Seattle, WA 98115–0700; phone (206)526–6150; fax (206)526–6426; and

Southwest Region, NMFS, 501 West Ocean Blvd., Suite 4200, Long Beach, CA 90802–4213; phone (562)980–4001; fax (562)980–4018.

FOR FURTHER INFORMATION CONTACT: Andrew Wright or Dr. Tammy Adams, (301)713–2289.

SUPPLEMENTARY INFORMATION: On March 9, 2006, notice was published in the Federal Register (71 FR 12185) that a request for a scientific research permit to take the species identified above had been submitted by the above–named organization. The requested permit has been issued under the authority of the Marine Mammal Protection Act of 1972, as amended (16 U.S.C. 1361 *et seq.*), and the Regulations Governing the Taking and Importing of Marine Mammals (50 CFR part 216).

The permit authorizes the holder to conduct five research projects related to population and health assessment and studies of the ecology of and disease in these pinniped species. The permit authorizes the holder to harass, capture, sample (blood and various tissues), mark (by dye, flipper tag, neoprene patch, and hot brand), and attach instruments to individuals and to inject California sea lion and northern fur seal pups with either an antihelminthic treatment or placebo. The permit also authorizes NMML a limited number of mortalities of each species per year incidental to the research. Please refer to the tables in the permit for details of the numbers of marine mammals that are authorized to be taken during the course of the various research activities. The permit will expire on April 30, 2011.

In compliance with the National Environmental Policy Act of 1969 (42 U.S.C. 4321 *et seq.*), a final determination has been made that the activity proposed is categorically excluded from the requirement to prepare an environmental assessment or environmental impact statement.

Dated: May 9, 2006.

Stephen L. Leathery,

Chief, Permits, Conservation and Education Division, Office of Protected Resources, National Marine Fisheries Service.

[FR Doc. E6–7356 Filed 5–12–06; 8:45 am]

BILLING CODE 3510–22–S

DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

[I.D. 050306A]

Small Takes of Marine Mammals Incidental to Specified Activities; Marine Geophysical Survey of the Western Canada Basin, Chukchi Borderland and Mendeleev Ridge, Arctic Ocean, July-August, 2006

AGENCY: National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce.

ACTION: Notice; receipt of application and proposed incidental take authorization; request for comments.

SUMMARY: NMFS has received an application from the University of Texas at Austin Institute for Geophysics (UTIG) for an Incidental Harassment Authorization (IHA) to take small numbers of marine mammals, by harassment, incidental to conducting a marine seismic survey in the Arctic Ocean from approximately July 15 – August 25, 2006. Pursuant to the Marine Mammal Protection Act (MMPA), NMFS is requesting comments on its proposal to issue an authorization to incidentally take, by harassment, small numbers of several species of marine mammals during the seismic survey.

DATES: Comments and information must be received no later than June 14, 2006.

ADDRESSES: Comments on the application should be addressed to Steve Leathery, Chief, Permits, Conservation and Education Division, Office of Protected Resources, National Marine Fisheries Service, 1315 East-West Highway, Silver Spring, MD 20910–3225. The mailbox address for providing email comments is *PR1.050306A@noaa.gov*. NMFS is not responsible for e-mail comments sent to addresses other than the one provided here. Comments sent via e-mail, including all attachments, must not exceed a 10–megabyte file size.

A copy of the application containing a list of the references used in this document may be obtained by writing to the address specified above, telephoning the contact listed below (see **FOR FURTHER INFORMATION CONTACT**), or visiting the internet at: *http://www.nmfs.noaa.gov/pr/permits/incidental.htm*.

Documents cited in this notice may be viewed, by appointment, during regular business hours, at the aforementioned address.

FOR FURTHER INFORMATION CONTACT: Jolie Harrison, Office of Protected Resources, NMFS, (301) 713–2289, ext 166.

SUPPLEMENTARY INFORMATION:

Background

Sections 101(a)(5)(A) and (D) of the MMPA (16 U.S.C. 1361 *et seq.*) direct the Secretary of Commerce to allow, upon request, the incidental, but not intentional, taking of marine mammals by U.S. citizens who engage in a specified activity (other than commercial fishing) within a specified geographical region if certain findings are made and either regulations are issued or, if the taking is limited to harassment, a notice of a proposed authorization is provided to the public for review.

Authorization shall be granted if NMFS finds that the taking will have a negligible impact on the species or stock(s), will not have an unmitigable adverse impact on the availability of the species or stock(s) for subsistence uses, and that the permissible methods of taking and requirements pertaining to the mitigation, monitoring and reporting of such takings are set forth. NMFS has defined ''negligible impact'' in 50 CFR 216.103 as ''...an impact resulting from the specified activity that cannot be reasonably expected to, and is not reasonably likely to, adversely affect the species or stock through effects on annual rates of recruitment or survival.''

Section 101(a)(5)(D) of the MMPA established an expedited process by which citizens of the United States can apply for an authorization to incidentally take small numbers of marine mammals by harassment. Except with respect to certain activities not pertinent here, the MMPA defines ''harassment'' as:

> any act of pursuit, torment, or annoyance which (i) has the potential to injure a marine mammal or marine mammal stock in the wild [Level A harassment]; or (ii) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering [Level B harassment].

Section 101(a)(5)(D) establishes a 45–day time limit for NMFS review of an application followed by a 30–day public notice and comment period on any proposed authorizations for the incidental harassment of marine mammals. Within 45 days of the close of the comment period, NMFS must either issue or deny issuance of the authorization.

Summary of Request

On March 8, 2006, NMFS received an application from UTIG for the taking, by harassment, of several species of marine mammals incidental to conducting, with research funding from the National Science Foundation (NSF), a marine seismic survey in the Western Canada Basin, Chukchi Borderland and Mendeleev Ridge of the Arctic Ocean during July through August, 2006. The seismic survey will be operated in conjunction with a sediment coring project, which will obtain data regarding crustal structure. The purpose of the proposed study is to collect seismic reflection and refraction data and sediment cores that reveal the crustal structure and composition of submarine plateaus in the western Amerasia Basin in the Arctic Ocean. Past studies have led many researchers to support the idea that the Amerasia Basin opened about a pivot point near the Mackenzie Delta. However, the crustal character of the Chukchi Borderlands could determine whether that scenario is correct, or whether more complicated tectonic scenarios must be devised to explain the presence of the Amerasia Basin. These data will assist in the determination of the tectonic evolution of the Amerasia Basin and Canada Basin which is fundamental to such basic concerns as sea level fluctuations and paleoclimate in the Mesozoic era.

Description of the Activity

The *Healy*, a U.S. Coast Guard (USCG) Cutter ice-breaker, will rendezvous with the science party off Barrow on or around 15 July. The *Healy* will then sail north and arrive at the beginning of the seismic survey, which will start >150 km (93 mi) north of Barrow. The cruise will last for approximately 40 days, and it is estimated that the total seismic survey time will be approximately 30 days depending on ice conditions. Seismic survey work is scheduled to terminate west of Barrow about 25 August. The vessel will then sail south to Nome where the science party will disembark.

The seismic survey and coring activities will take place in the Arctic Ocean. The overall area within which the seismic survey will occur is located approximately between 71°36′ and 79°25′ N., and between 151°57′ E. and 177°24′ E. The bulk of the seismic survey will not be conducted in any country's territorial waters. The survey will occur within the Exclusive Economic Zone (EEZ) of the U.S. for approximately 563 km.

The *Healy* will use a portable Multi-Channel Seismic (MCS) system to conduct the seismic survey. A cluster of eight airguns will be used as the energy source during most of the cruise, especially in deep water areas. The airgun array will have four 500–in^3 Bolt airguns and four 210–in^3 G. guns for a total discharge volume of 2840 in^3. In shallow water, occurring during the first and last portions of the cruise, a four 105 in^3 GI gun array with a total discharge volume of 420 in^3 will be used. Other sound sources (see below) will also be employed during the cruise. The seismic operations during the survey will be used to obtain information on the history of the ridges and basins that make up the Arctic Ocean.

The *Healy* will also tow a hydrophone streamer 100–150 m (328–492 ft) behind the ship, depending on ice conditions. The hydrophone streamer will be up to 200 m (656 ft) long. As the source operates along the survey lines, the hydrophone receiving system will receive and record the returning acoustic signals. In addition to the hydrophone streamer, sea ice seismometers (SIS) will be deployed on ice floes ahead of the ship using a vessel-based helicopter, and then retrieved from behind the ship once it has passed the SIS locations. SISs will be deployed as much as 120 km (74 mi) ahead of the ship, and recovered when as much as 120 km (74 mi) behind the ship. The seismometers will be placed on top of ice floes with a hydrophone lowered into the water through a small hole drilled in the ice. These instruments will allow seismic refraction data to be collected in the heavily ice-covered waters of the region.

The program will consist of a total of approximately 3625 km (2252 mi) of surveys, not including transits when the airguns are not operating, plus scientific coring at least seven locations. Water depths within the study area are 40–3858 m (131–12,657 ft). Little more than 8 percent of the survey (approximately 300 km (186 mi)) will occur in water depths <100 m (328 ft), 23 percent of the survey (approximately 838 km (520 mi)) will be conducted in water 100–1000 m (328–3280 ft) deep, and most (69 percent) of the survey (approximately 2486 km (1,544 mi)) will occur in water deeper than 1000 m (3280 ft). There will be additional seismic operations associated with airgun testing, start up, and repeat coverage of any areas where initial data quality is sub-standard. In addition to the airgun array, a multibeam sonar and sub-bottom profiler will be used during the seismic profiling and continuously when underway. A pinger may be used during coring to help direct the core bit.

The coring operations will be conducted in conjunction with the seismic study from the *Healy*. Seismic operations will be suspended while the USCG *Healy* is on site for coring. Several more coring sites may be identified and sampled depending on the ability to deploy SISs given ice and weather conditions. The plan is to extract one core from six of the seven identified sample locations along the seismic survey, and two cores at the last site on the Chukchi Cap. The coring system to be used is a piston corer that is lowered to the sea floor via a deep sea winch. Coring is expected to occur in 400–4000–m (1,312–13,120–ft) water depths. The piston corer recovers a sample in PVC tubes of 10 cm (3.9–in) diameter. Most of the cores will be approximately (approximately) 5–10 m long (16.4–32.8 ft); maximum possible length will be approximately 24 m (79 ft). The core is designed to leave nothing in the ocean after recovery.

Vessel Specifications

The *Healy* has a length of 128 m (420 ft), a beam of 25 m (82 ft), and a full load draft of 8.9 m (29 ft). The *Healy* iscapable of traveling at 5.6 km/h (3 knots) through 1.4 m (4.6 ft) of ice. A ''Central Power Plant'', four Sultzer 12Z AU40S diesel generators, provides electric power for propulsion and ship's services through a 60 Hz, 3–phase common bus distribution system. Propulsion power is provided by two electric AC Synchronous, 11.2 MW drive motors, fed from the common bus through a Cycloconverter system, that turn two fixed-pitch, four-bladed propellers. The operation speed during seismic acquisition is expected to be approximately 6.5 km/h (3.5 knots). When not towing seismic survey gear or breaking ice, the Healy cruises at 22 km/h (12 knots) and has a maximum speed of 31.5 km/h (17 knots). It has a normal operating range of about 29,650 km (18,423 mi) at 23.2 km/hr (12.5 knots).

Seismic Source Description

A portable MCS system will be installed on the Healy for this cruise. The source vessel will tow along predetermined lines one of two different airgun arrays (an 8–airgun array with a total discharge volume of 2840 in^3 or a four GI gun array with a total discharge volume of 420 in3), as well as a hydrophone streamer. Seismic pulses will be emitted at intervals of approximately 60 s and recorded at a 2 ms sampling rate. The 60–second spacing corresponds to a shot interval of approximately 120 m (394 t) at the anticipated typical cruise speed.

