

Sonar Allows for Real-Time **TRAINING SCENARIOS** & *Minimizes* *Impacts on* **MARINE MAMMALS**

THE CONTINUED USE OF ACTIVE SONAR WILL ALLOW THE NAVY TO CONDUCT REAL-TIME TRAINING ALL THE WHILE MINIMIZING THE POTENTIAL ADVERSE IMPACT TO MARINE MAMMALS. BUT ONGOING LITIGATION IS THREATENING THE NAVY'S ABILITY TO CONTINUE TO TRAIN TO DETECT THE NEXT GENERATION OF SUPER QUIET SUBMARINES.

BACKGROUND

Generally, there are two types of sonar the Navy uses—passive and active. Passive sonar is a matter of listening to sounds in the water by using underwater microphones, whereas active sonar systems introduce sounds into the water that reflect off objects, return to a receiver and are analyzed. Passive sonar technology involves listening for sounds generated by a submarine, such as the noise from a submarine's internal machinery. However, as newer and quieter submarines are built by a number of nations, including Iran and China, and exported to many nations, the effectiveness of passive detection has been reduced.

An active sonar system uses sound transmissions (“pings”) to listen for the reflection or echo of sound off submarines

that are too quiet to detect passively. By using specialized signals and echo location, the system increases the distance at which submarines can be detected and tracked.



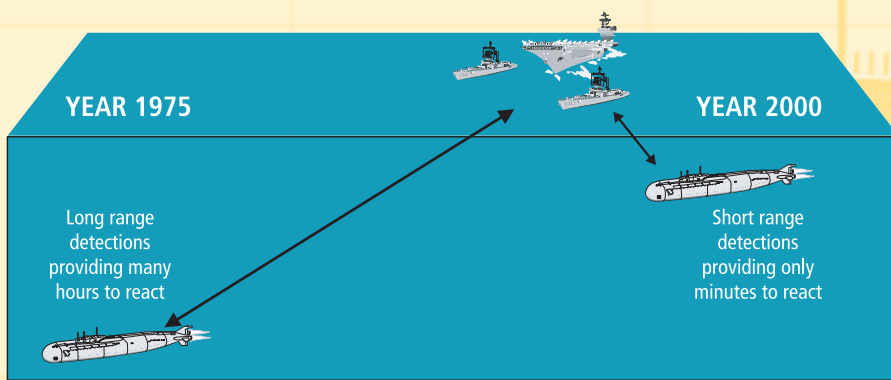
Humpback whale.
Photo by Vicki Beaver

TRAINING WITH
ACTIVE
SONAR

WHILE PROTECTING
MARINE
LIFE



Killer whale.



Passive Sonar.

Mid-frequency active sonar is the best way for the Navy to locate potential enemy submarines. There's a balancing act at work. While trying to make it clear that the training at issue in the courts must continue, the Navy is also going to great lengths to protect marine life.

THE VALUE OF REAL-TIME TRAINING

Petty Officer 1st Class Kevin Goude understands the value of real-time training using active sonar. The first time he heard a real ping was as a young seaman apprentice. And it was a big change from what he had heard in simulated training.

"There's a different sound that you get when you send out an active transmission, from different types of targets," he said recently aboard the USS MASON (DDG-87), where he is now the leading petty officer for 15 sonar technicians.

"Active sonar allows you to tell if the ping you're hearing is a sea mount or another ship," Goude said. "That's a big difference. In simulations, everything sounds the same. Nothing really changes. But using active sonar in real time, the things that are supposed to sound different sound different. The more we practiced, the more I was able to identify things based on the sounds they made."

Sailors need training with mid-frequency active sonar, but a recent court order has increased

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—Petty Officer 1st Class
Kevin Goude

concern about the Navy's continued ability to conduct such training. A preliminary injunction issued by a District Court judge in California threatened the Navy's ability to conduct training in Southern California. The step was part of litigation with an environmental organization that has criticized the effects of sonar training on marine mammals—though sonar has not been shown to be a factor in whale deaths there.

