Shell Exploration & Production Company
3601 C Street, Suite 1334
Anchorage, AK 99503

November 22, 2006

National Marine Fisheries Service
Office of Protected Resources
Marine Mammal Division
Attn: James H. Lecky, Director
1315 East - West Highway
Silver Spring, MD 20910-3226

Subject: Request for Approval, Incidental Harassment Authorization for Non-Lethal Taking of Whales and Seals in the Chukchi and Mid and Eastern Beaufort Sea, Alaska During 2007 Open Water Seismic Program

Dear Mr. Lecky:

Shell Offshore, Inc. (SOI) and its geophysical (seismic) contractor WesternGeco propose to conduct a marine geophysical (deep seismic) survey program during open-water season on various U.S. Minerals Management Service (MMS) Outer Continental Shelf (OCS) lease blocks in the Chukchi and Mid and Eastern Beaufort Seas. SOI and WesternGeco request an Incidental Harassment Authorization (IHA) pursuant to Section 101 (a) (5) (D) of the Marine Mammal Protection Act (MMPA), 16 U.S.C. § 1371 (a) (5), to allow non-lethal takes of whales and seals incidental to offshore geophysical seismic operations.

The only type of incidental taking sought in this application is takes by noise harassment stemming from WesternGeco's deep seismic survey vessel M/V Gilivar, the M/V Kilabuk (or ice-class seismic chase vessel of similar characteristics). The M/V Kilabuk will serve as a resupply, fueling and chase vessel and is capable of assisting in ice management operations but will not deploy seismic acquisition gear. The site clearance and shallow hazards surveys will be conducted by the M/V Henry Christoffersen, the same vessel used during SOI's 2006 site clearance and shallow hazard surveys. SOI will contract a Sikorsky S-61 helicopter to provide emergency rescue/evacuation and search and rescue services; it will be operating within flight controls mandated by the Conflict Avoidance Agreement (CAA) and/or other stipulations compliant with MMS National Environmental Policy Act (NEPA) documents.

The proposed Chukchi and Beaufort Sea deep seismic, site clearance and shallow hazard surveys will commence during the open water season from mid July to mid November. The timing is scheduled to avoid conflict with the Beaufort Sea subsistence hunt conducted by the Alaska Eskimo Whaling Commission's (AEWC) villages. SOI and WesternGeco will extend mitigation to avoid impacts to the traditional beluga whale hunt practiced by the village of Pt. Lay annually during July. SOI held Plan of Cooperation meetings in the communities of Nuiqsut and Barrow on October 16-17, 2006. Additional follow-up meetings are tentatively scheduled for May or June 2007 in the affected communities. SOI is currently working with the village of Kaktovik to schedule meetings for an as yet unidentified date. Negotiations were initiated beginning September 2006, and continued in October during the Alaska Federation of Natives (AFN) conference in Anchorage with the AEWC to create a CAA between SOI, and the whaling captains' associations of Kaktovik, Nuiqsut, Barrow, Pt. Hope and Wainwright for the 2007 activities. The CAA will cover both this proposed Beaufort Sea seismic program (including deep seismic, site clearance, shallow hazard surveys and a geotechnical seabed coring program). SOI has participated in early consultation and coordination with Native entities that conduct subsistence activities in the area and conveyed a strong desire for avoiding potential conflicts.

Any impacts on the whale and seal populations of the Chukchi and Beaufort Seas from seismic activity are likely to be short term and transitory in temporary displacement of individuals or small groups that may be exposed to seismic sounds at the 120-190 decibels received levels. The seismic activities will not result in any permanent impact on habitats used by marine mammals or their prey sources. There should be no adverse impacts on the availability of the whale species for subsistence users.

Items presented pursuant to 50 C.F.R. § 216.104, "Submission of Requests", and § 216.107, "Incidental Harassment Authorization for Arctic Waters", are attached with the application. The Marine Mammal Monitoring and Mitigation Measures Plan is forth-coming and will be directed to the appropriate parties when available.

Please contact me at (907) 770-3700 for further information.

Sincerely,
Shell Exploration and Production Co.

Susan Childs
Regulatory Coordinator, Alaska

Attachments:

- Application for Incidental Harassment Authorization for the Non-Lethal Taking of Whales and Seals in Conjunction with a Proposed Open Water Seismic Program in the Chukchi and Beaufort Seas, Alaska, During 2007

cc w/attachments:

Maggie Ahmaogak, Alaska Eskimo Whaling Commission - Barrow, AK
Jessica LeFevre, Alaska Eskimo Whaling Commission – Washington, D.C.
Jeff Walker, Minerals Management Service – Anchorage, AK
Doug DeMaster, NOAA Fisheries - Seattle, WA

Ken Hollingshead, NOAA Fisheries - Silver Spring, MD
Brad Smith, NOAA Fisheries - Anchorage, AK
Arnold Brower, Jr. - ICAS
Mark Stone - Shell
Chandler Wilhelm – Shell
A. Michael Macrander – Shell
Greg Horner – ASRC Energy Services
Project File
Administrative File

15067-22.1.4.3/O6-199

Application for Incidental Harassment Authorization for the Non-Lethal Taking of Whales and Seals in Conjunction with a Proposed Open Water Seismic Program in the Chukchi and Beaufort Seas, Alaska, During 2007

November 2006

Submitted to:

Shell Exploration and Production Company
3601 C Street, Suite 1334
Anchorage, Alaska 99503

Prepared by:

ASRC Energy Services
a subsidiary of Arctic Slope Regional Corporation
Regulatory & Technical Services

3900 C Street, Suite 601
Anchorage, Alaska 99503

Table of Contents

Page

Figures

Tables

Attachments

Shell Offshore Inc. (SOI), a legal entity of Shell Exploration and Production Company, used the following guidance to prepare its request for Incidental Harassment Authorization (IHA).

50 CFR 216.104 "Submission of Requests"

(a) In order for the National Marine Fisheries Service (NMFS) to consider authorizing the taking by U.S. citizens of small numbers of marine mammals incidental to a specified activity (other than commercial fishing), or to make a finding that incidental take is unlikely to occur, a written request must be submitted to the Assistant Administrator. All requests must include the following information for their activity:

1. A detailed description of the specific activity or class of activities that can be expected to result in incidental taking of marine mammals:

Information required by 50 CFR§216.104 (a):

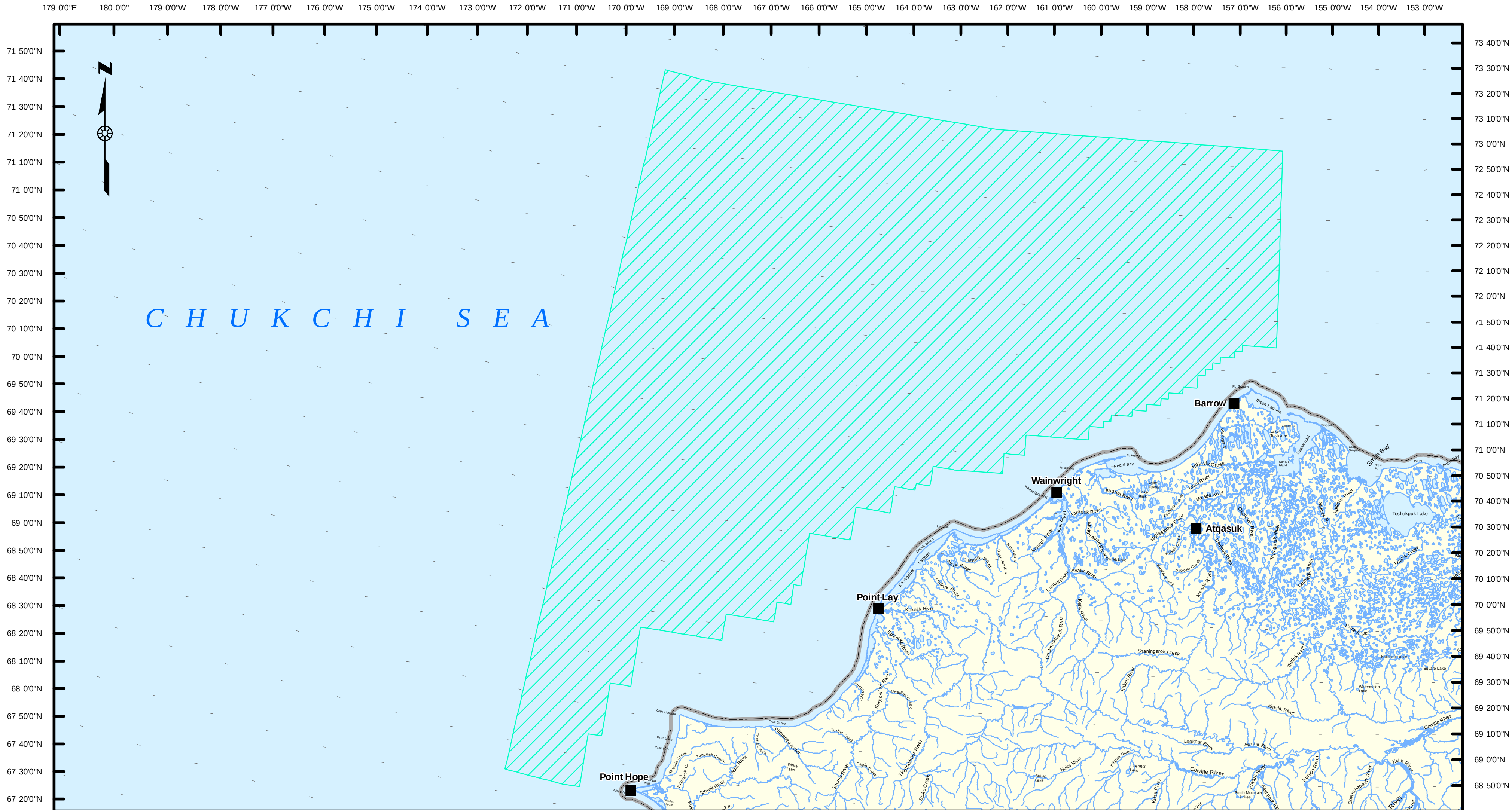
SOI is planning a variety of programs in the Chukchi and Beaufort Seas during the 2007 open water season. The programs include:

- Chukchi Sea Deep 3D Seismic;
- Beaufort Sea Deep 3D Seismic; and
- Beaufort Sea Marine Surveys (including site clearance and shallow hazards [sonar, shallow seismic, acoustic monitoring studies, seabed topography] and environmental monitoring).

<u>Chukchi Sea Deep 3D Seismic</u>

SOI and its geophysical (seismic) contractor WesternGeco propose to conduct a marine geophysical (deep seismic) survey program during open-water season on various U.S Minerals Management Service (MMS) Outer Continental Shelf (OCS) lease blocks in the Northern Chukchi Sea (See Figure 1). This seismic survey will consist of deep seismic surveys only conducted from WesternGeco's vessel M/V Gilavar. The M/V Kilabuk, or similar ice-class vessel, will serve as a resupply, fueling support of acoustic and marine mammal monitoring, and seismic chase vessel. It also is capable of assisting in ice management operations but will not deploy seismic acquisition gear. The Chukchi Sea 3D seismic work will not include any site clearance or shallow hazard surveys. In addition, a crew change vessel such as the M/V Peregrine (27.4 meters (m) length, (90 feet) (ft), 1 m, (3 ft) draft) will support the M/V Gilavar and the chase vessel in the Chukchi Sea.

The deep seismic survey in the Chukchi Sea will be conducted from WesternGeco's vessel M/V Gilavar 84.9 m (278.5 ft) length, 5.3 m (17.4 ft) draft. Detailed specifications of this purpose-built seismic survey vessel are provided in Attachment A – Seismic Survey, Overview/Description. These specifications include: (1) complete descriptions of the number and lengths of the streamers which form the air gun and hydrophone arrays; (2) air gun size and sound propagation properties which need to be known in order to estimate the number of takes by noise harassment of bowhead whales and other marine mammals which may occur within ensonified zones (see Section 6 of this application); and (3) additional detailed data on the M/V Gilavar's characteristics and capacities as a vessel. The seismic acquisition vessel will be supported by the M/V Kilabuk (or ice-class seismic chase vessel of similar characteristics) 62.5 m (205 ft) length, 4.3 m (14.2 ft) draft, or similar chase vessel will be capable of ice management should that be required. The M/V Kilabuk, or similar chase vessel will not deploy seismic acquisition gear and its only contribution to the shallow water marine noise field will come from the operation of the vessel. Specifications for the resupply and ice management vessel M/V Kilabuk are contained in Attachment A.



■ Villages
Prospective Seismic Acquisition Area

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SHELL EXPLORATION & PRODUCTION CO.

Open Water Program 2007:
3D Seismic Chukchi Sea

SCALE: 0 15 30 60 Mi

FIGURE: 1

Lynx: 15067-190.mxd, 10/10/06, R00

The M/V Gilavar and all support vessels (i.e., M/V Kilabuk and M/V Peregrine) will operate in accordance with the provisions of a Conflict Avoidance Agreement (CAA) being negotiated with the Alaska Eskimo Whaling Commission (AEWC) regarding times and areas to avoid any possible conflict with the bowhead whale migration and subsistence hunts by the villages of Pt. Hope or Wainwright. SOI and WesternGeco will extend mitigation to avoid impacts to the traditional beluga whale hunt practiced by the village of Pt. Lay annually during July. SOI and WesternGeco extend mitigation efforts toward all subsistence activities practiced by the coastal Chukchi villages.

Beaufort Sea Deep 3D Seismic

The M/V Gilavar and M/V Kilabuk also will be conducting the Beaufort Sea deep 3D seismic surveys. The detailed specifications outlined for each vessel in Attachment A apply to the Beaufort Sea activity. In addition, a crew change vessel such as the M/V Peregrine will support the M/V Gilavar and the chase vessel. The crew change vessel will be used to ferry people and supplies from nearshore docking sites (i.e., West Dock, Oliktok Dock, and possibly Barrow) during crew changes, and support of the marine mammal monitoring and mitigation program (4MP). Smaller vessels such as the Alaska Clean Seas (ACS) bay boats, or similar may be used to transport personnel and/or gear to support the 4MP.

The M/V Gilavar and all support vessels will operate in accordance with the provisions of a CAA being negotiated with the AEWC regarding times and areas in order to avoid any possible conflict with the bowhead subsistence whale hunts by Barrow, Kaktovik and Nuiqsut. Specifications and operating characteristics of the M/V Gilavar, M/V Kilabuk, and M/V Peregrine (e.g., Kilabuk and Peregrine as example vessels) are provided in Attachment A.

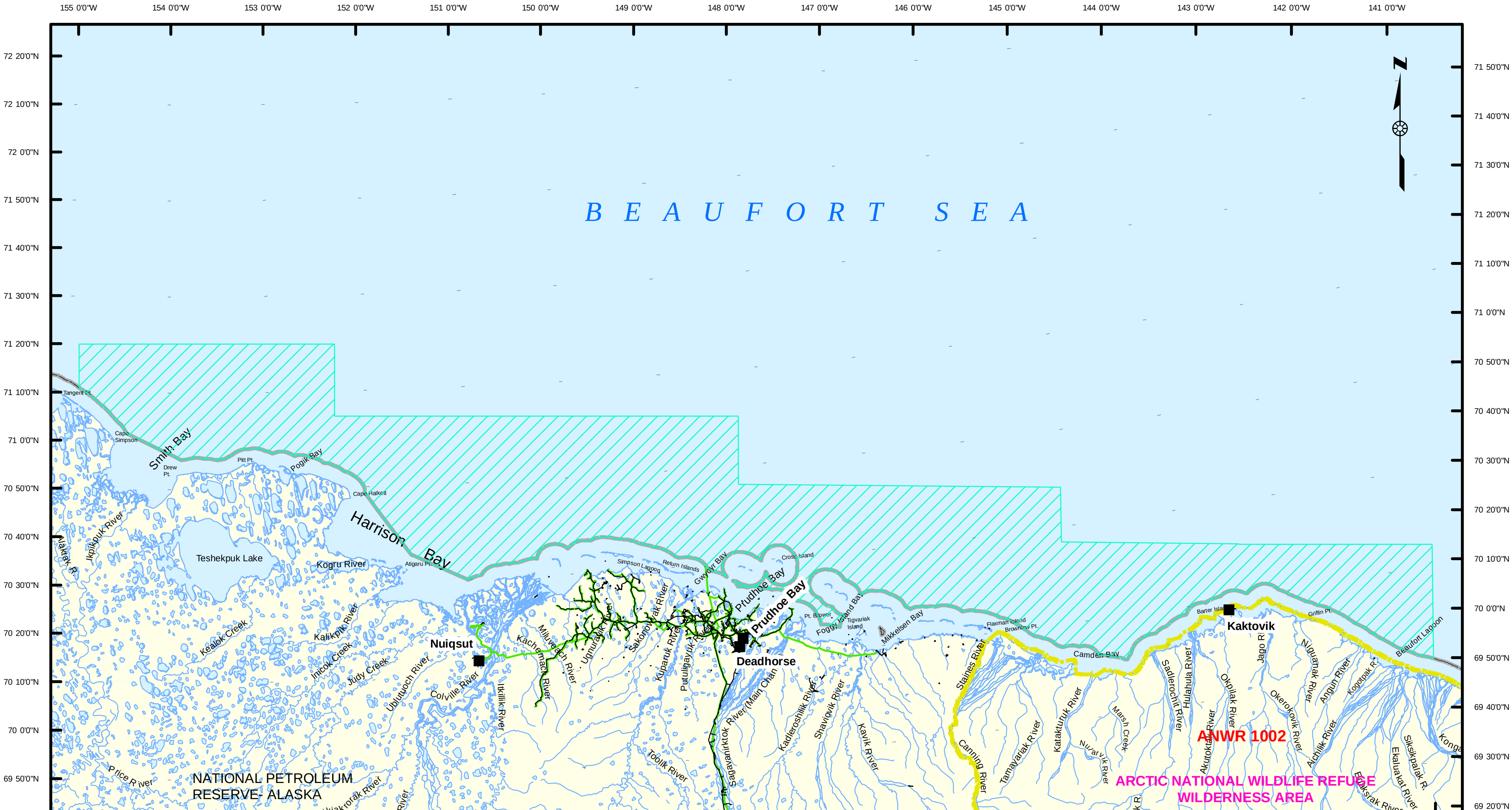
Beaufort Sea Marine Surveys

Marine surveys will include site clearance and shallow hazards surveys of potential exploratory drilling locations within SOI's OCS lease areas and a potential pipeline corridor within and outside of SOI OCS lease blocks as required by MMS regulations. Site clearance surveys are confined to small specific areas within OCS blocks. SOI is currently in the process of selecting site clearance/shallow hazards contractors and vessels. Site clearance surveys will be conducted contemporaneously with the 3D seismic survey program.

