

Enemy Mines
no match
for Marine Mammals



**Biosonar and Other Capabilities
Are Assets for Navy Missions**

In the shallow waters of the Port of Umm Qasr, Iraq, danger lurks.

Fortunately this danger is short lived, as a Navy diver streaks through the water, diving with incredible accuracy in the murky waters to locate mine-like objects in the near darkness. Within seconds, a potential mine is tagged for prosecution and the diver is well on his way to the next target.

Just as recent military operations in Iraq were at their height, humanitarian aid workers received help from an unexpected source—dolphins. These superhuman divers are part of the Navy's highly successful Marine Mammal Program, and are responsible for locating sea mines that might pose a threat to warships and military and civilian cargo ships operating in shallow waters of war zones, such as captured enemy harbors.

Beginning in late March 2003, a team of Atlantic bottlenose dolphins from the Navy's Marine Mammal Program, U.S. and allied Navy and Marine Corps divers, and unmanned undersea vehicles carefully swept the waters of Umm Qasr free of mines.

Umm Qasr is Iraq's only deep-water port. In a relatively short period of time, the team prosecuted more than 200 mine-like objects, rendering the harbor and nearby waterways safe for shipping, and allowing a British Royal Navy humanitarian aid ship to dock and distribute food to hungry Iraqis.

"Navy ship sonars are very effective in deep water. But object detection is more difficult in shallow water where sound waves bounce off the bottom and the surface of the water. There is a lot of ambient noise from ships and from wave action against piers and the shore," said Tom LaPuzza. LaPuzza is the Public Affairs Officer for the Space and Naval Warfare Systems Center San Diego and for the Navy Marine Mammal Program. "That is where



the dolphin's biological sonar is better. It allows dolphins to successfully perform the critical actions of navigating, finding food and protecting themselves from predators. It also makes dolphins a highly valuable resource in locating man-made objects (such as mines) in that environment."

During a mine-hunting mission in Iraq, a dolphin went out on a small boat and then swam around a selected area to look for potential sea mines. Once a dolphin found a potential target, it swam back to the boat where it received a marker from its Navy or Marine Corps enlisted handler to put near the object. (The animals are specifically trained not to touch the object itself.)



The team of dolphins prosecuted more than 200 mine-like objects, harbor and nearby waterways safe for shipping.

“Sea mines are designed to be set off by large metallic objects passing nearby that may have a magnetic field, not marine life, so teaching the animal to maintain a reasonable distance while it is marking a mine location adds another layer of safety,” LaPuzza said.

After an area had been completely searched and marked, the dolphin, having returned to the boat, came on board by jumping onto a “beaching tray”—a smooth vinyl mat that is cushioned and kept wet. This mat has three sides that close in pup-tent

fashion, shielding the dolphin from the sun. Once on board the small craft, the dolphin was taken back to its temporary quarters nearby. After all the animals were cleared from the harbor area, a team of Navy divers inspected the markers and properly disposed of the potential mines.

Several months before dolphins deployed to Iraq for mine hunting, another group of Navy marine mammals was contributing to force protection in neighboring Bahrain. A small set of California sea lions normally used for object detection and recovery was deployed to Manama harbor in Bahrain in early 2003 to demonstrate a new capability to detect and attach restraint devices to swimmers. Sea lions can swim up to 25 miles per hour for short bursts, and once on land can move as fast as humans. As a result, they are potential additional resources for detecting and

apprehending enemy swimmers. They were deployed to Bahrain at the request of the U.S. Fifth Fleet Commander, Vice Admiral Timothy Keating, as one of several resources to provide force protection capabilities.

Dolphins and other marine mammals such as sea lions and beluga whales have been of interest to the Navy since 1959. Navy scientists, who were hoping to learn about the animal’s underwater movement, observed a Pacific white-sided dolphin named “Notty”. The goal of the study was to gain a better understanding of dolphin hydrodynamics. Scientists wanted to know how a dolphin’s body design reduces drag while swimming in order to create more effective torpedoes and submarines. Although the hydrodynamic study resulted in little useful information, scientists working with the first Navy dolphins developed an interest in some of the dolphin’s other capabilities.



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Photo by Wilke Ford, U.S. Fish and Wildlife Service

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Their research eventually demonstrated that dolphins have exceptional biological sonar capabilities that are unmatched in shallow water by any manmade technology. It is for this reason dolphins are used for mine detection in port areas.

A few years later, in 1965, during a project called Sealab II in La Jolla, CA, a dolphin named "Tuffy" was trained to bring tools down to divers hundreds of feet underwater.

Through Alternative Mine Detection Capabilities, an Office of Naval Research project code-named ALTER, Navy researchers were able to gain a better perspective on dolphin underwater directional hearing capacities and their thresholds. During a project named "Deephear," white whales were trained to dive to various depths and whistle whenever they heard sounds. With this experiment, researchers were able to gain valuable knowledge about the hearing thresholds of marine mammals at various depths.

Various research studies demonstrated several marine mammal capabilities of significant importance to the Navy. From up to one hundred yards away, dolphins can detect objects using their biological sonar. They can also be used to discriminate between different kinds of materials based on their relative densities. Sea lions have exceptional low light level vision and amazing underwater directional hearing (much like dolphins).

In addition, these mammals dive more quickly and easily than humans. Dolphins are capable of diving more than 1,000 feet in a matter of minutes. Since man-made sonar technology is sufficient in deeper waters, the Navy seldom requires its dolphins to dive to such depths. Dolphin sonar is primarily sought for more shallow depths (one hundred feet or less). The primary advantage that dolphins have over human divers is their ability to make repeated dives quickly without the threat of decompression sickness.



