

beamwidth is measured to the 3 dB point, as is usually quoted for sonars. The other two modes are deep-water modes: The Omni mode is identical to the shallow-water mode except that the source output is 220 dB rms. The Omni mode is normally used only during start up. The Rotational Directional Transmission (RDT) mode is normally used during deep-water operation and has a 237 dB rms source output. In the RDT mode, each "ping" consists of five successive transmissions, each ensonifying a beam that extends 2.67 degrees fore-aft and approximately 30 degrees in the cross-track direction. The five successive transmissions (segments) sweep from port to starboard with minor overlap, spanning an overall cross-track angular extent of about 140 degrees, with tiny (<1 millisecond) gaps between the pulses for successive 30-degree segments. The total duration of the "ping", including all 5 successive segments, varies with water depth but is 1 millisecond in water depths <500 m (1640.4 ft) and 10 millisecond in the deepest water.

The sub-bottom profiler is normally operated to provide information about the sedimentary features and bottom topography that is simultaneously being mapped by the Hydrosweep. The energy from the sub-bottom profiler is directed downward by a 3.5-kHz transducer mounted in the hull of the *Maurice Ewing*. The output varies with water depth from 50 watts in shallow water to 800 watts in deep water. Sounds from the sub-bottom profiler are very short pulses, occurring for 1, 2 or 4 msec once every second. Pulse interval is 1 second but a common mode of operation is to broadcast five pulses at 1-s intervals followed by a 5-s pause. Most of the energy in the sound pulses emitted by this multi-beam sonar is at mid-frequencies, centered at 3.5 kHz. The beamwidth is approximately 30° and is directed downward.

Sound levels have not been measured for the sub-bottom profiler used by the *Maurice Ewing*, but Burgess and Lawson (2000) measured the sounds propagating more or less horizontally from a similar unit with similar source output (205 dB re 1  $\mu$ Pa-m). The 160 and 180 dB re 1  $\mu$ Pa (rms) radii, in the horizontal direction, were estimated to be near 20 m (66 ft) and 8 m (26 ft), respectively, from the source, as measured in 13 m (43 ft) water depth. The corresponding distances for an animal in the beam below the transducer would be greater, on the order of 180 m (591 ft) and 18 m (59 ft), assuming spherical spreading.

The sub-bottom profiler on the *Maurice Ewing* has a maximum source level of 204 dB re 1  $\mu$ Pa-m. Thus the

received level would be expected to decrease to 160 and 180 dB at about 160 m (525 ft) and 16 m (52 ft) below the transducer, respectively (assuming spherical spreading). Corresponding distances in the horizontal plane would be lower, given the directionality of this source (30° beamwidth) and the measurements of Burgess and Lawson (2000). Additional information on the airgun arrays, Atlas Hydrosweep, and sub-bottom profiler specifications is contained in the application, which is available upon request (see **ADDRESSES**).

### Comments and Responses

An earlier notice of an LDEO application and proposed IHA was published in the **Federal Register** on April 14, 2003 (68 FR 17909). That notice described, in detail, the characteristics of the *Ewing's* acoustic sources and, in general, the anticipated effects on marine mammals including masking, disturbance, and potential hearing impairment and other physical effects. In addition, another notice of receipt of an LDEO application and proposed IHA was published in the **Federal Register** on July 28, 2003 (68 FR 44291). That notice described in detail the proposed activity and the marine mammal species that may be affected by it. That information is not repeated here. During the 30-day public comment period, comments were received from the Marine Mammal Commission (Commission).

### Monitoring Concerns

*Comment 1:* The Commission believes that NMFS preliminary determinations are reasonable, provided NMFS is satisfied that the proposed mitigation and monitoring activities are adequate to detect marine mammals in the vicinity of the proposed operations and ensure that marine mammals are not being taken in unanticipated ways or numbers. In this regard, NMFS **Federal Register** notice and the application state that "[v]essel-based observers will monitor marine mammals near the seismic source vessel during all daylight airgun operations and during any nighttime startups of the airguns;" and that bridge personnel will watch for marine mammals during nighttime activities but that "[o]bservers will not be on duty during ongoing seismic operations at night. The **Federal Register** notice states that image-intensifier night-vision devices (NFDs) will be available for use at night, although past experience has shown that NFDs are of limited value for this purpose." Thus it is unclear that, for nighttime activities, the monitoring effort will be sufficient to determine that

no marine mammals are within the safety zones at start-up or will be an effective means of detecting when marine mammals enter the safety zones during operations such that activities are suspended before received levels of 180 and 190 dB (rms) are reached.

*Response:* As part of the IHA, NMFS is requiring that if the airguns are started up at night, two marine mammal observers will monitor for marine mammals within the safety radii for 30 minutes prior to start up using night vision devices as described later (see Monitoring and Reporting). Airgun operations will be suspended when marine mammals are observed within or about to enter designated safety zones, and operations will not resume until the animal is outside the safety radius. Once the safety zone is clear of marine mammals, the observer will advise that seismic surveys can re-commence. The "ramp-up" procedure will then be followed. Because the sizes of the two airgun arrays to be used are small, the safety zones are relatively small, and there are no "power-down" procedures, ramp-up may not commence unless the entire safety radii is visible for 30 minutes prior to ramp-up in either daylight or nighttime. The combination of the two conditions ensures, to the greatest extent practicable, that no mammals will be within the appropriate safety zones whenever the airguns are turned on, either in daylight or nighttime.

However, it is noted that at times, pinnipeds and even some small cetaceans will approach a vessel during transmissions (the vessel itself moving forward at about 3–5 knots) from the side of the vessel or the stern, meaning that the animal is voluntarily approaching a noise source that is increasing in strength as the animal gets closer. Experience indicates that pinnipeds will come from great distances to scrutinize seismic-reflection operations. Seals have been observed swimming within airgun bubbles only 10 m (33 ft) away from active arrays. Also, Canadian scientists, who were using a high-frequency seismic system that produced sound frequencies closer to pinniped hearing than those used by the *Ewing*, describe how seals frequently approached close to the seismic source, presumably out of curiosity. Therefore, because at least pinnipeds indicated no adverse behavioral reaction to seismic noise, NMFS has concluded that the above-mentioned mitigation requirement is reasonable because the bridge-watch will be concentrating on marine mammals approaching the vessel from the bow. Also, the night-vision ability of