Fact Sheet

How Loud is the Navy's SURTASS/LFA Sonar System?

The U.S. Navy is proposing deploying a Surveillance Towed Array Sensor System (SURTASS) Low Frequency Active (LFA) Sonar system promoted to detect "enemy" submarines. It will emit one of the loudest sounds ever created by humans in the world's seas. The LFA Sonar system, a towed array of 18 underwater speakers, can emit sound levels comparable to a Saturn V rocket (used to launch the Space Shuttle) in air.

Some confusion occurs in comparing water and air sound levels. Both are measured in decibels, but the two measurements are not equivalent. Sound acts differently in water and in air. Sound levels in water, a denser medium than air, will also vary greatly depending on water salinity, pressure, and temperature. The sound intensity can also vary considerably depending on whether the source is a focused beam (as is the case with LFA Sonar) or a sound broadcast in all directions (such as propeller noise or a depth-charge).

Beached beaked whale in the Bahamas near midrange Sonar testing.

We have prepared a chart (over) that shows how sound can be compared in air with sound in water, and to show how different sounds may relate to the intensity of LFA Sonar.

The only similarity between sound in air and sound in water is the use of the term "decibels" (dB) to express energy levels. Decibels are not an actual measure of energy, but rather they are an expression of relative energy levels.

The number used by the Navy to express the conversion between air and water is 61.5 dB. This number is accounted for by two elements, one expressing the numerical difference (26 dB), and the second expressing the qualitative difference (35.5 dB). There is controversy here, in that many experts believe that the two numbers should be considered separately, rather than added together as the Navy has done. We have chosen to use the Navy's own conversion factor in our examples, understanding that the sound energy intensity in water may in fact be much higher than the Navy claims.

The numerical difference

By convention, decibels used in expressing airborne sound energy is relative to the threshold of human hearing — the ability of human ears to detect a pressure gradient, which is considered "O dB" in air. Also by convention, a decibel used in expressing waterborne sound is relative to a convenient pressure gradient. The mathematical difference between these two numbers is 26 dB.

The qualitative difference

One of the ways sound works differently in water and air has to do with the differences in density between water and air, and how much more effectively water conducts sound than air does. This means that much more "work" can be done underwater than with an equivalent amount of sound energy in air. This quality is called "sound intensity." It happens that 35.5 dB more work can get done in water than with an equal amount of energy in air.

Decibel scale is logarithmic

Another important point to remember is that the decibel scale, like the Richter Scale used for measuring earthquake intensity, is logarithmic — each increase in 10 dB is 10 times more energy than the previous number. For example, 20 dB is not twice as much sound energy as 10 dB; it is rather 10 times as much energy. 30 dB is 100 times as much sound energy as 10 dB (10 times 10=100).

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