Sailors shove off from the USS GUNSTON HALL for a mission in the Arabian Gulf with a dolphin being transported in a beaching mat.

U.S. Navy photo by Photographer's Mate 1st Class Brien Aho



A pen is used to temporarily house dolphins while operating near a ship.

U.S. Navy photo by Photographer's Mate 1st Class Brien Aho



A bottlenose dolphin named "Spetz" on a beaching mat before being sent out of a training mission.

U.S. Navy photo by Photographer's Mate 1st Class Brien Aho



Inflatable pools aboard USS GUNSTON HALL are home to nine bottlenose dolphins operating in the Arabian Gulf.

U.S. Navy photo by Photographer's Mate 1st Class Brien Aho

“Navy divers can do two dives and then are done for the day. Dolphins can go back and forth quickly up to fifty times a day,” LaPuzza said.

This is because humans are susceptible to decompression sickness or “the bends,” and thus must make slow, careful dives and ascents. Dolphins however, are innately able to withstand these repeated deep dives.



U.S. Ambassador to Kuwait Richard H. Jones pays a visit to “Kona and Katrina” (two Navy dolphins) at Camp Patriot in Kuwait.

U.S. Navy photo by Journalist 1st Class Joseph Krpyel

Eventually, the Navy’s program managers took advantage of these capabilities (biological sonar, underwater direction hearing and low light level vision, and repeated deep dive capability) and developed operational systems for the Navy for object detection and recovery and force protection capabilities.

The Navy currently has five operational systems employing marine mammals: one using California sea lions for object recovery, one using dolphins for swimmer defense, and three employing dolphins for mine hunting. Shortly before the end of the deployment of sea lions to Bahrain to demonstrate a new force protection capability, the Navy’s swimmer defense dolphins were brought in to take up where the sea lions left off. Similar Navy dolphin systems were deployed to Manama harbor in 1987-88 to protect the Third Fleet flagship, the USS LASALLE (AGF-3), anchored there to direct U.S. Navy ships escorting Kuwaiti tankers through the Strait of Hormuz. Navy dolphins also served in Vietnam in 1970-71, protecting the Army ammunition pier in Cam Ranh Bay against attacks by enemy swimmers. In San Diego, CA, Navy dolphins supported the Secret Service security efforts at the 1996 Republican National Convention.



Sailors enjoy a lighter moment with a dolphin that is part of the swimmer defense team.

U.S. Navy photo by Photographer's Mate 2nd Class Veronica Birmingham

When operating in the field, Navy dolphins can be accommodated in a number of different ways. Some are temporarily maintained in large ship-board pools that have specially designed filtration systems and climate controls. The Navy also has smaller



NOAA photo

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mobile pools that can be placed in a hangar or on a dock for temporary maintenance of deployed animals. Each of these, like the shipboard pools, is designed with a water filtration system and climate control to keep the animals in an environment as much like San Diego as possible while they are away.

The Navy goes to extremes to make sure its marine mammals are properly cared for particularly while working in the line of duty. To the personnel working in combat zones with marine mammals, the safety of the animals is the utmost concern. While on duty, the animals receive daily check ups from veterinarians. A Mobile Marine Mammal Clinic with a complete suite of medical examination and diagnosis equipment and a full pharmacy accompanies the animals during deployments. A U.S. Army veterinarian and one of the Army enlisted veterinarian technicians are also assigned to the Navy's Marine Mammal Program and accompany the dolphins. (All together, the Navy has six veterinarians and four veterinarian technicians to provide state-of-the-art health and medical care to its 100 marine mammals.) A portable fish house is also included in deployment transports to ensure the animals receive their usual daily rations of higher-than-restaurant-quality fish.

The Navy's commitment to extraordinary animal care, not only in war zone operations but also in the day-to-day training efforts, has paid off over the

years. For the last decade, there has been a 95–97 percent survival rate for Navy dolphins. This percentage is higher than the reported survival rate for dolphins in the wild (92–95 percent).

The Space and Naval Warfare Systems Center San Diego (SSC San Diego) provides all training and care for the Navy's marine mammals. Enlisted personnel from Explosive Ordnance Disposal Mobile Unit Three and Navy Special Clearance Team One handle the animals that are assigned to operational systems. Assigned Navy civilian marine mammal experts of SSC San Diego supervise the care and training of the dolphins.

Teaching marine mammals to perform such important tasks requires several years of training and daily practice. Like their human military counterparts, marine mammals must train exactly as they would be expected to work in real-world situations. Thus, SSC San Diego technicians have been able to create non-explosive objects that look just like real sea mines. These inert or false mines are designed with impeccable detail and out of the same material as real mines so the acoustic returns from dolphin sonar transmissions sound exactly (to the dolphin) like those of a real mine containing authentic explosives.

"It is necessary to build these training aids with incredible precision because the dolphins have incredibly precise sonar," LaPuzza said.

Currently, the Navy is investing time and research into the development of Unmanned Underwater Vehicles (UUV) that will eventually relieve the mammals of their duties.

Since 1999, the Navy has developed and managed a successful breeding program from which a number of their trained dolphins have come. There is a general trend toward investing more time and research into manmade detection devices. Today, dolphins still hold the advantage in using sonar to detect objects in shallow water. Until science is able to catch up with the dolphins, these well-trained animals will continue to aid military and humanitarian efforts to ensure that people in and around areas of conflict can sail their vessels into port safely. 

Note: Jonathan Kohl, former intern with the Chief of Naval Operations, Environmental Readiness Division, made significant contributions to this article.

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