

2011 Plan of Cooperation Arctic Ocean

Prepared for

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I. INTRODUCTION

The University of Alaska Geophysics Institute (UAGI) is planning a marine seismic survey in the Arctic Ocean for fall 2011. The survey will take place from the R/V *Marcus G. Langseth*, which is operated by Lamont-Doherty Earth Observatory (L-DEO), under a cooperative agreement with the U.S. National Science Foundation (NSF). The survey is proposed to occur from 5 September to 9 October in the area 72.5–77°N, 160–175°W (Fig. 1). The *Langseth* will deploy an array of 10 airguns as an energy source, with a total discharge volume of ~1830 in³. The impacts of the project, as well as the measures that will be implemented to mitigate those impacts, are analyzed in the *Environmental Assessment*.

UAGI, in consultation with representatives from North Slope communities, has developed a Plan of Cooperation (POC) for the 2011 Arctic Ocean seismic survey. The purpose of this POC is to identify measures that will be taken to minimize any adverse effects on the availability of marine mammals for subsistence uses, and to ensure good communication between the project scientists and the potentially affected communities. UAGI will implement the POC during the 2011 seismic program to mitigate the potential for conflicts between the proposed activity and traditional subsistence activities. In addition, the POC details UAGI's communications and consultations with North Slope communities concerning the proposed 2011 program, potential conflicts with subsistence activities, and means of resolving any such conflicts. This POC may be amended to reflect additional communications with local subsistence users and any additional or revised mitigation measures that are adopted as a result.

UAGI has and will continue to consult with potentially affected North Slope subsistence communities, the North Slope Borough (NSB), and the Alaska Eskimo Whaling Commission (AEWC). Consultation is needed to discuss potential conflicts with the timing and proposed mitigating measures which could be implemented.

II. MEASURES IN PLACE

The following mitigation measures are integral to this POC, and were developed during consultation with potentially affected subsistence groups, communities, and the NSB. These measures will be implemented by UAGI during the 2011 seismic survey in the Arctic Ocean to monitor and mitigate potential impacts to subsistence users and resources. These measures are documented in the following sections: (1) marine mammal monitoring and mitigation measures, and (2) subsistence mitigation measures.

Marine mammal monitoring and mitigation measures

(1) Visual Monitoring

Protected Species Observers (PSOs) will watch for marine mammals near the seismic source vessel during all daytime airgun operations and during any start ups of the airguns at night. Airgun operations will be suspended when marine mammals are observed within, or about to enter, designated safety or exclusion zones where there is concern about potential effects on hearing or other physical effects. PSOs will also watch for marine mammals near the seismic vessel for at least 30 min prior to the planned start of airgun operations after an extended shut down of the airguns. When feasible, observations will also be made during daytime periods when the *Langseth* is underway without seismic operations, such as during transits.