As the airgun array is towed along the survey line, the towed hydrophone array receives the reflected signals and transfers the data to the on-board processing system. The SISs will store returning signals on an internal datalogger and also relay them in real-time to the *Healy* via a radio transmitter, where they will be recorded and processed.

The 8–airgun array will be configured as a four-G. gun cluster with a total discharge volume of 840 in^3 and a four Bolt airgun cluster with a total discharge volume of 2000 in^3. The source output is from 246–253 dB re 1 μPa m. The two clusters are four meters apart. The clusters will be operated simultaneously for a total discharge volume of 2840 in^3. The 4–GI gun array will be configured the same as the four G. gun portion of the 8–airgun array. The energy source (source level 239–245 dB re 1 μPa m) will be towed as close to the stern as possible to minimize ice interference. The 8–airgun array will be towed below a depressor bird at a depth of 7–20 m (23–66 ft) depending on ice conditions; the preferred depth is 8–10 m (26–33 ft).

The highest sound level measurable at any location in the water from the airgun arrays would be slightly less than the nominal source level because the actual source is a distributed source rather than a point source. The depth at which the source is towed has a major impact on the maximum near-field output, and on the shape of its frequency spectrum. In this case, the source is expected to be towed at a relatively deep depth of up to 9 m (30 ft).

The rms (root mean square) received sound levels that are used as impact criteria for marine mammals are not directly comparable to the peak or peak-to-peak values normally used to characterize source levels of airguns. The measurement units used to describe airgun sources, peak or peak-to-peak dB, are always higher than the rms dB referred to in much of the biological literature. A measured received level of 160 dB rms in the far field would typically correspond to a peak measurement of about 170 to 172 dB, and to a peak-to-peak measurement of about 176 to 178 decibels, as measured for the same pulse received at the same location (Greene, 1997; McCauley *et al.*, 1998, 2000). The precise difference between rms and peak or peak-to-peak values for a given pulse depends on the frequency content and duration of the pulse, among other factors. However, the rms level is always lower than the peak or peak-to-peak level for an airgun-type source. Additional discussion of the characteristics of airgun pulses is included in Appendix A of UTIG's application.

Safety Radii

NMFS has determined that for acoustic effects, using established acoustic thresholds in combination with corresponding safety radii is the most effective way to consistently both apply measures to avoid or minimize the impacts of an action and to quantitatively estimate the effects of an action. NMFS believes that cetaceans and pinnipeds should not be exposed to pulsed underwater noise at received levels exceeding, respectively, 180 and 190 dB re 1 μPa (rms) to avoid permanent physiological damage (Level A Harassment). NMFS also assumes that cetaceans or pinnipeds exposed to levels exceeding 160 dB re 1 μPa (rms) experience Level B Harassment. Thresholds are used in two ways: (1) To establish a mitigation shut-down or power down zone, i.e., if an animal enters an area calculated to be ensonified above the level of an established threshold, a sound source is powered down or shut down; and (2) to calculate take, in that a model may be used to calculate the area around the sound source that will be ensonified to that level or above, then, based on the estimated density of animals and the distance that the sound source moves, NMFS can estimate the number of marine mammals that may be ''taken''.

In order to implement shut-down zones, or to estimate how many animals may potentially be exposed to a particular sound level using the acoustic thresholds described above, it is necessary to understand how sound will propagate in a particular situation. Models may be used to estimate at what distance from the sound source the water will be ensonified to a particular level. Safety radii represent the estimated distance from the sound source at which the received level of sound would correspond to the acoustic thresholds of 190, 180, and 160 dB. Many models have been field tested in the water. Field verification has shown that some of the predictions are close to being accurate, an some are not.

UTIG proposed to base the safety radii for the *Healy* cruise on a model created by the Lamont-Doherty Earth Observatory and field tested in the Gulf of Mexico. UTIG has further proposed to enlarge some of the safety radii that relate to shut-down zones to provide further protection for marine mammals that may be in the area during seismic operations. The model utilized by UTIG to develop their safety radii is described below.

Safety Radii Proposed by UTIG

Received sound fields have been modeled by Lamont-Doherty Earth Observatory (L-DEO) for the 8–airgun and 4–GI gun arrays that will be used during this survey. Predicted sound fields were modeled using sound exposure level (SEL) units (dB re 1 μPa^2 s), because a model based on those units tends to produce more stable output when dealing with mixed-gun arrays like the one to be used during this survey. The predicted SEL values can be converted to rms received pressure levels, in dB re 1 μPa (as used in NMFS' impact criteria for pulsed sounds) by adding approximately 15 dB to the SEL value (Greene, 1997; McCauley *et al.*, 1998, 2000). The rms pressure is an average over the pulse duration. This is the measure commonly used in studies of marine mammal reactions to airgun sounds, and in NMFS guidelines concerning levels above which ''taking'' might occur. The rms level of a seismic pulse is typically about 10 dB less than its peak level.

The empirical data concerning 190, 180, and 160 dB (rms) distances in deep and shallow water acquired for various airgun array configurations during the acoustic verification study conducted by L-DEO in the northern Gulf of Mexico. Tolstoy *et al.*, (2004a,b) demonstrate that L-DEO's model tends to overestimate the distances applied in deep water. The proposed study area will occur mainly in water approximately 40–3858 m (131–12,657 ft) deep, with only approximately 8 percent of the survey lines in shallow (<100 m (<328 ft)) water and approximately 23 percent of the trackline in intermediate water depths (100–1000 m (328–3,280 ft)). The calibration-study results showed that radii around the airguns where the received level would be 180 dB re 1 μPa (rms), the safety criterion applicable to cetaceans (NMFS 2000), vary with water depth. Similar depth-related variation is likely in the 190–dB distances applicable to pinnipeds.

UTIG has applied the empirical data collected during the Gulf of Mexico verification study to the L-DEO model in the manner described below to develop the safety radii listed in Table 1:

- The empirical data indicate that, for deep water (>1000 m), the L-DEO model tends to overestimate the received sound levels at a given distance (Tolstoy *et al.*, 2004a,b). However, to be precautionary pending acquisition of additional empirical data, it is proposed that safety radii during airgun operations in deep water will be the values predicted by L-DEO's modeling, after conversion from SEL to rms (Table 1).

• Empirical measurements were not conducted for intermediate depths (100–1000 m). On the expectation that results would be intermediate between those from shallow and deep water, a 1.5 correction factor is applied to the estimates provided by the model for deep water situations (as noted before, NSF is recalculating the numbers using a more conservative, or larger, correction factor).

• Empirical measurements were not made for the 4 GI guns that will be employed during the proposed survey in shallow water (<100 m). (The 8–airgun array will not be used in shallow water.) The empirical data on operations of two 105 in^3 GI guns in shallow water showed that modeled values underestimated the distance to the actual 160 dB sound level radii in shallow water by a factor of approximately 3 (Tolstoy *et al.*, 2004b). Sound level measurements for the 2 GI guns were not available for distances <0.5 km (.31 mi)(from the source. The radii estimated here for the 4 GI guns operating in shallow water are derived from the L-DEO model, with the same adjustments for depth-related differences between modeled and measured sound levels as were used for 2 GI guns in earlier applications. Correction factors for the different sound level radii are approximately 12x the model estimate for the 190 dB radius in shallow water, approximately 7x for the 180 dB radius and approximately 4x for the 170 dB radius [Tolstoy 2004a,b]).

As mentioned above, UTIG has further proposed expanded safety radii, as they apply to the shutdown zones for marine mammals, and these are indicated by parentheses in Table 1.

Seismic Source Volume	Water depth	Estimated Distances for Received Levels (m) 190 dB (shut-down criterion for pinnipeds)	180 dB (shut-down criterion for cetaceans)	160 dB (assumed onset of behavioral harassment)
105 in^3 GI gun	>1000 m	10	27	275
	100–1000 m	15 (500*)	41 (max. vis., 2-3 km*)	413
	<100 m	125 (1000*)	200 (max. vis., 2-3 km*)	750
210 in^3 G. gun	>1000 m	20	78	698
	100–1000 m	30 (500*)	117 (max. vis., 2-3 km*)	1047
	<100 m	250 (1000*)	578 (max. vis., 2-3 km*)	1904
420 in^3 (4-GI gun array)	>1000 m	75	246	2441
	100–1000 m	113 (500*)	369 (max. vis., 2-3 km*)	3662
	<100 m	938 (1000*)	1822 (max. vis., 2-3 km*)	6657
2840 in^3 (8-airgun array)	>1000 m	230	716	7097
	100–1000 m	345 (500*)	1074 (max. vis., 2-3 km*)	10646
	<100 m	NA	NA	NA

Table 1. Estimated distances to which sound levels > 190, 180, and 160 dB re 1 miPa (rms) might be received from the various gun-types used during the 2006 Healy Arctic cruise.
*** Expanded shut-down radii proposed subsequent to IHA application submittal, for cetaceans, the Healy will cease operating seismic whenever a cetacean is sighted, regardless of distance.**

Other Acoustic Devices

Along with the airgun operations, additional acoustical systems will be operated during much of or the entire cruise. The ocean floor will be mapped with a multibeam sonar, and a sub-bottom profiler will be used. These two systems are commonly operated simultaneously with an airgun system. An acoustic Doppler current profiler will also be used through the course of the project, as well as a pinger.

Multibeam Echosounder (SeaBeam 2112)

A SeaBeam 2112 multibeam 12 kHz bathymetric sonar system will be used on the *Healy*, with a maximum source output of 237 dB re 1 μPa at one meter. The transmit frequency is a very narrow band, less than 200 Hz, and centered at 12 kHz. Pulse lengths range from less than one millisecond to 12 ms. The transmit interval ranges from 1.5 s to 20 s, depending on the water depth, and is longer in deeper water. The SeaBeam system consists of a set of underhull projectors and hydrophones. The transmitted beam is narrow (approximately 2°) in the fore-aft direction but broad (approximately 132°) in the cross-track direction. The system combines this transmitted beam with the input from an array of receiving hydrophones oriented perpendicular to the array of source transducers, and calculates bathymetric data (sea floor depth and some indications about the character of the seafloor) with an effective 2° by 2° foot print on the seafloor. The SeaBeam 2112 system on the *Healy* produces a useable swath width of slightly more than 2 times the water depth. This is narrower than normal because of the ice-protection features incorporated into the system on the *Healy*.

Hydrographic Sub-bottom Profiler (Knudsen 320BR)

The Knudsen 320BR will provide information on sedimentary layering, down to between 20 and 70 m, depending on bottom type and slope. It will be operated with the multibeam bathymetric sonar system that will simultaneously map the bottom topography.

The Knudsen 320BR sub-bottom profiler is a dual-frequency system with operating frequencies of 3.5 and 12 kHz:

Low frequency - Maximum output power into the transducer array, as wired on the Healy (125 ohms), at 3.5 kHz is approximately 6000 watts (electrical), which results in a maximum source level of 221 dB re 1 μPa at 1 m downward. Pulse lengths range from 1.5 to 24 ms with a bandwidth of 3 kHz (FM sweep from 3 kHz to 6 kHz). The repetition rate is range dependent, but the maximum is a 1–percent duty cycle. Typical repetition rate is between 1/2 second (in shallow water) to 8 seconds in deep water.

High frequency - The Knudsen 320BR is capable of operating at 12 kHz; but the higher frequency is rarely used because it interferes with the SeaBeam 2112 multibeam sonar, which also operates at 12 kHz. The calculated maximum source level (downward) is 215 dB re 1 μPa at 1 m (3.28 ft). The pulse duration is typically 1.5 to 5 ms with the same limitations and typical characteristics as the low frequency channel.