This issue reached a crescendo in the courts on the West Coast this year that reverberated across the nation—right into the Oval Office. In January 2008, President Bush and the Council on Environmental Quality took actions to allow the Navy to continue the practice of its craft. Litigation hasn't stopped the sea service's need for the only proven way to find a new generation of quiet submarines. As of this writing, the injunction remains in place while the Navy appeals the decision to the Ninth Circuit Court of Appeals.

Petty Officer 1st Class Kevin Goude and his 15 sonar technicians aboard the USS MASON understand the value of real-time training using active sonar. "The more we practiced (with active sonar), the more I was able to identify things based on the sounds they made," said Goude.

U.S. Navy photo





The USS MASON (DDG-87).
U.S. Navy photo by Cliff Steenhoff

As submarine quieting technologies improved, the ability to detect them with passive sonar decreased and they became harder to “see.”



1970s



1980s



1990s



2000s

Relative Loss of Sonar Capability.

ONGOING PROTECTIVE MEASURES

The Navy already employs 29 protective measures to limit negative contact with marine mammals while training with active sonar. These measures include:

1. Marine mammal awareness training for key shipboard personnel;
2. Multiple lookouts aboard sonar-equipped ships during exercises; and
3. Special operating procedures, including safety zones for reducing power or shutting off sonar at specified distances from marine mammals, as well as coordination and reporting requirements for marine mammal strandings, beachings, mortalities, or unusual behavior.

The measures were developed with the National Marine Fisheries Service, the regulatory agency that oversees the protection of marine life. In addition, the Navy funds about half of the marine mammal research conducted world-wide. Much of the \$18 million the Navy spends annually goes toward studying the effects of sound on marine life.

The Navy took a number of other steps to ensure that it had adequately assessed the potential impact of using active sonar, including performing modeling of animal movements and acoustic exposure, and conducting concurrent studies to ensure that the system would not harm humans who were scuba diving in the ocean.

There are additional restrictions including restrictions on operations within 22 kilometers (12 nautical miles) of any coastline, designated offshore biologically important areas, and known recreational and commercial dive sites.

CHANGES IN THE THREAT

“Threats have changed since the Cold War, when the United States (U.S.) generally hunted Soviet nuclear submarines in deep water with passive sonar,” said Rear Admiral (RDML) Lawrence S. Rice, director of the Chief of Naval Operations Environmental Readiness Division. Rice continued, “Modern diesel-electric submarines and new fuel-cell submarines are cheaper for potential enemies to get. And they’re super quiet, too.”

“Without the ability to hear the new generation of super quiet submarines using microphones in the water, the only way we can find them is with active sonar,” Rice said.

Systems that employ active sonar can calculate the distance between the naval craft and the object—a vitally important ability, particularly when hunting enemy submarines in the world’s coastal regions. Those are areas through which much of the world’s trade—90 percent of it is delivered by sea—must navigate. They are where U.S. access to significant areas could be thwarted.

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Killer whales.

The Navy needs to train with active sonar in environments that are similar to the places where Sailors may deploy.

—RADM Richard J. O'Hanlon

RADM Richard J. O'Hanlon, the deputy chief of staff for operational readiness and training at U.S. Fleet Forces Command, said the Navy needs to train with active sonar in environments that are similar to the places where Sailors may deploy.

“This means training in the open ocean, or deep water, as well as near the coast, in

the littorals,” he said. “The littorals are where we are spending most of our time these days because the underwater threat has evolved into very quiet diesel submarines which operate near the coast. There is more shipping in these areas which combined with the waves, weather and abundant marine life, affects what you hear. That makes it harder to find submarines in these environments, and that’s using both passive and active sonar. When you factor in that these submarines we are looking for are much quieter, that compounds the problem.”