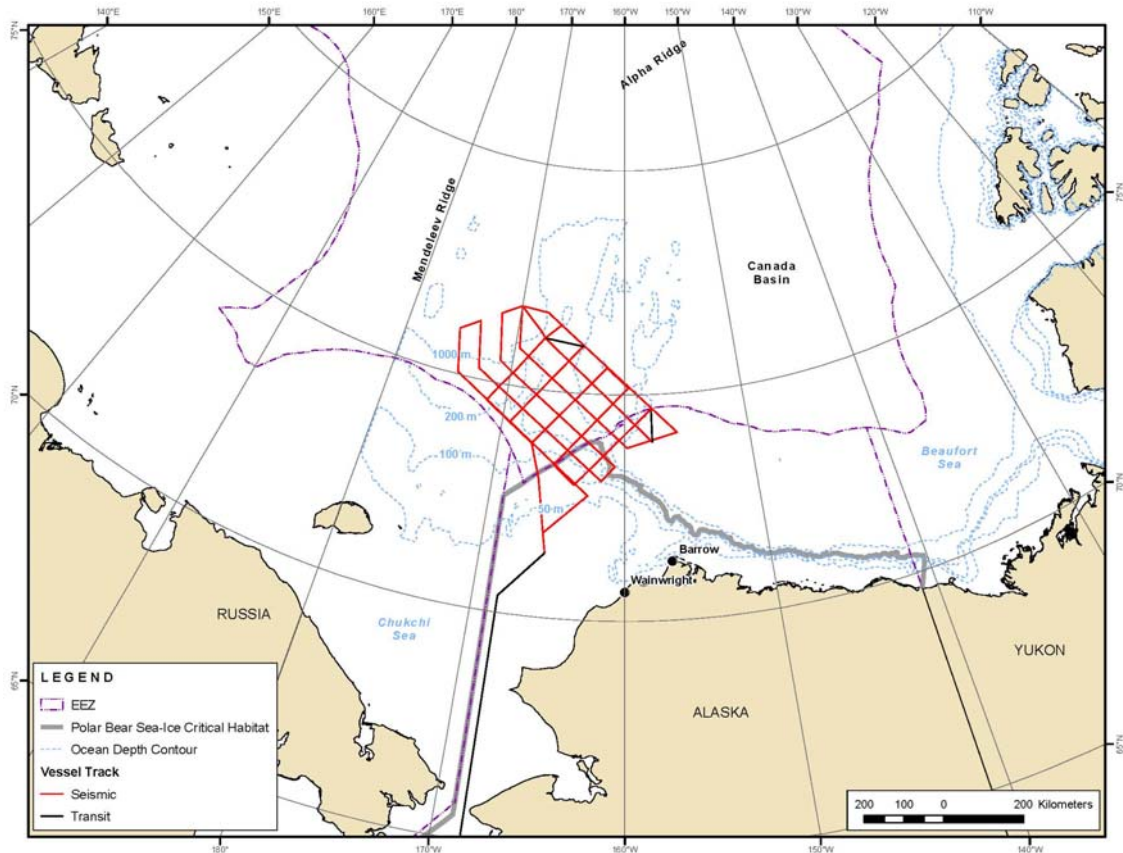


FIGURE 1. Proposed location of UAGI's September–October 2011 Arctic Ocean seismic survey lines. The precise track may vary somewhat from this proposed version depending on ice conditions.

During seismic operations, at least five PSOs will be based aboard the *Langseth*. PSOs will be appointed by L-DEO with National Marine Fisheries Service (NMFS) concurrence. Observations will take place during ongoing daytime operations and nighttime start ups of the airguns. During the majority of seismic operations, two PSOs will monitor marine mammals near the seismic vessel. Use of two simultaneous observers will increase the effectiveness of detecting animals near the source vessel. However, during meal times, only one PSO may be on duty. PSO(s) will be on duty in shifts of duration no longer than 4 h. Other crew will also be instructed to assist in detecting marine mammals and implementing mitigation requirements. Before the start of the seismic survey, the crew will be given additional instruction regarding how to do so.

The *Langseth* is a suitable platform for marine mammal observations. When stationed on the observation platform, the eye level will be ~21.5 m above sea level, and the observer will have a good view around the entire vessel. During daytime, the PSO(s) will scan the area around the vessel systematically with reticle binoculars (e.g., 7×50 Fujinon), Big-eye binoculars (25×150), and with the naked eye. During darkness, night vision devices (NVDs) will be available (ITT F500 Series Generation 3 binocular-image intensifier or equivalent), when required. Laser rangefinding binoculars (Leica LRF 1200 laser rangefinder or equivalent) will be available to assist with distance estimation. Those are useful in training observers to estimate distances visually, but are generally not useful in measuring distances to animals directly; that is done primarily with the reticles in the binoculars.

When mammals are detected within or about to enter the designated exclusion zone, the airguns will immediately be powered down or shut down if necessary. The PSO(s) will continue to maintain watch to determine when the animal(s) are outside the exclusion zone. Airgun operations will not resume until the animal has left the exclusion zone.

