

# **APPENDIX C**

## **COMBAT SWIMMERS BACKGROUND**



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**LIST OF ACRONYMS AND ABBREVIATIONS**

CB	construction battalions (SeaBees)
DA	direct action
EOD	Explosive Ordnance Disposal
fsw	feet of seawater (depth)
IED	improvised explosive devices
NCDU	Navy Combat Demolition Units
SCUBA	Self-Contained Underwater Breathing Apparatus
SEAL	Sea, Air, And Land (Navy Special Warfare personnel)
SOF	Special Operations Force
SR	special reconnaissance
U.S.	United States
UDT	Underwater Demolition Team

## **1.0 HISTORICAL OVERVIEW**

Man has ventured into the sea for thousands of years, seeking food, items for commerce, treasure, and the remains of shipwrecks and other disasters. Since it is not his natural environment, he must adapt himself to it, using his own available physiological resources or developing equipment that will allow greater adaptation. This equipment helped to assist humans to breathe underwater, to fight the cold, to withstand underwater pressure, and to resist the diseases associated with deep water depths. As in many other areas of life, humans have developed much of this equipment to aid in the conduct of war.

The Navy, Marines, Army, Air Force, and Coast Guard maintain units of divers specially trained to support national needs related to operating effectively in the oceans. Scores of tasks are performed on and under the water's surface, but can be generalized into a handful of categories—salvage/object recovery, rescue, equipment and platform maintenance, handling of underwater ordnance, and special warfare. It is possible to generalize further and characterize these various tasks and categories into two main categories, combat diving and non-combat diving, although clearly there are tasks in which the distinctions are hazy. For the sake of this discussion, combat swimmer or combat diver are generic titles for an individual trained to perform military missions involving confrontation with an enemy on, under, or near the water. Thus, Navy Special Forces personnel who move from a ship at sea to smaller craft and come ashore to make a precision strike or initiate a larger beach landing are combat swimmers. Explosive Ordnance Disposal (EOD) divers who hunt for and disarm or destroy enemy mines guarding a narrow expanse of water such as a strait or a harbor entrance are combat divers. Divers who clear obstructions to navigation and check ship hulls underwater for marine growth or collision damage are non-combat divers.

Clearly, however, there are very obvious connections between these sets of divers: both use similar suits and equipment that are the result of centuries of scientific experimentation and engineering development. Both benefit from scientific study into the causes of and remedies for physiological disease generally affecting only divers—nitrogen narcosis and decompression sickness. And both participate in a profession that is fairly dangerous whether or not combat is involved.

### **1.1 DIVING PIONEERS**

A brief history is useful in providing background to the current state of diving in the U.S. military. As is usual in histories like this, a number of individuals stand out as pioneers in their field, either through personal exploits or by their contributions to the advancement of that field. Some of those in the diving (both combat and non-combat) arena include the following:

- A Greek in the 5th Century BCE (Before Christian Era) named Scyllis, according to an account of Herodotus (Father of History), was captured by the enemy and taken aboard one of its ships as a prisoner. Learning the Persian King Xerxes intended to attack the Greek fleet, he jumped overboard armed with a knife. Subsequent searching by the Persians failed to find him, and he was presumed drowned. Under cover of night, and using a hollow reed as a snorkel to avoid detection, he reportedly

swam from ship to ship of the Persian fleet, cutting their mooring lines and setting the ships adrift. He then swam nine miles to the island of Euboea to rejoin the Greek forces. By his actions, he may be regarded as one of the very first combat swimmers.

