

shutdown procedure should be accomplished within several seconds or 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 observer 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 (not a factor in Hess Deep), 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 Hess Deep project.

Ramp-up will begin with the smallest gun in the array that is being used (80 in<sup>3</sup> for the 10- and 12-gun arrays). 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).

#### **Monitoring and Reporting**

LDEO proposes to conduct marine mammal monitoring of its 2003 seismic program in the Hess Deep and acoustical verification of safety radii, in order to satisfy the anticipated requirements of the IHA.

#### *Vessel-based Visual Monitoring*

Two observers dedicated to marine mammal observations will be stationed aboard LDEO's seismic survey vessel for the seismic survey in the Hess Deep area. It is proposed that one or both marine mammal observers aboard the seismic vessel will search for and observe marine mammals whenever seismic operations are in progress during daylight hours. When feasible, two observers will be on duty for at least 30 minutes prior to the start of seismic

shooting and during ramp-up procedures. The 30-minute observation period is only required prior to commencing seismic operations following an extended shut down period.

If ramp-up procedures must be performed at night, two observers will be on duty 30 minutes prior to the start of seismic shooting and during the subsequent ramp-up procedures. Otherwise, no observers will be on duty during seismic operations at night. However, LDEO bridge personnel (port and starboard seamen and one mate) will assist in marine mammal observations whenever possible, and especially during operations at night, when designated marine mammal observers will not normally be on duty. A marine mammal observer will be on "standby" at night, in case bridge personnel see a marine mammal. An image-intensifier night-vision device (NVD) will be available for use at night, although past experience has shown that NVDs are of limited value for this purpose.

The observer(s) will watch for marine mammals from the bridge, the highest practical vantage point on the vessel. The observer's eye level will be approximately 11 m (36 ft) above sea level when stationed on the bridge, allowing for good visibility within a 210° arc. The observer(s) will systematically scan the area around the vessel with 7 X 50 Fujinon reticle binoculars or with the naked eye during the daytime. At night, night vision equipment will be available (ITT F500 Series Generation 3 binocular image intensifier or equivalent), if required. Laser rangefinding binoculars (Bushnell Lytespeed 800 laser rangefinder with 4 optics or equivalent) will be available to assist with distance estimation. If a marine mammal is seen well outside the safety radius, the vessel may be maneuvered to avoid having the mammal come within the safety radius (see Mitigation). 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 Level B 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; and (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. Data will be entered into a custom database using a laptop computer when observers are off-duty. The accuracy of the data entry will be verified by computerized validity data checks as the data are entered and by subsequent manual checking of the database. These procedures will allow initial summaries of data to be prepared during and shortly after the field program, and will facilitate transfer of the data to statistical, graphical or other programs for further processing and archiving.

At least one experienced marine mammal observer will be on duty aboard the seismic vessel. During seismic operations in the Hess Deep area, two observers, including one qualified contract biologist and one observer appointed by LDEO, will be based aboard the vessel. Observers appointed by LDEO will complete a one-day training/refresher course on marine mammal monitoring procedures, given by a contract employee experienced in vessel-based seismic monitoring projects.

Observers will be on duty in shifts of duration no longer than 4 hours. The second observer will also be on watch part of the time, including the 30 minute periods preceding startup of the airguns and during ramp ups. 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.