The vessel-based monitoring will provide data to estimate the numbers of marine mammals exposed to various received sound levels, to document any apparent disturbance reactions or lack thereof, and thus to estimate the numbers of mammals potentially “taken” by harassment. It will also provide the information needed in order to power down or shut down the airguns at times when mammals are present in or near the exclusion zone. When a 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 the airguns or vessel (e.g., none, avoidance, approach, paralleling, etc.), and behavioral pace.
2. Time, location, heading, speed, activity of the vessel, sea state, visibility, 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 observations and power downs or shut downs will be recorded in a standardized format. Data will be entered into an electronic database. The accuracy of the data entry will be verified by computerized data validity 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, and other programs for further processing and archiving.

Results from the vessel-based observations will provide

1. The basis for real-time mitigation (airgun power down or shut down).
2. Information needed to estimate the number of marine mammals potentially taken by harassment, which must be reported to NMFS.
3. Data on the occurrence, distribution, and activities of marine mammals in the area where the seismic study is conducted.
4. Information to compare the distance and distribution of marine mammals relative to the source vessel at times with and without seismic activity.
5. Data on the behavior and movement patterns of marine mammals seen at times with and without seismic activity.

(2) Passive Acoustic Monitoring

Passive acoustic monitoring (PAM) will take place to complement the visual monitoring program. Visual monitoring typically is not effective during periods of poor visibility or at night, and even with good visibility, is unable to detect marine mammals when they are below the surface or beyond visual range. Acoustical monitoring can be used in addition to visual observations to improve detection, identification, and localization of marine mammals. The acoustic monitoring will serve to alert visual observers (if on duty) when vocalizing cetaceans are detected. It is only useful when marine mammals call, but it can be effective either by day or by night, and does not depend on good visibility. It will be monitored in real time so that the visual observers can be advised when marine mammals are detected.

The PAM system consists of hardware (i.e., hydrophones) and software. The “wet end” of the system consists of a towed hydrophone array that is connected to the vessel by a tow cable. The tow cable is 250 m long, and the hydrophones are fitted in the last 10 m of cable. A depth gauge is attached to the free end of the cable, and the cable is typically towed at depths <20 m. The array will be deployed from a winch located on the back deck. A deck cable will connect the tow cable to the electronics unit in the main computer lab where the acoustic station, signal conditioning, and processing system will be located. The acoustic signals received by the hydrophones are amplified, digitized, and then processed by the Pamguard software. The system can detect marine mammal vocalizations at frequencies up to 250 kHz.

The towed hydrophones will ideally be monitored 24 h per day while at the seismic survey area during airgun operations, and during most periods when the *Langseth* is underway while the airguns are not operating. However, PAM may not be possible if damage occurs to the array or back-up systems during operations. One PSO will monitor the acoustic detection system at any one time, by listening to the signals from two channels via headphones and/or speakers and watching the real-time spectrographic display for frequency ranges produced by cetaceans. PSOs monitoring the acoustical data will be on shift for 1–6 h at a time. All PSOs are expected to rotate through the PAM position, although the most experienced with acoustics will be on PAM duty more frequently.

When a vocalization is detected while visual observations are in progress, the acoustic PSO will contact the visual PSO immediately, to alert him/her to the presence of cetaceans (if they have not already been seen), and to allow a power down or shut down to be initiated, if required. The information regarding the call will be entered into a database. The data to be entered include an acoustic encounter identification number, whether it was linked with a visual sighting, date, time when first and last heard and whenever any additional information was recorded, position and water depth when first detected, bearing if determinable, species or species group (e.g., unidentified dolphin, sperm whale), types and nature of sounds heard (e.g., clicks, continuous, sporadic, whistles, creaks, burst pulses, strength of signal, etc.), and any other notable information. The acoustic detection can also be recorded for further analysis.