- Two millennia later, in the 15th/16th Century, Leonardo da Vinci, ahead of his time in so many areas, briefly mentions the concept of air tanks to allow a swimmer to breathe underwater. As with a number of his inventions, he kept the description sketchy because he foresaw such a device as an aid to hostile actions such as sinking ships. Some of his drawings feature snorkels and a sort of diving suit including a face mask and a small container for air.
- In the early 1700s, Englishman John Lethbridge invented a diving suit that was actually a watertight barrel with a viewing port and watertight arm holes, which enabled him to conduct useful work underwater in a more mobile fashion for about half an hour.
- In 1828, a suit originally designed five years earlier by brothers John and Charles Deane for firefighters to breathe in heavy smoke had evolved into a diving dress, with insulation against the cold, a helmet featuring viewing ports, and connections for air coming from the surface.
- Augustus Siebe modified the Deane design, which had critical flaws if the diver did not remain upright (if, for example, he tripped and fell), and developed Siebe's Improved Diving Dress, which was viewed as a direct early relation to the Navy's standard Mark V deep-diving dress.
- More sophisticated diving hardware began appearing around the time of the Civil War, when Frenchmen Benoit Rouquayrol and Auguste Denayrouze developed an air tank with the first known air regulator. The diver carried his air supply on his back, rather than having it supplied from the surface, and used a device to regulate the flow of high-pressure air so he could breathe effectively and comfortably, even at depths previously considered prohibitive due to the significant pressure. Captain Nemo discusses this equipment in Jules Verne's *20,000 Leagues Under the Sea*, with highly improbable claims of bottom-time capability of 9 to 10 hours (Verne 1870).
- At about the same time, U.S. Army Brevet Major General John G. Foster, a West Point graduate and decorated veteran of the Battle of Fort Sumter and other Civil War engagements, wrote a paper titled *Submarine Blasting in Boston Harbor* in 1869. The techniques described for underwater diving became the standard reference for divers conducting underwater demolition for almost 50 years.
- J.S. Haldane, a British physiologist, is credited with early 20th Century studies related to diving diseases, such as decompression sickness. He developed a rate of air flow to counter carbon dioxide build-up in diving helmets, and invented a set of diving tables for safe decompression in stages.
- One of the diving's most critical developments occurred during World War II in German-occupied France, as Frenchmen Jacques-Yves Cousteau and Emile Gagnan

experimented with and perfected high-pressure air tanks and an improved demand regulator, creating the Aqua-Lung, the first efficient and safe Self-Contained Underwater Breathing Apparatus (SCUBA). With the end of the war, it became a phenomenal commercial success, with obvious applications for military divers in both combat and non-combat roles.

## **1.2 U.S. NAVY DIVING HISTORY**

The U.S. Naval Historical Center website (Navy 2007) presents a fairly detailed history of diving worldwide, which is a copy of its original description in the *Navy Diving Manual* (Navy 2005). A summary of the diving portions of this description follows.

The U.S. Navy began employing divers for various tasks beginning about the middle of the 19<sup>th</sup> Century. In 1898, Navy divers from Key West, Florida, were sent to Havana harbor, Cuba, to investigate the explosion that sank the battleship USS Maine. A series of sinkings accompanying the rapid growth of the Navy submarine force led to a similar growth in numbers of Navy divers and in diving technology and capability, including diving tables to ensure safe decompression following dives. Of particular note was the March 25, 1915, sinking of the submarine USS F-4 near Honolulu, Hawaii, after a battery explosion which killed 21 crew members. According to the Naval Historical Center account (Navy 2007): “Navy divers salvaged the submarine and recovered the bodies of the crew. The salvage effort incorporated many new techniques, such as the use of lifting pontoons, but what was most remarkable was that the divers completed a major salvage effort working at the extreme depth of 304 fsw [feet of seawater], using air as a breathing mixture. These dives remain the record for the use of standard deep-sea diving dress. Because of the depth and the necessary decompression, each diver could remain on the bottom for only ten minutes. Even for such a limited time, the men found it hard to concentrate on the job at hand. They were unknowingly affected by nitrogen narcosis.”

Important long-term results of this incredible effort were the publication of the first U.S. Navy Diving Manual and the establishment of a Navy Diving School at Newport, Rhode Island. It also led, a decade later, to experiments in the use of helium-oxygen mixtures, which were found to shorten decompression time and eliminate the mental effects of breathing air at great depths. This testing supported development of improved equipment and more reliable decompression tables. A nearly year-long salvage effort for the USS S-51 (SS-162), which sank off Block Island, Massachusetts, highlighted inadequacies of training and numbers of divers, resulting in re-establishment of the Naval School, Diving and Salvage at the Washington Navy Yard in 1927. Shortly afterward, the Navy Experimental Diving Unit was also moved to the Navy Yard, consolidating the dive training and technology development efforts in one location.

