

acoustic verification program, provided that doing so will not compromise operational safety requirements:

#### *Course alteration*

If a marine mammal is detected outside the safety radius and, based on its position and the relative motion, is likely to enter the safety radius, alternative ship tracks will be plotted against anticipated mammal locations. If practical, the vessel's course and/or speed will be changed in a manner that avoids approaching within the safety radius while also minimizing the effect to the planned science objectives. The marine mammal activities and movements relative to the seismic vessel will be closely monitored to ensure that the marine mammal does not approach within the safety radius. If the mammal appears likely to enter the safety radius, further mitigative actions will be taken (i.e., either further course alterations or shutdown of the airguns).

#### *Shutdown procedures*

Vessel-based observers using visual aids and acoustical arrays will monitor marine mammals near the seismic vessel for 30 minutes prior to start up and during all airgun operations. No airguns will be operated during periods of darkness. Airgun operations will be suspended immediately when marine mammals are observed or otherwise detected within, or about to enter, designated safety zones where there is a possibility of physical effects, including effects on hearing (based on the 180 dB criterion specified by NMFS). The shutdown procedure should be accomplished within several seconds (or a "one shot" period) of the determination that a marine mammal is within or about to enter the safety zone. Airgun operations will not resume until the marine mammal is outside the safety radius. Once the safety zone is clear of marine mammals, the observers will advise that seismic surveys can recommence. The "ramp-up" procedure will then be followed.

#### *Ramp-up procedure*

A "ramp-up" procedure will be followed when the airgun arrays begin operating after a specified-duration period without airgun operations. Under normal operational conditions (vessel speed 4–5 knots), a ramp-up would be required after a "no shooting" period lasting 2 minutes or longer. At 4 knots, the source vessel would travel 247 m (810 ft) during a 2-minute period. If the towing speed is reduced to 3 knots or less, as sometimes required when maneuvering in shallow water, it is proposed that a ramp-up would be

required after a "no shooting" period lasting 3 minutes or longer. At towing speeds not exceeding 3 knots, the source vessel would travel no more than 277 m (909 ft) in 3 minutes. These guidelines would require modification if the normal shot interval were more than 2 or 3 min, respectively, but that is not expected to occur during the GOM project.

Ramp-up will begin with the smallest gun in the array that is being used (80 in3). Guns will be added in a sequence such that the source level of the array will increase in steps not exceeding 6 dB per 5-minute period over a total duration of approximately 18–20 min (10–12 gun arrays).

#### *Avoidance of Cetacean Concentrations*

The *Ewing* will be involved in separately-permitted studies of sperm whales during the late May and June period when the proposed acoustical measurements will be obtained. Thus the scientists in charge of this program will have first-hand knowledge of the locations of concentrations of sperm whales and other cetaceans. The proposed acoustical measurements therefore will be able to avoid operating near known concentrations of marine mammals.

#### **Monitoring and Reporting**

##### *Vessel-based Visual Monitoring*

As mentioned under Mitigation, two observers dedicated to marine mammal observations will be stationed aboard LDEO's seismic survey vessel during the acoustical measurement program in the GOM. It is proposed that two marine mammal observers aboard the seismic vessel will search for and observe marine mammals whenever airgun operations are in progress. Airgun operations will be restricted to periods with good visibility during daylight hours. Two observers will be on duty for at least 30 minutes prior to the start of airgun operations and during ramp-up procedures. The observers will watch for marine mammals from the highest practical vantage point on the vessel, which is the bridge. The observer(s) will systematically scan the area around the vessel with 7X50 Fujinon reticle binoculars or with the naked eye. "Bigeye" (25 X 150) binoculars will be available during this cruise to assist with species identification of marine mammals that are sighted. Laser rangefinding binoculars (Bushnell Lytespeed 800 laser rangefinder with 4X optics or equivalent) will be available to assist with distance estimation. If a marine mammal is detected well outside the safety radius, the vessel may be

maneuvered to avoid having the mammal come within the safety radius. When mammals are detected within or about to enter the designated safety radii, the airguns will be shut down immediately. The observer(s) will continue to maintain watch to determine when the animal is outside the safety radius. Airgun operations will not resume until the animal is outside the safety radius.

The vessel-based monitoring will provide data required to estimate the numbers of marine mammals exposed to various received sound levels, to document any apparent disturbance reactions, and thus to estimate the numbers of mammals potentially taken by harassment. It will also provide the information needed in order to shut down the airguns at times when mammals are present in or near the safety zone. When a mammal sighting is made, the following information about the sighting will be recorded: (1) Species, group size, age/size/sex categories (if determinable), behavior when first sighted and after initial sighting, heading (if consistent), bearing and distance from seismic vessel, sighting cue, apparent reaction to seismic vessel (e.g., none, avoidance, approach, paralleling, etc.), and behavioral pace; (2) Time, location, heading, speed, activity of the vessel (shooting or not), sea state, visibility, cloud cover, and sun glare (The data listed under (2) will also be recorded at the start and end of each observation watch and during a watch, whenever there is a change in one or more of the variables.) All mammal observations and airgun shutdowns will be recorded in a standardized format.

At least two experienced marine mammal observers (with at least one previous year of marine mammal observation experience) will be on duty aboard the seismic vessel.

Prior to the start of the project, the primary observers will participate in a 1-day meeting and training or refresher course on the specific marine mammal monitoring procedures required for this project.

Two observers will be on duty in shifts of duration no longer than 4 hours. Use of two simultaneous observers will increase the proportion of the marine mammals present near the source vessel that are detected. Bridge personnel additional to the dedicated marine mammal observers will also assist in detecting marine mammals and implementing mitigation requirements, and before the start of the seismic survey will be given instruction in how to do so. The results from the vessel-based observations will provide (1) the