The site clearance and shallow hazards surveys will be conducted by the M/V Henry Christoffersen (M/V Henry "C" – the same vessel used during SOI's 2006 site clearance and shallow hazard surveys), a 45.23 m (148 ft) long, 15.87 m (52 ft) wide, 1.3 m (4 ft) draft diesel-powered tug (see Attachment B). It is proposed that the following acoustic instrumentation used from the M/V Henry "C" during 2006 will again be used during 2007:

- Dual frequency subbottom profiler Datasonics CAP6000 Chirp II (2-7kHz or 8-23 kHz); Medium penetration subbottom profiler, Datasonics SPR-1200 Bubble Pulser (400 (hertz [Hz]);
- Hi-resolution multi-channel 2D system, 240 cubic inches (in^3)(4X60) gun array (0-150 Hz);
- Multi-beam bathymetric sonar, Seabat 8101 (240 Hz); and
- Side-scan sonar system, Datasonics SIS-1500 (190 – 210 kHz).

These systems will be used in order to examine and measure bathymetry, seabed topography, potential geohazards and other seabed characteristics (i.e. boulder patches). Actual locations of site clearance and shallow hazard surveys have not been definitively set as of this date, although these will occur within the area outlined in Figure 2. Before the commencement of operations, survey location information will be supplied to NMFS, AEWC and other affected agencies as it becomes available. Several (>10) sonabouys (passive acoustic monitoring equipment) are to be positioned in and around potential drilling locations within the Sivulliq lease block. The timing is scheduled to avoid conflict with the Beaufort Sea subsistence hunts conducted by the Whaling Captain's Associations of Barrow, Kaktovik, and Nuiqsut via the CAA with the AEWC.



Prospective Seismic Acquisition Area (Beaufort)	State-Federal Water Boundary
Roads	Arctic National Wildlife Refuge
Pipelines	Villages

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SHELL EXPLORATION & PRODUCTION CO.

Open Water Program 2007:
3D Seismic Beaufort Sea

SCALE: 0 10 20 40 Mi

FIGURE: 2

Lynx: 15067-187.mxd, 11/01/06, R00

The multi-beam bathymetric sonar and the side-scan sonar system operate at frequencies >180 kHz, the highest frequency considered by knowledgeable marine mammal biologists to be of possible influence to marine mammals. No measurements of those two sources were planned, and the recording equipment had a practical upper limit of 90 kHz. As determined during the sound measurement process, there should be no exclusion zones for seals or whales during operation of those two sources.

2. The dates and duration of such activity and the specific geographic region where it will occur:

Chukchi Sea Deep 3D Seismic

The proposed deep seismic survey in the Chukchi Sea will occur before and after the survey activity in the Beaufort Sea. As sea ice coverage conditions allow, seismic activity will begin approximately July 15 and continue to early-to-mid August when the M/V Gilavar and M/V Kilabuk, or similar vessel, will transit to the Beaufort Sea to start work on a deep seismic survey on SOI lease-holdings in the mid and eastern Beaufort. The M/V Peregrine or similar vessel will conduct crew change transfers. After mid-October when sea ice conditions in the mid and eastern Beaufort Sea make further survey work there impractical, the survey activity will return to the Chukchi Sea. The M/V Gilavar and M/V Kilabuk will transit to the Chukchi Sea and continue the deep seismic survey program until such time as sea ice and weather conditions preclude further work, probably sometime in mid- to late-November 2007. Obviously the dates indicated here represent what might occur under ideal conditions for performing marine seismic work whereas the actual dates will depend on sea ice and weather conditions as they occur in summer and mid-autumn of 2007. However, the proposed commencement date of July 15 will not occur earlier than that even if marine conditions allow since the timing is designed to ensure that there will be no conflict with the spring bowhead whale migration and hunts conducted by Barrow, Pt. Hope, or Wainwright or the beluga subsistence hunt conducted by the village of Pt. Lay in July. SOI will contract a Sikorsky S-61 helicopter to provide emergency rescue/evacuation and search and rescue services. It will be operating within flight controls mandated by the CAA and/or other stipulations compliant with MMS NEPA documents.

The geographic region where the proposed deep seismic survey will occur is the Chukchi Sea MMS OCS Program Area designated as Chukchi Sea Sale 193 (1989) and the proposed 2002-2007 Chukchi Sea Program Area (See Figure 1, MMS Chukchi Sea Sale 193). Since the Chukchi deep seismic program is being conducted most likely as a pre-lease activity, the exact locations where operations will occur remain confidential for business competitive reasons. That is, the seismic data acquired will be used by SOI to determine what leases it will bid on in a forth-coming competitive lease sale. In general, however, seismic acquisition will take place well offshore from the Alaska coast beyond any exclusion areas stipulated in the MMS Chukchi Sea Planning Area Oil and Gas Lease Sale EIS (193; currently in preparation) on OCS waters averaging greater than 40 meter (m) depths.

Beaufort Sea Deep 3D Seismic

The deep seismic program will take place in OCS waters on SOI leases beginning east of the Colville River delta to east of the village of Kaktovik (Figure 2). Within this area, SOI has acquired four separate groups of lease blocks, totaling 85 leases. The program is planned to occur during open-water from late July to the end of October. SOI will contract a Sikorsky S-61 helicopter to provide emergency rescue/evacuation and search and rescue services. It will be operating within flight controls mandated by the CAA and/or other stipulations compliant with MMS NEPA documents. A CAA, currently being drafted with the AEWC will determine blackout dates, if any, regarding surveying through Bowhead whale migration.

Site Clearance and Shallow Hazard Surveys:

Site clearance surveys are to take place at specific sites on various SOI leases from the Sivulliq lease block north of Pt. Thomson east to the Olympia block north of Barter Island (Figure 2). All of these sites are in OCS waters. Additional site clearance studies are planned over a corridor from the center of the Sivulliq lease block south to Pt. Thomson, a distance of approximately 22.4 km (14 miles [mi]).

Sonar surveys will be initiated as soon as open water conditions are available, with a planned start of early July 2007. Including delays and potential black-out dates, it is anticipated that the surveying will be completed early to mid October 2007.

The positioning of sonobouys will be delayed until after the Bowhead whaling season in late September, and will be collected as late as possible in the open water season.

Strudel scour over-flights to investigate possible sources of overflood water will include local streams that discharge in the vicinity of Point Thomson including the Staines River, which discharges to the east into Flaxman Lagoon and the Canning River, which discharges to the east directly into the Beaufort Sea. These helicopter reconnaissance flights will occur during late May/early June 2007 and should take no more than two days. There are no planned landings during these over-flights.

Areas that have strudel scour identified during the aerial survey will be verified and surveyed with a marine vessel. It is anticipated that this will be the 13.1 m (43 ft) diesel-powered research vessel Annika Marie. SOI will contract a Sikorsky S-61 helicopter to provide emergency rescue/evacuation and search and rescue services. It will be operating within flight controls mandated by the CAA and/or other stipulations compliant with MMS NEPA documents. All site clearance activities will be subject to terms agreed to under a CAA.

3. Species and numbers of marine mammals in area:

The species and numbers of marine mammals likely to be found within the Eastern Beaufort Sea activity areas are listed in Table 4-1.

A total of three cetacean species (bowhead, gray, and beluga whale), three species of pinnipeds (ringed, spotted, and bearded seal), and one marine carnivore (polar bear) are known to occur in or near the proposed study area. The harbor porpoise and killer whale are more likely to occur in the Chukchi Sea than the eastern portion of the Beaufort Sea, because of the rarity of the latter species in the eastern part of the Beaufort Sea, they are not expected to be exposed to or affected by any activities associated with the areas of proposed seismic work, and are not discussed further; the discussion of these two species found in the following section is therefore more applicable to the Chukchi Sea activities. Only the bowhead whale is listed as “Endangered” under the Endangered Species Act (ESA). Other ESA-listed species which are known to occur in the adjacent Bering Sea include Steller sea lion, sperm whale, humpback whale, fin whale, blue whale, and northern right whale, however, these species are considered to be extralimital in the Chukchi and Beaufort Seas. Due to the very remote chance of interaction or potential impact, these species are not discussed further under this IHA application.

In an effort to reduce redundancy, we have included the required information about these species and abundance estimations (to the extent known) of these species in Section 4 below.

4. Status, distribution and seasonal distribution of affected species or stocks of marine mammals:

The following six species of cetaceans and seals can be expected to occur in the region of the proposed seismic activity: bowhead, gray and beluga whales, and ringed, spotted and bearded seals. These six species are the species for which general regulations governing potential incidental takes of small numbers of marine mammals are sought. The geographic boundaries and distribution, primary habitats, and population trends and risks are discussed under each species.

Three species of marine mammals—the Pacific walrus, sea otter, and polar bear—are managed by the U.S. Fish and Wildlife Service (USFWS). Within the project activity areas in the Chukchi and Eastern Beaufort Seas, the polar bear is known to occur in significant numbers and potential incidental take of this species will be dealt with under a separate application for a Letter of Authorization from the USFWS; the Pacific walrus occur in the in the seismic activity in the Chukchi Sea and will be covered under a separate application for a Letter of Authorization from the USFWS. General status information on polar bear and the Pacific walrus is included in Table 4-1 but is not discussed further under the species discussions.

Bowhead Whale (*Balaena mysticetus*)

The Western Arctic stock (discussed below) is distributed in seasonally ice-covered waters of the Arctic and near-arctic, generally between 60 and 75 degrees N latitudes in the western Arctic Basin (Moore and Reeves 1993). Currently, five bowhead whale stocks are recognized by the International Whaling Commission (IWC 1992). Small stocks occur in the Canadian Arctic and West Greenland (Baffin Bay, Davis Strait, and Hudson Bay), the Okhotsk Sea (eastern Russia), and the Northeast Atlantic from Spitzbergen westward to eastern Greenland (Zeh et al. 1993). The largest population is the Western Arctic stock, also know as the Bering, Chukchi, and Beaufort Sea stock (Rugh et al. 2003), and is the focus of this IHA.

In Alaskan waters, the majority of bowhead whales winter in the central and northwestern Bering Sea (November to March), migrate through the Chukchi Sea in the spring (March through June) following offshore ice leads around the coast of Alaska, and summer in the Canadian Beaufort Sea (mid-May through September) (Braham et al. 1980; Moore and Reeves 1993).

Bowheads tend to migrate west in deeper water (farther offshore) during years with higher-than average ice coverage than in years with less ice (Moore 2000). During fall migration, most bowheads migrate west in water ranging from 15 to 200 m deep (Miller et al. 2002 *in* Richardson and Thomson 2002); some individuals enter shallower water, particularly in light ice years, but very few whales are ever seen shoreward of the barrier islands.

Table 4-1 Species that May be Encountered During Activities

A list of species that may be encountered during activities within the Beaufort Sea, including their habitats, conservation status, and estimated abundance numbers.

Species (Stock)	Habitat	Beaufort Sea Stock and/or ESA Status [1]	Estimated Abundance [2]
Cetaceans			
bowhead whale (*Balaena mysticetus*) (Western Arctic stock)	Pack ice and coastal	ESA listed as Endangered, listed as depleted under MMPA, and classified as a strategic stock	10,545
gray whale (*Eschrichtius robustus*) (eastern north Pacific)	Coastal, lagoons	Not listed under ESA, not listed as depleted under MMPA, and not classified as a strategic stock	18,813
beluga whale (*Delphinapterus leucas*) (Beaufort Sea/eastern Chukchi Sea)	Offshore, coastal, ice edges	Not listed under ESA, not listed as depleted under MMPA, and not classified as a strategic stock	39,258/3,710
killer whale (*Orcinus orca*) (eastern North Pacific Alaska resident stock)	Widely distributed	Not listed under ESA, not listed as depleted under MMPA, and not classified as a strategic stock	1,123
Harbor porpoise (*Phocoena phocoena*) (Bering Sea Stock)	Coastal, inland waters	Not listed under ESA, not listed as depleted under MMPA, and not classified as a strategic stock	47,356
Pinnipeds			
ringed seal (*Phoca hispida*) (Alaska)	Landfast and pack ice	Not listed under ESA, not listed as depleted under MMPA, and not classified as a strategic stock	Up to 3.6 million; Currently, no reliable abundance estimate is available for the Beaufort Sea, however, combined with surveys from the Chukchi Sea, approximately 249,000 are estimated.
spotted seal (*Phoca largha*)	Pack ice	Not listed under ESA, not listed as depleted under MMPA, and not classified as a strategic stock	Several thousand and several tens of thousands. An estimate with correction using 1992 data = 59,214 seals but is preliminary at best.
bearded seal (*Erignathus barbatus*)	Pack ice	Not listed under ESA, not listed as depleted under MMPA, and not classified as a strategic stock	Currently, no reliable abundance estimate is available for this stock. Early estimates of the Bering-Chukchi Seas ranged from 250,000 to 300,000.
Carnivora			
polar bear (*Ursus maritimus*)	Coastal, ice	Not listed under ESA, not listed as depleted under MMPA, and not classified as a strategic stock	Population estimates for the Southern Beaufort Sea population of northern Alaska is 2,272 bears.

1. ESA = Endangered Species Act. Stocks listed as depleted under the MMPA (Marine Mammal Protection Act) is described as any stock that falls below its optimum sustainable population (OSP) must be classified as "depleted," 16 U.S.C. § 1362(1)(A). The numeric threshold for OSP has been interpreted by NMFS and USFWS as being above 0.6 K (i.e. greater than 60 percent of K, or carrying capacity). In other words, a stock that dropped in numbers to below 60 percent of K would qualify as "depleted" under the MMPA. The term "strategic stock" is defined as a marine mammal stock: (A) for which the level of direct human-caused mortality exceeds the Potential Biological Removal level; (B) which, based on the best available scientific information, is declining and is likely to be listed as a threatened species under the ESA of 1973 . . . within the foreseeable future; or (C) which is listed as a threatened species or endangered species under the ESA of 1973 . . ., or is designated as depleted under [the MMPA].
2. See text under individual species for population estimate sources.

Bowhead whales typically reach the Barrow area during their westward migration from the feeding grounds in the Canadian Beaufort Sea in mid-September to late-October. Although, over the years, local residents report having seen a small number of bowhead whales feeding off Barrow or in the pack-ice off Barrow during the summer, indicating that this area may be an important feeding area. Autumn bowhead whaling near Barrow normally begins in mid-September, but may begin as early as August if whales are observed and ice conditions are favorable (USDI/BLM 2005). Whaling can continue into October, depending on the quota and conditions.

The pre-exploitation population of bowhead whales in the Bering, Chukchi, and Beaufort seas is estimated to be 10,400 to 23,000 whales, and was reduced by commercial whaling to perhaps 3,000 (Woodby and Botkin 1993). Up to the early 1990s, the population size was believed to be increasing at a rate of about 3.2 percent per year (Zeh et al. 1996; Angliss and Lodge 2002) despite annual subsistence harvests of 14 to 74 bowheads from 1973 to 1997 (Suydam et al. 1995) and 42, 35, 49, 37, and 35 in 1999 through 2003, respectively (Suydam and George 2004). This is consistent with an annual population growth rate of 3.4 percent (95 percent CL 1.7-5 percent) from 1978 to 2001 reported by George et al. (2004) who estimated the population in 2001 at approximately 10,470 animals. Based on the most recent abundance estimates using 2001 data, approximately 10,545 bowhead whales make up the Western Arctic stock, with a minimum estimate [coefficient of variation [CV](N) = 0.128] of 9,472 whales (Angliss and Outlaw 2005).

The inclusion of the abundance estimate for 2001 results in a rate of increase of 3.5 percent (confidence intervals [CI] = 2.2 to 4.9 percent) (Brandon and Wade 2004 *cited in* Angliss and Outlaw 2005). Calve counts in 2001 were the highest recorded at 121 individuals, and lends building evidence of a growing population.