A single 12 kHz transducer and one 3.5 kHz, low frequency (sub-bottom) transducer array, consisting of 16 elements in a 4 by 4 array will be used for the Knudsen 320BR. The 12 kHz transducer (TC–12/34) emits a conical beam with a width of 30° and the 3.5 kHz transducer (TR109) emits a conical beam with a width of 26°.

12–kHz Pinger (Benthos 2216)

A Benthos 12–kHz pinger may be used during coring operations, to monitor the depth of the corer relative to the sea floor. The pinger is a battery-powered acoustic beacon that is attached to the coring mechanism. The pinger produces an omnidirectional 12 kHz signal with a source output of approximately 192 dB re 1 μPa m at a one pulse per second rate. The pinger produces a single pulse of 0.5, 2 or 10 ms duration (hardware selectable within the unit) every second.

Acoustic Doppler Current Profiler (150 kHz)

The 150 kHz acoustic Doppler current profiler (ADCP) has a minimum ping rate of 0.65 ms. There are four beam sectors, and each beamwidth is 3°. The pointing angle for each beam is 30° off from vertical with one each to port, starboard, forward and aft. The four beams do not overlap. The 150 kHz ADCP's maximum depth range is 300 m.

Acoustic Doppler Current Profiler (RD Instruments Ocean Surveyor 75)

The Ocean Surveyor 75 is an ADCP operating at a frequency of 75 kHz, producing a ping every 1.4 s. The system is a four-beam phased array with a beam angle of 30°. Each beam has a width of 4°, and there is no overlap. Maximum output power is 1 kW with a maximum depth range of 700 m (2,297 ft).

Description of Habitat and Marine Mammals Affected by the Activity

A detailed description of the Beaufort and Chukchi sea ecosystems and their associated marine mammals can be found in several documents (Corps of Engineers, 1999; NMFS, 1999; Minerals Management Service (MMS), 2006, 1996 and 1992). MMS' Programmatic Environmental Assessment (PEA) - Arctic Ocean Outer Continental Shelf Seismic Surveys - 2006 may be viewed at: *http://www.mms.gov/alaska/*.

Marine Mammals

A total of 8 cetacean species, 4 species of pinnipeds, and 1 marine carnivore are known to or may occur in or near the proposed study area (Table 2). Two of these species, the bowhead and fin whale, are listed as ''Endangered'' under the ESA, but the fin whale is unlikely to be encountered along the planned trackline.

The marine mammals that occur in the proposed survey area belong to three taxonomic groups: odontocetes (toothed cetaceans, such as beluga whale and narwhal whale), mysticetes (baleen whales), and carnivora (pinnipeds and polar bears). Cetaceans and pinnipeds (except walrus) are the subject of the IHA Application to NMFS; in the U.S., the walrus and polar bear are managed by the USFWS.

The marine mammal species most likely to be encountered during the seismic survey include one or perhaps two cetacean species (beluga and perhaps bowhead whale), three pinniped species (ringed seal, bearded seal, and walrus), and the polar bear. However, most of these will occur in low numbers and encounters with most species are likely to be most common within 100 km (62 mi) of shore where no seismic work is planned to take place. The marine mammal most likely to be encountered throughout the cruise is the ringed seal. Concentrations of walruses might also be encountered in certain areas, depending on the location of the edge of the pack ice relative to their favored shallow-water foraging habitat. The most widely distributed marine mammals are expected to be the beluga, ringed seal, and polar bear.

Three additional cetacean species, the gray whale, minke whale and fin whale, could occur in the project area. It is unlikely that gray whales will be encountered near the proposed trackline; if encountered at all, gray whales would be found closer to the Alaska coastline where no seismic work is planned. Minke and fin whales are extralimital in the Chukchi Sea and will not likely be encountered as the proposed trackline borders their known range. Two additional pinniped species, the harbor and spotted seal, are also unlikely to be seen.

Table 2 also shows the estimated abundance and densities of the marine mammals likely to be encountered during the *Healy*'s Arctic cruise. Additional information regarding the distribution of these species and how the estimated densities were calculated may be found in Conoco's application and NMFS' Updated Species Reports at: (*http://www.nmfs.noaa.gov/pr/readingrm/MMSARS/2005alaskasummarySARs.pdf).*

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Species	Habitat	Abundance	ESTIMATED DENSITIES Offshore Barrow Average	Offshore Barrow Maximum	Polar Pack Ice Average	Polar Pack Ice Maximum	Requested Take Authorization Max (Best)
Odontocetes							
Beluga whale (*Delphinapterus leucas*)	Offshore, Coastal, Ice edges	50,000 (W. Alaska) 39257 (Beaufort)	0.0034	0.0135	0.0003	0.0014	134 (33)
Narwhal (*Monodon monoceros*)	Offshore, Ice edge	Rare	0	0.0001	0	0.0001	5
Killer whale (*Orcinus orca*)	Widely distributed	Rare	0	0	Not	Present	10
Harbor Porpoise (*Phocoena phocoena*)	Coastal, inland waters	Extralimital	0	0.0002	Not	Present	5
Mysticetes							
Bowhead whale* (*Balaena mysticetus*)	Pack ice & coastal	10545 (near Barrow)	0.0032	0.0064	0.0003	0.0006	63 (31)
Gray whale (*Eschrichtius robustus*) (eastern Pacific population)	Coastal, lagoons	488 (S.Chukchi/N.Bering) 17500 (N. Pacific)	0.0022	0.0045	0	0	29 (14)
Minke whale (*Balaenoptera acutorostrata*)	Shelf, coastal	0	0	0	0	0	5
Fin whale* (*Balaenoptera physalus*)	Slope, mostly pelagic	0	0	0	0	0	5
Pinnipeds							
Walrus (*Odobenus rosmarus*)	Coastal, pack ice, ice	188316 (Pacific)	0.0731	0.6169	0	0.0001	N/A
Bearded seal (*Erignathus barbatus*)	Pack ice	300,000-450,000 (Alaska) 4863 (E. Chukchi)	0.0128	0.0256	0.0013	0.0023	487 (127)
Spotted seal (*Phoca largha*)	Pack ice	1000	0.0001	0.0005	0	0	5
Ringed seal (*Pusa hispida*)	Landfast & pack ice	Up to 3.6 million (Alaska) 245048 (Bering/Chukchi) 326500 (Alaskan Beaufort)	0.251	1.004	0.0251	0.1004	7934 (1984)
Carnivora							
Polar bear (*Ursus maritimus*)	Coastal, ice	>2500 (Amstrup et al.) 15000 (NWT W&F)	0.0016	0.004	0.0002	0.0004	N/A

Table 2. Estimated abundance and density of marine mammals likely to be encountered during the Healy's Arctic seismic survey Requested take authorization for each species, based on estimated exposures > 160 dB and maximum density, is also included.

* Listed as endangered under the U.S. Endangered Species Act

Potential Effects on Marine Mammals

Potential Effects of Airguns

The effects of sounds from airguns 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 effects (Richardson *et al.*, 1995). Because the airgun sources planned for use during the present project involve only 4 or 8 airguns, the effects are anticipated to be less than would be the case with a large array of airguns. It is very unlikely that there would be any cases of temporary or especially permanent hearing impairment, or non-auditory physical effects. Also, behavioral disturbance is expected to be limited to relatively short distances.

Tolerance

Numerous studies have shown that pulsed sounds from airguns are often readily detectable in the water at distances of many kilometers. Numerous studies have shown that marine mammals at distances more than a few kilometers from operating seismic vessels often show no apparent response (see Appendix A (e) of application). That is often true even in cases when the pulsed sounds must be readily audible to the animals based on measured received levels and the hearing sensitivity of that mammal group. Although various baleen whales, toothed whales, and (less frequently) pinnipeds have been shown to react behaviorally to airgun pulses under some conditions, at other times mammals of all three types have shown no overt reactions. In general, pinnipeds, small odontocetes, and sea otters seem to be more tolerant of exposure to airgun pulses than are baleen whales.

Masking

Masking effects of pulsed sounds (even from large arrays of airguns) on marine mammal calls and other natural sounds are expected to be limited, although there are very few specific data of relevance. Some whales are known to continue calling in the presence of seismic pulses. Their calls can be heard between the seismic pulses (e.g., Richardson *et al.*, 1986; McDonald *et al.*, 1995; Greene *et al.*, 1999; Nieukirk *et al.*, 2004). Although there has been one report that sperm whales cease calling when exposed to pulses from a very distant seismic ship (Bowles *et al.*, 1994), a more recent study reports that sperm whales off northern Norway continued calling in the presence of seismic pulses (Madsen *et al.*, 2002). That has also been shown during recent work in the Gulf of Mexico (Tyack *et al.*, 2003). Masking effects of seismic pulses are expected to be negligible in the case of the smaller odontocete cetaceans, given the intermittent nature of seismic pulses. Also, the sounds important to small odontocetes are predominantly at much higher frequencies than are airgun sounds. For more information on masking effects, see Appendix A (d) of the application.

Disturbance Reactions

Disturbance includes a variety of effects, including subtle changes in behavior, more conspicuous changes in activities, and displacement. Reactions to sound, if any, depend on species, state of maturity, experience, current activity, reproductive state, time of day, and many other factors. If a marine mammal does react briefly to an underwater sound by changing its behavior or moving a small distance, the impacts of the change are unlikely to be significant to the individual, let alone the stock or the species as a whole. Alternatively, if a sound source displaces marine mammals from an important feeding or breeding area for a prolonged period, impacts on the animals are most likely significant. There are some uncertainties in predicting the quantity and types of impacts of noise on marine mammals. When attempting to quantify potential take for an authorization, NMFS estimates how many mammals were likely within a certain distance of sound level that equates to the received sound level.

The sound criteria used to estimate how many marine mammals might be disturbed to some biologically-important degree by a seismic program are based on behavioral observations during studies of several species. However, information is lacking for many species. Detailed studies have been done on humpback, gray, and bowhead whales, and on ringed seals. Less detailed data are available for some other species of baleen whales, sperm whales, small toothed whales, and sea otters.

Baleen Whales: Baleen whales generally tend to avoid operating airguns, but avoidance radii are quite variable. Whales are often reported to show no overt reactions to pulses from large arrays of airguns at distances beyond a few kilometers, even though the airgun pulses remain well above ambient noise levels out to much longer distances. However, as reviewed in Appendix A (e) of the application, baleen whales exposed to strong noise pulses from airguns often react by deviating from their normal migration route and/or interrupting their feeding and moving away. In the case of the migrating gray and bowhead whales, the observed changes in behavior appeared to be of little or no biological consequence to the animals. They simply avoided the sound source by displacing their migration route to varying degrees, but within the natural boundaries of the migration corridors.

Studies of gray, bowhead, and humpback whales have determined that received levels of pulses in the 160–170 dB re 1 μPa rms range seem to cause obvious avoidance behavior in a substantial fraction of the animals exposed. In many areas, seismic pulses from large arrays of airguns diminish to those levels at distances ranging from 4.5 to 14.5 km (2.8–9 mi) from the source. A substantial proportion of the baleen whales within those distances may show avoidance or other strong disturbance reactions to the airgun array. Subtle behavioral changes sometimes become evident at somewhat lower received levels, and recent studies reviewed in Appendix A (e) of the application have shown that some species of baleen whales, notably bowhead and humpback whales, at times show strong avoidance at received levels lower than 160–170 dB re 1 μPa rms. Bowhead whales migrating west across the Alaskan Beaufort Sea in autumn, in particular, are unusually responsive, with substantial avoidance occurring out to distances of 20–30 km (12.4–18.6 mi) from a medium-sized airgun source (Miller *et al.*, 1999; Richardson *et al.*, 1999). More recent research on bowhead whales (Miller *et al.*, 2005), however, suggests that during the summer feeding season (during which the proposed project will take place) bowheads are not nearly as sensitive to seismic sources and can be expected to react to the more typical 160–170 dB re 1 Pa rms range.

