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DRAFT ENVIRONMENTAL ASSESSMENT (DEA) PURSUANT TO THE NATIONAL ENVIRONMENTAL POLICY ACT, 42 U.S.C. 4321, *et seq.*

Marine Seismic Survey in the Gulf of Alaska September-October 2010

OCE# 0926614
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Project Title: Megathrust seismic hazards by reflection mapping

This constitutes a draft environmental assessment (DEA) by the National Science Foundation (NSF) for a marine seismic survey proposed to be conducted in September-October 2010 on board the research vessel (R/V) *Marcus G. Langseth* in the Gulf of Alaska. This DEA is based, in part, on an Environmental Assessment report prepared by LGL Limited environmental research associates (LGL) on behalf of NSF, entitled, "Environmental Assessment of a Marine Geophysical Survey by the R/V *Marcus G. Langseth* in the Gulf of Alaska, September-October 2010" (Report #TA4884-1) (Attachment 1). The conclusions from the LGL report were used to inform the Division of Ocean Sciences (OCE) management of potential environmental impacts of the cruise. OCE has reviewed and concurs with the report's findings. Accordingly, the LGL report is incorporated into this DEA by reference as if fully set forth herein.

Project Objectives and Context

The proposed seismic survey would characterize the subduction zone off southern Alaska, which produces large and destructive earthquakes (See Attachment 1, Figure 1). Subduction zones are plate tectonic boundaries where two plates converge and one plate is thrust beneath the other. This process results in geohazards, such as earthquakes and volcanoes, which affect millions of people around the world, particularly around the edges of the Pacific Ocean which mainly consist of subduction zones. The largest earthquakes on Earth occur at the interface between the two plates, called the megathrust. Recent examples include the magnitude 8.8 earthquake in Chile in February 2010 and the magnitude 9.1 earthquake offshore Sumatra in December 2004; the latter triggered a devastating tsunami. In 1964, the magnitude 9.2 "Good Friday" earthquake caused 131 deaths and produced widespread destruction across southcentral Alaska.

Earthquakes are caused by movement over a finite area of the plate interface called the seismogenic zone (See Attachment 1, Figure 2). Stress builds up in this zone and is released catastrophically in one or more earthquakes. Above and below this area, stress cannot build up, and the movement between the plates occurs smoothly through time and thus does not produce earthquakes. To improve our predictions and estimates of the likely damage that would be

associated with an earthquake in a given location, we require better constraints on the size of the seismogenic zone, particularly the location of the lower limit.

The primary purpose of the proposed study would be to use seismic reflection and refraction data to: (1) estimate the size of the seismogenic zone, the portion of the fault that controls the magnitude of earthquakes, off southern Alaska, and (2) provide critical information on how the properties of the seismogenic zone change along the subduction zone such that some areas produce large earthquakes and others do not.

The megathrust in the east Aleutian/Alaska subduction zone provides an ideal laboratory in which to test the ability of seismic reflection and refraction data to characterize the seismogenic zone because: 1) the earthquake history of this subduction zone is well known due to the relatively short recurrence rate of earthquakes (e.g., ~50-75 years in some places as compared to >300 years beneath the northwest U.S.); and 2) unlike many other subduction zones, the landward edge of the seismogenic zone lies offshore, allowing it to be studied with relatively inexpensive marine reflection profiling. The proposed study would focus on the Semidi segment of the Alaska-Aleutian subduction zone (See Attachment 1, Fig. 1); 71 years have passed since the 1938 earthquake, and the average megathrust repeat times for this zone appear to be 50 to 75 years, making it a highly relevant locality for further study. To meet the scientific and societal objectives, it would be necessary for the proposed survey lines extend close to the coastline to fully capture the downdip extent of the seismogenic zone and the transition to stable sliding below**.**

The project is a multiyear research project that would support scientists, graduate students, technicians, and other support personnel.

Summary of Proposed Action and Alternatives

The procedures to be used for the survey would be similar to those used during previous seismic surveys by L-DEO and would use conventional seismic methodology. The proposed survey would take place from approximately September 3 through October 9, 2010 in the Pacific Ocean, in the Gulf of Alaska, within the US Exclusive Economic Zone in water <100 m to >1000 m (See Attachment 1, Figure 1). Some minor deviation from these proposed dates might be required, depending on logistics and weather.

The seismic survey would consist of ~2553 km of transect lines. The survey would involve the R/V *Marcus G. Langseth* as the source vessel which would deploy an array of 36 airguns with a total discharge volume of ~6600 in^3. The receiving system would consist of two 8-km long hydrophone streamers and/or 21 ocean bottom seismometers (OBSs). The hydrophone streamer would receive the returning acoustic signals of the airgun array towed along the survey lines and the data would be transferred to the on-board processing system. The OBSs would be deployed and retrieved during the cruise and would record the returning acoustic signals internally for later analysis. The shot interval would be relatively short (22 s or 50 m) for MCS surveying with the hydrophone streamers, and long (120 s or 280 m) when recording data on the OBSs. The tow depth of the array would be 12 m during OBS refraction and MCS surveys. In addition to the operations of the airgun array, a multibeam echosounder (MBES) and a subbottom profiler (SBP) would also be operated from the R/V *Langseth* continuously throughout the cruise.

Seismic operations would be carried out for ~16 days, with the balance of the cruise occupied in transit and in deployment and retrieval of OBSs (~8 days).

