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Geosciences Directorate
Division of Ocean Sciences
Arlington, Virginia**

**DRAFT ENVIRONMENTAL ASSESSMENT
PURSUANT TO THE NATIONAL ENVIRONMENTAL POLICY ACT (NEPA),
42 U.S.C. 4321, *et seq.*
AND EXECUTIVE ORDER 12114**

Marine Seismic Survey in the Northeast Pacific Ocean, August/September 2009

OCE # 0454747

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Project Title: Collaborative Research: Testing Models of Magmatic and Hydrothermal Segmentation: A 3-D Seismic Tomography Experiment at the Endeavour Ridge

This constitutes a revised 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 the northeast Pacific Ocean in August/September 2009. This potential cruise was originally scheduled for October 2008. However, due to potential weather and ship scheduling challenges, it was postponed until August/September 2009. Prior to rescheduling, a DEA was posted on the NSF website for public comment for a 30 day period between June 09, 2008 and July 09, 2008. No public comments on the DEA were received by NSF during, or after, this open public comment period. The DEA was based, in part, on an Environmental Assessment 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 Northeast Pacific Ocean, October 2008" (Report #TA4597-1).

The cruise postponement will not result in any changes to the project objectives or scope. Due to the change in cruise dates however, NSF has revised the DEA, based on a revised Environmental Assessment prepared by LGL on behalf of NSF, entitled, "Environmental Assessment of a Marine Geophysical Survey by the R/V *Marcus G. Langseth* in the Northeast Pacific Ocean, August-September 2009" (Attachment 1), which reevaluated the analysis with respect to the new potential cruise dates. Additional information regarding threatened and endangered fish, essential fish habitat, and habitat areas of particular concern were added to the assessment. No significant changes or impacts to the marine environment were identified during the reevaluation as the original cruise dates are within a similar seasonal timeframe as the new proposed cruise dates. No changes were made to the take requests. The conclusions from the LGL report were used to inform the Division of Ocean Sciences (OCE) management of potential environmental impacts of the 2009 cruise. After the LGL report was fully and independently reviewed by OCE management, OCE management concurred with the report's findings. Accordingly, the LGL report is incorporated into this DEA by reference and fully adopted as if fully set forth herein.

Project Objectives and Context

The Endeavour Tomography study (ETOMO), would include a seismic survey that would provide data integral to advancing scientific understanding of the sub-seafloor structure of volcanic and hydrothermal features that form as a result of movements of the Earth's plates. The survey would obtain information on the 3-D seismic structure of the crust and top-most mantle along an 80-km-long section of the Juan de Fuca Ridge in the Canadian Endeavour Marine Protected Area (MPA). This information would define the distribution of magma beneath active volcanoes and the nature of the reaction zone that connects magmatic and hydrothermal systems. Such data would help us to better understand the transfer of energy and mass between the solid earth and the oceans. Past studies using manned submersibles and remotely piloted vehicles have mapped the locations and characteristics of vent fields along this ridge segment. The ETOMO study would extend that mapping beneath the seafloor and allow us to understand the dynamics of these systems. This study would provide basic subsurface constraints on the magmatic and hydrothermal processes that lead to the hydrothermal vents which are the focus of the Canadian MPA.

The ETOMO study would directly benefit one of the primary science nodes of a cable-linked seafloor observatory in the Northeast Pacific Ocean, which is being installed by the North-East Pacific Time-series Undersea Networked Experiments (NEPTUNE) Canada (<http://www.neptunecanada.ca>). More specifically, the information collected would improve knowledge of the regional seismic velocity structure. This information would in turn be used to obtain improved locations of earthquakes. Such information would be vital to understanding plate tectonic processes and their effects on earthquake occurrence and distribution. In addition, the information would lead to a better understanding of the Endeavour magmatic and hydrothermal systems, and thus improve interpretations of time-series observations obtained by NEPTUNE Canada in and around the Endeavour vent fields.

Summary of Proposed Action and Alternatives

The 2009 survey is proposed to be conducted ~250 southwest of Vancouver Island, within the Canadian Endeavour MPA and the Exclusive Economic Zone of Canada. A 36-airgun array, with a maximum discharge volume of 6600 in³ total, would be used as the energy source during the experiment. The receiving system for the returning acoustic signals would consist of 64 Ocean Bottom Seismometers (OBSs) which the *Langseth* would also deploy and retrieve. A hydrophone streamer would not be used to receive geophysical data during this survey. The planned seismic survey would consist of ~1800 km of survey lines. All survey efforts would take place in deep (>1000 m) water.

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. Alternative survey times offer minimal advantages or disadvantages in this location.

Another alternative to conducting the proposed activities would be the “No Action” alternative, i.e., 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, and no environmental impacts of other types. The seismic data from the proposed seismic survey to advance scientific understanding of the sub-seafloor structure of volcanic and hydrothermal features that form as a result of movements of the Earth’s plate would not be available for use and the project objectives as described above would not be met. It is anticipated that the data collected from a survey such as that proposed will be critical in furthering the understanding of sub-seafloor structure of volcanic and hydrothermal vent systems, plate tectonics, and earthquake occurrence and distribution. 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 institutions, investigators, students, and technicians involved would lose collection of new data, thus halting support of the greater effort to process and interpret these data, and introduce new results into the greater scientific community. 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 are described in detail in Attachment 1 (pages 52-84 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, but this would be localized and short-term.

The proposed activity would include a mitigation program to minimize 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 8-18; and 67), mitigation measures that would be adopted 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 when practicable, power downs (or if necessary shut downs) when mammals or turtles are detected in or about to enter designated exclusion zones, and additional special measures applicable to North Pacific right whales.

With the planned monitoring and mitigation measures, unavoidable impacts to each species of marine mammal and turtle that could be encountered are 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 are expected on individual marine mammals, sea turtles, or the populations to which they belong, or on their habitats.

The proposed project would have little impact on fish resources, and the only effect on fish habitat would be short term disturbance that could lead to temporary relocation of pelagic fish

species or their food. Impacts of seismic sounds on birds are possible, although none are expected to be significant to their populations. Impacts on benthic invertebrates are unlikely. Considering the location of the planned seismic survey, no significant impacts are expected on the availability of marine mammals or fish for subsistence harvest.

As marine mammals are expected to be found throughout the proposed study area and throughout the time period during which the project may occur, no significant benefits would be gained from the alternative to conduct the survey at a different time (see Attachment 1, page 84).

The “no action” alternative would not have any environmental consequences; although it would preclude important scientific research from going forward.

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.