Malme *et al.* (1986, 1988) studied the responses of feeding eastern gray whales to pulses from a single 100 in^3 airgun off St. Lawrence Island in the northern Bering Sea. They estimated, based on small sample sizes, that 50 percent of feeding gray whales ceased feeding at an average received pressure level of 173 dB re 1 μPa on an (approximate) rms basis, and that 10 percent of feeding whales interrupted feeding at received levels of 163 dB. Those findings were generally consistent with the results of experiments conducted on larger numbers of gray whales that were migrating along the California coast.

Data on short-term reactions (or lack of reactions) of cetaceans to impulsive noises do not necessarily provide information about long-term effects. It is not known whether impulsive noises affect reproductive rate or distribution and habitat use in subsequent days or years. However, gray whales continued to migrate annually along the west coast of North America despite intermittent seismic exploration and much ship traffic in that area for decades (Appendix A in Malme *et al.*,1984). Bowhead whales continued to travel to the eastern Beaufort Sea each summer despite seismic exploration in their summer and autumn range for many years (Richardson *et al.*,1987). Populations of both gray whales and bowhead whales grew substantially during this time. In any event, the brief exposures to sound pulses from the proposed airgun source are highly unlikely to result in prolonged effects.

Toothed Whales: Little systematic information is available about reactions of toothed whales to noise pulses. Few studies similar to the more extensive baleen whale/seismic pulse work summarized above and in Appendix A of the application have been reported for toothed whales. However, systematic work on sperm whales is underway (Tyack *et al.*, 2003), and there is an increasing amount of information about responses of various odontocetes to seismic surveys based on monitoring studies (e.g., Stone, 2003; Smultea *et al.*, 2004).

Seismic operators sometimes see dolphins and other small toothed whales near operating airgun arrays, but in general there seems to be a tendency for most delphinids to show some limited avoidance of seismic vessels operating large airgun systems. However, some dolphins seem to be attracted to the seismic vessel and floats, and some ride the bow wave of the seismic vessel even when large arrays of airguns are firing. Nonetheless, there have been indications that small toothed whales sometimes move away, or maintain a somewhat greater distance from the vessel, when a large array of airguns is operating than when it is silent (e.g., Goold, 1996a,b,c; Calambokidis and Osmek, 1998; Stone, 2003). Aerial surveys during seismic operations in the southeastern Beaufort Sea recorded much lower sighting rates of beluga whales within 10–20 km (6.2–12.4 mi) of an active seismic vessel. These results were consistent with the low number of beluga sightings reported by observers aboard the seismic vessel, suggesting that some belugas might be avoiding the seismic operations at distances of 10–20 km (6.2–12.4 mi) (Miller *et al.*, 2005).

Similarly, captive bottlenose dolphins and (of some relevance in this project) beluga whales exhibit changes in behavior when exposed to strong pulsed sounds similar in duration to those typically used in seismic surveys (Finneran *et al.*, 2000, 2002). However, the animals tolerated high received levels of sound (pk-pk level >200 dB re 1 μPa) before exhibiting aversive behaviors. With the presently-planned source, such levels would be found within approximately 400 m (1,312 ft) of the 4 GI guns operating in shallow water.

Odontocete reactions to large arrays of airguns are variable and, at least for small odontocetes, seem to be confined to a smaller radius than has been observed for mysticetes. UTIG proposed using a 170–dB acoustic threshold for behavioral disturbance of delphinids and pinnipeds in lieu of the 160–dB NMFS currently uses as the standard threshold. However, NMFS does not believe there is enough data to support changing the threshold at this time and will utilize the 160 dB safety radii. NMFS is currently developing new taxa-specific acoustic criteria and they are scheduled to be made available to the public within the next two years.

Pinnipeds: Pinnipeds are not likely to show a strong avoidance reaction to the medium-sized airgun sources that will be used. Visual monitoring from seismic vessels has shown only slight (if any) avoidance of airguns by pinnipeds, and only slight (if any) changes in behavior-see Appendix A (e) of the application. Those studies show that pinnipeds frequently do not avoid the area within a few hundred meters of operating airgun arrays (e.g., Miller *et al.*, 2005; Harris *et al.*, 2001). However, initial telemetry work suggests that avoidance and other behavioral reactions to small airgun sources may at times be stronger than evident to date from visual studies of pinniped reactions to airguns (Thompson *et al.*, 1998). Even if reactions of the species occurring in the present study area are as strong as those evident in the telemetry study, reactions are expected to be confined to relatively small distances and durations, with no long-term effects on pinniped individuals or populations.

Hearing Impairment and Other Physical Effects

Temporary or permanent hearing impairment is a possibility when marine mammals are exposed to very strong sounds, but there has been no specific documentation of this for marine mammals exposed to sequences of airgun pulses. Current NMFS practice regarding exposure of marine mammals to high-level sounds is to establish mitgation that will avoid cetaceans and pinnipeds exposure to impulsive sounds 180 and 190 dB re 1 μPa (rms), respectively (NMFS, 2000). Those criteria have been used in defining the safety (shut down) radii planned for the proposed seismic survey. As summarized here,

- The 180 dB criterion for cetaceans may be lower than necessary to avoid temporary threshold shift (TTS), let alone permanent auditory injury, at least for belugas and delphinids.
- The minimum sound level necessary to cause permanent hearing impairment is higher, by a variable and generally unknown amount, than the level that induces barely-detectable TTS.
- The level associated with the onset of TTS is often considered to be a level below which there is no danger of permanent damage.

NMFS is presently developing new noise exposure criteria for marine mammals that account for the now-available scientific data on TTS and other relevant factors in marine and terrestrial mammals.

Several aspects of the proposed monitoring and mitigation measures for this project are designed to detect marine mammals occurring near the airguns (and multi-beam bathymetric sonar), and to avoid exposing them to sound pulses that might, at least in theory, cause hearing impairment (see Mitigation). In addition, many cetaceans are likely to show some avoidance of the area with high received levels of airgun sound (see above). In those cases, the avoidance responses of the animals themselves will reduce or (most likely) avoid any possibility of hearing impairment.

Non-auditory physical effects might also occur in marine mammals exposed to strong underwater pulsed sound. Possible types of non-auditory physiological effects or injuries that theoretically might occur in mammals close to a strong sound source include stress, neurological effects, bubble formation, and other types of organ or tissue damage. It is possible that some marine mammal species (i.e., beaked whales) may be especially susceptible to injury and/or stranding when exposed to strong pulsed sounds. However, as discussed below, there is no definitive evidence that any of these effects occur even for marine mammals in close proximity to large arrays of airguns and beaked whales do not occur in the present study area. It is unlikely that any effects of these types would occur during the present project given the brief duration of exposure of any given mammal, and the planned monitoring and mitigation measures (see below). The following subsections discuss in somewhat more detail the possibilities of TTS, permanent threshold shift (PTS), and non-auditory physical effects.

TTS: TTS is the mildest form of hearing impairment that can occur during exposure to a strong sound (Kryter, 1985). While experiencing TTS, the hearing threshold rises and a sound must be stronger in order to be heard. TTS can last from minutes or hours to (in cases of strong TTS) days. For sound exposures at or somewhat above the TTS threshold, hearing sensitivity recovers rapidly after exposure to the noise ends. Few data on sound levels and durations necessary to elicit mild TTS have been obtained for marine mammals, and none of the published data concern TTS elicited by exposure to multiple pulses of sound.

For toothed whales exposed to single short pulses, the TTS threshold appears to be, to a first approximation, a function of the energy content of the pulse (Finneran et al., 2005, 2002). Given the available data, the received level of a single seismic pulse might need to be approximately 210 dB re 1 Pa rms (approximately 221–226 dB pk-pk) in order to produce brief, mild TTS. Exposure to several seismic pulses at received levels near 200–205 dB (rms) might result in slight TTS in a small odontocete, assuming the TTS threshold is (to a first approximation) a function of the total received pulse energy. Seismic pulses with received levels of 200–205 dB or more are usually restricted to a radius of no more than 200 m around a seismic vessel operating a large array of airguns.

For baleen whales, there are no data, direct or indirect, on levels or properties of sound that are required to induce TTS. However, no cases of TTS are expected given the moderate size of the source, and the strong likelihood that baleen whales would avoid the approaching airguns (or vessel) before being exposed to levels high enough for there to be any possibility of TTS.

In pinnipeds, TTS thresholds associated with exposure to brief pulses (single or multiple) of underwater sound have not been measured. Initial evidence from prolonged exposures suggested that some pinnipeds may incur TTS at somewhat lower received levels than do small odontocetes exposed for similar durations (Kastak *et al.*, 1999; Ketten *et al.*, 2001; cf. Au *et al.*, 2000).

A marine mammal within a radius of 100 m (328 ft) around a typical large array of operating airguns might be exposed to a few seismic pulses with levels of 205 dB, and possibly more pulses if the mammal moved with the seismic vessel. The sound level radius would be similar (100 m) around the proposed 8–airgun array while surveying in intermediate depths (100–1000 m). This would occur for <23 percent (approximately 838 km (520 mi)) of the survey when the survey will be conducted in intermediate depths. Also, the PIs propose using the 4 GI guns for some of the intermediate-depth survey, which would greatly reduce the 205 dB sound radius. (As noted above, most cetacean species tend to avoid operating airguns, although not all individuals do so.) However, several of the considerations that are relevant in assessing the impact of typical seismic surveys with arrays of airguns are not directly applicable here:

- ''Ramping up'' (soft start) is standard operational protocol during startup of large airgun arrays. Ramping up involves starting the airguns in sequence, usually commencing with a single airgun and gradually adding additional airguns. This practice will be employed when either airgun array is operated.
- It is unlikely that cetaceans would be exposed to airgun pulses at a sufficiently high level for a sufficiently long period to cause more than mild TTS, given the relative movement of the vessel and the marine mammal. In this project, most of the seismic survey will be in deep water where the radius of influence and duration of exposure to strong pulses is smaller.
- With a large array of airguns, TTS would be most likely in any odontocetes that bow-ride or otherwise linger near the airguns. In the present project, the anticipated 180–dB distances in deep and intermediate-depth water are 716 m (2,349 ft) and 1074 m (3,524 ft), respectively, for the 8–airgun gun system (Table 1) and 246 m (840 ft) and 369 m (1,207 ft), respectively for the 4–GI gun system. The waterline at the bow of the *Healy* will be approximately 123 m (404 ft) ahead of the airgun. However, no species that occur within the project area are expected to bow-ride.

The predicted 180 and 190 dB distances for the airguns operated by UTIG vary with water depth. They are estimated to be 716 m (2,349 ft) and 230 m (754 ft), respectively, in deep water for the 8–airgun system, and 246 m (807 ft) and 75 m (246 ft), respectively, in deep water for the 4–GI gun system. In intermediate depths, these distances are predicted to increase to 1074 m (3,523 ft) and 345 m (1,131 ft), respectively for the 8–airgun system, and 369 m (1,210 ft) and 113 m (371 ft), respectively for the 4–GI gun system. The predicted 180 and 190 dB distances for the 4–GI gun system in shallow water are 1822 m (5,978 ft) and 938 m (3,077 ft), respectively (Table 1). The 8–airgun array will not be operated in shallow water. Shallow water (<100 m (328 ft)) will occur along only 300 km (186 mi) (approximately 8 percent) of the planned trackline. Furthermore, those sound levels are not considered to be the levels above which TTS might occur. Rather, they are the received levels above which, in the view of a panel of bioacoustics specialists convened by NMFS before TTS measurements for marine mammals started to become available, one could not be certain that there would be no injurious effects, auditory or otherwise, to marine mammals. As summarized above, data that are now available imply that TTS is unlikely to occur unless odontocetes are exposed to airgun pulses much stronger than 180 dB re 1 Pa rms and since no bow-riding species occur in the study area, it is unlikely such exposures will occur.

