Embargoed until July 15 at 1:30
SURTASS LFA Sonar
Questions and Answers about Ocean Noise

Question: What is the noise budget of the ocean, including natural and human sounds?

Answer: The question is unanswerable at this time. A National Research Council panel on ambient noise (convened by ONR and NOAA Fisheries in 2000) is considering this question. The Panel's report, available within one year, will make the first ever attempt to describe such a noise budget. The data it uses were not collected with this purpose in mind, so the resultant noise budget will be tentative. The report will outline research needed to construct a better budget.

Question: How does the loudness of SURTASS LFA compare to natural sounds?

Answer: SURTASS LFA is neither the "loudest" source in the oceans (in terms of source level), nor does it produce more acoustic energy than other sources. The loudness, duration, and repetition rate of SURTASS LFA pings are described in detail in the FEIS. Briefly, the loudest measurable sound it can produce is 215 dB re 1 µ Pa for up to 100 seconds out of every six to 15 minutes for 432 hours per year. Realistically, only two vessels will operate within the five years of this authorization, one in the Atlantic and one in the Pacific.

The loudest natural sounds in the ocean are lightning strikes, with a source level of about 260 dB re 1 µ Pa. Strikes occur at a rate of about two per km^2 per year in most of the world's coastal regions[1] where coincidentally marine mammals abound. Rates are lower in high seas areas where fewer marine mammals reside.

Earthquakes and volcanic eruptions are the second greatest natural sounds in terms of level, but they produce considerably more total energy than lightning strikes because they last longer. Each year the Pacific Ocean has more than 1,000 earthquakes having a source level greater than 230 dB re 1 µ Pa and 10,000 earthquakes with a source level greater than 215 dB re 1 µ Pa. Earthquakes and volcanic eruptions occur mostly at tectonic plate boundaries along coasts or mid-ocean ridges[2] where they are audible to marine mammals. Far more earthquakes are detectable in the oceans than on land. Underwater landslides may also be quite intense and energetic, but they occur less frequently than earthquakes or volcanism[3].

Question: How does the loudness of SURTASS LFA compare to other human sounds at sea?

Answer: The loudest human sounds at sea, other than explosions, are airgun arrays used in exploring for gas and oil. The largest arrays produce source levels of 255 dB re 1 µ Pa, although U.S. arrays average about 235 dB. Each boom lasts only milliseconds, but arrays produce a boom every 15 seconds, around the clock, sometimes for months on end. These booms may propagate thousands of miles under water[3]. On any given day of the year about three such "seismic surveys" are held in the Gulf of Mexico alone. Worldwide there are 155 seismic survey vessels operating in 2002; the number per year varies with the market for oil.

It is not true that SURTASS LFA is louder than other military sonars used in antisubmarine warfare. SURTASS LFA uses a different waveform and a lower frequency than other sonars, which means the sound propagates farther.

The human activity that puts the greatest amount of acoustic energy into the ocean is shipping. The source levels of the largest ships may exceed 190 dB re 1 μ Pa, and the sound is continuous from port to port. Tens of thousands of cruises are made yearly, worldwide. Ship noise dominates natural sound in a certain part of the ocean noise spectra[4] .

In addition to shipping and seismic exploration, many human activities add noise to the oceans. Some examples are jet skis, fishing boats, offshore boat races, oil drilling, harbor and bridge construction, pile driving, explosive removal of oil wells. military weapons testing, ship shock trials, sonic booms, rocket launches, fireworks displays over water, military sonar, fish finders, depth sounders, sidescan sonar, bottom profilers, oceanographic experiments, underwater communications, pingers on fishing nets, and acoustic harassment devices used in aquaculture. Rail and highway sound from large coastal cities is detectable some distance at sea.

In summary, SURTASS LFA sonar is not as loud as many natural sounds or even some other human sounds at sea. Also, the amount of acoustic energy SURTASS LFA produces is small relatively to the thousands of commercial vessel trips, and hundreds of seismic operations per year. It is likely that SURTASS LFA will increase the ocean ambient noise level only by a very small amount. This amount will not be measurable using present methods.

Question: What is being done to reduce human noise in the oceans, or to protect marine mammals from it?

Answer: Attempts to reduce human noise are few and scattered. Some small explosions and pile driving operations are enclosed within bubble curtains which reduce the sound energy escaping into nearby waters. Some vessels enclose their propellers in cylindrical "nozzles" which reduce noise except in the front/back direction. Military vessels have developed extensive quieting technology, but to date this technology has not been adopted by most non military vessels. NOAA Fisheries, Navy and the Marine Mammal Commission are sponsoring a symposium in 2002 to encourage this transfer of technology.

Few of the sound sources mentioned above use any mitigation measures to protect marine mammals from exposure. In the U.S., airgun arrays use ramp-up procedures to give mammals time to move away. They also use deck observers who can trigger array shut-down in case marine mammals breach a safety zone, the size of which depends on the loudness of the source. Other mitigation measures focus on staging activities at times of year and in locations that are not used by many marine mammals. The development of High Frequency Marine Mammal Monitoring sonar (HFM3) to detect marine mammals near SURTASS LFA operations is exceptional in the history of acoustic projects. NOAA

Fisheries has never required such extensive mitigation on any other acoustic project. Furthermore, SURTASS LFA uses three forms of mitigation (visual sighting, passive acoustic, and HFM3) whereas others use only visual sighting.

Endnotes.

1. See http://science.nasa.gov/headlines/y2001/ast05dec%5F1.htm for a distribution map of lightning strikes on the world's surface, including the oceans.

2. See www.geol.binghamton.edu/faculty/jones/seisvole.readme for a distribution map of all earthquakes and volcanic eruptions recorded worldwide between 1960 and the present. Note that many if not most of them occur in areas where their sound is propagated into water.

3. See www.pmel.noaa.gov/vents/acoustics/env-noise/env-noise.html for seismic array sounds recorded more than 1,000 miles from the source, as well as information on earthquakes, volcanic activity, landslides, and other sounds being recorded by NOAA under water.

4. See Figure 5.3 in Richardson et al., 1995. (Marine mammals and noise. Academic Press, San Diego, CA) for the Wenz curves.