHANIE N
PV2 HOWELL, LINCOLN D
PFC MOORE, JESSE D
PFC RAMIREZ, JORDAN J
PFC RODRIGUEZGONZALEZ, CES
SPC SAUSERGREEN, DEREK A
SPC WALCOTT, WILLIAM C