PTS: When PTS occurs, there is physical damage to the sound receptors in the ear. In some cases, there can be total or partial deafness, whereas in other cases, the animal has an impaired ability to hear sounds in specific frequency ranges.

There is no specific evidence that exposure to pulses of airgun sound can cause PTS in any marine mammal, even with large arrays of airguns. However, given the possibility that mammals close to an airgun array might incur TTS, there has been further speculation about the possibility that some individuals occurring very close to airguns might incur PTS. Single or occasional occurrences of mild TTS are not indicative of permanent auditory damage in terrestrial mammals. Relationships between TTS and PTS thresholds have not been studied in marine mammals, but are assumed to be similar to those in humans and other terrestrial mammals. PTS might occur at a received sound level at least several decibels above that inducing mild TTS if the animal were exposed to the strong sound pulses with very rapid rise time-see Appendix A (f) of the application.

It is highly unlikely that marine mammals could receive sounds strong enough (and over a sufficient duration) to cause permanent hearing impairment during a project employing the medium-sized airgun sources planned here. In the proposed project, marine mammals are unlikely to be exposed to received levels of seismic pulses strong enough to cause TTS, as they would probably need to be within 100–200 m (328–656 ft) of the airguns for that to occur. Given the higher level of sound necessary to cause PTS, it is even less likely that PTS could occur. In fact, even the levels immediately adjacent to the airgun may not be sufficient to induce PTS, especially because a mammal would not be exposed to more than one strong pulse unless it swam immediately alongside the airgun for a period longer than the inter-pulse interval. Baleen whales generally avoid the immediate area around operating seismic vessels. The planned monitoring and mitigation measures, including visual monitoring, power downs, and shut downs of the airguns when mammals are seen within the ''safety radii'', will minimize the already-minimal probability of exposure of marine mammals to sounds strong enough to induce PTS.

Non-auditory Physiological Effects: Non-auditory physiological effects or injuries that theoretically might occur in marine mammals exposed to strong underwater sound include stress, neurological effects, bubble formation, and other types of organ or tissue damage. However, studies examining such effects are very limited. If any such effects do occur, they probably would be limited to unusual situations when animals might be exposed at close range for unusually long periods. It is doubtful that any single marine mammal would be exposed to strong seismic sounds for sufficiently long that significant physiological stress would develop. That is especially so in the case of the proposed project where the airgun configuration is moderately sized, the ship is moving at 3–4 knots (5.5–7.4 km/hr), and for the most part, the tracklines will not ''double back'' through the same area.

Until recently, it was assumed that diving marine mammals are not subject to the bends or air embolism. This possibility was first explored at a workshop (Gentry [ed.], 2002) held to discuss whether the stranding of beaked whales in the Bahamas in 2000 (Balcomb and Claridge, 2001; NOAA and USN, 2001) might have been related to bubble formation in tissues caused by exposure to noise from naval sonar. However, the opinions were inconclusive. Jepson *et al.* (2003) first suggested a possible link between mid-frequency sonar activity and acute and chronic tissue damage that results from the formation in vivo of gas bubbles, based on the beaked whale stranding in the Canary Islands in 2002 during naval exercises. Fernandez *et al.* (2005a) showed those beaked whales did indeed have gas bubble-associated lesions as well as fat embolisms. Fernandez *et al.* (2005b) also found evidence of fat embolism in three beaked whales that stranded 100 km north of the Canaries in 2004 during naval exercises. Examinations of several other stranded species have also revealed evidence of gas and fat embolisms (e.g., Arbelo *et al.*, 2005; Jepson *et al.*, 2005a; Mendez *et al.*, 2005). Most of the afflicted species were deep divers. There is speculation that gas and fat embolisms may occur if cetaceans ascend unusually quickly when exposed to aversive sounds, or if sound in the environment causes the destabilization of existing bubble nuclei (Potter, 2004; Arbelo *et al.*, 2005; Fernandez *et al.*, 2005a; Jepson *et al.*, 2005b). Even if gas and fat embolisms can occur during exposure to mid-frequency sonar, there is no evidence that that type of effect occurs in response to airgun sounds. Also, most evidence for such effects have been in beaked whales, which do not occur in the proposed study area.

In general, little is known about the potential for seismic survey sounds to cause auditory impairment or other physical effects in marine mammals. Available data suggest that such effects, if they occur at all, would be limited to short distances and probably to projects involving large arrays of airguns. However, the available data do not allow for meaningful quantitative predictions of the numbers (if any) of marine mammals that might be affected in those ways. Marine mammals that show behavioral avoidance of seismic vessels, including most baleen whales, some odontocetes (including belugas), and some pinnipeds, are especially unlikely to incur auditory impairment or other physical effects. Also, the planned monitoring and mitigation measures include shut downs of the airguns, which will reduce any such effects that might otherwise occur.

Strandings and Mortality

Marine mammals close to underwater detonations of high explosive can be killed or severely injured, and the auditory organs are especially susceptible to injury (Ketten *et al.*, 1993; Ketten, 1995). Airgun pulses are less energetic and have slower rise times, and there is no proof that they can cause serious injury, death, or stranding even in the case of large airgun arrays. However, the association of mass strandings of beaked whales with naval exercises and, in one case, an L-DEO seismic survey, has raised the possibility that beaked whales exposed to strong pulsed sounds may be especially susceptible to injury and/or behavioral reactions that can lead to stranding. Appendix A (g) of the application provides additional details.

Seismic pulses and mid-frequency sonar pulses are quite different. Sounds produced by airgun arrays are broadband with most of the energy below 1 kHz. Typical military mid-frequency sonars operate at frequencies of 2–10 kHz, generally with a relatively narrow bandwidth at any one time. Thus, it is not appropriate to assume that there is a direct connection between the effects of military sonar and seismic surveys on marine mammals. However, evidence that sonar pulses can, in special circumstances, lead to physical damage and mortality (NOAA and USN, 2001; Jepson *et al.*, 2003; Fernandez *et al.*, 2005a), even if only indirectly, suggests that caution is warranted when dealing with exposure of marine mammals to any high-intensity pulsed sound.

In May 1996, 12 Cuvier's beaked whales stranded along the coasts of Kyparissiakos Gulf in the Mediterranean Sea. That stranding was subsequently linked to the use of low- and medium-frequency active sonar by a North Atlantic Treaty Organization (NATO) research vessel in the region (Frantzis, 1998). In March 2000, a population of Cuvier's beaked whales being studied in the Bahamas disappeared after a U.S. Navy task force using mid-frequency tactical sonars passed through the area; some beaked whales stranded (Balcomb and Claridge, 2001; NOAA and USN, 2001).

In September 2002, a total of 14 beaked whales of various species stranded coincident with naval exercises in the Canary Islands (Martel, n.d.; Jepson et al., 2003; Fernandez et al., 2003). Also in September 2002, there was a stranding of two Cuvier's beaked whales in the Gulf of California, Mexico, when the L-DEO vessel Maurice Ewing was operating a 20 airgun, 8490 in3 array in the general area. The link between the stranding and the seismic surveys was inconclusive and not based on any physical evidence (Hogarth, 2002; Yoder, 2002). Nonetheless, that plus the incidents involving beaked whale strandings near naval exercises suggests a need for caution in conducting seismic surveys in areas occupied by beaked whales. However, no beaked whales are found within this project area and the planned monitoring and mitigation measures are expected to minimize any possibility for mortality of other species.

Potential Effects of Other Acoustic Devices

Bathymetric Sonar Signals

A SeaBeam 2112 multibeam 12 kHz bathymetric sonar system will be operated from the source vessel essentially continuously during the planned study. Sounds from the multibeam are very short pulses, depending on water depth. Most of the energy in the sound pulses emitted by the multibeam is at moderately high frequencies, centered at 12 kHz. The beam is narrow (approximately 2°) in fore-aft extent and wide (approximately 130°) in the cross-track extent. Any given mammal at depth near the trackline would be in the main beam for only a fraction of a second. Therefore, marine mammals that encounter the SeaBeam 2112 at close range are unlikely to be subjected to repeated pulses because of the narrow fore-aft width of the beam, and will receive only limited amounts of pulse energy because of the short pulses. Similarly, Kremser *et al.* (2005) noted that the probability of a cetacean swimming through the area of exposure when a multibeam sonar emits a pulse is small. The animal would have to pass the transducer at close range and be swimming at speeds similar to the vessel in order to be subjected to sound levels that could cause TTS.

Navy sonars that have been linked to avoidance reactions and stranding of cetaceans (1) generally are more powerful than the SeaBeam 2112 sonar, (2) have a longer pulse duration, (3) are directed close to horizontally vs. downward for the SeaBeam 2112, and (4) have a wider beam width. The area of possible influence of the bathymetric sonar is much smaller, a narrow band oriented in the cross-track direction below the source vessel. Marine mammals that encounter the bathymetric sonar at close range are unlikely to be subjected to repeated pulses because of the narrow fore-aft width of the beam, and will receive only small amounts of pulse energy because of the short pulses. In assessing the possible impacts of a similar multibeam system (the 15.5 kHz Atlas Hydrosweep multibeam bathymetric sonar), Boebel *et al.* (2004) noted that the critical sound pressure level at which TTS may occur is 203.2 dB re 1 μPa (rms). The critical region included an area of 43 m (141 ft) in depth, 46 m (151 ft) wide athwartship, and 1 m (3.3 ft) fore-and-aft (Boebel *et al.*, 2004). In the more distant parts of that (small) critical region, only slight TTS could potentially be incurred. This area is included within the 160 dB isopleth for airguns, in which Level B Harassment is already assumed to occur when th airguns are operating.

Behavioral reactions of free-ranging marine mammals to military and other sonars appear to vary by species and circumstance. Observed reactions have included silencing and dispersal by sperm whales (Watkins *et al.*, 1985), increased vocalizations and no dispersal by pilot whales (Rendell and Gordon, 1999), and the previously-mentioned beachings by beaked whales. Also, Navy personnel have described observations of dolphins bow-riding adjacent to bow-mounted mid-frequency sonars during sonar transmissions. During exposure to a 21–25 kHz whale-finding sonar with a source level of 215 dB re 1 μPa m, gray whales showed slight avoidance (approximately 200 m (656 ft)) behavior (Frankel, 2005).

However, all of those observations are of limited relevance to the present situation. Pulse durations from the Navy sonars were much longer than those of the bathymetric sonars to be used during the proposed study, and a given mammal would have received many pulses from the naval sonars. During UTIG's operations, the individual pulses will be very short, and a given mammal would rarely receive more than one of the downward-directed pulses as the vessel passes by.

Captive bottlenose dolphins and a white whale exhibited changes in behavior when exposed to 1 second of pulsed sounds at frequencies similar to those that will be emitted by the bathymetric sonar to be used by UTIG, and to shorter broadband pulsed signals. Behavioral changes typically involved what appeared to be deliberate attempts to avoid the sound exposure (Schlundt *et al.*, 2000; Finneran *et al.*, 2002; Finneran and Schlundt, 2004). The relevance of those data to free-ranging odontocetes is uncertain, and in any case, the test sounds were quite different in either duration or bandwidth as compared with those from a bathymetric sonar.

