

FM 20-11

**HEADQUARTERS,
DEPARTMENT
OF THE ARMY**



**Military
Diving**



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Foreword

Department of the Navy
Naval Sea Systems Command
20 January 1999

Revision 4 of the U.S. Navy Diving Manual is a comprehensive update and reorganization of the previous revisions. Most significantly, the Manual has been divided into 5 stand-alone volumes to replace the previous two volumes, which will allow the operators to take the necessary volumes to the dive site.

The dive manual is updated to provide the latest procedures and equipment currently being utilized by military divers. It also includes two entirely new procedures to provide greater flexibility for diving operations: Chapter 10 on Nitrogen-Oxygen (NITROX) Operations and the Diving at High Altitude section of Chapter 9.

This new revision is also reformatted for electronic dissemination. It will be promulgated on a CD-ROM disk as well as in hard copy. Changes to the manual will be posted on the NAVSEA 00C web site (www.navsea.navy.mil/sea00c) to ensure that the most accurate and timely updates are provided to military divers.

This revision is a compilation of input and review by Navy divers involved in all aspects of diving operations. Experts from every area of military diving were consulted on specifics in their field and also utilized to review the finished version.

Many people were involved in this colossal effort, however I would like to pass along special thanks to a dedicated professional who expended countless hours to produce the best tools for military divers possible. HTCM (MDV) Mike Washington was the driving force behind the completion of this revision. His invaluable expertise makes this revision reflect what the fleet needs.

On behalf of all Navy divers everywhere, I want to thank MDV Washington for his unparalleled dedication and professionalism in completing this important task.



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CHAPTER 1
History of Diving

1-1 INTRODUCTION

- 1-1.1 Purpose.** This chapter provides a general history of the development of military diving operations.
- 1-1.2 Scope.** This chapter outlines the hard work and dedication of a number of individuals who were pioneers in the development of diving technology. As with any endeavor, it is important to build on the discoveries of our predecessors and not repeat mistakes of the past.
- 1-1.3 Role of the U.S. Navy.** The U.S. Navy is a leader in the development of modern diving and underwater operations. The general requirements of national defense and the specific requirements of underwater reconnaissance, demolition, ordnance disposal, construction, ship maintenance, search, rescue and salvage operations repeatedly give impetus to training and development. Navy diving is no longer limited to tactical combat operations, wartime salvage, and submarine sinkings. Fleet diving has become increasingly important and diversified since World War II. A major part of the diving mission is inspecting and repairing naval vessels to minimize downtime and the need for dry-docking. Other aspects of fleet diving include recovering practice and research torpedoes, installing and repairing underwater electronic arrays, underwater construction, and locating and recovering downed aircraft.

1-2 SURFACE-SUPPLIED AIR DIVING

The origins of diving are firmly rooted in man's need and desire to engage in maritime commerce, to conduct salvage and military operations, and to expand the frontiers of knowledge through exploration, research, and development.

Diving, as a profession, can be traced back more than 5,000 years. Early divers confined their efforts to waters less than 100 feet deep, performing salvage work and harvesting food, sponges, coral, and mother-of-pearl. A Greek historian, Herodotus, recorded the story of a diver named Scyllis, who was employed by the Persian King Xerxes to recover sunken treasure in the fifth century B.C.

From the earliest times, divers were active in military operations. Their missions included cutting anchor cables to set enemy ships adrift, boring or punching holes in the bottoms of ships, and building harbor defenses at home while attempting to destroy those of the enemy abroad. Alexander the Great sent divers down to remove obstacles in the harbor of the city of Tyre, in what is now Lebanon, which he had taken under siege in 332 B.C.

Other early divers developed an active salvage industry centered around the major shipping ports of the eastern Mediterranean. By the first century B.C., operations

in one area had become so well organized that a payment scale for salvage work was established by law, acknowledging the fact that effort and risk increased with depth. In 24 feet of water, the divers could claim a one-half share of all goods recovered. In 12 feet of water, they were allowed a one-third share, and in 3 feet, only a one-tenth share.

1-2.1

Breathing Tubes. The most obvious and crucial step to broadening a diver's capabilities was providing an air supply that would permit him to stay underwater. Hollow reeds or tubes extending to the surface allowed a diver to remain submerged for an extended period, but he could accomplish little in the way of useful work. Breathing tubes were employed in military operations, permitting an undetected approach to an enemy stronghold (Figure 1-1).

At first glance, it seemed logical that a longer breathing tube was the only requirement for extending a diver's range. In fact, a number of early designs used leather hoods with long flexible tubes supported at the surface by floats. There is no record, however, that any of these devices were actually constructed or tested. The result may well have been the drowning of the diver. At a depth of 3 feet, it is nearly impossible to breathe through a tube using only the body's natural respiratory ability, as the weight of the water exerts a total force of almost 200 pounds on the diver's chest. This force increases steadily with depth and is one of the most important factors in diving. Successful diving operations require that the pressure be overcome or eliminated. Throughout history, imaginative devices were designed to overcome this problem, many by some of the greatest minds of the time. At first, the problem of pressure underwater was not fully understood and the designs were impractical.



Figure 1-1. Early Impractical Breathing Device. This 1511 design shows the diver's head encased in a leather bag with a breathing tube extending to the surface.

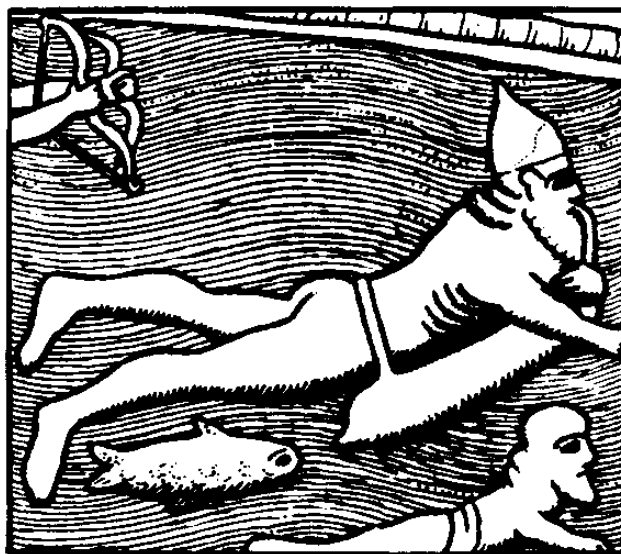


Figure 1-2. Assyrian Frieze (900 B.C.).