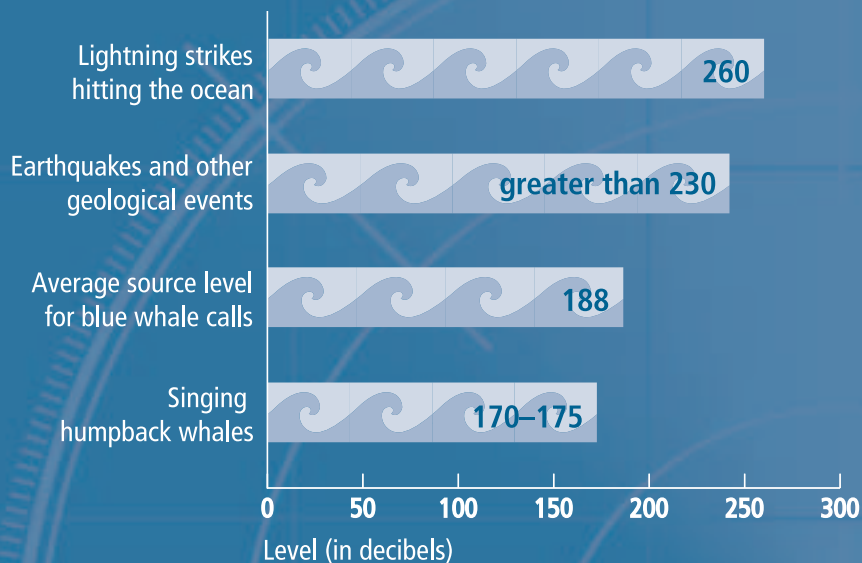


Rear Admiral
Richard J. O'Hanlon.



Right whale.
NOAA Photo Library

SOUNDS IN THE OCEAN



The U.S. Navy's mid-frequency active sonar system can transmit sound at a level of approximately 235 decibels (dB). The signals transmitted by active sonar are loudest at the source and diminish rapidly over the first kilometer. Due to the natural attenuation of sound in the ocean environment and the protective measures the Navy uses to reduce risks to marine mammals, the chances that any animal would experience levels greater than 180 dB are minimal.

The submarines are in the hands of more than 40 nations, including China, North Korea and Iran. There are more than 300 of them around the world.

"The Sailor's ability to remain afloat and alive depends on how well they can find that submarine outside that submarine's weapons range," said Jene Nissen, a retired surface warfare officer who is the environmental program acoustics manager at U.S. Fleet Forces Command.

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"Passive sonar does not give you that capability. The submarines just don't make enough noise."

To detect these threats quickly, sonar operators need to train as much as possible.

"There is some confusion on the part of the folks who aren't that familiar with how the Navy trains with active sonar," Rice said. "They have the impression that the Sailors get down in front of their scopes, turn them on and, like a video game, all of a sudden they see little submarines all over their scopes. In fact, nothing could be further from the truth."

"Anybody who has ever been scuba diving in the water knows that the ocean is a noisy place," Rice continued. "You've got boat noise. You've got marine mammal noise. You've got seismic noise. And scattered in there somewhere is a very quiet submarine. So these operators go through the classroom, they go through synthetic training and obviously live training. Our Sailors have got to get out there in the conditions we're going to operate in and train in those same conditions." (For more insights from RDML Rice, see our sidebar entitled, "RDML Rice Discusses Use of Sonar & New Web Site.")

CONTINUED ON PAGE 16



Humpback whale.



Killer whale.

RDML RICE

DISCUSSES USE OF SONAR & NEW WEB SITE

RDML Lawrence S. Rice, director of the Chief of Naval Operations Environmental Readiness Division (N45) has spearheaded the creation of a new web site to better educate and inform the public and Sailors on what the U.S. Navy is doing to protect the seas and its inhabitants during crucial training exercises. RDML Rice recently discussed why training with sonar is important and vital to national security with MC2 Kathleen Smith of the Naval Media Center.

“We cannot send our American Sailors and Marines into potential trouble spots around the world without adequate training to defend them,” said Rice. “This is a national security issue, and we must use all methods available to ensure that arbitrary and excessive restrictions do not hamper our ability to train.”