We are not aware of any data on the reactions of pinnipeds to sonar sounds at frequencies similar to those of the multibeam sonar (12 kHz). Based on observed pinniped responses to other types of pulsed sounds, and the likely brevity of exposure to the bathymetric sonar sounds, pinniped reactions to the sonar sounds are expected to be limited to startle or otherwise brief responses of no lasting consequence to the animals.

Sub-bottom Profiler Signals

A Knudsen 320BR sub-bottom profiler will be operated from the source vessel at nearly all times during the planned study. The Knudsen 320BR produces sound pulses with lengths of up to 24 ms every 0.5 to approximately 8 s, depending on water depth. The energy in the sound pulses emitted by this sub-bottom profiler is at mid- to moderately high frequency, depending on whether the 3.5 or 12 kHz transducer is operating. The conical beamwidth is either 26°, for the 3.5 kHz transducer, or 30°, for the 12 kHz transducer, and is directed downward.

Source levels for the Knudsen 320 operating at 3.5 and 12 kHz have been measured as a maximum of 221 and 215 dB re 1 μPa m, respectively. Received levels would diminish rapidly with increasing depth. Assuming circular spreading, received level directly below the transducer(s) would diminish to 180 dB re 1 μPa at distances of about 112 m (367 ft) when operating at 3.5 kHz, and 56 m when operating at 12 kHz. The 180 dB distances in the horizontal direction (outside the downward-directed beam) would be substantially less. Kremser *et al.* (2005) noted that the probability of a cetacean swimming through the area of exposure when a bottom profiler emits a pulse is small, and if the animal was in the area, it would have to pass the transducer at close range and in order to be subjected to sound levels that could potentially cause TTS.

The sub-bottom profiler is usually operated simultaneously with other higher-power acoustic sources. Many marine mammals will move away in response to the approaching higher-power sources or the vessel itself before the mammals would be close enough for there to be any possibility of effects from the sub-bottom profiler (see Appendix A in the application). In the case of mammals that do not avoid the approaching vessel and its various sound sources, mitigation measures that would be applied to minimize effects of the higher-power sources would further reduce or eliminate any minor effects of the sub-bottom profiler.

Pinger Signals

A pinger will be operated during all coring, to monitor the depth of the core relative to the sea floor. Sounds from the pinger are very short pulses, occurring for 0.5, 2 or 10 ms once every second, with source level approximately 192 dB re 1 μPa m at a one pulse per second rate. Most of the energy in the sound pulses emitted by this pinger is at mid frequencies, centered at 12 kHz. The signal is omnidirectional. The pinger produces sounds that are within the range of frequencies used by small odontocetes and pinnipeds that occur or may occur in the area of the planned survey.

Marine mammal behavioral reactions to other pulsed sound sources are discussed above, and responses to the pinger are likely to be similar to those for other pulsed sources if received at the same levels. However, the pulsed signals from the pinger are much weaker than those from the bathymetric sonars and from the airgun. Therefore, neither behavioral responses nor TTS would potentially occur unless marine mammals were to get very close to the source, which is unlikely due to the fact that animals will probably move away from the ship in response to the louder sounds from the other sources operating and the vessel itself, and the fact that the proposed mitigation and monitoring measures will be implemented during the operation of the airguns.

Effects of Helicopter Activities

Collection of seismic refraction data requires the deployment of hydrophones at great distances from the source vessel. In order to accomplish this in the ice-covered waters of the Arctic Ocean, the science party plans to deploy SISs along seismic lines in front of the *Healy* and then retrieve them off the ice once the vessel has passed. Vessel-based helicopters will be used to shuttle SISs along seismic track lines. Deployment and recovery of SISs every 10–15 km (6.2–9.3 mi) along the track line and as far as 120 km (75 mi) ahead or behind the vessel will require as many as 24 on-ice landings per 24–hr period during seismic shooting.

Levels and duration of sounds received underwater from a passing helicopter are a function of the type of helicopter used, orientation of the helicopter, the depth of the marine mammal, and water depth. A civilian helicopter service will be providing air support for this project and we do not yet know what type of helicopter will be used. Helicopter sounds are detectable underwater at greater distances when the receiver is at shallow depths. Generally, sound levels received underwater decrease as the altitude of the helicopter increases (Richardson *et al.*, 1995). Helicopter sounds are audible for much greater distances in air than in water.

Cetaceans

The nature of sounds produced by helicopter activities above the surface of the water does not pose a direct threat to the hearing of marine mammals that are in the water; however minor and short-term behavioral responses of cetaceans to helicopters have been documented in several locations, including the Beaufort Sea (Richardson *et al.*, 1985a,b; Patenaude *et al.*, 2002). Cetacean reactions to helicopters depend on several variables including the animal's behavioral state, activity, group size, habitat, and the flight patterns used, among other variables (Richardson *et al.*, 1995). During spring migration in the Beaufort Sea, beluga whales reacted to helicopter noise more frequently and at greater distances than did bowhead whales (38 percent vs.14 percent of observations, respectively). Most reaction occurred when the helicopter passed within 250 m (820 ft) lateral distance at altitudes <150 m (492 ft). Neither species exhibited noticeable reactions to single passes at altitudes >150 m (492 ft). Belugas within 250 m (820 ft) of stationary helicopters on the ice with the engine running showed the most overt reactions (Patenaude *et al.*, 2002). Whales were observed to make only minor changes in direction in response to sounds produced by helicopters, so all reactions to helicopters were considered brief and minor. Cetacean reactions to helicopter disturbance are difficult to predict and may range from no reaction at all to minor changes in course or (infrequently) leaving the immediate area of the activity.

Pinnipeds

Few systematic studies of pinniped reactions to aircraft overflights have been completed. Documented reactions range from simply becoming alert and raising the head to escape behavior such as hauled out animals rushing to the water. Ringed seals hauled out on the surface of the ice have shown behavioral responses to aircraft overflights with escape responses most probable at lateral distances <200 m (656 ft) and overhead distances <150 m (492 ft) (Born *et al.*, 1999). Although specific details of altitude and horizontal distances are lacking from many largely anecdotal reports, escape reactions to a low flying helicopter (<150 m (492 ft) altitude) can be expected from all four species of pinnipeds potentially encountered during the proposed operations. These responses would likely be relatively minor and brief in nature. Whether any response would occur when a helicopter is at the higher suggested operational altitudes (below) is difficult to predict and probably a function of several other variables including wind chill, relative wind chill, and time of day (Born *et al.*, 1999).

In order to limit behavioral reactions of marine mammals during deployment of SISs, helicopters will maintain a minimum altitude of 1000 ft (304 m) above the sea ice except when taking off or landing. Sea-ice landings within 1000 ft (304 m) of any observed marine mammal will not occur, and the helicopter flight path will remain along the seismic track line. Three or four SIS units will be deployed/retrieved before the helicopter returns to the vessel. This should minimize the number of disturbances caused by repeated over-flights.

Estimated Take by Incidental Harassment for Chukchi Sea Seismic Survey

All anticipated takes would be ''takes by harassment'', as described previously, involving temporary changes in behavior. In the sections below, we describe methods to estimate ''take by harassment'' and present estimates of the numbers of marine mammals that might be affected during the proposed seismic study in the Arctic Ocean. The estimates are based on data obtained during marine mammal surveys in and near the Arctic Ocean by Stirling *et al.* (1982), Kingsley (1986), Koski and Davis (1994), Moore *et al.* (2000a), and Moulton and Williams (2003), and on estimates of the sizes of the areas where effects could potentially occur. In some cases, these estimates were made from data collected from regions and habitats that differed from the proposed project area. Adjustments to reported population or density estimates were made on a case by case basis to take into account differences between the source data and the general information on the distribution and abundance of the species in the project area. This section provides estimates of the number of potential ''exposures'' to sound levels equal or greater than 160 dB.

Although several systematic surveys of marine mammals have been conducted in the southern Beaufort Sea, few data (systematic or otherwise) are available on the distribution and numbers of marine mammals in the northern Chukchi and Beaufort Seas or offshore water of the Arctic Ocean. The main sources of distributional and numerical data used in deriving the estimates are described in detail in UTIG's application. There is some uncertainty about the representativeness of those data and the assumptions used below to estimate the potential ''take by harassment''. However, the approach used here seems to be the best available at this time.

The following estimates are based on a consideration of the number of marine mammals that might be disturbed appreciably by approximately 3624 line kilometers (2,251 mi) of seismic surveys across the Arctic Ocean. An assumed total of 4530 km (2,815 mi) of trackline includes a 25–percent allowance over and above the planned approximately 3624 km (2,251 mi) to allow for turns, lines that might have to be repeated because of poor data quality, or for minor changes to the survey design.

As noted above, there is some uncertainty about the representativeness of the data and assumptions used in the calculations. To provide some allowance for the uncertainties, ''maximum estimates'' as well as ''best estimates'' of the numbers potentially affected have been derived (Table 1). For a few marine mammal species, several density estimates were available, and in those cases, the mean and maximum estimates were calculated from the survey data. When the seismic survey area is on the edge of the range of a species, we used the available mammal survey data as the maximum estimate and assumed that the average density along the seismic trackline will be approximately 0.10 times the density from the available survey data. The assumed densities are believed to be similar to, or in most cases higher than, the densities that will actually be encountered during the survey.

The anticipated radii of influence of the bathymetric sonar, sub-bottom profiler, and pinger are less than those for the airgun configurations. NMFS assumes that, during simultaneous operations of all the airgun array, sonar, and profiler, any marine mammals close enough to be affected by the sonars would already be affected by the airguns. The pinger will operate only during coring while the airguns are not in operation. However, whether or not the airguns are operating simultaneously with the sonar, profiler or pinger, marine mammals are expected to exhibit no more than short-term and inconsequential responses to the sonar, profiler or pinger given their characteristics (e.g., narrow downward-directed beam) and other considerations described previously. Such reactions are not considered to constitute ''taking'' and, therefore, no additional allowance is included for animals that might be affected by the sound sources other than the airguns.

The potential number of occasions when members of each species might be exposed to received levels 160 dB re 1 μPa (rms) was calculated for each of three water depth categories (<100 m (328 ft), 100–1000 m (328–3,280 ft), and >1000 m (>3,280 ft)) within the two survey areas (south of 75° N. ''near Barrow'' and north of 75° N. ''polar pack'') by multiplying

- the expected species density, either ''average'' (i.e., best estimate) or ''maximum'', corrected as described above,
- the anticipated line-kilometers of operations with both the 4–GI and 8–airgun array in each water-depth category after applying a 25 percent allowance for possible additional line kilometers as noted earlier,
- the cross-track distances within which received sound levels are predicted to be 160 dB for each water-depth category (2 X the 160 dB safety radii).

Unlike other species whose ''best'' and ''maximum'' density estimates were multiplied by the entire trackline within each of the two portions of the project area (''near Barrow'' and ''polar pack'') to estimate exposures, gray whale and walrus densities were only multiplied by the proposed seismic trackline in water depths <200 m (<656 ft) along the final SW leg of the survey, south of 75° N. Gray whales tend to remain in the shallow, nearshore waters of the Chukchi Sea and rarely occur in the Beaufort Sea. Basing exposures on the entire SW seismic trackline south of 75° N should somewhat overestimate the number of gray whales that may be encountered while conducting seismic operations.

Based on this method, the ''best'' and ''maximum'' estimates of the numbers of marine mammal exposures to airgun sounds with received levels 160 dB re 1 μPa (rms) were obtained using the average and ''maximum'' densities from Tables 1, and are presented in Table 1. Using these calculations, for some species zero individuals were expected to be exposed to 160 dB. Since they are occasionally seen, however, UTIG increased the requested take to 5 to allow for the unlikely chance that they are encountered and exposed to 160 dB (Table 1). Additional information regarding how these estimated take numbers were calculated is available in the application.