(3) Proposed Exclusion Zones

Received sound levels for the 10-airgun array have been predicted by Marine Acoustics, Inc., in relation to distance and direction from the airguns, and received sound levels for a single 40-in³ mitigation airgun have been predicted by L-DEO. Table 1 shows the distances at which three rms sound levels are expected to be received from the 10-airgun array and a single airgun. The 180- and 190-dB levels are shut-down criteria applicable to cetaceans and pinnipeds, respectively, as specified by NMFS; these levels were used to establish the exclusion zones. If the PSO detects marine mammal(s) within or about to enter the appropriate exclusion zone, the airguns will be powered down (or shut down if necessary) immediately.

(4) Mitigation During Operations

Mitigation measures that will be adopted during the survey include (1) power-down procedures, (2) shut-down procedures, and (3) ramp-up procedures.

Power-down Procedures.—A power down involves decreasing the number of airguns in use such that the radius of the 180-dB (or 190-dB) zone is decreased to the extent that marine mammals are no longer in or about to enter the exclusion zone. A power down of the airgun array can also occur when the vessel is moving from one seismic line to another. During a power down for mitigation, one airgun will be operated. The continued operation of one airgun is intended to alert marine mammals to the presence of the seismic vessel in the area. In contrast, a shut down occurs when all airgun activity is suspended.

TABLE 1. Maximum predicted distances to which sound levels ≥ 190 , 180, and 160 dB re 1 $\mu\text{Pa}_{\text{rms}}$ could be received in various water-depth categories during the proposed survey in the Arctic Ocean. The distances for the 10-airgun array are the averages of modeled 95% percentile distances at modeling sites in each depth range.

Source and Volume	Tow Depth (m)	Water Depth	Predicted RMS Radii (m)		
			190 dB	180 dB	160 dB
Single Bolt airgun 40 in ³	6	Deep (>1000 m)	12	40	385
		Intermediate (100–1000 m)	18	60	578
		Shallow (<100)	150	296	1050
1 string 10 airguns 1830 in ³	6	Deep (>1000 m)	130	425	14,070
		Intermediate (200–1000 m)	130	1400	13,980
		Shallow (<200)	190	1870	14,730

If a marine mammal is detected outside the exclusion zone but is likely to enter the exclusion zone, the airguns will be powered down before the animal is within the exclusion zone. Likewise, if a mammal is already within the safety zone when first detected, the airguns will be powered down immediately. During a power down of the airgun array, the 40-in³ airgun will be operated. If a marine mammal is detected within or near the smaller exclusion zone around that that single airgun (Table 1), it will be shut down (see next subsection).

Following a power down, airgun activity will not resume until the marine mammal has cleared the safety zone. The animal will be considered to have cleared the safety zone if

- it is visually observed to have left the exclusion zone, or
- it has not been seen within the zone for 15 min in the case of small odontocetes (or pinnipeds), or
- it has not been seen within the zone for 30 min in the case of mysticetes and large odontocetes, including sperm, pygmy sperm, dwarf sperm, and beaked whales.

The airgun array will be ramped up gradually after the marine mammal has cleared the safety zone. Ramp-up procedures are described below.

Shut-down Procedures.—The operating airgun(s) will be shut down if a marine mammal is seen within or approaching the exclusion zone for the single airgun. Shut downs will be implemented (1) if an animal enters the exclusion zone of the single airgun after a power down has been initiated, or (2) if an animal is initially seen within the exclusion zone of the single airgun when more than one airgun (typically the full array) is operating. Airgun activity will not resume until the marine mammal has cleared the safety zone, or until the PSO is confident that the animal has left the vicinity of the vessel. Criteria for judging that the animal has cleared the safety zone will be as described in the preceding subsection.

Ramp-up Procedures.—A ramp-up procedure will be followed when the airgun array begins operating after a specified period without airgun operations or when a power down has exceeded that period. It is proposed that, for the present cruise, this period would be ~8 min. Similar periods (~8–10 min) were used during previous L-DEO surveys.