This bowhead population is currently listed as Endangered under the ESA and is classified as a strategic stock by NMFS (Angliss and Outlaw 2005).

Gray Whale (*Eschrichtius robustus*)

Gray whales originally inhabited both the North Atlantic and North Pacific oceans. The Atlantic populations are believed to have become extinct by the early 1700s, while a relic population survives in the western North Pacific. The eastern North Pacific or California gray whale population has recovered significantly from commercial whaling, and now numbers about 18,813, and this stock is the focus for this IHA (Angliss and Outlaw 2005).

The eastern North Pacific population of the gray whale ranges from the Bering, Chukchi, and Beaufort Seas (in summer) to the Gulf of California (in winter) (Rice 1998). Gray whales have also been documented foraging during summer in waters off of Southeast Alaska, British Columbia, Washington, Oregon, and California (Rice and Wolman 1971; Berzin 1984; Darling 1984; Quan 2000; Calambokidis et al. 2002). Most of the eastern North Pacific population migrates annually from Alaska waters to Baja California in Mexico, more than 8,000 km (5,000 miles) roundtrip. From late May to early October, the majority of the population concentrates in the northern and western Bering Sea and the Chukchi Sea.

Gray whales are found primarily in shallow water, and usually remain closer to shore than any other large cetacean. Gray whales are considered common in the nearshore waters of the eastern Chukchi Sea, and occasionally are seen east of Point Barrow in late-spring and summer. On wintering grounds, mainly along the west coast of Baja California, gray whales utilize shallow, nearly land-locked lagoons and bays (Rice et al. 1981). From late February to June, the population migrates back to arctic and subarctic seas (Rice and Wolman 1971).

Most summering gray whales congregate in the northern Bering Sea, and in the southern Chukchi Sea (Moore et al. 2000). More recently, Moore et al. (2003) suggested that gray whale use of Chirikov Basin was reduced, likely as a result of the combined effects of changing currents resulting in altered secondary productivity dominated by lower quality food. The northeastern-most of the recurring feeding areas is in the northeastern Chukchi Sea southwest of Barrow (Clarke et al. 1989).

A small number gray whales have been observed entering the Beaufort Sea east of Point Barrow. Maher (1960) reported hunters at Cross Island took one gray whale in 1933. Aerial surveys conducted in the central Alaskan Beaufort Sea documented only one gray whale between 1979 to 1997. Since 1997, small numbers of gray whales have been documented on several occasions in the central Alaskan Beaufort—mainly in the Harrison Bay area (Miller et al. 1999; Treacy 2000). Other reports of single gray whale sightings have been documented farther east of Harrison Bay (Rugh and Fraker 1981). In August 2001, Williams and Coltrane (2002) reported a single sighting of a gray whale near the Northstar production facility, indicating that small numbers do travel through the waters offshore from the Prudhoe Bay region during some summers. Given their rare occurrence in the eastern portion of the Beaufort Sea in summer, no more than a few are expected during the summer and early fall.

Gray whales have been counted as they migrate southward past Granite Canyon in central California each year since 1967. The most recent abundance estimates are from southbound migration counts in 1997/98, 2000/01, and 2001/02 periods with abundance estimates for the aforementioned periods of 29,758, 19,448, and 18,178, respectively (Rugh et al. [in press] *in* Angliss and Outlaw 2005).

Previous variations in estimates may be attributed to differences in the proportion of the gray whale stock migrating as far as the central California coast each year. The decline in abundance estimates between the 2000/01, and 2001/02 may be an indication that the abundance was responding to environmental limitations as the population approaches carrying capacity (Angliss and Outlaw 2005). The lower counts conducted in 2000/01 and 2001/02 may have been due to a large number of whales that did not migrate as far south as Granite Canyon, or possibly, abundance may have actually declined following high mortality rates documented in 1999 and 2000 (Rugh et al. [in press] *cited in* Angliss and Outlaw 2005; Gulland et al. 2005).

Using the mean of the 2000/01 and 2001/02 abundance estimates noted above is 18,813 animals (Angliss and Outlaw 2005). Gray whale numbers increased steadily until at least 1998, with an estimated annual growth rate of 3.3 percent between 1967 and 1988 (Buckland et al. 1993). More recent estimated growth rates from 1967/68 through 2001/02 indicate and annual growth rate of 1.9 percent (SE = 0.32 percent) (Rugh et al. [in press] *in* Angliss and Outlaw 2005). In addition, Rugh et al. (in press) estimated carrying capacity of 26,290 (CV = 0.059), indicating that recent reductions in abundance estimates may be a function of the population reaching its carrying capacity.

The eastern Pacific stock was removed from the Endangered Species List in 1994 and is not considered by NMFS to be a strategic stock.

Beluga Whale (*Delphinapterus leucas*)

The beluga whale is an arctic and subarctic species with several populations (stocks) occurring in Alaska: Beaufort Sea, eastern Chukchi Sea, eastern Bering Sea, Bristol Bay, and Cook Inlet (O'Corry-Crowe et al. 1997, Angliss and Lodge 2004). For the proposed project, only the Beaufort Sea stock and eastern Chukchi Sea stocks will be encountered. Some eastern Chukchi Sea animals enter the Beaufort Sea in late summer (Suydam et al. 2001).

Beluga whales of the Beaufort stock winter in the Bering Sea, summer in the eastern Beaufort Sea, and migrate around western and northern Alaska (Angliss and Lodge 2002). The majority of belugas in the Beaufort stock migrate into the Beaufort Sea in April or May, although some whales may pass Point Barrow as early as late March and as late as July (Braham et al. 1984; Ljungblad et al. 1984; Richardson et al. 1995).

Much of the Beaufort Sea seasonal population enters in the Mackenzie River estuary for a short period during July and August to molt their epidermis, but they spend most of the summer in offshore waters of the eastern Beaufort Sea and Amundsen Gulf (Davis and Evans 1982; Harwood et al. 1996). Belugas are rarely seen in the central Alaskan Beaufort Sea during the summer. During late summer and autumn, most belugas migrate far offshore near the pack ice front (Hazard 1988; Clarke et al. 1993; Miller et al. 1998) and may select deeper slope water independent of ice cover (Moore et al. 2000b). Small numbers of belugas are sometimes observed near the north coast of Alaska during the westward migration in late summer and autumn (Johnson 1979) but the main fall migration corridor of beluga whales is greater than 100 km (62 miles) north of the coast. Aerial- and vessel-based seismic monitoring programs conducted in the central Alaskan Beaufort Sea from 1996 through 2001 observed only a few beluga whales migrating along or near the coast (LGL and Greeneridge 1996; Miller et al. 1998, 1999). The vast majority of belugas seen during those projects were far offshore. Satellite-linked telemetry data show that some belugas migrate west considerably farther offshore, as far north as 78 degrees N latitude (Richard et al. 1997, 2001).

The Beaufort population was estimated to contain 39,258 individuals as of 1992 (Angliss and Lodge 2002). This estimate is based on the application of a sightability correction factor of 2 times to the 1992 uncorrected census of 19,629 individuals made by Harwood et al. (1996). This estimate was obtained from a partial survey of the known range of the Beaufort population and may be an underestimate of the true population size. This population is not considered by NMFS to be a strategic stock but the current population trend of the Beaufort Sea stock of beluga whales is unknown (Angliss and Outlaw 2005).

The abundance estimate considered the "most reliable" for the eastern Chukchi Sea beluga whale stock is 3,710, a result from 1989–1991 aerial surveys (Frost et al. 1993, Angliss and Lodge 2004). Additional surveys were conducted in 1998 (DeMaster et al. 1998) and again in July 2002 (Lowry and Frost 2002, *cited in* Angliss and Outlaw 2005), but both were partial surveys and therefore, a more recent abundance estimate is not available. This stock will not likely be encountered during the seismic surveys in the eastern Beaufort Sea, the population size is considered stable and not considered to be a strategic stock.

Killer Whale (*Orcinus orca*)

Killer whales are found throughout the world's oceans and seas, from tropical waters near the equator to the cooler waters in the high latitudes. They are most common in cooler coastal waters of both hemispheres, but appear in greatest numbers within 800 km from continental coasts (Mitchell 1975). Killer whales are found throughout the North Pacific and along the entire Alaskan coast, extending from the Bering and Chukchi Seas with small numbers possibly occurring in the Beaufort Sea. It is unclear which stock of killer whales may move into the waters of the Chukchi; however small numbers have been reported west of Point Barrow in the late spring and early summer, presumably following the bearded seal migration (pers comm., C. George, NMML, November 8, 2005).

Based on data regarding association patterns, acoustics, movements, and genetic differences, eight killer whale stocks are now recognized within the Pacific U.S.: 1) the Alaska Resident stock - occurring from southeastern Alaska to the Aleutian Islands and Bering Sea; 2) the Northern Resident stock - occurring from British Columbia through part of southeastern Alaska; 3) the Southern Resident stock - occurring mainly within the inland waters of Washington State and southern British Columbia, but also in coastal waters from British Columbia through California; 4) the Gulf of Alaska, Aleutian Islands, and Bering Sea Transient stock - occurring mainly from Prince William Sound through the Aleutian Islands and Bering Sea; 5) the AT1 transient stock - occurring in Alaska from Prince William Sound through the Kenai Fjords; 6) the West Coast transient stock - occurring from California through southeastern Alaska; and 7) the Offshore stock - occurring from California through Alaska, and 8) the Hawaiian stock.

The Alaska resident stock is a transboundary stock, but is found from southeastern Alaska to the Aleutian Islands and Bering Sea (Angliss and Outlaw 2005). The NMML began killer whale studies in 2001 in

Alaskan waters west of Kodiak Island, including the Aleutian Islands and Bering Sea. Line-transect surveys were conducted in July and August in 2001-2003. Based on these surveys an estimated abundance of resident killer whales was 991 (CV = 0.52), with 95 percent confidence interval of 380-2585 (Zerbini et al. in prep. *cited in* Angliss and Outlaw 2005). Because areas such as Prince William Sound and the Bering Sea were outside the line-transect survey area and movement of whales were known to move out of the survey area over the course of the 3-year study, counts of known 'resident' whales in these areas were combined, using photo identification, to produce a minimum number estimate of 1,123 killer whales belonging to the Alaska Resident stock (Angliss and Outlaw 2005). The eastern North Pacific Alaska resident stock of killer whales is not classified as a strategic stock.

Harbor Porpoise (*Phocoena phocoena*)

The harbor porpoise is the smallest cetacean, found in shallow, coastal waters from temperate to arctic zones of the northern hemisphere (Read 1999). In the eastern North Pacific Ocean, the harbor porpoise ranges from Point Barrow, along the Alaska coast, and down the west coast of North America to Point Conception, California (Gaskin 1984). The Bering Sea stock of the harbor porpoise primarily frequents coastal waters, and in the Gulf of Alaska and Southeast Alaska, they occur most frequently in waters less than 100 m in depth (Waite and Hobbs, in review, *cited in* Angliss and Outlaw 2005).

The northern extent of the harbor porpoise's range is the Chukchi Sea near Point Barrow south through the Bering Sea, southeastern shore of Bristol Bay, and south to San Luis Obispo, California (Suydam and George 1992). There are extralimital records of harbor porpoise documented further east of Point Barrow near the mouth of the Mackenzie River in the Northwest Territories, Canada.

Aerial surveys conducted in June and July 1999 in the waters of Bristol Bay provide an abundance estimate (with correction) of 47,356 (CV = 0.223) (Angliss and Outlaw 2005).

The estimate for 1999 can be considered conservative, as the surveyed areas did not include known harbor porpoise range near either the Pribilof Islands or in the waters north of Cape Newenham, approximately 59 degrees N (Angliss and Outlaw 2005). This estimate is higher than the 1991 estimate of 10,946 (Dahlheim et al. 2000) but differences in survey techniques make direct comparisons of the surveys difficult.

Surveys conducted in 1999 were more extensive than during the 1991 surveys, and additional areas (Dahlheim et al. 2000). In addition, the use of a second correction factor for the 1999 estimate confounds direct comparison. The density of harbor porpoise resulting from the 1999 surveys was still substantially higher than that reported in Dahlheim et al. (2000), but it is unknown whether the increase in density is a result of a population increase or is a result of survey design.

Harbor porpoise is unlikely to occur within the seismic acquisition area as transects will occur well offshore in water depth averaging approximately 250 m in depth. Harbor porpoise are not listed as "depleted" under the MMPA or listed as "threatened" or "endangered" under the ESA. The Bering Sea stock of harbor porpoise is not classified as a strategic stock. Population trends and status of this stock relative to optimum sustainable population (OSP) are currently unknown.

Ringed Seal (*Phoca hispida*)

In the North Pacific, ringed seals are found in the southern Bering Sea and range as far south as the Seas of Okhotsk and Japan. Ringed seals have an affinity for ice-covered waters and are well adapted to occupying seasonal and permanent ice, and are year-round residents throughout the Beaufort, Chukchi, and Bering Seas, as far south as Bristol Bay in years of extensive ice coverage. They tend to prefer large floes (more than 48 m in diameter) and are often found in the interior ice pack where the sea ice coverage is greater than 90 percent (Simpkins et al. 2003), and remain in contact with ice most of the year and pup on the ice in late winter-early spring.

During winter, ringed seals occupy landfast ice and offshore pack ice of the Bering, Chukchi, and Beaufort Seas. Ringed seals maintain breathing holes in the ice and occupy lairs in accumulated snow (Smith and Stirling 1975). They give birth in lairs from mid-March through April, nurse their pups in the lairs for 5–8 weeks, and mate in late-April and May (Smith 1973; Hammill et al. 1991; Lydersen and Hammill 1993).

During late-April through June, ringed seals are distributed throughout their range from the southern ice edge northward (Braham et al. 1984). Preliminary results from recent surveys conducted in the Chukchi Sea in May-June 1999 and 2000 indicate that ringed seal density is higher in nearshore fast and pack ice, and lower in offshore pack ice (Bengtson et al. [in review] *cited in* Angliss and Outlaw 2005). Frost and Lowry (1999) conducted surveys in May and results indicated that, in the Alaskan Beaufort Sea, the density of ringed seals in May-June is greater to the east of Flaxman Island than to the west.

While no accurate estimate for the size of the Alaska ringed seal stock is currently available, a minimum abundance estimate in the eastern Chukchi and Beaufort Sea is 249,000 (Angliss and Outlaw 2005). Past ringed seal population estimates in the Bering-Chukchi-Beaufort area ranged from 1 to 3.6 million (Frost et al. 1988). Frost and Lowry (1981) estimated 80,000 ringed seals in the Beaufort Sea during summer and 40,000 during winter.

Aerial surveys within 20 nautical miles (nm) of shore were conducted in May-June between 1986 and 1987 for a portion of the range of the ringed seal estimated 44,360 +/-9,130 (96 percent CI) (Frost et al. 1988). Spring density estimates in the same area from 1985-1987 ranged from 1.01 to 2.94 seals/km^2 (Frost and Lowry 1988). Similar surveys for the Alaska Beaufort Sea between Kaktovik and Barrow occurred in the spring during several years in the 1990s with density estimates for all years ranging from 0.81-1.17 seals/kilometers squared [(km^2) Frost et al. 2002, 2004] with a mean of 0.98 seals/km^2 or approximately 18,000 hauled out ringed seals in the survey area. Surveys conducted in 1999 and 2000 between Shishmaref to Barrow in the eastern Chukchi Sea estimated abundance of ringed seals at 252,488 (SE = 47,204) and 208,857 (SE = 25,502), respectively (Bengtson et al. [in review] *cited in* Angliss and Outlaw 2005). Combining the numbers of Alaska Beaufort Sea ringed seals with the average abundance estimate of 230,673 seals from the eastern Chukchi Sea, results in a total of 249,000 seals.

It is not known whether the more recent lower densities correspond to an actual reduction in the population or are related to earlier survey dates in 1990s. At earlier dates, a higher proportion of the seals are still using their lairs and are unavailable to be counted by aerial surveyors (Kelly et al. 2005). Frost et al. (2002) reanalyzed the earlier estimates for 1985-87 and reported ringed seal densities surveyed between Oliktok Point and Flaxman Island ranged from 0.56 to 1.16 seals/km^2 (about half the density originally reported) during the spring seasons of 1985 to 1987. Based on more recent surveys from 1996 through 1999, ringed seal density in fast-ice areas between Oliktok Point and Flaxman Island ranged from 0.48 to 0.77 seals/km^2 (Frost et al. 2002).

BP Exploration (Alaska), Inc.'s (BP's) Northstar project, located near Prudhoe Bay, developed a seal survey and monitoring program to establish a baseline prior to construction and to monitor during initial operations for comparison. Ringed seal densities reported by Moulton et al. (2002) ranged from 0.39 to 0.63 seals/km^2 prior to construction in the Northstar development area. Ringed seal densities close to Northstar in 2000, 2001, and 2002 were not reduced relative to those farther away or to those during the 1997 to 1999 pre-development period (Moulton et al. 2003 a, b), however, because aerial surveys will underestimate actual seal densities, the above density figures should be used as minimum estimates.