Rice added that the U.S. Navy has trained in Southern California for the past 40 years and they have had zero incidents with marine mammals—no strandings, no deaths, and no documented injuries.

“We want to keep that up,” added Rice. “In order to accomplish this, we have 29 protective measures that we already employ. The additional training restrictions that the court levied on us frankly don’t help us take care of the environment—and it restricts our training.”

Rice added that it is important for Sailors and citizens to know how small an impact Navy sonar has on the marine environment.

As part of learning what type of impact the Navy is having, Rice encourages everyone to visit the Navy’s newest sonar web site (at www.navy.mil/oceans) which features information on whales, video clips, environmental stories, Currents magazine and more.

Rice also added that it is important that people are aware of the many reasons for strandings.

For nations that track such events, worldwide naval use of active sonar has been correlated with the stranding of approximately 50 whales during the 10-year period from 1996–2006.

“Contrast that with over 3,500 marine mammal ‘normal’ strandings that occur on U.S. shores annually, and 600,000 marine mammal deaths each year by commercial fishing interests,” Rice said. “So, let’s examine this: 600,000 are attributable to commercial fishing, over 3,500 a year are contributable to normal causes, and approximately five a year to sonar. And remember that in the last couple of years sonar-caused deaths have been zero.”

NO.	CAUSE	ESTIMATED YEARLY MARINE MAMMAL DEATHS
1.	Commercial Fishing Interests	600,000
2.	Normal Causes	Over 3,500
3.	Sonar	5*

* In the last couple of years, sonar-related marine mammal deaths have been zero.



Rear Admiral
Lawrence S. Rice.

The U.S. Navy has trained in Southern California for the past 40 years and they have had zero incidents with marine mammals—no strandings, no deaths, and no documented injuries.

—RDML Lawrence S. Rice



More than 300 extremely quiet diesel electric submarines operate in 41 countries worldwide.



Rice attributes the U.S. Navy's success with sonar to the fleet operators who are paying attention to what is going on in the world with marine mammals and sonar—they realize that this is really important. The recent court case in Southern California only reaffirms its importance.

“Their actions directly influence their ship’s training that will be following them. The folks that preceded the Abraham Lincoln Strike Group took precautions; they used the 29 protective measures, they ensured that our record of zero marine mammal incidents in Southern California was kept up. It’s important that we keep that up so the training can continue,” said Rice.

Rice added that one of the reasons for zero strandings associated with sonar is the result of continued U.S. Navy research.

“The U.S. Navy funds \$18 million a year in marine mammal research, including independent, peer-reviewed research conducted by Boston University, Duke University, the University of Hawaii and Woods Hole Oceanographic Institution. Research topics include sound effects on marine mammals,” said Rice.

While the U.S. Navy works hard to train in an environmentally responsible manner, submarine technology is improving and widely available to interested nations. More than 300 extremely quiet diesel electric submarines operate in 41 countries worldwide. These submarines are cheap, mass produced and readily available to any country that wants to pursue this technology.

Rice explained how difficult it is for sonar technicians to pinpoint the sound of an extremely quiet submarine.

“As you know the ocean isn’t like the atmosphere. The ocean is changing all of the time, whether it is the salinity, whether it is the

density, whether it is the currents out there. It is a noisy place; not only are there submarines out there, but there is wave sound, rain sounds, there are other marine mammals, there are seismic sounds, earthquakes, volcanoes—a lot of sounds in the oceans, and they have to pick out that really quiet diesel electric submarine amongst all of those other sounds. That isn’t something that we can simulate,” said Rice.

The U.S. Navy employs 29 protective measures to protect marine life when using mid-frequency active sonar during a major exercise or within established ranges or operating area. The measures include:

- Stationing trained lookouts,
- Passive acoustics monitoring for marine mammals,
- Employing night vision,
- Establishing protective safety zones around ships,
- Taking appropriate action when marine mammals are spotted, and
- Employing extra precautions during chokepoint exercises.