Ramp up will begin with the smallest airgun in the array (40 in³). Airguns will be added in a 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 ~15 to 20 min. During ramp up, the PSOs will monitor the exclusion zone, and if marine mammals are sighted, a power down or shut down will be implemented as though the full array were operational.

If the complete exclusion zone has not been visible for at least 30 min prior to the start of operations in either daylight or nighttime, ramp up will not commence unless at least one airgun (40 in³ or similar) has been operating during the interruption of seismic survey operations. Given these provisions, it is likely that the airgun array will not be ramped up from a complete shut down at night or in thick fog, because the outer part of the safety zone for that array will not be visible during those conditions. If one airgun has operated during a power-down period, ramp up to full power will be permissible at night or in poor visibility, on the assumption that marine mammals will be alerted to the approaching seismic vessel by the sounds from the single airgun and could move away. Ramp up of the airguns will not be initiated if a marine mammal is sighted within or near the applicable exclusion zones during the day or at night.

Subsistence Mitigation Measures

The proposed activity has been timed so as to avoid overlap with the main harvests of marine mammals (especially bowhead whales) and is not expected to affect the success of subsistence fishers. In the past, the bulk of the Barrow bowhead harvest has been taken during the spring hunt. The proposed survey is scheduled for the fall, from 5 September to 9 October. Some whales are also taken during the autumn hunt at Barrow usually beginning in mid September, and mainly in the waters east and northeast of Point Barrow. The proposed survey is located far to the north and west of Point Barrow. The scheduling and location far (>200 km) offshore of this seismic survey has been discussed with representatives of those concerned with the subsistence bowhead hunt, most notably the AEW and the Barrow Whaling Captains' Association. No major concerns have been expressed. The timing of the proposed survey is after the beluga harvest and would occur well outside the area where seismic surveys would influence any late beluga hunting by Barrow hunters.

Although ringed seals are available year-round, the seismic survey will not occur during the primary period when these seals are harvested. Also, the seismic survey in offshore waters will not influence ringed, spotted, or bearded seals in the nearshore areas where they are hunted. It is unlikely that accessibility to walrus during the subsistence hunt could be impaired during the *Langseth's* traverse north of Barrow to the starting point of the seismic survey in September and October. The area affected, in any case, would be an area in close proximity to the ship. The airguns would not be operating at this time. Similarly, it is not expected that the seismic survey will interfere with polar bear subsistence hunting because of the limited annual harvest documented by the U.S. Fish and Wildlife Service (USFWS) and the fact that the subsistence hunt typically takes place in the winter and spring, either well after or well before the scheduled survey.

A Barrow resident knowledgeable about the mammals and fish of the area will be included as a member of the PSO team aboard the *Langseth*. Although his primary duties will be as a member of the PSO team responsible for implementing the monitoring and mitigation requirements, he will also be able to act as liaison with hunters and fishers if they are encountered at sea.

In the highly unlikely event that subsistence fishing (or hunting) is occurring within 5 km of the *Langseth's* trackline, the airgun operations will be suspended until the *Langseth* is >5 km away.

III. COMMUNITY MEETINGS

The principal investigator (PI) of the study initially contacted Dr. Glenn Sheehan of the Barrow Arctic Science Consortium and the North Slope Borough (NSB) Department of Wildlife Management biologist, Dr. Robert Suydam, on 7 January 2010 to inform them of the proposed study and the elements intended to minimize potential subsistence conflict. The PI presented the proposed survey at a meeting of the AEW in Barrow on 11 February 2010 and again on 17–18 February 2011; representatives from all NSB communities attended. The PI explained the survey plans to the local residents, including NSB biologists, Robert Suydam and Craig George, consulted with stakeholders about their concerns, and discussed the aspects of the survey designed to mitigate impacts. The PI also attended the Open-Water Meeting in Anchorage during 7–8 March 2011. No major concerns have been expressed at the meetings thus far. As requested by AEW, communication lines between the NSB and the *Langseth* during the survey will be kept open in order to minimize potential conflicts.