Potential Effects on Habitat

The proposed seismic survey will not result in any permanent impact on habitats used by marine mammals, or to the food sources they utilize. Although feeding bowhead whales may occur in the area, the proposed activities will be of short duration in any particular area at any given time; thus any effects would be localized and short-term. The main impact issue associated with the proposed activity will be temporarily elevated noise levels and the associated direct effects on marine mammals.

One of the reasons for the adoption of airguns as the standard energy source for marine seismic surveys was that, unlike explosives, they do not result in any appreciable fish kill. However, the existing body of information relating to the impacts of seismic on marine fish and invertebrate species is very limited.

In water, acute injury and death of organisms exposed to seismic energy depends primarily on two features of the sound source: (1) the received peak pressure, and (2) the time required for the pressure to rise and decay (Hubbs and Rechnitzer, 1952 in Wardle *et al.*, 2001). Generally, the higher the received pressure and the less time it takes for the pressure to rise and decay, the greater the chance of acute pathological effects. Considering the peak pressure and rise/decay time characteristics of seismic airgun arrays used today, the pathological zone for fish and invertebrates would be expected to be within a few meters of the seismic source (Buchanan *et al.*, 2004). For the proposed survey, any injurious effects on fish would be limited to very short distances.

The only designated Essential Fish Habitiat (EFH) species that may occur in the area of the project during the seismic survey are salmon (adult), and their occurrence in waters ≤150 km (93 mi) north of the Alaska coast is highly unlikely. Adult fish near seismic operations are likely to avoid the source, thereby avoiding injury. No EFH species will be present as very early life stages when they would be unable to avoid seismic exposure that could otherwise result in minimal mortality.

The proposed Arctic Ocean seismic program for 2006 is predicted to have negligible to low physical effects on the various life stages of fish and invertebrates for its approximately 40 day duration and 3625–km (2,252–mi) extent and will not result in any permanent impact on habitats used by marine mammals, or to the food sources they use. Nonetheless, the main impact issue associated with the proposed activities will be temporarily elevated noise levels and the associated direct effects on marine mammals, as discussed above.

During the seismic study only a small fraction of the available habitat would be ensonified at any given time. Disturbance to fish species would be short-term and fish would return to their pre-disturbance behavior once the seismic activity ceases. Thus, the proposed survey would have little, if any, impact on the abilities of marine mammals to feed in the area where seismic work is planned.

Some mysticetes, including bowhead whales, feed on concentrations of zooplankton. Although the main summering area for bowheads is in the Canadian Beaufort Sea, at least a few feeding bowhead whales may occur in offshore waters of the western Beaufort Sea and northern Chukchi Sea in July and August, when the Healy will be in the area. A reaction by zooplankton to a seismic impulse would only be relevant to whales if it caused a concentration of zooplankton to scatter. Pressure changes of sufficient magnitude to cause that type of reaction would probably occur only very close to the source. Impacts on zooplankton behavior are predicted to be negligible, and that would translate into negligible impacts on feeding mysticetes.

Thus, the proposed activity is not expected to have any habitat-related effects that could cause significant or long-term consequences for individual marine mammals or their populations, since operations at the various sites will be limited in duration.

Potential Effects on Subsistence Use of Marine Mammals

Subsistence hunting and fishing continue to be prominent in the household economies and social welfare of some Alaskan residents, particularly among those living in small, rural villages (Wolfe and Walker, 1987). Subsistence remains the basis for Alaska Native culture and community. In rural Alaska, subsistence activities are often central to many aspects of human existence, including patterns of family life, artistic expression, and community religious and celebratory activities. The National Science Foundation offers guidelines for science coordination with native Alaskans at *http://www.arcus.org/guidelines/*.

Marine mammals are legally hunted in Alaskan waters near Barrow by coastal Alaska Natives; species hunted include bowhead whales, beluga whales, ringed, spotted, and bearded seals, walrus, and polar bears. In the Barrow area, bowhead whales provided approximately 69 percent of the total weight of marine mammals harvested from April 1987 to March 1990. During that time, ringed seals were harvested the most on a numerical basis (394 animals).

Bowhead whale hunting is the key activity in the subsistence economies of Barrow and two smaller communities to the east, Nuiqsut and Kaktovik. The whale harvests have a great influence on social relations by strengthening the sense of Inupiat culture and heritage in addition to reinforcing family and community ties.

An overall quota system for the hunting of bowhead whales was established by the International Whaling Commission in 1977. The quota is now regulated through an agreement between NMFS and the Alaska Eskimo Whaling Commission (AEWC). The AEWC allots the number of bowhead whales that each whaling community may harvest annually (USDI/BLM 2005).

The community of Barrow hunts bowhead whales in both the spring and fall during the whales' seasonal migrations along the coast. Often, the bulk of the Barrow bowhead harvest is taken during the spring hunt. However, with larger quotas in recent years, it is common for a substantial fraction of the annual Barrow quota to remain available for the fall hunt. The communities of Nuiqsut and Kaktovik participate only in the fall bowhead harvest. The spring hunt at Barrow occurs after leads open due to the deterioration of pack ice; the spring hunt typically occurs from early April until the first week of June. The fall migration of bowhead whales that summer in the eastern Beaufort Sea typically begins in late August or September. The location of the fall subsistence hunt depends on ice conditions and (in some years) industrial activities that influence the bowheads movements as they move west (Brower, 1996). In the fall, subsistence hunters use aluminum or fiberglass boats with outboards. Hunters prefer to take bowheads close to shore to avoid a long tow during which the meat can spoil, but Braund and Moorehead (1995) report that crews may (rarely) pursue whales as far as 80 km. The autumn hunt at Barrow usually begins in mid-September, and mainly occurs in the waters east and northeast of Point Barrow. The whales have usually left the Beaufort Sea by late October (Treacy, 2002a,b).

The scheduling of this seismic survey has been discussed with representatives of those concerned with the subsistence bowhead hunt, most notably the AEWC and the Barrow Whaling Captains' Association,. For this among other reasons, the project has been scheduled to commence in mid-July and terminate approximately 25 August, before the start of the fall hunt at Barrow (or Nuiqsut or Kaktovik), to avoid possible conflict with whalers.

Although the timing of the *Healy*'s seismic survey may overlap with potential subsistence harvest of beluga whales, ringed seals, spotted seals, or bearded seals, the hunting takes place well inshore of the proposed survey, which is to start >150 km (93 mi) offshore and terminate >200 km (124 mi) offshore.

NMFS does not anticipate any unmitigable adverse impacts on the subsistence hunt of these species or stocks to result from the proposed Healy seismic survey.

Plan of Cooperation

UTIG and the AEWC will develop a ''Plan of Cooperation'' for the 2006 Arctic Ocean seismic survey, in consultation with representatives of the Barrow whaling community. UTIG is working with the people of Barrow to identify and avoid areas of potential conflict. The proposed plan has been presented to and discussed with the Whaling Captains' Association's, local residents, the AEWC, and the biologists in North Slope Borough Department of Wildlife Management.

A Barrow resident knowledgeable about the mammals and fish of the area is expected to be included as a member of the MMO team aboard the *Healy*. Although his primary duties will be as a member of the MMO 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. However, 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.

The Plan of Cooperation will cover the initial phases of UTIG's Arctic Ocean seismic survey planned to occur 15 July to 25 August. The purpose of this plan will be 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 community of Barrow.

Subsequent meetings with whaling captains, other community representatives, the AEWC, NSB, and any other parties to the plan will be held as necessary to negotiate the terms of the plan and to coordinate the planned seismic survey operation with subsistence whaling activity.

The proposed Plan of Cooperation may address the following:

- Operational agreement and communications procedures
- Where/when agreement becomes effective
- General communications scheme
- On-board Inupiat observer
- Conflict avoidance
- Seasonally sensitive areas
- Vessel navigation
- Air navigation
- Marine mammal monitoring activities
- Measures to avoid impacts to marine mammals
- Measures to avoid conflicts in areas of active whaling
- Emergency assistance
- Dispute resolution process

As noted above, in the unlikely event that subsistence hunting or fishing is occurring within 5 km (3 mi) of the *Healy*'s trackline, the airgun operations will be suspended until the Healy is >5 km (3 mi) away.

Mitigation

For the proposed seismic survey in the Arctic Ocean, UTIG will deploy airgun sources involving 4 GI guns or 8 airguns. These sources will be small-to-moderate in size and source level, relative to airgun arrays typically used for industry seismic surveys. However, the airguns comprising the arrays will be clustered with only limited horizontal separation, so the arrays will be less directional than is typically the case with larger airgun arrays, which will result in less downward directivity than is often present during seismic surveys, and more horizontal propagation of sound.

Several important mitigation measures have been built into the design of the project:

• The project is planned for July-August, when few bowhead whales are present and no bowhead hunting is occurring;

• Airgun operations will be limited to offshore waters, far from areas where there is subsistence hunting or fishing, and in waters where marine mammal densities are generally low;

• When operating in shallower parts of the study area, airgun operations will be limited to the smaller source (4 GI guns);

In addition to these mitigation measures that are built into the general design, several specific mitigation measures will be implemented to avoid or minimize effects on marine mammals encountered along the tracklines and are discussed below.

Vessel-based observers will monitor marine mammals near the seismic source vessel during all airgun operations. These observations will provide the real-time data needed to implement some of the key mitigation measures. When marine mammals are observed within, or about to enter, designated safety zones (see below) where there is a possibility of significant effects on hearing or other physical effects, airgun operations will be powered down (or shut down if necessary) immediately. Vessel-based observers will watch for marine mammals near the seismic vessel during all periods of shooting and for a minimum of 30 min prior to the planned start of airgun operations after an extended shut down. Due to the timing of the survey situated at high latitude, the project will most likely take place during continuous daylight and monitoring adjustments will not be necessary for nighttime (darkness).

In addition to monitoring, mitigation measures that will be adopted will include (1) speed or course alteration, provided that doing so will not compromise operational safety requirements, (2) power down or shut-down procedures, and (3) no start up of airgun operations unless the full 180 dB safety zone is visible for at least 30 min during day or night.

Speed or Course Alteration

If a marine mammal is detected outside the safety radius and, based on its position and the relative motion, is likely to enter the safety radius, the vessel′s speed and/or direct course may, when practical and safe, be changed in a manner that also minimizes the effect on the planned science objectives. The marine mammal activities and movements relative to the seismic vessel will be closely monitored to ensure that the marine mammal does not approach within the safety radius. If the mammal appears likely to enter the safety radius, further mitigative actions will be taken, i.e., either further course alterations or power down or shut down of the airgun(s). However, in regions of complete ice cover, which are common north of 75° N., cetaceans are unlikely to be encountered because they must reach the surface to breathe.

Power-down Procedures

A power-down involves decreasing the number of airguns in use such that the radius of the 180–dB zone is decreased to the extent that marine mammals are no longer within the 180–dB safety radius. A power down may also occur when the vessel is moving from one seismic line to another. During a power down, one airgun (or some other number of airguns less than the full airgun array) is 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.

If a marine mammal is detected outside the safety radius but is likely to enter the safety radius, and if the vessel′s speed and/or course cannot be changed to avoid having the mammal enter the safety radius, the airguns may (as an alternative to a complete shut down) be powered down before the mammal is within the safety radius. Likewise, if a mammal is already within the safety zone when first detected, the airguns will be powered down if the power-down results in the animal being outside of the 180–dB isopleth, else the airguns will be shut down. During a power-down of the 4- or 8–airgun array, one airgun (either a single 105 in3 GI gun or one 210 in3 G. gun, respectively) will be operated. If a marine mammal is detected within or near the smaller safety radius around that single airgun (see Table 2), it will be shut down as well (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 safety zone; or has not been seen within the zone for 15 min in the case of small odontocetes and pinnipeds; or has not been seen within the zone for 30 min in the case of mysticetes (large odontocetes do not occur within the study area).