During summer, ringed seals are found dispersed throughout open water areas, although in some regions they move into coastal areas (Smith 1987; Harwood and Stirling 1992). During the open water period, ringed seals in the eastern Beaufort Sea are widely dispersed as single animals or small groups (Harwood and Stirling 1992). Marine mammal monitoring in the nearshore central Beaufort Sea confirms these generalities (Moulton and Lawson 2002; Williams et al. 2004).

Large concentrations of ringed seals are not expected to be encountered near each of the proposed activity areas in the eastern Beaufort Sea during the summer and fall time period. The Alaska stock of ringed seals is not classified as a strategic stock by the NMFS.

Spotted Seal (*Phoca largha*)

Spotted seals occur in the Beaufort, Chukchi, Bering and Okhotsk Seas, and south to the northern Yellow Sea and western Sea of Japan (Shaughnessy and Fay 1977). Based on satellite tagging studies, spotted seals migrate south from the Chukchi Sea in October and pass through the Bering Strait in November and overwinter in the Bering Sea along the ice edge (Lowry et al. 1998).

During spring when pupping, breeding, and molting occur, spotted seals tend to prefer small floes (less than 20 m in diameter), and inhabit mainly the southern margin of the ice in the Okhotsk and Bering Seas, with movement to coastal habitats after the retreat of the sea ice (Shaughnessy and Fay 1977; Quakenbush 1988; Rugh et al. 1997; Simpkins et al. 2003).

In summer, the majority of spotted seals are found in the Bering and Chukchi Seas, but do range into the Beaufort Sea (Rugh et al. 1997; Lowry et al. 1998) from July until September. At this time of year, spotted seals haul out on land part of the time, but also spend extended periods at sea. The seals are most commonly seen in bays, lagoons, and estuaries and are typically not associated with pack ice unless it is near to shore.

A small number of spotted seal haul-outs are documented in the central Beaufort Sea near the deltas of the Colville River and, previously, the Sagavanirktok River. Historically, these sites supported as many as 400 to 600 spotted seals, but in recent times less than 20 seals have been seen at any one site (Johnson et al. 1999).

As the ice cover thickens with the onset of winter, spotted seals leave the northern portions of their range and move into the Bering Sea (Lowry et al. 1998).

Previous studies from 1996 to 2001 indicate that few spotted seals (a few tens) utilize the central Alaskan Beaufort Sea (Moulton and Lawson 2002; Treacy 2002 a, b). In total, there are probably no more than a few tens of spotted seals along the coast of the central Alaska Beaufort Sea during summer and early fall with very few, if any, occurring in the eastern portion of the Beaufort Sea.

A reliable abundance estimate for spotted seal is not currently available (Angliss and Outlaw 2005), however, early estimates of the size of the world population of spotted seals was 335,000 to 450,000 animals and the size of the Bering Sea population, including animals in Russian waters, was estimated to be 200,000–250,000 animals (Burns 1973 *cited in* Angliss and Lodge 2004). The total number of spotted seals in Alaskan waters is not known (Angliss and Lodge 2004), but the estimate is most likely between several thousand and several tens of thousands (Rugh et al. 1997). Using maximum counts at known haul-outs from 1992 (4,135 seals), and a preliminary correction factor for missed seals developed by the Alaska Department of Fish and Game (Lowry et al. 1994), an abundance estimate of 59,214 was calculated for the Alaska stock (Angliss and Lodge 2004).

The activities associated with the proposed work in the eastern Beaufort Sea are expected to encounter few to no spotted seals. The Alaska stock of spotted seals is not classified as a strategic stock by NMFS.

Bearded Seal (*Erignathus barbatus*)

Bearded seals are associated with sea ice and have a circumpolar distribution (Burns 1981). Bearded seals are predominately benthic feeders, and prefer waters less than 200 m in depth.

Seasonal movements of bearded seals are directly related to the advance and retreat of sea ice and to water depth (Kelly 1988). During winter they are most common in broken pack ice and in some areas also inhabit shorefast ice (Smith and Hammill 1981). In Alaska waters, bearded seals are distributed over the continental shelf of the Bering, Chukchi, and Beaufort Seas, but are more concentrated in the northern part of the Bering Sea from January to April (Burns 1981).

During winter, most bearded seals in Alaskan waters are found in the Bering Sea. In the Chukchi and Beaufort Seas, favorable conditions are more limited, and consequently, bearded seals are less abundant there during winter. From mid- to late-April to June, as the ice recedes, some of the bearded seals migrate northward through the Bering Strait and spend the summer along the ice edge in the Chukchi Sea (Burns 1967; Burns 1981).

Recent spring surveys along the Alaskan coast indicate that bearded seals tend to prefer areas of nautical miles between 70 and 90 percent sea-ice coverage, and are typically more abundant greater than 20 nm of shore, with the exception of high concentrations nearshore to the south of Kivalina in the Chukchi Sea (Bengtson et al. 2000; Simpkins et al. 2003).

During the summer in the Chukchi Sea, bearded seals are most associated with the pack ice edge near the continental shelf. The nearshore areas of the central and western Beaufort Sea provide somewhat more limited habitat because the continental shelf is narrower and the pack ice edge frequently occurs seaward of the shelf and over waters greater than 200 m in depth. The preferred habitat in the Beaufort Sea during the open water period is the continental shelf seaward of the scour zone.

A reliable abundance estimate for the Alaska stock of bearded seals is currently not available. The most recent surveys occurred in May-June of 1999 and 2000 between Shismaref and Barrow with average densities of 0.07 seals per km^2 and 0.14 seals per km^2, respectively, however, there is no correction factor available for these data. Early estimates of the Bering-Chukchi Sea population ranged from 250,000 to 300,000 (Burns 1981).

No reliable estimate of bearded seal abundance is available for the Beaufort Sea (Angliss and Lodge 2002). Aerial surveys conducted by Minerals Management Services in fall 2000 and 2001 sighted a total of 46 bearded seals during survey flights conducted between September and October (Treacy 2002 a, b), with all but two sightings recorded east of 147 degrees W and all sightings were within 40 nm of shore. Aerial surveys conducted from 1997 to 2002 in the vicinity of Northstar Island also reported small numbers (up to 15) of bearded seals (Moulton et al. 2003c).

The proposed activity areas may encounter bearded seals during the open-water season, however, the number of bearded seals is expected to be small. The Alaska stock of bearded seals is not classified by NMFS as a strategic stock.

5. The type of incidental taking authorization that is being requested (i.e. takes by harassment only; takes by harassment, injury and /or death) and the method of incidental taking:

The only type of incidental taking sought in this application is that of takes by noise harassment. The only sources of project created noise will be those stemming from of the vessels M/V Gilavar and M/V Kilabuk (or similar vessel). Sounds other than vessels will include; operation of the seismic air guns and other acoustic registration equipment used in the site clearance program. For estimates of takes associated with these noise sources, see Section 6, below.

6. Numbers of marine mammals that may potentially be taken

SOI seeks authorization for potential “taking” of small numbers of marine mammals under the jurisdiction of the NMFS in the proposed region of activity. Species for which authorization is sought are bowhead, gray, killer and beluga whales, harbor porpoise, and ringed, spotted, and bearded seals.

The only anticipated impacts to marine mammals associated with noise propagation from vessel movement, seismic acquisition operations and seabed profiling work would be temporary and short term displacement of seals and whales from within ensonified zones produced by such noise sources.

The activities in the Beaufort and Chukchi Seas proposed by SOI are not expected to "take" more than small numbers of marine mammals, or have more than a negligible effect on their populations.

Reactions of marine mammals to noise sources, particularly mobile sources, such as marine vessels, vary. Reactions depend on the individual's prior exposure to the disturbance source and their need or desire to be in the particular habitat or area where they are exposed to the noise and visual presence of the disturbance sources. Activities associated with the proposed activities that have the potential for disturbance to the above species are discussed below and include:

- noise disturbance from vessel traffic (seismic and support ships);
- noise disturbance from aircraft traffic (support, reconnaissance, emergency); and
- potential polar bear/human interactions.

Basis for Estimating Numbers of Marine Mammals that Might be "Taken by Harassment"

Taking into account the total volume and sound output of the air gun sources and supporting vessels, and mitigation measures that are planned, effects on cetaceans and pinnipeds are generally expected to be limited to avoidance of an area (ensonification zone) around the seismic operation and short-term changes in behavior, falling within the MMPA definition of "Level B harassment".

The methods to estimate "take by harassment" and present estimates of the numbers of marine mammals that might be affected during the proposed seismic acquisition areas in the Beaufort Sea are described below. The density estimates for the species covered under this IHA are based on the estimates developed by LGL (2005) University of Alaska IHA and used here for consistency. Density estimates are based on the data from Moore et al. (2000) on summering bowhead, gray, and beluga whales in the Beaufort and Chukchi Seas, and relevant studies on ringed seal estimates including Stirling et al. (1982), Kingsley (1986).

This section provides estimates of the number of potential "exposures" to sound levels greater than 160 dB re 1 μPa (rms) and greater than 170 dB. The greater than 160 dB criterion is applied for all species of cetaceans and pinnipeds; the criterion is applied for delphinids and pinnipeds. The 170 dB criterion is considered appropriate for those two groups, that tend to be less responsive, whereas the 160 dB criterion is considered appropriate for other cetaceans (LGL 2005).

The following estimates are based on a consideration of the number of marine mammals that might be disturbed appreciably by as much as 6,437 km of seismic surveys in Beaufort Sea and/or the Chukchi Sea. Source arrays are composed of identically tuned Bolt gun sub-arrays operating at 2,000 psi, air pressure. In general, the signature produced by an array composed of multiple sub-arrays has the same shape as that produced by a single sub-array while the overall acoustic output of the array is determined by the number of sub-arrays employed. The gun arrangement for the 1,049 square inches (in^3) sub-array is detailed below and is comprised of three subarrays comprising a total 3,147 in^3 sound source. The anticipated radii of influence of the bathymetric sonars and pinger are less than those for the air gun configurations described in Attachment A. It is assumed that, during simultaneous operations of those additional sound sources and the air gun(s), any marine mammals close enough to be affected by the sonars or pinger would already be affected by the air gun(s). In this event, marine mammals are still not expected to exhibit more than short-term and inconsequential responses, and such responses have not been considered to constitute "taking" therefore, potential taking estimates only include noise disturbance from the use of air guns.

The specifications of the equipment, including site clearance activities, to be used and areas of ensonification are described more fully in Attachment B.

Cetaceans

For belugas and gray whales, in both the Beaufort and Chukchi Seas and bowhead whales in the Chukchi Sea Moore et al. (2000b and c) offer the most current data to estimate densities during summer. Density estimates for bowhead whale in the Beaufort Sea were taken from Miller et al, 2002.

Table 6-1 gives the average and maximum densities for each cetacean species likely to occur within the project areas based on the density estimates developed and corrected as needed by LGL for the Beaufort and Chukchi Seas (LGL 2005), however, these estimates were based on surveys of offshore waters (less than 100 m in depth). Whereas, all seismic activities within the three areas proposed under this IHA will occur in waters between 20 and 40 m in depth.

The estimated numbers of potential exposures presented in Table 6-1 are based on the 160 dB re 1 μPa (rms) criteria for most cetaceans, because this range is assumed to be the sound source level at which marine mammals may change their behavior sufficiently to be considered "taken by harassment."

Table 6-1 Recommended Zone Radii for the M/V Gilavar Acoustic Sources

Expected densities of marine mammals during open-water seismic surveys proposed for offshore areas of the Chukchi and Beaufort Seas.

Species	Average Density ($\#/km^2$) [1]	Maximum Density ($\#/km^2$) [1]
Cetaceans		
bowhead whale	0.0064	0.0256
gray whale	0.0045	0.0179
beluga whale	0.0034	0.0135
Pinnipeds		
ringed seal	0.251	0.444
spotted seal	0.0001	0.0005
bearded seal	0.0128	0.0226

1. These estimates are calculated from various sources including Moore et al. 2000, Stirling et al. 1982, Kingsley 1986, and presented in LGL 2005, Table 4.

Pinnipeds

Ringed, spotted, and bearded seals are all associated with sea ice, and most census methods used to determine density estimates for pinnipeds are associated with counting the number of seals hauled out on ice.

Correction factors have been developed for most pinniped species that address biases associated with detectability and availability of a particular species. Although extensive surveys of ringed and bearded seals have been conducted in the Beaufort Sea, the majority of the surveys have been conducted over the landfast ice and few seal surveys have been in open water. The most comprehensive survey dataset on ringed seals (and bearded seal) from the central and eastern Beaufort Sea was conducted on offshore pack ice in late spring (Kingsley 1986). It is important to note that all proposed activities will be conducted during the open-water season and density estimates used here were based on counts of seals on ice. Therefore, densities and potential take numbers will overestimate the numbers of seals that would likely be encountered and/or exposed because only the animals in the water would be exposed to the seismic and clearance activity sound sources.

Although the estimated numbers of potential exposures presented in Table 6-1 are based on two sound source ranges (greater than 160 dB and greater than_170 dB re 1 µPa [rms]), for most pinnipeds, the 170 dB threshold should be used to determine "take by harassment" because this range is assumed to be the sound source level at which most pinnipeds may change their behavior in reaction to increased sound exposure.

Exposure Calculations for Cetaceans and Pinnipeds

Except for bowheads in the Beaufort Sea, number of exposures of a particular species to sound levels between 160 decibels (dB) and 180 dB re 1 µPa (rms) was calculated by multiplying:

- the expected species density average and maximum), taken from LGL (2005);
- the maximum anticipated total line-kilometers (km) of operations in the Chukchi and/or Beaufort Seas the three 1,049 in^3 subarrays (6,437 km); and
- the cross-track distances within which received sound levels are predicted to be greater than 160 dB and greater than 170 dB.

Distances of sound propagation are taken from direct measurement of sound level at distances from the M/V Gilavar in the Chukchi Sea during the 2006 open water season (Table 6-2).

Table 6-2 Mitigation Radii Based on Empirical data

Ensonified Radii	Three-string 3,147 in^3
190 dB	440 m
180 dB	1,200 m
170 dB	3,300 m
160 dB	8,400 m

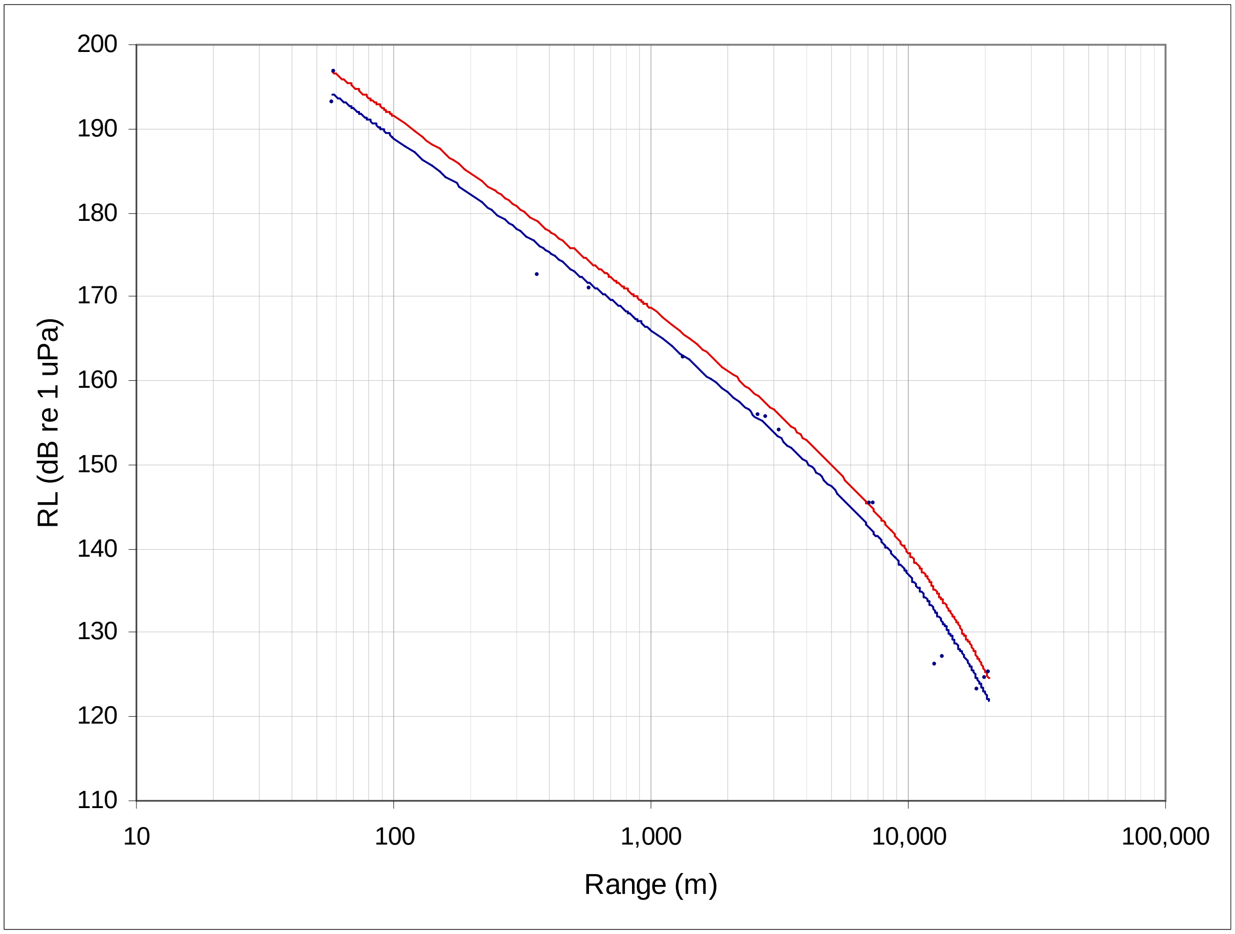
For the bowhead in the Beaufort Sea, Richardson et al. (2002) provide estimates of densities specific to a given area (subdivided east to west and by depth) and time (two week intervals during summer and fall). The total number of individuals expected to be in the specific area where seismic operations are to occur in the Beaufort Sea is multiplied by that portion of the area expected to be ensonified above 160 dB.