These measures were developed with and are fully supported by Federal environmental regulators, including the National Marine Fisheries Service.

For more information about Navy’s use of sonar and ocean stewardship, visit the Navy’s newest sonar web site at www.navy.mil/oceans.

CONTINUED FROM PAGE 12

“The Navy is already balancing its need to meet this threat with its responsibility as an environmental steward,” O’Hanlon said.

“We consider marine life in all of our training,” he said. “We have better environmental controls in place to collect plastics and deal with waste and discharge. These are examples of how the Navy consistently is

improving the way it works with marine life and in the environment as a whole.”

“We want to strike a proper, responsible balance. We have a very important primary mission—to train our forces and deploy when we are called to service. The missions of regulatory agencies we work with are important, too. We are working with them and listening to them.”

Nissen said the Navy is conducting environmental reviews to determine the potential effects of its sonar use in the marine environment.



Beluga whale.
Photo by Klaas Lingbeek-van Kranen

ACTIVE SONAR: THE BASICS

- 1** *The Navy Fleet Commanders-in-Chief have determined that active sonar is a vital element of the Navy's ASW operations and is an asset required for our national security.*
- 2** *Active sonar will be employed in compliance with the National Environmental Policy Act, Marine Mammal Protection Act, Endangered Species Act, Coastal Zone Management Act, and Presidential Executive Order 12114 (Environmental Effects Abroad of Major Federal Actions). **
- 3** *Active sonar must transmit sound at sufficient levels in order to detect ultra-quiet submarines.*
- 4** *Undersea earthquakes and even lightning strikes generate powerful low frequency sounds. Many whale species also produce loud low, mid and high frequency sounds. These natural phenomena were part of the environment in which marine mammals evolved.*
- 5** *To provide an objective analysis of potential effects from active sonar on marine life, the Navy is currently spending approximately \$18 million per year on marine mammal research, focused on four main areas:*
 - 1. Investigating marine mammal locations, abundance, and movement at sea;*
 - 2. Developing criteria and thresholds to estimate the effects of sound on the physiology and behavior of marine mammals;*
 - 3. Developing mitigation methods and new technologies for risk assessment; and*
 - 4. Characterizing manmade underwater sound fields. The research includes the development of a “proof of concept” marine mammal mitigation and monitoring system that utilizes existing tracking and surveillance technology on our training ranges in southern California.*
- 6** *Monitoring and mitigation measures will reduce to a negligible level the risk of harm to any marine mammal from active sonar.*

** This Executive Order applies to major federal actions that occur outside the U.S., its territories and possessions. This Order enables responsible officials of Federal agencies having ultimate responsibility for authorizing and approving actions encompassed by this Order to be informed of pertinent environmental considerations and to take such considerations into account, with other pertinent considerations of national policy in making decisions regarding such actions.*



Humpback whales.

“As science has evolved over the past few years, we’ve come to better understand the potential effects that sonar could have on marine mammals,” Nissen said.

Aboard the USS MASON, crew members discussed how they have briefings to prepare for encountering marine life. They talked about using programs that help them plan for possible interactions with marine life and training for watch standers that specifically addresses whales. And they mentioned how, during training in December 2007, they simply stopped pinging because they spotted whales.

“We certainly can do basic anti-submarine warfare (ASW) off of the trainers and the simulators,” said Lieutenant Commander (LCDR) Jason Eaton, the ship’s executive officer. “However, when a matter of seconds is the difference between reacting quickly enough to get a weapon in the water before a hostile submarine can get one in on you, those seconds are going to come down to proficiency. We’d prefer to be the more proficient operator. Without training, we’re not.”

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—LCDR Jason Eaton

“If I’m turning on my sonar for the first time in combat,” Eaton said, “it’s not a question of if a ship is going to go down, it’s how many, from my perspective. There will be a bill to pay for not training. I just hope the bill doesn’t include the lives of some of my guys.” ⚓

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