Because of the expanded shut-down radii proposed by UTIG (below), power-downs will only be used in deep water. In shallow and intermediate depth water, an immediate shutdown will occur when marine mammals are sighted within the designated safety radii.

Shut-down Procedures

The operating airgun(s) will be shut down completely if a marine mammal approaches or enters the then-applicable safety radius and a power down is not practical (or shut down is specifically prescribed, see expanded shut down radii in Table 1). The operating airgun(s) will also be shut down completely if a marine mammal approaches or enters the estimated safety radius around the source that would be used during a power down.

After submitting their application, UTIG proposed expanded shut down zones for shallow and intermediate depth water. As reflected in Table 1, in shallow or intermediate depth water, the *Healy* will cease operating airguns if a cetacean is seen at any distance from the vessel (most likely maximum visibility 2–3 km (1.2–1.9 mi)). For pinnipeds, in shallow water the *Healy* will implement a 1000–m (3,280–ft) shut-down zone, and for intermediate depth water, the Healy will implement a 500–m (1,640–ft) shut-down zone.

Ramp-up Procedures

A ''ramp-up'' procedure will be followed when the airgun array begins operating after a specified-duration period without airgun operations. NMFS normally requires that the rate of ramp up be no more than 6 dB per 5 min period. The specified period depends on the speed of the source vessel and the size of the airgun array that is being used. Ramp-up will begin with one of the G. guns (210 in^3) or one of the Bolt airguns (500 in^3) for the 8–airgun array, or one of the 105 in^3 GI guns for the 4–GI gun array. One additional airgun will be added after a period of 5 minutes. Two more airguns will be added after another 5 min, and the last four airguns (for the 8–airgun array) will all be added after the final 5 min period. During the ramp-up, the safety zone for the full airgun array in use at the time will be maintained.

If the complete 180–dB safety radius has not been visible for at least 30 min prior to the start of operations, ramp up will not commence unless at least one airgun has been operating during the interruption of seismic survey operations. This means that it will not be permissible to ramp up the 4–GI gun or 8–airgun source from a complete shut down in thick fog or darkness (which may be encountered briefly in late August); when the outer part of the 180 dB safety zone is not visible. If the entire safety radius is visible, then start up of the airguns from a shut down may occur at night (if any periods of darkness are encountered during seismic operations). If one airgun has operated during a power-down period, ramp up to full power will be permissible 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 if they choose. Ramp up of the airguns will not be initiated during the day or at night if a marine mammal has been sighted within or near the applicable safety radii during the previous 15 or 30 min, as applicable.

Airgun activity will not resume until the marine mammal has cleared the safety radius. The animal will be considered to have cleared the safety radius if it is visually observed to have left the safety radius, or if it has not been seen within the radius for 15 min (small odontocetes and pinnipeds) or 30 min (mysticetes).

Helicopter Flights

The use of a helicopter to deploy and retrieve SISs during the survey is expected, at most, to cause brief behavioral reactions of marine mammals. To limit disturbance to marine mammals, helicopters will follow the survey track line. UTIG would avoid landing within 1000 ft (304 m) of an observed marine mammal, and maintain a minimum altitude of 1000 ft (304 m), unless weather or other circumstances require a closer landing for human safety. For efficiency, each helicopter excursion will be scheduled to deploy/retrieve three or four SIS units. This will minimize the number of flights and the number of potential distubances to marine mammals in the area.

Monitoring

UTIG proposes to sponsor marine mammal monitoring during the present project, in order to implement the proposed mitigation measures that require real-time monitoring, and to satisfy the anticipated monitoring requirements of the IHA.

Vessel-based observers will monitor marine mammals near the seismic source vessel during all seismic operations. There will be little or no darkness during this cruise. Airgun operations will be shut down when marine mammals are observed within, or about to enter, designated safety radii (see below) where there is a possibility of significant effects on hearing or other physical effects. Vessel-based MMOs 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 airgun. When feasible, observations will also be made during daytime periods without seismic operations (e.g., during transits and during coring operations).

During seismic operations in the Arctic Ocean, four observers will be based aboard the vessel. MMOs will be appointed by UTIG with NMFS concurrence. A Barrow resident knowledgeable about the mammals and fish of the area is expected to be included as one of the team of marine mammal observers (MMOs) aboard the *Healy*. At least one observer, and when practical, two observers, will monitor marine mammals near the seismic vessel during ongoing operations and nighttime start ups (if darkness is encountered in late August). Use of two simultaneous observers will increase the proportion of the animals present near the source vessel that are detected. MMO(s) will normally be on duty in shifts of duration no longer than 4 hours. The USCG crew will also be instructed to assist in detecting marine mammals and implementing mitigation requirements (if practical). Before the start of the seismic survey the crew will be given additional instruction on how to do so.

The *Healy* is a suitable platform for marine mammal observations. When stationed on the flying bridge, the eye level will be approximately 27.7 m (91 ft) above sea level, and the observer will have an unobstructed view around the entire vessel. If surveying from the bridge, the observer's eye level will be 19.5 m (64 ft) above sea level and approximately 25° of the view will be partially obstructed directly to the stern by the stack (Haley and Ireland, 2006). The MMO(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 any periods of darkness (minimal, if at all, in this cruise), NVDs will be available (ITT F500 Series Generation 3 binocular-image intensifier or equivalent), if and when required. The survey will take place at high latitude in the summer when there will be continuous daylight, but night (darkness) is likely to be encountered briefly at the southernmost extent of the survey in late August. Laser rangefinding binoculars (Leica LRF 1200 laser rangefinder or equivalent) will be available to assist with distance estimation; these are useful in training observers to estimate distances visually, but are generally not useful in measuring distances to animals directly.

To assure prompt implementation of shut downs, additional channels of communication between the MMOs and the airgun technicians will be established in 2006 as compared with the arrangements on the Healy in 2005 (cf. Haley and Ireland, 2006). During power downs and shut downs, the MMO(s) will continue to maintain watch to determine when the animal(s) are outside the safety radius. Airgun operations will not resume until the animal is outside the safety radius. The animal will be considered to have cleared the safety radius if it is visually observed to have left the safety radius, or if it has not been seen within the radius for 15 min (small odontocetes and pinnipeds) or 30 min (mysticetes).

All observations and airgun power or shut downs will be recorded in a standardized format. Data will be entered into a custom database using a notebook computer. The accuracy of the data entry will be verified by computerized validity data 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, or other programs for further processing and archiving.

Results from the vessel-based observations will provide

1.The basis for real-time mitigation (airgun power 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.

Reporting

A report will be submitted to NMFS within 90 days after the end of the cruise. The report will describe the operations that were conducted and the marine mammals that were detected near the operations. The report will be submitted to NMFS, providing full documentation of methods, results, and interpretation pertaining to all monitoring. The 90–day report will summarize the dates and locations of seismic operations, and all marine mammal sightings (dates, times, locations, activities, associated seis-mic survey activities). The report will also include estimates of the amount and nature of the impacts on marine mammals resulting from the seismic survey. Analysis and reporting conventions will be consistent with those for the 2005 *Healy* cruise to factilitate comparisons and (where appropriate) pooling of data across the two seasons.

Endangered Species Act

Pursuant to section 7 of the ESA, the National Science Foundation (NSF) has begun consultation on this proposed seismic survey. NMFS will also consult on the issuance of an IHA under section 101(a)(5)(D) of the MMPA for this activity. Consultation will be concluded prior to a determination on the issuance of an IHA.

National Environmental Policy Act (NEPA)

NSF prepared a Draft Environmental Assessment of a Marine Geophysical Survey by the USCG Healy of the Western Canada Basin, Chukchi Borderland and Mendeleev Ridge, Arctic Ocean, July-August 2006. NMFS will either adopted NSF's EA or prepare their own NEPA document prior to the issuance of an IHA. A copy of the EA is available at the NMFS website (see ADDRESSES).

Preliminary Conclusions

NMFS has preliminarily determined that the impact of conducting the seismic survey in the Arctic Ocean may result, at worst, in a temporary modification in behavior (Level B Harassment) of small numbers, relative to the population sizes, of certain species of marine mammals. The maximum estimates of take indicate that no more than 2.5 percent of the gray whale and ringed seal populations would be harassed, and no more than 1 percent of any of the other affected stocks. This activity is expected to result in a negligible impact on the affected species or stocks.

To summarize the reasons stated previously in this document, this preliminary determination is supported by: (1) the likelihood that, given sufficient notice through slow ship speed and ramp-up, marine mammals are expected to move away from a noise source that is annoying prior to its becoming potentially injurious; (2) recent research that indicates that TTS is unlikely (at least in delphinids) until levels closer to 200–205 dB re 1 μPa are reached rather than 180 dB re 1 μPa; (3) the fact that 200–205 dB isopleths would be well within 100 m (328 ft) of the vessel; and (4) the likelihood that marine mammal detection ability by trained observers is close to 100 percent during daytime and remains high at night to that distance from the seismic vessel. As a result, no take by injury or death is anticipated, and the potential for temporary or permanent hearing impairment is very low and will be avoided through the incorporation of the proposed mitigation measures mentioned in this document.

While the number of potential incidental harassment takes will depend on the distribution and abundance of marine mammals in the vicinity of the survey activity, the number of potential harassment takings is estimated to be small, and has been mitigated to the lowest level practicable through incorporation of the measures mentioned previously in this document.

The proposed seismic program will not interfere with any legal subsistence hunts, since seismic operations will not be conducted in the same space and time as the hunts in subsistence whaling and sealing areas. Therefore, NMFS believes the issuance of an IHA for this activity will not have an unmitigable adverse effect on any marine mammal species or stocks used for subsistence purposes.

Proposed Authorization

As a result of these preliminary determinations, NMFS proposes to issue an IHA to UTIG for conducting a seismic survey in the Arctic Ocean from July 15 - August 25, 2006, provided the previously mentioned mitigation, monitoring, and reporting requirements are incorporated.

Dated: May 9, 2006.

Donna Wieting,

Deputy Director, Office of Protected Resources, National Marine Fisheries Service.

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DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

[I.D. 040706C]

Gulf of Mexico Fishery Management Council; Public Meeting

AGENCY: National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce.

ACTION: Notice of meeting cancellation.

SUMMARY: The Gulf of Mexico Fishery Management Council is cancelling the previously-published meeting of the Ad Hoc Shrimp Effort Working Group (SEWG) scheduled for May 23–24, 2006.

DATES: The SEWG meeting scheduled to convene at 9 a.m. on Tuesday May 23, 2006 and conclude no later than 3 p.m. on Wednesday May 24, 2006 has been cancelled and will be rescheduled at a later date.

ADDRESSES: Gulf of Mexico Fishery Management Council, 2203 North Lois Avenue, Suite 1100, Tampa, FL 33607.

FOR FURTHER INFORMATION CONTACT: Assane Diagne, Economist, telephone (813) 348–1630.

SUPPLEMENTARY INFORMATION: The original notice published in the **Federal Register** on April 13, 2006 (71 FR 19167). The Gulf of Mexico Fishery Management Council (Council) has canceled the meeting of the Ad Hoc Shrimp Effort Working Group scheduled to convene at 9 a.m. on Tuesday May 23, 2006 and conclude no later than 3 p.m. on Wednesday May 24, 2006 and will be rescheduled at a later date.

Dated: May 9, 2006.

Tracey L. Thompson,

Acting Director, Office of Sustainable Fisheries, National Marine Fisheries Service.

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