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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 Southeast Asia, March-July 2009

OCE #0408609
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Project Title: Collaborative Research: Integrated Investigation of the Geodynamics of the Taiwan Orogeny [TAIGER]

This constitutes a draft environmental assessment (DEA) by the National Science Foundation (NSF) for a marine seismic survey proposed to be conducted on board the research vessel (R/V) *Marcus G. Langseth* in Southeast Asia during March – July 2009. 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 Southeast Asia, March-July 2009" (Report #TA4553-1) (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 will provide data integral to advancing scientific understanding of the process of large-scale mountain building, or "orogeny," which in turn can provide information on locations and source properties of regional earthquakes. This study addresses fundamental questions about a key step in the growth of continents - arc accretion - in one of its most active examples, along the Taiwan arc-continental collision in the China and Philippine seas. Taiwan is one of only a few sites of arc-continent collision worldwide. The vicinity of Taiwan is particularly well-suited for this type of study, because the collision can be observed at different stages of its evolution, from incipient, to mature, and finally to post-collision. As a result of its location in an ongoing tectonic collision zone, Taiwan experiences a great number of earthquakes; most are small, but some are large and destructive. This project will provide a great deal of information about the nature of the earthquakes around Taiwan and will lead to a better assessment of earthquake hazard in the area. The information obtained from this study will help the people and government of Taiwan to better assess the potential for future seismic events and may thus mitigate some of the loss of life and economic disruptions that will inevitably occur.

The information learned in this location may also be applicable to other rare, but similar geologic sites.

By combining detailed 2-D studies along transects and 3-D images for the whole region, the orogen and its evolution can be characterized. The work would result in the first detailed 3-D picture of an orogen from surface to mantle. The geometry of the plate interactions, the mode of crustal deformation, and the material properties will provide a new quantitative basis for geodynamic modeling. The project will be an international collaborative effort, including support from the US, Taiwan and Japan.

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 will use conventional seismic methodology. The survey would take place from March through July 2009 in the Exclusive Economic Zones (EEZ) of Taiwan, China, Philippines, and Japan, in water depths ranging from <100 to >1000 m. 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 a hydrophone streamer and ~100 ocean bottom seismometers (OBSs). The R/V *Langseth* would deploy an 8-km long streamer for most transects requiring a streamer; however, a shorter streamer (500 m to 2 km) would be used during surveys in Taiwan (Formosa) Strait. As the airgun array is towed along the survey lines, the hydrophone streamer would receive the returning acoustic signals and transfer the data to the on-board processing system. The OBSs record the returning acoustic signals internally for later analysis. The OBSs to be used for the 2009 program would be deployed and retrieved numerous times by a combination of four or five Taiwanese support vessels (see Attachment 1, page 6), as well as perhaps the R/V *Langseth*. The R/V *Langseth* would also retrieve 20 OBSs that were deployed in the study area during previous years to record earthquake activity. 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.

The proposed seismic survey would consist of ~15,902 km of transect lines within the South and East China seas as well as the Philippine Sea, with the majority of survey effort occurring in the South China Sea (see Attachment 1, Figure 1). Most survey effort (~80%) would occur in deep (>1000 m) water, 13% would take place in intermediate-depth waters (100–1000 m), and 7% would occur in shallow water (<100 m deep).

Although breeding humpback whales are known to occur in the study area at the time of the proposed survey, seismic operations in areas where humpbacks breed would be avoided at least during the month of March, when peak numbers of animals occur there. In addition, green and hawksbill sea turtles are known to nest in the TAIGER study area at the time of the survey, and loggerhead turtles are known to nest in nearby Okinawa. Although green turtles nest in the area year round, the peak nesting season appears to fall outside of the study period.

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 2009 and beyond. Other national and international research activities planned within the region also would need to be considered. Given the limited weather window for the operations, and the fact that cetaceans are widespread in the survey area throughout the year, altering the timing of the proposed project likely would result in no 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 in understanding large-scale mountain building and source properties of regional earthquakes 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 international collaboration, involving institutions, investigators, students, and technicians, would be lost along with the collection of new data, interpretation these data, and introduction of new results into the greater scientific community and applicability of this data to other collisional settings. Loss of NSF support often represents a significant negative impact to the academic infrastructure.

Summary of environmental consequences

The potential effects of sounds from airguns on marine species, mammals and turtles of particular concern, are described in detail in Attachment 1 (pages 46-81 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 is 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 is expected, if animals are 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 that may be present during the conduct of the research to a level of insignificance. As detailed in Attachment 1 (pages 7-16; and 59) 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 minutes before and during ramp-ups during the day and at night (and when possible at other times), passive acoustic monitoring (PAM) during the day and night to complement visual monitoring (when practicable), power downs (or if necessary shut downs) when mammals or turtles are detected in or about to enter designated exclusion zones. Also, special mitigation measures would be in place for Western Pacific gray whales, North Pacific right whales, humpback whales, and Indo-Pacific humpback dolphins. 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 is the relatively wide spacing of the airgun shots during OBS operations (up to ~125 meters or 60 seconds).

With the planned monitoring and mitigation measures, unavoidable impacts to each species of marine mammal and turtle that could be encountered would be expected to be limited to short-term, localized changes in behavior (such as brief masking of natural sounds) 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, or the populations to which they belong or on their habitats.

A survey at an alternative time may not be advantageous. Marine mammals and sea turtles are expected to be found throughout the proposed study area. Humpback whales are known to winter in the study area. Breeding areas would be avoided as practical, particularly during peak occurrence in March.

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 address environmental processes/concerns.

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.