Navy divers were substantially involved in World War II less than two hours after it began when dive teams worked to cut through the hull of the overturned USS Oklahoma (BB-37) in Pearl Harbor to rescue sailors trapped inside. Other dive teams recovered ammunition from sunken ships to be used in case of resumption of the attack. Over the next year and a half, Navy divers made 4,000 dives totaling more than 16,000 hours to salvage the battleships and other surface ships that littered Pearl Harbor and to help the naval station and shipyard

prepare for active war support. An ocean and a continent away, Navy divers were salvaging the former French passenger ship *Normandie*, converted into a U.S. Navy ship, which caught fire and sank in a New York harbor, obstructing access to a pier badly needed for the war. As part of the effort, the Navy established the Naval Training School, which primarily supported salvage efforts, on site.

Although the majority of the publicized Navy dive efforts up to this point were to salvage sunken ships, divers had previously conducted underwater reconnaissance missions to gather intelligence and remove obstacles to beach landings. An early group of Navy divers, referred to as the Scouts and Raiders, were assigned to identify and come ashore on beaches designated for landing and to guide assault forces ashore. Commissioned in October 1942, the group supported landings in North Africa, Sicily, Salerno, Anzio, and Normandy. Other Scouts and Raiders units operated in New Guinea and China.

Navy Combat Demolition Units (NCDU) were formed to eliminate obstacles on enemy-held beaches prior to an invasion. A training unit was established on June 6, 1943, and one year later on Omaha Beach at Normandy NCDU divers, working under intensive enemy fire, blew eight complete gaps and two partial gaps in the German defenses as the landing craft came ashore. At Utah Beach, divers of another NCDU cleared 700 yards of beach in two hours and another 900 yards by the afternoon.

In the Pacific, following the November 1943 battle of Tarawa, 30 officers and 150 enlisted men formed the nucleus of a demolition training program, becoming Underwater Demolition Teams (UDT) One and Two. The teams combined bomb disposal experts and Navy combat engineers in construction battalions (CBs), also known as SeaBees. Their mission was to remove hazardous material from shallow water to provide access for landing craft. Originally set up to remove German barricades off French beaches, they saw their first combat in January 1944 in the Marshall Islands, and conducted a day-time demolition and reconnaissance effort off Saipan in June 1944. In March 1945, UDT personnel off Okinawa removed 1,200 underwater obstacles in two days under heavy fire, preparing for the invasion of the island, amazingly without a single casualty.

Regarding the UDT teams, the Navy Special Warfare Command (2007) states: “Eventually, 34 UDT teams were established. Wearing swim suits, fins, and facemasks on combat operations, these ‘Naked Warriors’ saw action across the Pacific in every major amphibious landing including: Eniwetok, Saipan, Guam, Tinian, Angaur, Ulithi, Pelilui, Leyte, Lingayen Gulf, Zambales, Iwo Jima, Okinawa, Labuan, Brunei Bay, and on 4 July 1945 at Balikpapan on Borneo which was the last UDT demolition operation of the war.”

According to the Navy Diving Manual (Navy 2005): “Fleet diving has become increasingly important and diversified since World War II. A major part of the diving mission is the inspection and repair of naval vessels to minimize downtime and the need for day-docking. Other aspects of fleet diving include the recovery of practice and research torpedoes, installation and repair of underwater electronic arrays, underwater construction, and location and recovery of downed aircraft. Ship sinkings and beachings caused by storm damage and human error continue to demand the fleet’s salvage and harbor clearance capabilities in peacetime as well as in times of hostilities.”

As indicated earlier, the loss of submarines prompted major efforts to increase the number of Navy divers and improve the equipment needed to perform their missions. The April 1963 loss of the new nuclear attack submarine USS Thresher (SSN-593) had a similar result. The ship sank in 8,400 fsw, far beyond hull crush depth and even farther beyond a rescue capability. In addition to the standard Court of Inquiry to investigate causes of the sinking, a second significant group was formed, called the Deep Submergence Review Group, to assess the Navy's undersea capabilities. Among important achievements of this group were the design, development, and fielding of the Deep Submergence Rescue Vehicle, which became operational in 1972, providing a 5,000 fsw rescue capability for submarine crews stranded on the bottom, and the series of Man-in-the-Sea saturation diving experiments known as SeaLab.