Estimates of numbers of cetaceans and pinnipeds exposed to sound levels greater than 160 and 170 dB resulting from seismic acquisition activities in the Chukchi Sea are presented in Table 6-3. Estimates of exposure levels for the Beaufort Sea are presented in Table 6-4.

Acoustic Sound Sources for the M/V Henry "C"

Through the analysis of sound data, it was determined that the air gun cluster was the strongest source on the M/V Henry "C". The following Figure 3 shows 15 measured received levels at distances from 58 to 20,530 m. Based on those measurements, the following equation was derived by standard least-squares curve fitting:

Figure 3 M/V Henry Christoffersen Measured Received Levels



RL (received level in decibels [dB] re 1 μPa rms) = 233.4 – 22.2*log(R) – 0.000758*R (for R in meters).

The coefficient of determination is 0.9857. The equation results in the following exclusion zone radii and estimated 190 to 160 dB distances.

Received Level (dB)	Distance (m)
190	89
180	248
160	1,750

Table 6-3 Estimated Exposures and Requested Take Levels for Chukchi Sea Operations

	Average Density	190 dB	180 dB	170 dB	160 dB	Maximum Density	190 dB	180 dB	170 dB	160 dB	Requested Take
Cetaceans											
bowhead whales	0.0011		17	47	119	0.006		93	255	649	649
gray whale	0.0018		28	77	195	0.0072		112	306	779	779
Beluga	0.0034		53	145	368	0.0135		209	574	1,460	1,460
killer whale	0.0001		2	5	11	0.0004		7	17	44	44
Minke whale	0.0001		2	5	11	0.0004		7	17	44	44
Fin whale	0		0	0	0	0.0001		2	5	11	11
Pinnipeds											
ringed seal	0.0234	14	362	995		0.0935	53	1,445	3,973		3,973
spotted seal	0.0002	1	4	9		0.0009	1	14	39		39
bearded seal	0.0093	6	144	396		0.037	21	572	1573		1,573

Table 6-4 Estimated Exposures and Requested Take Levels for Beaufort Sea Operations

	Average Density	190 dB	180 dB	170 dB	160 dB	Maximum Density	190 dB	180 dB	170 dB	160 dB	Requested Take
Cetaceans											
bowhead whales	NA					2,004.236		172	473	1203	1,203
gray whale	0.0001		2	5	11	0.0004		7	17	44	44
Beluga	0.0068		106	289	736	0.0135		209	574	1460	1,460
Harbor Porpoise	0		0	0	0	0.0002		4	9	22	22
Pinnipeds											
ringed seal	0.3547	201	5481	15071		0.7094	402	10,961	30,141		30,141
spotted seal	0.0037	3	58	158		0.0149	9	231	634		634
bearded seal	0.0181	11	280	770		0.0362	21	560	1,539		1539

Because the fitted equation and above-listed distances are based on a standard least-squares fit to the measured data, about 50% of the measurements fall above and 50% fall below the fitted curve.

Increasing the constant term from 233.4 to 236 results in an equation that predicts 190, 180, and 160 dB (rms) distances larger than most of the actual measurements. The curve shown in the following diagram corresponds to the adjusted equation with constant term 236. This provides a basis for setting exclusion zone radii that includes some margin for the inevitable variability in propagation conditions from one site to another. The distances are displayed in the "Recommended zone radii" column of Table 6-1, along with the values predicted before the field season by JASCO Research Inc. based on acoustical modeling. (The original modeled values did not include the 50% margin factor.)

Table 6-5 Recommended Zone Radii for the M/V Henry "C" Acoustic Sources

Received Level (dB re 1 μPa)	Recommended Zone Radii[a]	Radii based on Modeling, with 50% Margin[b]	Factor ([c])
190	120	30	4
180	330	240	1.38
170	880	680	1.3
160	2,220	2,200	1

[a] Based on best-fit equation with constant term adjusted upward such that the fitted line is near the top of an envelope around the empirical data.

[b] Radii predicted by JASCO prior to the field season, assuming that the 4-air gun source was operating in 30 m water depth in the Beaufort Sea.

[c] Ratio of recommended radius to predicted radius.

The M/V Henry Christoffersen conducting the site clearance and shallow hazard surveys will operate in accordance with the provisions of the CAA with the AEWC regarding timing and avoidance areas with respect to the bowhead subsistence whale hunts by Kaktovik and Nuiqsut whalers.

Exposure of individual marine mammals (Table 6-6) was estimated for seismic operations by the Henry "C" in the same manner as for the Gilavar in the Beaufort, i.e.;

- Bowhead exposures = portion of population passing through the area to be ensonified during operations; and
- All other species = Density of species x Maximum line distance x Cross track distance.

Table 6-6 Estimated Exposures and Requested Take Levels for Beaufort Sea Henry "C" Operations

	Average Density	190 dB	180 dB	170 dB	160 dB	Maximum Density	190 dB	180 dB	170 dB	160 dB
Cetaceans										
bowhead whales	NA					2004.236		48	126	315
gray whale	0.0001		1	1	1	0.0004		1	1	2
beluga	0.0068		3	7	18	0.0135		6	14	35
Harbor Porpoise	0		0	0	0	0.0002		1	1	1
Pinnipeds										
ringed seal	0.3547	49	135	359	898	0.7094	98	270	718	
spotted seal	0.0037	1	2	4		0.0149	3	6	16	
bearded seal	0.0181	3	7	19		0.0362	5	14	37	

7. The anticipated impact of the activity on the species or stock:

The only anticipated impacts to marine mammals associated with SOI activities in respect to noise propagation are from vessel movements, and seismic air gun operations. The impacts would be temporary and short term displacement of seals and whales from within ensonified zones produced by such noise sources. Any impacts on the whale and seal populations of the Beaufort Sea activity area are likely to be short term and transitory arising from the temporary displacement of individuals or small groups from locations they may occupy at the times they are exposed to seismic sounds at the 160-190 db received levels. As noted in Section 6, above, it is highly unlikely that animals will be exposed to sounds of such intensity and duration as to physically damage their auditory mechanisms. In the case of bowhead whales that displacement might well take the form of a deflection of the swim paths of migrating bowheads away from (seaward of) received noise levels greater than 160 db (Richardson et al. 1999). The cited and other studies conducted to test the hypothesis of the deflection response of bowheads have determined that bowheads return to the swim paths they were following at relatively short distances after their exposure to the received sounds. There is no evidence that bowheads so exposed have incurred injury to their auditory mechanisms. Additionally, there is no conclusive evidence that exposure to sounds exceeding 160 db have displaced bowheads from feeding activity (Richardson, W.J. and D.H. Thomson [eds]. 2002).

There is no evidence that seals are more than temporarily displaced from ensonified zones and no evidence that seals have experienced physical damage to their auditory mechanisms even within ensonified zones.

8. The anticipated impact of the activity on the availability of the species or stocks of marine mammals for subsistence uses:

There could be an adverse impact on the Inupiat bowhead subsistence hunt if the whales were deflected seaward (further from shore) in traditional hunting areas. The impact would be that whaling crews would necessarily be forced to travel greater distances to intercept westward migrating whales thereby creating a safety hazard for whaling crews and/or limiting chances of successfully striking and landing bowheads. This potential impact is mitigated by application of the procedures established in the CAA between the seismic operators and the AEWC and the Whaling Captains' Associations of Kaktovik, Nuiqsut, Barrow, Pt. Hope and Wainwright. The times and locations of seismic and other noise producing sources are to be curtailed during times of active scouting and whaling within the traditional subsistence hunting areas of the potentially affected communities. (See Section 12, below). Survey activities will be scheduled to avoid the traditional subsistence beluga hunt which annually occurs in July in the community of Pt. Lay.

There should be no adverse impacts on the availability of the whale species for subsistence uses.

9. Anticipated impact on habitat:

The activities will not result in any permanent impact on habitats used by marine mammals, or to their prey sources. 3D seismic activities will occur during the time of year when bowhead whales are present (i.e., mid- to late-July through September). Any effects would be temporary and of short duration at any one place. The primary potential impacts to marine mammals is associated with elevated sound levels from the proposed seismic (air guns) and site clearance (sonar) work discussed in detail earlier in Sections 6 and 7.

A broad discussion on the various types of potential effects of exposure to seismic on fish and invertebrates can be found in LGL (2005), and includes a summary of direct mortality (pathological/physiological) and indirect (behavioral) effects.

Mortality to fish, fish eggs and larvae from seismic energy sources would be expected within a few meters (0.5 to 3 m) from the seismic source. Direct mortality has been observed in cod and plaice within

48 hours that were subjected to seismic pulses 2 m from the source (Matishov 1992), however other studies did not report any fish kills from seismic source exposure (La Bella et al. 1996, IMG 2002, Hassel et al. 2003). To date, fish mortalities associated with normal seismic operations are thought to be slight. Saetre and Ona (1996) modeled a worst-case mathematical approach on the effects of seismic energy on fish eggs and larvae, and concluded that mortality rates caused by exposure to seismic are so low compared to natural mortality that issues relating to stock recruitment should be regarded as insignificant.

Limited studies on physiological effects on marine fish and invertebrates to acoustic stress have been conducted. No significant increases in physiological stress from seismic energy were detected for various fish, squid, and cuttlefish (McCauley et al. 2000) or in male snow crabs (Christian et al. 2003). Behavioral changes in fish associated with seismic exposures are expected to be minor at best. Because only a small portion of the available foraging habitat would be subjected to seismic pulses at a given time, fish would be expected to return to the area of disturbance anywhere from 15-30 minutes (McCauley et al. 2000) to several days (Engas et al. 1996).

Available data indicate that mortality and behavioral changes do occur within very close range to the seismic source, however, the proposed seismic acquisition activities in distinct areas in the Chukchi and Beaufort Seas is predicted to have a negligible effect to the prey resource of the various life stages of fish and invertebrates available to marine mammals occurring during the project's seismic activity.

10. Anticipated impact of habitat loss or modification:

The effects of the planned activities are expected to be negligible, as described in Section 9. It is estimated that only a small portion of the animals utilizing the areas of the proposed activities would be temporarily displaced.

During the period of seismic acquisition (mid-July through mid-November), most marine mammals would be dispersed throughout the area. The peak of the bowhead whale migration through the Chukchi and Beaufort Seas typically occurs in October, and efforts to reduce potential impacts during this time will be addressed with the actual start of the migration and with the whaling communities. The timing of seismic activities in the eastern Beaufort Sea will take place when the whales are not present, or in very low numbers. Starting in late August bowheads may travel in proximity to the aforementioned activity areas to hear sounds from vessel traffic and seismic activities, of which some might be displaced seaward by the planned activities. The numbers of cetaceans and pinnipeds subject to displacement of 0.6 to 1.2 km and 0.4 to 0.9 km (or more), respectively, are small in relation to abundance estimates for the mammals addressed under this IHA.

In addition, feeding does not appear to be an important activity by bowheads migrating through the eastern and central part of the Alaskan Chukchi and Beaufort Seas in most years. A few bowheads can be found in the Chukchi and Bering Seas during the summer and Rugh et al. (2003) suggests that this may be an expansion of the western Arctic stock although more research is needed. In the absence of important feeding areas, the potential diversion of a small number of bowheads from part is not expected to have any significant or long-term consequences for individual bowheads or their population. Bowheads, gray, or beluga whales are not predicted to be excluded from any habitat.

The proposed activities are not expected to have any habitat-related effects that would produce long-term affects to marine mammals or their habitat due to the limited extent of the acquisition areas and timing of the activities.

11. The availability and feasibility (economic and technological), methods, and manner of conducting such activity or means of effecting the least practicable impact upon affected species or stock, their habitat, and of their availability for subsistence uses, paying particular attention to rookeries, mating grounds, and areas of similar significance:

Five main mitigations regarding deep penetrating seismic in the Chukchi and Beaufort Seas are proposed: (1) the timing and locations for active seismic acquisition work will be scheduled to curtail operations when whaling captains inform the operator that they are scouting or hunting within traditional hunting areas; (2) to configure air guns in a manner that directs energy primarily down to the seabed thus decreasing the range of horizontal spreading of seismic noise; (3) using a seismic energy source which is as small as possible while still accomplishing the geophysical objectives; (4) using the ramp-up and soft start methods of initiating seismic operations which is intended to alert any marine mammals either within or approaching an operating air gun array so that they may swim away from the source; and (5) curtailing active seismic work when the marine mammal observers visually sight (from shipboard) or aerially the presence of marine mammals within identified ensonified zones. Details of the proposed mitigations are discussed further in the Marine Mammal Monitoring and Mitigation Plan that is included as an Attachment C to this application.

12. Where the proposed activity would take place in or near a traditional Arctic subsistence hunting area and/or may affect the availability of a species or stock of marine mammal for Arctic subsistence uses, the applicant must submit a plan of cooperation or information that identifies what measures have been taken and/or will be taken to minimize any adverse effects on the availability of marine mammals for subsistence uses. A plan must include the following:

i. A statement that the applicant has notified and provided the affected subsistence community with a draft plan of cooperation.

Negotiations were initiated beginning September 2006, and continued during October 2006 at the Alaska Federation of Natives (AFN) conference in Anchorage. SOI met with the AEWC to create a CAA between SOI, and the subsistence hunting communities of Barrow, Nuiqsut, and Kaktovik for the 2007 activities. SOI anticipates multiple engagements between November 2006 and March 2007 with these communities. The CAA will cover both this proposed Beaufort Sea seismic program (including deep seismic, site clearance and shallow hazard surveys) and the Chukchi Sea deep seismic survey.

Plan of Cooperation meetings occurred in Barrow and Nuiqsut on October 16 and 17, 2006, and follow-up meetings will be May or June 2007 in these communities. SOI is working with all public and private organizations to hold a series of meetings in Kaktovik during 2006/2007. The communities of Point Hope, Point Lay and Wainwright will be engaged in January 2007 to discuss 2006 survey activities in the Chukchi Sea, followed by another series of Plan of Cooperation meetings in May or June 2007. Following those meetings, a Plan of Cooperation report will be prepared.

ii A schedule for meeting with the affected subsistence communities to discuss proposed activities and to resolve potential conflicts regarding any aspects of either the operation or the plan of cooperation.

SOI held community meetings with the affected Beaufort Sea whaling communities of Barrow and Nuiqsut in mid-October and will hold meetings again in early 2007. SOI is currently working with the village of Kaktovik to schedule meetings for an as yet unidentified date. As mentioned above, meetings with the affected Chukchi Sea communities will also occur in 2007.

iii A description of what measures the applicant has taken and/or will take to ensure that proposed activities will not interfere with subsistence whaling or sealing;

The CAA will incorporate all appropriate measures and procedures regarding the timing and areas of the operator's planned activities (to wit: times and places where seismic operations will be curtailed or moved in order to avoid potential conflicts with active subsistence whaling and sealing); communications system between operator's vessels and whaling and hunting crews (i.e., the communications center will be located in strategic areas); provision for marine mammal observers/Inupiat communicators aboard all project vessels; conflict resolution procedures; and provisions for rendering emergency assistance to subsistence hunting crews.

iv What plans the applicant has to continue to meet with the affected communities, both prior to and while conducting activity, to resolve conflicts and to notify the communities of any changes in the operation.

Plan of Cooperation meetings will be held in spring 2007 in the affected communities. In addition, the applicant can meet with North Slope officials and community leaders on an as-requested basis before the open water season in order to discuss the proposed activities.

If requested, post season meetings will also be held to assess the effectiveness of the 2007 CAA, to address how well conflicts (if any) were resolved; and to receive recommendations on any changes (if any) might be needed in the implementation of future CAAs.

It is anticipated that a final draft of the 2007 CAA for the Chukchi and Beaufort Seas will be available for consideration and review by NMFS and the MMS by early spring.

13. The suggested means of accomplishing the necessary monitoring and reporting that will result in increased knowledge of the species, the level of taking or impacts on the population of marine mammals that are expected to be present while conducting activities and suggested means of minimizing burdens by coordinating such reporting requirements with other schemes already applicable to persons conducting such activity. Monitoring plans should include a description of the survey techniques that would be used to determine the movement and activity of marine mammals near the activity site(s) including migration and other habitat uses, such as feeding:

The proposed Marine Mammal Monitoring and Mitigation Plan for the deep seismic, site clearance and shallow hazards surveys is included as Attachment C of this application. It should be noted that all sightings of polar bear and walrus by shipboard or aerial observers will be recorded and reported to the USFWS.

