

by compressors on board the source vessel. In addition to the operations of the airgun array, a multibeam bathymetric sonar will be operated from the source vessel continuously throughout the entire cruise, and a lower-energy sub-bottom profiler will also be operated during most of the survey.

The *Seward Johnson* will have four deployments of OBSs, prior to the time when the *Maurice Ewing* conducts airgun operations in that area. After each line is shot, the *Seward Johnson* will retrieve the OBSs, download the data, and refurbish the units before redeploying the OBSs along the next line that will be shot. During the Southeast Caribbean cruise, there will be four deployments of OBSs, one deployment along each of the OBS lines. OBSs will also be deployed at two other locations near each line to fill data gaps between islands.

In addition, the ocean floor will be mapped with an Atlas Hydrosweep DS-2 multibeam 15.5-kHz bathymetric sonar, and a 3.5-kHz sub-bottom profiler will also be operated along with the multibeam sonar. Both of these sound sources will be operated simultaneously with the airgun array. For more information regarding the Atlas Hydrosweep DS-2 multibeam bathymetric sonar, please refer to previous **Federal Register** Notices (68 FR 44291, July 28, 2003, and 68 FR 17773, April 11, 2003).

During the airgun operations, the vessel will travel at 7.4–9.3 km/hr (4–5 knots), and seismic pulses will be emitted at intervals of 60–90 sec (OBS lines) and approximately 20 sec (MCS lines). The 20 sec spacing corresponds to a shot interval of about 50 m (164 ft). The 60–90 sec spacing along OBS lines is to minimize reverberation from previous shot noise during OBS data acquisition, and the exact spacing will depend on water depth. The 20-airgun array will include airguns ranging in chamber volume from 80 to 850 in³. These airguns will be spaced in an approximate rectangle of dimensions of 35 m (115 ft) across track by 9 m (30 ft) along track.

Along the selected lines, the OBSs will be positioned by the *Seward Johnson* prior to the time when the *Maurice Ewing* conducts airgun operations in that area. After each line is shot, the *Seward Johnson* will retrieve the OBSs, download the data, and refurbish the units before redeploying the OBSs along the next line that will be shot. During the Southeast Caribbean cruise, there will be four deployments of OBSs, one deployment along each of the OBS lines. OBSs will also be deployed

at two other locations near each line to fill data gaps between islands.

When airgun operations with the 20-gun array commence after a period without airgun operations, the number of guns firing will be increased gradually (“ramped up,” also described as a “soft start”). Operations will begin with the smallest gun in the array (80 in³). Guns will be added in sequence such that the source level of the array will increase in steps not exceeding 6 dB per 5-min period over a total duration of approximately 25 minutes. Throughout the ramp-up procedure, the safety zone for the full 20-gun array will be maintained. Given the presence of the streamer and airgun array behind the vessel, the turning rate of the vessel with trailing streamer and array is no more than five degrees per minute, limiting the maneuverability of the vessel during operations.

Along with the airgun operations, two additional acoustical data acquisition systems will be operated during most or all of the cruise. The ocean floor will be mapped with an Atlas Hydrosweep DS-2 multibeam 15.5-kHz bathymetric sonar, and a 3.5-kHz sub-bottom profiler will also be operated along with the multibeam sonar. These sound sources are commonly operated from the *Maurice Ewing* simultaneous with the airgun array.

The Atlas Hydrosweep is mounted on the hull of the *Maurice Ewing*, and it operates in three modes, depending on the water depth. There is one shallow water mode and there are two deep-water modes: an Omni mode and a Rotational Directional Transmission mode (RDT). When water depth is less than 400 m (1312.3 ft), the source output is 210 dB re 1 μ Pa m rms and a single 1-millisecond pulse or “ping” per second is transmitted, with a beamwidth of 2.67 degrees fore-aft and 90 degrees athwartship. The beamwidth is measured to the -3 dB point, as is usually quoted for sonars. 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 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 and overall cross-track angular extent of about 140 degrees, with small gaps between the pulses for successive 30-degree segments. The total duration of

the “ping,” including all five successive segments, varies with water depth, but is 1 millisecond in water depths less than 500 m (1640.5 ft) and 10 millisecond in the deepest water. For each segment, “ping” duration is 1/5th of these values or 2/5th for a receiver in the overlap area ensonified by two beam segments. The “ping” interval during RDT operations depends on water depth and varies from once per second in less than 500 m (1640.5 ft) water depth to once per 15 seconds in the deepest water.

The sub-bottom profiler is normally operated to provide information about the sedimentary features and the 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. 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.

Additional information on the airgun arrays, bathymetric sonars, and sub-bottom profiler specifications is contained in the application, which is available upon request (see **ADDRESSES**).

Description of Habitat and Marine Mammals Affected by the Activity

A detailed description of the Southeast Caribbean Sea and its associated marine mammals can be found in a number of documents referenced in the LDEO application as well as in the LDEO application itself, and is not repeated here. In the Southeast Caribbean Sea and adjacent Atlantic Ocean, 30 marine mammal species are known to occur within the proposed study areas. Six species are listed as endangered under the U.S. Endangered Species Act (ESA): sperm, humpback, sei, fin, and blue whales, as well as West Indian manatees. These species included in this application are the sperm whale (*Physeter macrocephalus*), pygmy sperm whale (*Kogia breviceps*), dwarf sperm whale (*Kogia sima*), Cuvier's beaked whale (*Ziphius cavirostris*), Gervais' beaked whale (*Mesoplodon europaeus*), Blainville's beaked whale (*Mesoplodon densirostris*), rough-toothed dolphin (*Steno bredanensis*), tucuxi (*Sotalia uvialis*), bottlenose dolphin (*Tursiops truncatus*), Pantropical spotted dolphin (*Stenella attenuata*), Atlantic spotted dolphin (*Stenella frontalis*), spinner dolphin (*Stenella longirostris*), clymene dolphin (*Stenella clymene*), striped dolphin (*Stenella coeruleoalba*), long-beaked common dolphin (*Delphinus capensis*), Fraser's dolphin