In subsequent years, saturation diving became a standard for long-term, deep-water projects, a majority of which require salvage, either to recover valuable platforms and equipment or to clear areas needed for transit or docking of ships.

The Navy's Sea, Air, and Land (SEAL) force originated with President Kennedy's stated desire for the U.S. Armed Forces to develop an unconventional warfare capability. In response, the Navy established SEAL Teams One and Two in January 1962. Formed entirely with personnel from Navy Underwater Demolition Teams, the SEAL's mission was to conduct counter guerilla warfare and clandestine operations in maritime and riverine environments. SEALs served in Vietnam in an advisory capacity; among other responsibilities, they instructed a training course for South Vietnamese UDT commandos. In February 1966, a small detachment of SEAL Team One began direct-action missions over the next five years. Before departing the country in December 1971, eight SEAL platoons operated in Vietnam on a continuing basis.

UDTs also experienced combat in Vietnam, supporting Navy Amphibious Ready Groups, conducting operations with river patrol boats and patrolling beaches, riverbanks, and even into the countryside to destroy bunkers and other hazards.

On May 1, 1983, all UDTs were re-designated as SEAL Teams or Swimmer Delivery Vehicle Teams, which have since been re-designated SEAL Delivery Vehicle Teams. The current organizational structure for SEALs, Naval Special Warfare Command, was commissioned April 16, 1987, in Coronado, California.

SEAL post-Vietnam War operations included combat missions in Grenada, the Persian Gulf, Panama, Somalia, Bosnia, Haiti, and Liberia. In response to the attacks on America September 11, 2001, Naval Special Warfare forces were in Afghanistan in October, and a senior Navy SEAL officer was there shortly afterward commanding a joint task force of Navy, Army, Air Force, and Coalition Special Forces. SEALs executed more than 75 special reconnaissance and direct action missions during Operation Enduring Freedom. For Operation Iraqi Freedom, the military had the largest number of SEALs and special warfare craft operators in its history.

Navy EOD units also were active in Vietnam, providing mine clearance capabilities both at sea and in Vietnam river systems, ensuring shipping and maritime operations safety. Also

tracing their history to World War II units, initial EOD efforts began with a group of volunteers who trained with British unexploded ordnance teams in 1940, before the U.S. entered the war. When they returned to the U.S., they attended the first class of the Mine Recovery School. In all, 19 classes graduated from the school between 1941 and 1945, and then they deployed throughout the Pacific and Mediterranean areas assigned to Mobile Explosive Investigative Units. They cleared explosive hazards both at sea and on land. During the Korean conflict, now titled EOD units, they served on minesweepers but also participated in in-country intelligence operations.

After Vietnam, the deteriorating world situation and increased tasking stimulated substantial increases in EOD units. During the Persian Gulf War, EOD personnel cleared more than 500 sea mines. Navy EOD personnel were also involved in joint operations in Bosnia, Haiti, Kosovo, and Somalia, and they are serving today in Afghanistan and Iraq, forward deployed and heavily involved in dealing with the improvised explosive devices (IED) threat.

Today, in addition to the highly specialized Special Warfare and EOD communities, Navy divers rotate regularly through shipyards, research and development commands, dive lockers aboard ships and submarines, and mobile salvage and diving units (Daubon 2007, personal communication). One Navy diver commented on this capability, saying all personnel attending Navy dive schools are trained in all diving gear they will use during their careers, except for special purpose equipment (Bagley 2007, personal communication).

## **2.0 CURRENT MILITARY DIVER/COMBAT SWIMMER UNITS AND MISSIONS**

The Navy, Marines, Army, Air Force, and Coast Guard maintain units of divers, with the Navy providing the lead and much of the training for all military divers. The Navy separates its diving billets into eight major categories—fleet maintenance, salvage, SEALs, EOD, submarine support, research and development, aviation support, and training billets. The Navy currently has more than 5,000 divers. The U.S. Navy Assistant Supervisor of Diving, who is also the program manager of a major new Navy saturation diving capability, states that most of the Navy's current non-combat divers are assigned to mobile salvage and diving units (Daubon 2007, personal communication). Statistical data provided by his office indicate there are currently about 1,225 non-combat Navy divers, with about 240 divers assigned to salvage billets and another 275 divers to fleet maintenance duties. Additionally, approximately 160 divers support the submarine force and 80 divers are assigned to various Navy research and development commands. Over the next six years, the total number of these divers is expected to increase to 1,300 personnel.