14. Suggested means of learning of, encouraging, and coordinating research opportunities, plans, and activities relating to reducing such incidental taking and evaluating its effects:

Marine mammal studies in the Beaufort Sea may be undertaken by various agencies and programs during the course of the 2007 open-water season. It is unclear if these studies might be relevant to SOI's proposed activities. SOI is prepared to share information obtained during implementation of our marine mammal monitoring program with a variety of groups who may find the data useful in their research. A suggested list of recipients includes:

- The NSB Department of Wildlife Management (C. George)
- The USFWS Office of Wildlife Management (C. Perham)
- The MMS's Bowhead Whale Aerial Survey Program (C. Monnett)
- The Kuukpik Subsistence Oversight Panel (KSOP)
- Alaska Eskimo Whaling Commission (Barrow)
- Alaska Beluga Whale Commission (ABWC, Kotzebue)
- North Slope Science Initiative (Ken Taylor)

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Attachment A – Seismic Survey, Overview/Description of Vessels

Appendix A

Offshore Alaska
Chukchi and Beaufort Seas

Seismic Surveys

Overview / Description

November 2006

Table of Contents

Seismic 3-D Surveys

Purpose

Marine three-dimensional (3-D) seismic surveys are the current industry standard method of gathering subsurface information in the offshore environment. They provide a detailed image of geological structures such as bedding layers and faults. This information is essential for exploration and production of hydrocarbons. The improved information from 3-D seismic relative to older two-dimensional seismic allows exploration well to be drilled with a higher likelihood of success as well as reducing the number of development wells required.

Overview of Marine 3-D Seismic Acquisition

In the seismic method, reflected sound energy, produces graphic images of seafloor and sub-seafloor features. The seismic system consists of sources and detectors, the positions of which must be accurately measured at all times. The sound signal comes from arrays of towed energy sources. These energy sources store compressed air which is released on command from the towing vessel. The released air forms a bubble which expands and contracts in a predictable fashion, emitting sound waves as it does so. Individual sources are configured into arrays. These arrays have an output signal which is more desirable than that of a single bubble and also serves to focus the sound output primarily in the downward direction which is useful for the seismic method. This array effect also minimizes the sound emitted in the horizontal direction.

The downward propagating sound travels to the seafloor and into the geologic strata below the seafloor. Changes in the acoustic properties between the various rock layers result in a portion of the sound being reflected back toward the surface at each layer. This reflected energy is received by detectors called hydrophones, which are housed within submerged streamer cables which are towed behind the seismic vessel. Data from these hydrophones are recorded to produce seismic records or profiles. Seismic profiles often resemble geologic cross-sections along the course traveled by the survey vessel.

During the seismic acquisition the vessel to be used, the M/V Gilavar, is operated by WesternGeco. Specifications for the Gilavar are included in Appendix 1. The Gilavar will tow two source arrays, comprising three identical subarrays each, which will be fired alternately as the ship sails downline in the survey area. The Gilavar will tow up to 6 streamer cables up to 5,400 meters (m) long. With this configuration each pass of the Gilavar can record 12 subsurface lines spanning a swath of up to 360 m.

The Gilavar will be accompanied by a support vessel, M/V Kilabuk (or similar vessel) which is owned and operated by Northern Transport Company Limited (NTCL). The Kilabuk is an icebreaker class support vessel which will be used to resupply and refuel the Gilavar. Specifications for the Kilabuk are included in Appendix 3. The presence of second vessel adds to the safety of the operation in the event of a marine emergency.

Operational Plan

The M/V Gilavar will be in the Chukchi Sea in early July to begin deploying the acquisition equipment. Seismic acquisition is planned to begin on or about July 15, 2007. The approximate area of operations are shown in Figure 1. Acquisition will continue in the Chukchi Sea until ice conditions permit a transit into the Beaufort Sea around early August. Seismic acquisition is planned to continue in the Beaufort Sea until early October depending on ice conditions. These 3-D areas are shown in Figures 1 and 2 in the IHA Application. For the 3-D areas, the Gilavar will traverse the area multiple times until data over the area of interest has been recorded. At the conclusion of seismic acquisition in the Beaufort Sea, the

Gilavar will return to the Chukchi Sea and resume recording data there until mid November.

Marine Mammal Mitigation Plan

APPENDIX 1 – VESSEL SPECIFICATIONS
M/V GILAVAR

WesternGeco reserves the right to alter specifications without prior notice.

Maritime Specifications / Particulars

Main Particulars

Ships Name	**"GILAVAR"**
Call sign	4JKW
International Maritime Org. (IMO) No.	8008539
Owner	Caspian Geophysical Ltd. Baku, Azerbaijan.
Previous Name	"Geco Gamma"
Flag state & port of registry	Azerbaijan, Baku
Azerbaijan Official No.	12885
Date of Build	February 1981
Hull No. and type of vessel	132 / Seismic Research Vessel. / "Trosvik-Class"
Yard built	Trosvik, Norway
Date converted / power upgraded	April 1994 / April 1998 / August 2003
Yard converted	Motorwerken, Bremerhaven, Germany. Navy dock Yard, Baku by Transmarine
Classification Society and Class	RMRS / DNV+1A1 - EO - Ice C - Helideck.
DNV Class ID No.	12885
Main Class renewal	04/2004. Valid to year 2009
Classification Machinery System	Planned Maintenance System (PMS) Year 1997
Class approved maintenance system	1 x Electronic plan / rec. TM-Master 1.76. Build 76. Replaced RAST OM 3.81 in 03.02.
International Safety Management, (ISM) code compliance	RMRS June 02, 2002. Renewal next due: June 05.
Safe Manning certificate (minimum)	12 Maritime crewmembers. (Galley dep. not incl.)

Principal Particulars

Gross tonnage (GRT)	3953 metric ton
GRT national & international	3953 / 3953 metric ton
Gross tonnage (GRT) Suez canal	N/A
Net registered tonnage (NRT) Panama Canal	N/A
NRT National & International	1186
NRT Suez canal	N/A
Lightship displacement	2773 metric ton
Deadweight	1359 metric ton
Length over all (LOA)	84.90 m
Length between perpendiculars	75.80 m
Breadth (moulded)	18,4
Breadth (extreme)	19.1 m Helideck (NB! Hinged flap on stb side)
Depth (moulded)	8.60 m
Summer draft (max)	5.3 m
Draft (mean)	
Air draft (to highest antenna)	28.1 m at design draft: 5.30 m
Helicopter Deck rating	Bell 214 / Super Puma / Year 1994
Helicopter Deck diameter (D-value)	19.10m
Helicopter Deck markings standard	Azal Helicopter Company / CAA UK

Capacities And Endurance's

HP air source, standard m³ / hour	2 x 2700, 1 x 1224. Total 6624 m³ at 4.8 knots
Engine Room HP air compressors	2 x Sperre
Pulling power, dynamic at full ahead	27 ton at 4.5 knots water speed
Fresh water capacity	4 tanks. Total x 208 metric tons
Fresh water maker production	1 x Evaporator 6 - 16 m³/day, dependent on engine load 1 x Reverse Osmosis, 12 m³ / day.
Potable water system	1 x Common potable & wash water system
Fuel capacity, all tanks topped	14 x tanks. Total x 810 m³
Fuel, useful for 100 % consumption	730 m³ (3 days safety margin in addition)
Fuel type	Marine Gas Oil (MGO) Grade DMA Distillate. Standard: ISO 8217,1996. Grade ISO 8216,1985
Fuel tank heating	None
Lube oil, engine oil (m³)	2 x tanks. Total x 22 m³ Shell Gadina 40
Cylinder oil, HP compressors (m³)	2 x tanks. Total x 6.75 m³ Mobil Rarus 827
Cable oil, kerosene (clean/separated/dirty)	3 x tanks. Total x 21.1 m³, Isopar M
Ballast, sea water (m³)	6 x tanks. Total x 316 m³
Speed, transit, max in calm sea	14 knots (336 nautical miles/24 hours)
Speed, transit economy, ditto	11 knots (264 nautical miles/24 hours)
Consumption x fuel, full speed	18.6 m³ / 24 hours
Consumption x fuel, economy speed	12 m³ / 24 hours (only 2 generators in service)
Operational endurance	39 days at full speed / 60 days at economy speed
Endurance x fuel during survey	45 - 23 days, dependent on configuration x gear.
Consumption x fuel during survey	Minimum 16 m³, maximum 32 m³ per 24 hours at full thrust. Azimuth Thruster and 3 HP compressors
Consumption x fuel in port	3 m³ / 24 hours
Safety equipment certificate	Maximum 50 persons allowed onboard when at sea

Bridge Navigation Equipment

Radar no 1	1 x Krupp Atlas 9600, ARPA X-band, Y 1996
Radar no 2	1 x Krupp Atlas 8600, ARPA S-band, Y 1986
Radar no 3	None
ECDIS	None
Gyro compass	1 x Robertson RGC 11
Auto-Pilot	1 x Robertson AP 9 MK II with Robnav
AIS	SAAB R4 AIS Class A Transponder System
GPS receiver (for AIS)	Furuno GP-90
GPS receiver	1 x Raystar 390 GPS
Speed log	1 x JRC: JLR-203 Doppler log
Echo Sounder	1 x Simrad EN-200 Bridge. 1 x EA-500 in I-room
Radios, VHF, GMDSS*, type 1	1 x Shipmate RS8100
Radios, VHF, GMDSS*, type 2	3 x Sailor 2048, 2 with DSC
Radios, VHF, GMDSS*, type 3	None
Radios, UHF	6 x Motorola GP300
Radio direction finder	1 x Furuno VHF Direction finder FD 525
Weather facsimile	1 x Furuno WFR Fax 108
NAVTEX receiver	1 x JRC, NRC 300 A
UPS, power supply to all GMDSS radio's	1 x Metric M-2000, Year 1994

Communication Equipment, Compliant With GMDSS Requirements

Radio Station license No.	00547 Azerbaijan (23776-B Panama)
Class / corr. category	33a CP H8
Ship / Aircraft radio	1 x (type unknown), 1 x Portable, ICOM
Helicopter Beacon	1 x RS110 + Automatic keying device 6ANG
Transmitter / receiver, main (MF)	1 x Sailor C2140 Simplex
Transmitter / receiver, reserve (MF)	1 x Skanti 8000, Year 1994
Transmitter / receiver, main (VHF)	4 x Sailor RT 2048
Transmitter / receiver, main (DSC)	1 x GMDSS, VHF DSC RM 2042
Radio, portable, UHF	6 x Motorola GP 300
Booster unit for portable radio (UHF)	1 x base repeater, TP Radio 6725 B
Emergency radio beacon (EPIRB)	1 x Tron 30S MK II
Radar transponder	2 x Tron Sart 9
Radio, Liferaft, VHF	4 x Sailor 3110

Satellite Communications

Inmarsat type B	1 x Nera Saturn B Mk2
Inmarsat type C	1 x Sailor H2095B
Inmarsat telephone No./ Fax No./HSD (64kb)	+873-342309010 / +873-342309012 / +873-391015139
V-Sat	Spacetrack 4000 SESAT
V-Sat online Tele-link to Aberdeen, 24 hrs	(+44) 2075 766865 - (+1) 713 296 5365
Telefax machine	1 x Canon T-301 (Sat), 1 x Panafax UF450 (Mob)
TV-Satellite receiver	1 x Skipper DMC. 4 channels internally distributed
Internal E-mail & PC-network	12 x Work areas and Senior staff cabins
E-mail address to vessel	Department head title before @ i.e. Party_Chief or Captain@gilavar.vessel.caspian.slb.com

Safety Equipment Crew

Liferaft davits	2 - One either side x Bridge Deck
Liferafts type / capacity	6 Viking 25DKF (25 persons), 1 MOB raft, Viking 6DKR (6 persons)
Number x life rafts	6 (MOB raft excluded)
Lifejackets no.	43 x Seamaster 83, 38 x Seamaster 69, 20 x T-vest 87. **Total No. Onboard: 101**
Survival suits, Thermo Insulated	44 x Helly Hansen E 305-7, E 305, E353. 6 x Helly Hansen E 351, E 305, D 602. **Total No. Onboard: 50**
Work suits, Thermo Insulated	9 x Helly Hansen E 300-2
Man overboard boat (MOB) type	1 x Springer MP-741. Year 1996
Engine, MOB and speed x boat	1 x Cummings 6B TA5. 9M2, 30 knots / 2400 rpm
Waterjet and gear drive, mob	Hamilton 273 with Borg Warner 72 C
Work boat	Norpower 25 feet. Year 1999
Engine, work boat and speed x boat	Cummings Diesel 220 hp. 15 knots

Fixed Fire Extinguisher System

Engine room	7 x Halon 1301. Year 1981
Separator room	1 x Halon 1301 (combined with tape store)
Tape store	1 x Halon 1301 (combined with sep. room)
Incinerator room / Galley ducting	None
Cable store	1 x Sprinkler system, foam AFFF. Year 1994
Steamer Winch Room	1 x Sprinkler system, AFFF, plus full coverage x CO2
Helicopter deck	1 x Foam monitor, AFFF
Paint store	1 x Seawater sprinkler system. Year 1994
Chemical store	1 x Sprinkler system, foam AFFF. Year 1994
Main foam pump, AFFF foam mixture	1 x 110 m^3/h 8 bar (Engine Room starboard)
Main fire pump	2 x 32 m^3/hr 8 bar. (Engine room stbd.fwd and port aft)
Emergency fire pump	1 x 32 m^3/hr 8 bar. (El. driven, B/T room)
Fire detection monitoring system	1 x 12 loops, Servoteknik AS, entire vessel, Y -96

Hull Outfitting

Anchor	2 Stockless - Hall type
Windlass	2 x Norwinch Type: 1A33/38-36 "Split", Y -81
Mooring winches	2 x Capstan on end x each windlass.
Capstan no 1	1 x Br. Bauer-Nilsen, 5 ton (stbd. shelter deck) Y -96
Capstan no 2	1 x Br. Bauer-Nilsen, 5 ton (port shelter deck) Y -81
Deck crane 1, capacity/reach/location	1 x Hydralift 5,5 ton/ 16,5 m / stbd side, Y 1999
Decks crane 2, capacity/reach/location	1 x Has 30h, 3 ton/ 10 m. / port side, Y 1981
Stores / personnel elevator	1 x Fortuna – load 500 kg
Anti rolling damping system	1 x Flume tank (passive) under Heli-deck. Y-94
Heeling tanks, volume and fuel/FW/SW	2 x 30 ton fuel each, active system, bridge operated
Bunker connections, locations	2 on shelter deck, each side. 1 on bow
Bunker connections, type(s)	Flange ND100/220 mm
Bunker hose length and dimension (loose)	Yes / 3 x 6", 10 m length, total 30 m. Year 1995
Crew accommodation, no x bunks	50
Single berth cabins	30. Each cabin with toilet and shower
Double berth cabins	10 x Each cabin w/toilet and shower
Client cabins, single berth	1 x All facilities incl. Live TV and video. Y 1998
Business conference and training room	1 x 12 persons. TV / video / 2 x computers
Sauna and fitness room	1 x sauna, 1 x well equipped fitness room. Y 1996

International Oil Pollution Prevention (IOPP) Equipment

Incinerator, sludge and waste oil	1 x Fredrikstad 2.1 L. Year 1981
Bilge / oily water separator	1 x ROW. SKIT S 2.5 (ton/h) Year 1997 Compliance MARPOL 73/78. IMO Res. A 393 (x)
Oily water / sludge tanks cap.	4 x Total 102 m^3
Oil spill absorbent / damage control	2 x Absorbent kits + 200 l. chem. Seacare O.S.D
Sewage treatment plant	ORCA IIA-70 / Marine Sanitation Device. 9,46 m3
Sewage/grey water holding tank capacity	170m3 / 20 days
Waste compactor	1 For tins and sheet metal recycling