One alternative to the proposed action would be to conduct the survey at an alternative time. Constraints for vessel operations and availability of equipment (including the vessel) and personnel would need to be considered for alternative cruise times. Limitations on scheduling the vessel include the additional research studies planned on the vessel for 2010 and beyond. Other research activities planned within the region also would need to be considered. Given the fact that marine mammals are in the survey area throughout the year, altering the timing of the proposed project likely would result in few net benefits.

Another alternative to conducting the proposed activities would be the "No Action" alternative, i.e. do not issue an IHA and do not conduct the operations. If the planned research were not conducted, the "No Action" alternative would result in no disturbance to marine mammals attributable to the proposed activities, but geological data of considerable scientific value and relevance for increasing our understanding of the subduction zone and the relationship between large earthquakes and physical properties within the plate boundary, both in this region and around the world, would not be acquired and the project objectives as described above would not be met. The "No Action" alternative would result in a lost opportunity to obtain important scientific data and knowledge relevant to a number of research fields and to society in general. The collaboration, involving institutions, investigators, students, and technicians, would be lost along with the collection of new data, interpretation of these data, and introduction of new results into the greater scientific community and applicability of this data to other similar settings. Loss of NSF support often represents a significant negative impact to the academic community.

Summary of environmental consequences

The potential effects of sounds from airguns on marine species, including mammals and turtles of particular concern, are described in detail in Attachment 1 (pages 54-93 and Appendices B-E) and might include one or more of the following: tolerance, masking of natural sounds, behavioral disturbance, and at least in theory, temporary or permanent hearing impairment, or non-auditory physical or physiological effects. It would be unlikely that the project would result in any cases of temporary or especially permanent hearing impairment, or any significant nonauditory physical or physiological effects. Some behavioral disturbance would be expected, if animals were in the general area during seismic operations, but this would be localized, short-term, and involve limited numbers of animals.

The proposed activity would include a mitigation program to further minimize potential impacts on marine mammals and sea turtles that could be present during the conduct of the research to a level of insignificance. As detailed in Attachment 1 (pages 8-15; and 68-69) monitoring and mitigation measures would include: ramp ups, minimum of one dedicated observer maintaining a visual watch during all daytime airgun operations, two observers for 30 min before and during ramp ups during the day and at night (and when possible at other times), no start ups during poor visibility or at night unless at least one airgun has been operating, passive acoustic monitoring (PAM) via towed hydro-phones during both day and night to complement visual monitoring (when practicable), power downs (or if necessary shut downs) when mammals or sea turtles are detected in or about to enter designated exclusion zones. Also, special mitigation measures

would be in place for situations or species of particular concern, such as shut downs for North Pacific right, sei, blue, and beluga whale (see Attachment 1, page 15). The fact that the 36-airgun array, as a result of its design, directs the majority of the energy downward, and less energy laterally, would also be an inherent mitigation measure, as would the relatively wide spacing of the airgun shots during OBS operations (~120 s).

With the planned monitoring and mitigation measures, unavoidable impacts to each species of marine mammal and turtle that may be encountered would be expected to be limited to short-term, localized changes in behavior and distribution near the seismic vessel. At most, effects on marine mammals may be interpreted as falling within the U.S. Marine Mammal Protection Act (MMPA) definition of "Level B Harassment" for those species managed by the National Marine Fisheries Service. No long-term or significant effects would be expected on individual marine mammals, sea turtles, seabirds, or the populations to which they belong or on their habitats.

The proposed project could potentially impact the availability of marine mammals for harvest in a very small area immediately around the *Langseth*, and for a very short time period during seismic activities. Considering the limited time and locations for the planned seismic surveys, the proposed project would not be expected to have any significant impacts to the availability of Steller sea lions, harbor seals, or sea otters for subsistence harvest. L-DEO would minimize the potential to negatively impact the subsistence fish harvest by avoiding areas where subsistence fishers are fishing, if requested or viewed necessary. L-DEO would consult with communities near the planned project area to identify and avoid areas of potential conflict. These consultations would include all marine subsistence activities (mammals and fisheries).

A survey at an alternative time would result in few net benefits. Marine mammals would be expected to be found throughout the proposed study area and throughout the time period during which the project may occur. A number of marine mammal species (killer whales, harbor seals, Steller sea lions, sea otters) are year-round residents in the GOA, so altering the timing of the proposed project likely would result in no net benefits for those species. Other marine mammal species (e.g., the humpback whale) are migratory, spending the summer months in the project area, and vacating the region in late fall, although not all humpback whales leave the area. Conversely, gray whales spend the summer in the Bering Sea, but migrate through the project area from October through January and again in spring. However, some occur in the GOA year-round. Even though postponing the proposed project to a later time in the year may reduce or avoid humpback whale as well as fisheries issues, gray whale occurrence in the area would increase later in the year. If the project were to be postponed to 2011, the seismic survey may occur in the area at the same time that the Navy is expanding its program in the GOA to include active sonar and vessel sinking exercises.

The "no action" alternative would remove the potential of the limited direct environmental consequences as described. However, it would preclude important scientific research from going forward that has distinct potential to improve our understanding of geologic processes, in particular earth quakes in Alaska, and other subduction zone areas around the world.

Conclusions

NSF has reviewed and concurs with the conclusions of the LGL Environmental Assessment (Attachment 1) that implementation of the proposed activity will not have a significant impact on the environment.