The largest number of Navy combat divers is assigned to the Special Warfare community, which maintains a current force of 2,450 SEALs and another 325 reservists. They are supported by more than 700 Special Warfare Combatant-craft Crewmen and another 700 support personnel (Navy Special Warfare Command 2007). They are also supported by another 150 regular Navy divers (of the 1,225 stated above), who maintain their diving equipment and assist in maintaining SEAL diving proficiency. It is anticipated the largest increase in the regular Navy diving community over the next six years will be in this role of Special Warfare requirements support. The EOD community has about half the number of

divers assigned to the Navy Special Warfare Command, including 100 regular Navy divers who provide the same equipment and training maintenance support.

Divers with the U.S. Marine Corps are members of reconnaissance units, with the no-nonsense nickname of “swift, silent, and deadly” units and with diving only one of several critical skills. They are trained in a variety of disciplines, including basic and advanced reconnaissance, close quarters combat, urban warfare, rappelling, and parachuting, in addition to survival, evasion, and escape training. They receive their dive training (the Marine Combatant Diver Course) at the Naval Dive Training Center at Panama City Beach, Florida (Pomykal 2001). Typical of Marine units to which these personnel are assigned is the 24th Marine Expeditionary Unit (Special Operations Capable), Maritime Special Purpose Force, 2nd Force Reconnaissance Battalion, operating recently in the Central Command Theater of Operation, where the unit participated in underwater dive and aerial free fall/static line training to enhance their capabilities in those areas. They also conducted training with the Diver Propulsion Device, a commercial product rigorously tested by the National Aeronautics and Space Administration and U.S. Navy SEALs prior to its release to Recon Marines. This torpedo-shaped device weighs less than 200 pounds and provides a means for rapid underwater insertion and extraction of Marine divers. The two-man device tows Marines from a water insertion site over the horizon (and thus out of enemy sight) into the beach in a short amount of time (Walker 2004), eliminating what one Marine Corps veteran described as 10,000 meters of “finning,” just to get to the beach for the start of the reconnaissance operation.

Like the Navy, the U.S. Army has a corps of engineer divers tracing its roots back to World War II. Several hundred enlisted personnel and 17 officers made up the Port Construction and Repair Groups trained at Fort Screven, Georgia. Of these, 16 personnel became deep sea divers trained by the Navy. The Army divers of the 1056<sup>th</sup> Port Construction and Repair Group landed on Utah Beach shortly after the D-Day invasion and within three weeks had moved to Cherbourg, France, and cleared the port of sunken ships and other underwater obstacles to navigation and berthing. Within months the port was capable of handling 25,000 tons of cargo essential to the war effort. After similar efforts in Belgium, the 1056<sup>th</sup> moved into Germany in March 1945 and built the first fixed railroad bridge across the Rhine River, a span more than 2,000 feet long completed in only 10 days.

Army divers also performed port and harbor reconstruction work during the Korean and Vietnam wars. They performed port security operations in Saudi Arabia and Kuwait during the Persian Gulf War.

Typical Army diver duties include inspection, cleaning, and repair of watercraft propellers and hulls; salvaging sunken equipment; patrolling the waters below watercraft at anchor; and surveying and clearing rivers, beaches, and harbors for underwater obstacles. In the Middle East, Army divers currently provide security sweeps of allied ships for hull-attached explosives that could be brought into harbors, and also help recover bodies of soldiers killed in action. In several recent incidents, divers of the 544<sup>th</sup> Engineers recovered the bodies of nine Marines lost when their troop carrier flipped over while trying to negotiate a flooded street in Iraq, recovered other Marines whose helicopter crashed into a lake west of Baghdad,

and helped find a Marine killed by a roadside bomb on a bridge outside Fallujah; they found his body more than a kilometer downriver from the bridge.

Army diver categories, similar to the Navy's, are second class diver, salvage diver, first class diver, and master diver. For descriptions of these classifications and their responsibilities, please see (Army 2007a).

The Army's official publication on diving (Army 2007b) is the service's guide to its policy on diving. Included are two categories of divers—engineer diver and combat diver. The publication provides requirements, qualifications, etc. for those interested in pursuing this career.