Machinery Equipment

Air capacity, each and total (cfm)	2 x 2700, 1 x 1224. Total 6624 m^3/hr.
HP compressor drive motors, large	2 x ASEA 60 Hz 600V, Y 825A MF 560L 660 kW
HP compressor drive motors, small	1x ABB 60 Hz 600V, Y 410A M2BA 355/360 kW
Main engine or electric prop. motors	4 x Asea LAB-450 LN 600kW, tot. 2400 bkW. Y-98
Redundancy propulsion, Azimuth thruster	1 x Brunvoll AR-LNC-1650 / 736 bkW. Year 1994
Vessels total brake hp / kw for prop.	1 x 2400 kW and 1 x 736 kW = 3136 bkW/4265 bhp
Main engines, power supply	4 x SCR (rectifiers) convert DC power to M/E. Y-81
Auxiliary engines (generator drive)	4 x Bergen Diesel KRGB-9 x 2065 bhp Tot. 8260 bhp
Aux. Engine manufacturer nos. 1 to 4	Nos. 2865, 2863, 2864, 2915. Year 1998
Aux. eng. turbochargers	1 x Brown Boveri ser. No. HT-344738, Type: VTR250, Specification ZB8C19.8 IVMH 110AW3P/A2
Propeller type, main propulsion	1 x 4 blade, Hjelseth, CPP / bronze / Nozzle. Y -94
Propeller, noise & pitch control	1 x Step-less adjustment x pitch/rpm (10-240 rpm)
Propeller blade, spare	1 x Ulstein / bronze. Stored in cable store. Y 1994
Generators / Alternators	4 x ABB/AMG 560 S8, 1900kva / 1445 kW. Y -98
Electric power, useful, out from main switchboard	4 x 1400 kW, 600V 60 Hz each. Tot. X 5600 kW
UPS power to instrument room	1 x Merlin Gerin 80 KVA. 15 min. back up. Y -98
Power supply instrument room back-up	1 x Watt AS Rotating conv. SGB 434/4KR. Y -81
Emergency & Harbour generator engine	1 x Cummings Diesel, NTA-855-G. Year 1980/-99
Emergency & Harbour generator	1 x Stamford MC534C. 440V / 250 kW. Y 1980
Fuel back-up system for aux. eng.	1 x Automatic changeover if main system fails. Year 1995
Cooling system for aux. engines	2 x Segregated systems. 2 x eng. on each. Y -98
Bow thruster	1 x Brunvoll SPT VP 600 / 450 kW. Year 1981
Azimuth thruster	1 x Brunvoll AR-LNC-1650 / 736 bkW
Stern thruster	None
Fresh water generator (FWG)	1 x Alfa Laval Nirex 10-11. Year 1994 1 x Atlas Reverse Osmosis 12m3 per day
Boiler, exhaust gas & oil fired	1 x Pyro A800-1500 Hot water boiler, 85° C. Y -94
Steering gear	1 x Porsgrunn 260-12. Dual type, 2 pumps. Y -81

Seismic Specifications

Main Particulars

Streamers	8 (Max spread 6 x 6km limited by propulsion power x 27 tons)
Tow Points	8
Sub Arrays	6 x Sub Array Y1998 Y (Max 8)

Energy Systems

Gun Controller (Type & Manufacturer)	WesternGeco TRISOR 1.5
Guns (Manufacturer, Type & Capacities)	Bolt - Long Life Airgun, 1500 & 1900 – 30m³ to 290m³
Nominal Source Pressure	2000 psi
Pressure Release	Solenoid
Sensor Return	Piezoelectric
Timing Resolution	0.1 ms
Source	Combinations x variable sub arrays, up to 6 strings
Total Compressor Capacity	3900 CFM
Compressors (Manufacturer & Capacity)	2 x Burchardt B5S 1.55.1 – 1590 CFM 1 x LMF 200HD – 720 CFM
Near Field Phone (Manufacturer & Type)	WesternGeco, HD-1TC (Typically one NFP per ultrabox)
Far Field Phone (Manufacturer & Type)	None
Depth Indicators	TSED Fjørd – Pt # P20004931

Streamer Systems

Streamer (Manufacturer & Type)	TMS Solid Streamer Sentry/Guardian 150m
Streamer Deflector Type	Doors 300%
Section Breaking Strength (Typical)	>60 kN
Typical Towed-Streamer Stress	1000 - 2500 kg
Streamer Capacity (Max)	24000m
Nap-4	None
Streamers Vs. Length (Max)	1 x 8000m to 4 x 6000m
Nap-4	None
Streamer Spread (Max Spread Configuration)	300m using 300% doors
Streamer Control Device (Manufacturer & Type)	DigiCourse, 5011
Recording System (Manufacturer & Type)	Serce, Syntrak 960-24

Navigation Systems

Instrument Room Gyrocompass (Manufacturer & Type)	SG Brown SGB 1000
Source Positioning System (Manufacturer & Type)	Navia Maritime A/S, Seatrack 330
Global Positioning System (GPS) Receivers (Manufacturer & Type)	2 x Novatel, Millennium dual frequency 1 x leica, MX9400 single frequency
DGPS Qc System (Manufacturer & Type)	PDN Norway, TRINAV rGPS
Integrated Navigation System (Manufacturer & Type)	PDN Norway, TRINAV RT 2.6.0
3-D Quality Control System (Manufacturer & Type)	PDN Norway, TRINAV QC
Tailbuoy (Manufacturer & Type)	PDN Norway, TAG 3
Tailbuoy Navigation (Manufacturer & Type)	Navia Maritime A/S, Seatrack 220
Onboard Tailbuoy Positioning (Manufacturer & Type)	PDN Norway, TRINAV rGPS
Ultra-Short Baseline (USBL) Acoustic Positioning System (Manufacturer & Type)	None
Acoustic Positioning System (Manufacturer & Type)	Sonardyne, SIPSI & HGPS
Current Profiler (Manufacturer, Type & Frequency)	RDI, ADCP, 600kHz
Temperature/Salinity Dip Profiler (Manufacturer & Type)	12 x Sippicans 1 x Valeport, Mk600
Echo Sounder (Manufacturer & Type)	1 x Simrad EA-500
Transducer Frequency & Theoretical Range	1 x 38 kHz to 3400m 1 x 18 kHz to 9000m 1 x 200 kHz to 200m
Transducer Draft	-5.75m
Recording System	
Format	P1/90, P2/94, SPS, SEG-D for acquisition tapes
Media	IBM 3590 tape
Device	IBM 3590

Other Systems

Single & Multi-Trace Plotter (Manufacturer & Type)	OYO, GS 622

Onboard Seismic Qc

System	Omega QC
Software	Omega
Hardware	SUN Enterprise 6000

Onboard Seismic Processing

System	TRIPRO
Software	Omega (Latest Version)
Hardware	SUN enterprise 6000

Note:

Additional system, equipment, hardware and, software information may be available. Please refer to the appropriate specification sheets and/or manuals for more information.

Appendix 2 – WesternGeco's 3,147 in^3 Bolt Gun Array for 3-D Operations

WesternGeco's source arrays are composed of identically tuned Bolt gun sub-arrays operating at 2,000 psi, air pressure. In general, the signature produced by an array composed of multiple sub-arrays has the same shape as that produced by a single sub-array while the overall acoustic output of the array is determined by the number of sub-arrays employed. In this manner WesternGeco can offer a consistent source signature across our fleet of survey vessels.

The gun arrangement for the 1,049 in^3 sub-array is detailed below.

Standard 1,049 in^3 sub-array - 3 subarrays comprise each 3,147 in^3 Source

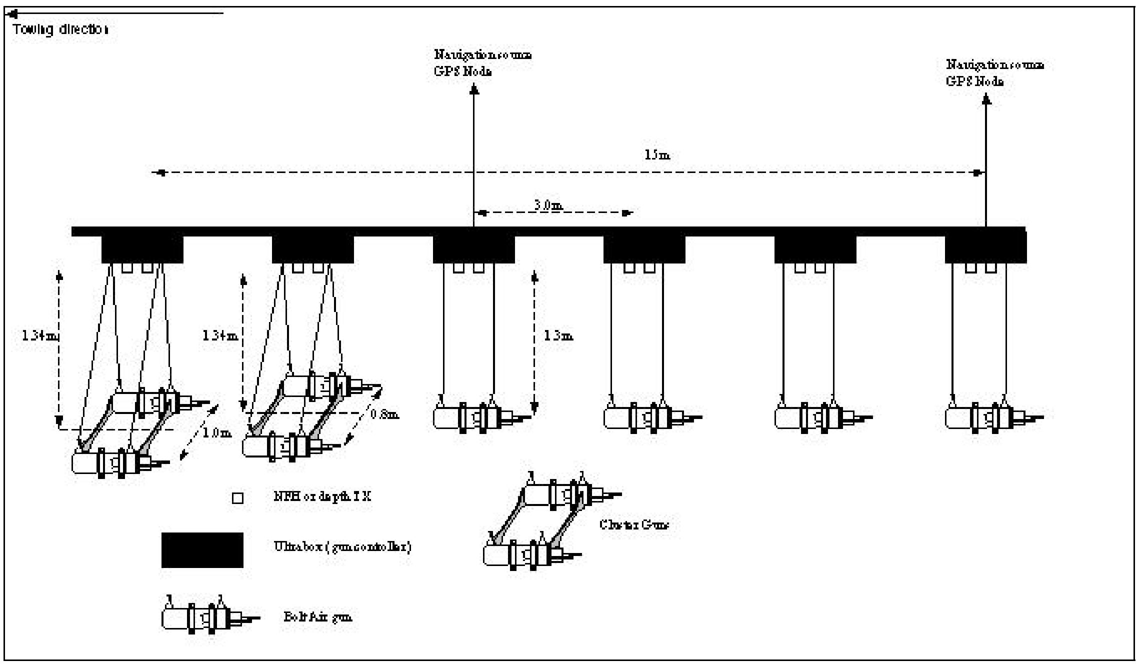


Figure 1 - Standard 1,049 in^3 sub-array

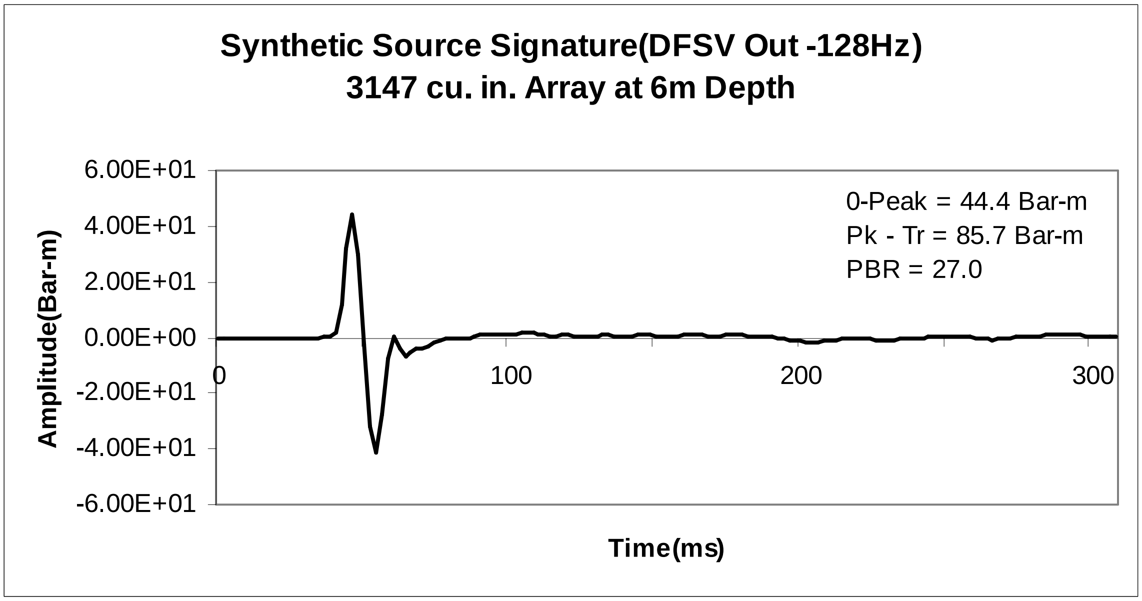
As indicated in the diagram, the sub-array is composed of six tuning elements; two 2-gun clusters and four single guns. The clusters have their component guns arranged in a fixed side-by-side fashion with the distance between the gun ports set to maximise the bubble suppression effects of clustered guns. A near-field hydrophone is mounted about 1 m above each gun station (one phone is used per cluster), one depth transducer per position is mounted on the gun's ultrabox, and a high pressure transducer is mounted at the aft end of the subarray to monitor high pressure air supply. All the data from these sensors are transmitted to the vessel for input into the onboard systems and recording to tape.

The standard configuration of a source array for 3D surveys consists of one or more 1049 in^3 sub-arrays. When more than one sub-array is used the strings are lined up parallel to each other with either 8 m or 10 m cross-line separation between them. This separation had been chosen so as to minimise the areal dimensions of the array in order to approximate point source radiation characteristics for frequencies in the nominal seismic processing band. For the 3,147 in^3 array the overall dimensions of the array are 15 m long by 16 m wide.

3,147 in^3 Array Signature and Acoustic Radiation Patterns

The following pages show the time series and amplitude spectrum for the far-field signature and the computed acoustic emission pattern for the vertical inline and crossline planes for the 3,147 in^3 array with guns at a depth of 6 m.

The signature for this array was computed using GSAP, WesternGeco's in house signature modelling software. The following table lists the gun parameters used as input to the model.



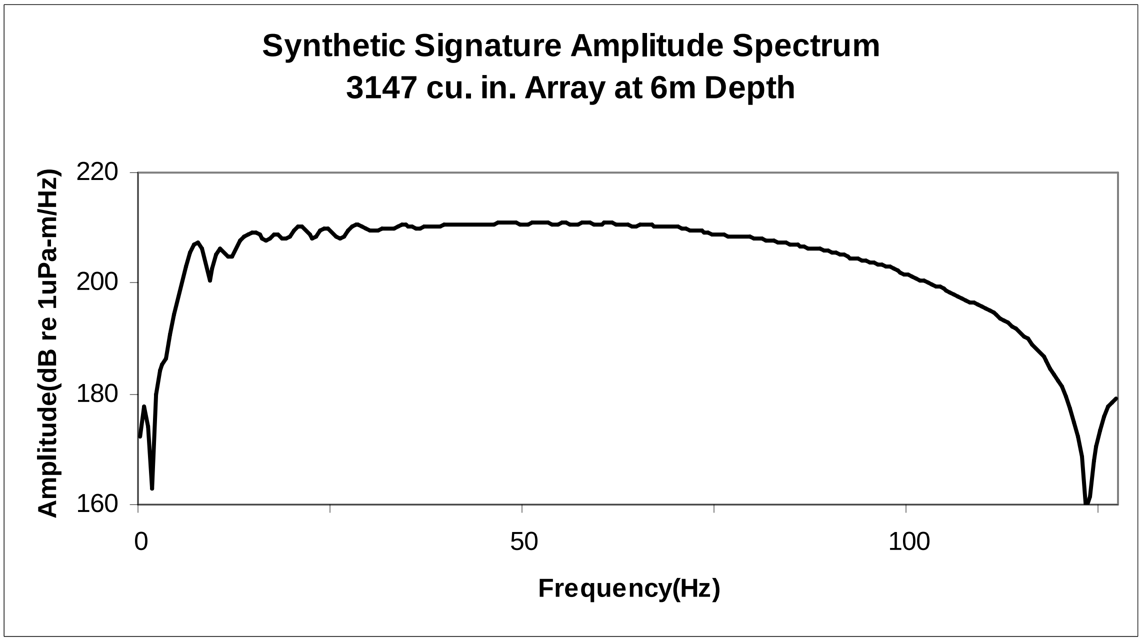


Figure - 2 3,147 in^3 Array Far Field Signature and Spectrum

3,147 cu. in. Array Far Field Pressure Distribution

The following figures demonstrate modeled pressure around the array in:

- 0 degree azimuth vertical plane
- 90 degree azimuth vertical plane
- horizontal plane at 20 m depth