Occasionally the Navy and Army work together on underwater projects. Following are current/recent examples: Army and Navy divers operating from an Army service craft are salvaging a Russian Juliet-class submarine from the harbor in Providence, Rhode Island. The submarine was a tourist attraction until large, storm-generated waves swept into open hatches and sank it. The recovery is providing an invaluable training opportunity for the divers. During the collapse of a major interstate highway bridge in Minneapolis on August 1, 2007, Army Corps of Engineers personnel and Navy divers played key roles in recovery of bodies from the river and removal of vehicles that posed hazards to navigation. Off the coast of Florida, teams of Army, Navy, and Coast Guard divers are working to reverse a well-intentioned environmental effort gone wrong, recovering more than two million tires dumped into the Atlantic to create the world's largest man-made reef; the tires are now destroying the natural reef and are washing ashore as a major environmental problem.

### **3.0 COMBAT DIVING**

Today's Navy combat swimmers/divers are divided into two groups with distinct missions—EOD divers, whose mission is handling, defining, and disposing of munitions and other explosives; and the SEAL special operations teams, the Navy's component of the military's Special Forces. Their missions include special reconnaissance (SR), direct action (DA), unconventional warfare, combat responses to terrorism, foreign internal defense, information warfare, security assistance, counter-drug operations, personnel recovery, and hydrographic reconnaissance. Navy Special Warfare core training is focused on SR and DA—critical skills needed to combat current and future terrorist threats (Naval Special Warfare Command 2007).

According to the Naval Special Warfare Command website, "The most important trait that distinguishes Navy SEALs from all other military forces is that SEALs are maritime Special Forces, as they strike from and return to the sea... Their stealth and clandestine methods of operation allow them to conduct multiple missions against targets that larger forces cannot approach undetected. From 1962 when the first SEAL teams were commissioned, to present day, Navy SEALs have distinguished themselves as an individually reliable, collectively disciplined and highly skilled maritime force."

The major operational components of Naval Special Warfare Command are Naval Special Warfare Groups One and Three in San Diego, California, and Groups Two and Four in Norfolk, Virginia. These components deploy SEAL Teams, SEAL Delivery Vehicle Teams,

and Special Boat Teams worldwide to meet the training, exercise, contingency, and wartime requirements of theater commanders.

“Navy Explosive Ordnance Disposal Technicians render safe all types of ordnance, both conventional and unconventional, improvised, chemical, biological, and nuclear to include Improvised Explosive Devices (IEDs) and Weapons of Mass Destruction. They perform land and underwater location, identification, render-safe, and recovery (or disposal) of foreign and domestic ordnance. They conduct demolition of hazardous munitions, pyrotechnics, and retrograde explosives using detonation and burning techniques. They forward deploy and fully integrate with the various Combatant Commanders, Special Operations Force (SOF), and various warfare units within the Navy, Marine Corps, and Army. They are also called upon to support military and civilian law enforcement agencies” (EOD 2007).

The major Navy EOD forces are as follows:

- EOD Group One (San Diego), which includes Mobile Diving and Salvage Unit 1 in Pearl Harbor, Hawaii; ; EOD Mobile Units 1, 3, 5, and 11; and a reserve mobile unit. EOD Mobile Unit 1 focuses its efforts on mine clearance and operates the Navy’s mine-hunting dolphins, and EOD Mobile Unit 3, in addition to its traditional duties, operates the Navy’s swimmer defense dolphins.
- EOD Group Two (Norfolk), which includes Mobile Diving and Salvage Unit 2; EOD Mobile Units 2, 4, 6, and 8; and a reserve mobile unit.

#### **4.0 SUMMARY**

For more than a century and a half, heroic human achievements, inventive experimentation, and technology development have provided the Navy with substantial diving capability. Many lives and numerous platforms have been saved; depth records have been shattered; and warriors from the sea have preceded and ensured the success of major amphibious landings. Today’s Navy combat divers have two primary responsibilities: (1) prosecution of underwater ordnance to save ships and lives; and (2) clandestine underwater and nearshore operations in high-threat areas to gather intelligence and to strike quickly and successfully against targets out of the reach of larger forces.

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