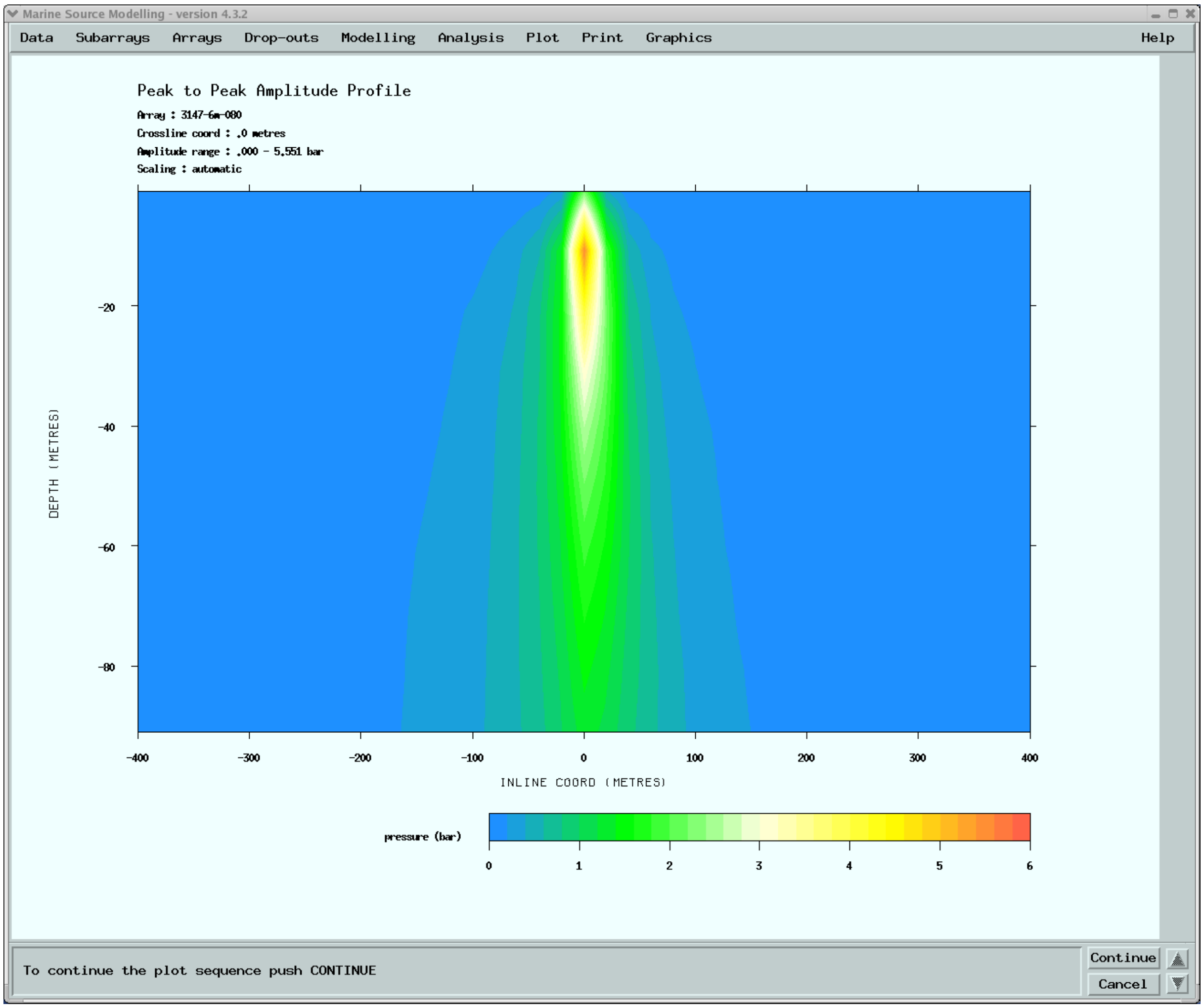


Figure 3 - Azimuth = 0 deg. pressure field. Peak to Peak amplitude

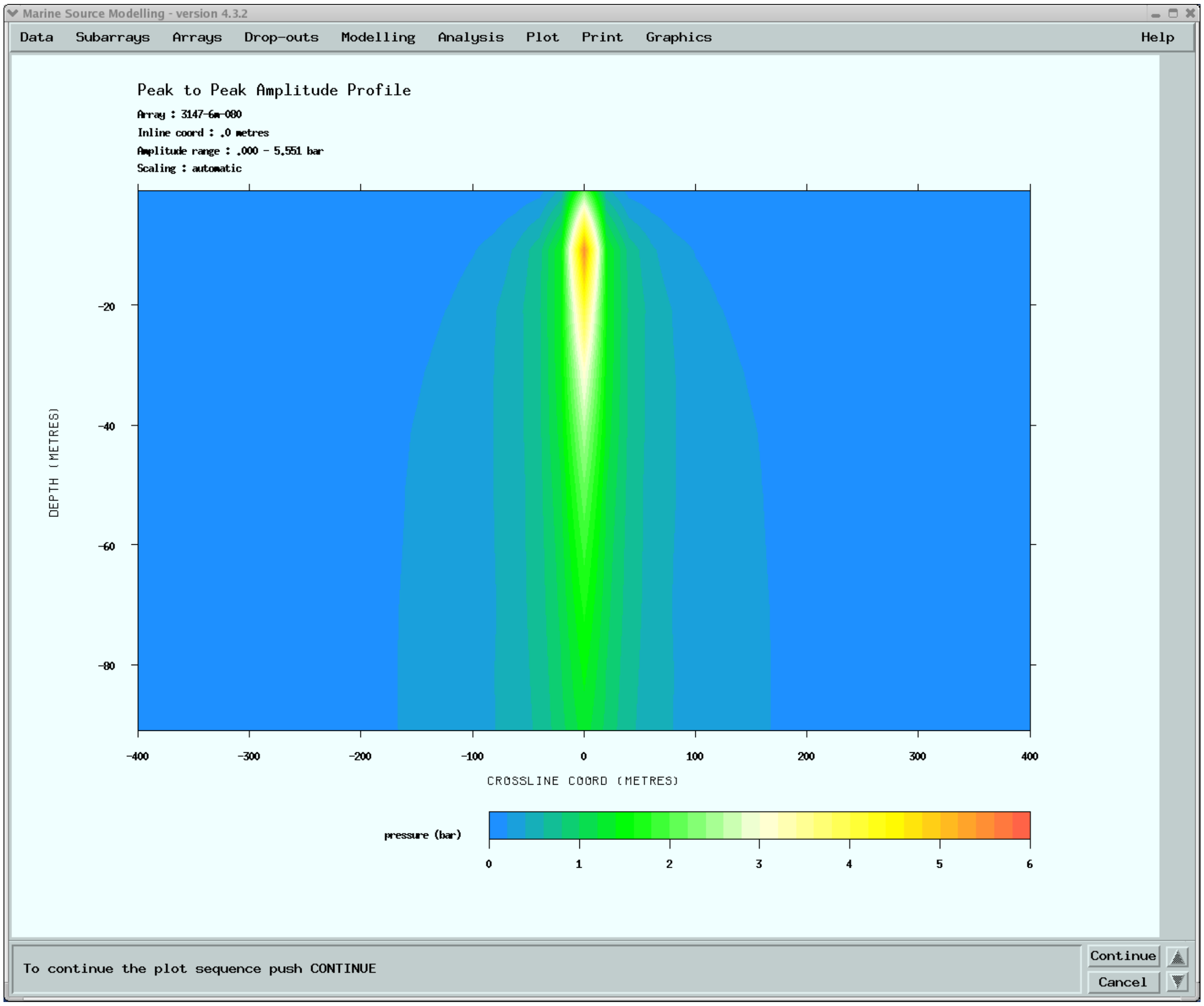


Figure 4 - Azimuth = 90 deg. pressure field. Peak to Peak amplitude

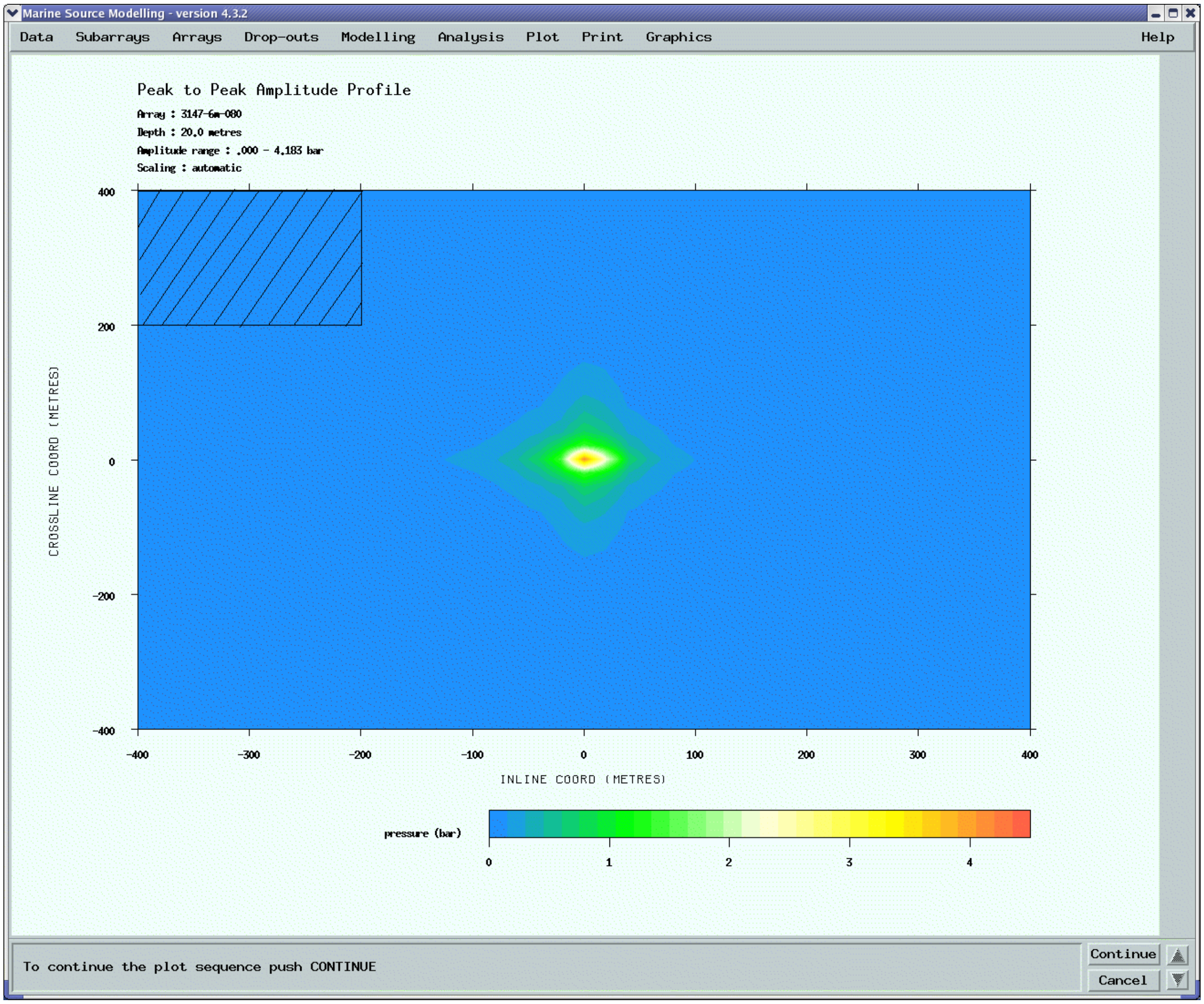


Figure 5 - Horizontal plane at 20 m depth pressure field. Area of -400 to +400 m centered on the array. Peak to Peak amplitude. Hatched area enlarged below to show farthest 200m to 400m.

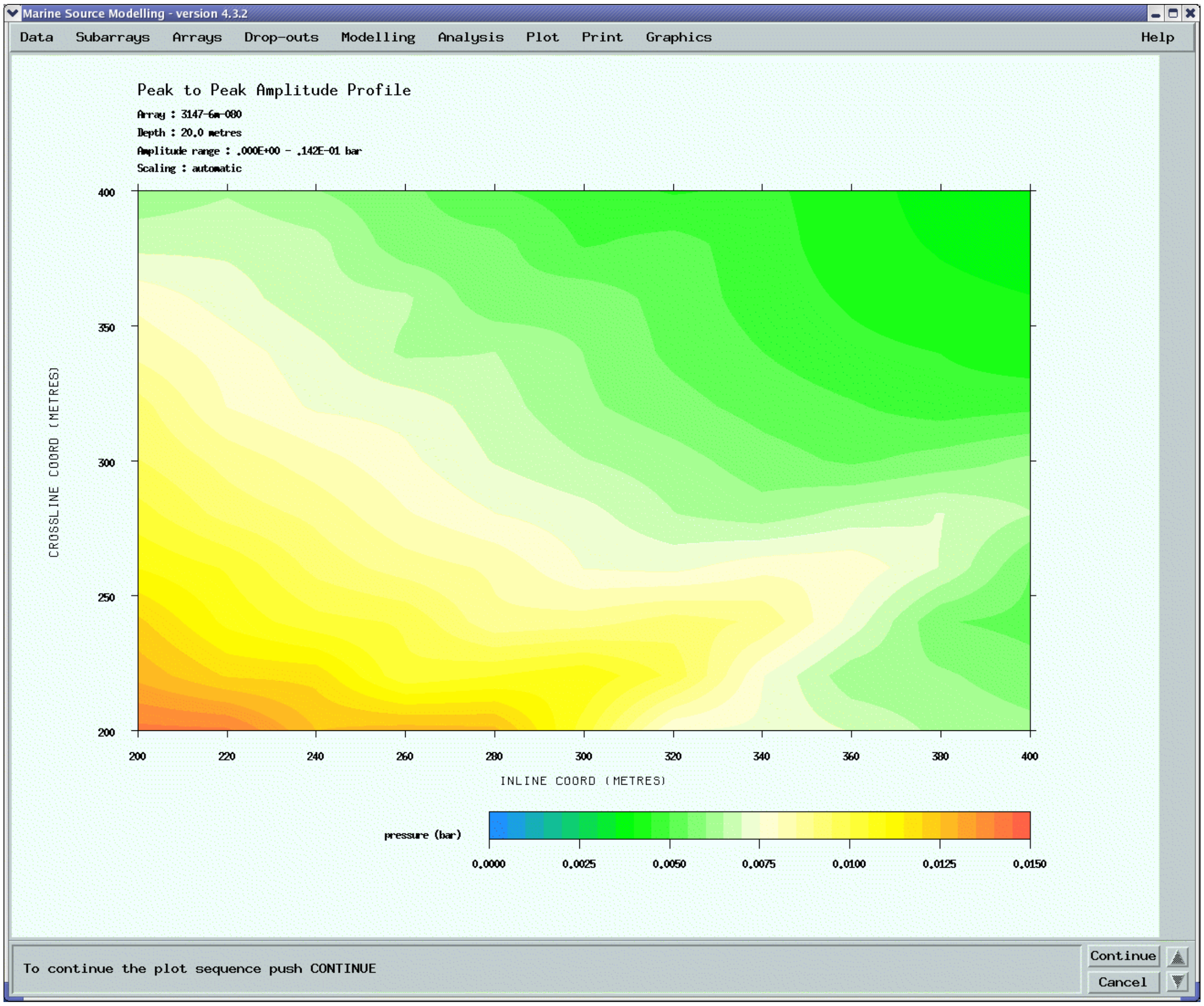


Figure 6 - Hatched area of previous figure. Horizontal plane at 20 m depth pressure field. Peak to Peak amplitude.

Appendix 3 – M/V Jim Kilabuk

Ship Name: **Jim Kilabuk**

Official Ship Number: **370261** *(Transport Canada)*

Owner: **Northern Transportation Company**
42003 MCKENZIE HWY.
HAY RIVER NT X0E 0R9
867-874-5134

Operator: **Northern Transportation Company**
42003 MCKENZIE HWY.
HAY RIVER NT X0E 0R9
867-874-5134

Port of Registry: **VANCOUVER**

Date of Registry: **1995/05/31**

Government Ownership:

Ship Operation

Usage: **Offshore supply** *(Primary)*

Area of Service: **East Coast**

Features: **Ocean-going Capacity**

Dimensions

Gross Tonnage:	**1,190 t**
Net Tonnage:	**387 t**
Dead Weight Tonnage:	
Length:	**62.48 m**
Breadth:	**13.72 m**
Depth:	**5.56 m**
Draught:	**4.33 m**
Self-Propelled Power:	**7,200 brake horsepower**
Speed:	**15.5 knots**
Fuel Type:	**Diesel**
Year of Rebuild:	

M/V Peregrine

Attachment B – Spec Sheets for M/V Henry "C"

Attachment B: M/V Henry Christoffersen Specifications

M/V Henry Christoffersen

M.V. Edgar Kotokak / M.V. Henry Christoffersen

Attachment B: M/V Henry Christoffersen Specifications

Pusher – Towing Tugs

REGISTRATION

Edgar Kotokak	**Built by** Burrard Drydock Co. Ltd. North Vancouver, B.C.
Henry Christoffersen	**Built by** Yarrows Shipbuilders Ltd. Victoria, B.C.
Owner	Northern Transportation Company Limited 42003 Mackenzie Highway Hay River, Northwest Territories Canada X0E 0R9
Port of Registry	Edmonton - Edgar Kotokak Edmonton - Henry Christoffersen
Official Number	347537 Edgar Kotokak 347544 Henry Christoffersen
Radio Call Sign	CZ3694 - Edgar Kotokak CZ2730 - Henry Christoffersen
Certification	Home Trade II - Western Arctic Great Slave Lake & Mackenzie River
Flag	Canadian

PRINCIPAL DIMENSIONS

Length O.A.	153'3"
Length at W.L.	145'6"
Breadth Moulded	52'1"
Depth Moulded	9'6"
Light Draft	3'6"
Loaded Draft	3'9"
Gross Tonnage	783
Net Tonnage	382
Accommodation	13 crew 5 Supernumeraries

NAVIGATION AND COMMUNICATION EQUIPMENT

1 – Gyrocompass
2 – Radars
3 – Searchlights
1 – Satellite Navigator (Hope only)
1 Recording Echo Sounder
2 – Flashing Echo Sounders
1 – Mobile Telephone, Northwestel network
3 – VHF Radio Telephones
2 – HF Radio Telephones, single side band
1 – Marine Fax (Hope only)
1 – Watchkeeping Receiver
1 – E.P.I.R.B.
1 – Loudhailer
1 – Magnetic Compass

CAPACITIES

Fuel	313,000 litres/68,900 Imp. gallons
Lube Oil	4,450 litres/980 Imp. gallons
Fresh Water	5,850 litres/1,300 Imp. gallons
Oily Water Separator	Hope - Framarine Model CPS-3 Meets Marpol requirements Christoffersen - Turbulo TE2-6S

REFRIGERATED STORAGE

Freezer	240 cubic feet
Cooler	240 cubic feet
Storage Dry Goods	960 cubic feet

MACHINERY

Main Engines	4 - Caterpillar V16 D399 Developing 1125 HP each at 1225 RPM
Reduction Gears	4 - Caterpillar 7261 2.89: 1 ahead - 424 shaft RPM max 3.18: 1 astern - 385 shaft RPM
Propellors	4 - Inboard turning 56" dia x 56" pitch (open)
Rudders	Eight
Auxiliary Generators	2 - Caterpillar 3306 c/w two Kato 440V, 3PH, 60 HZ, 115 KW each
Fuel Consumption	550 litres per hour
Range	5,000 nautical miles
Speed	14 knots

DECK EQUIPMENT

Towing Winch	Burrard Iron Works Ltd. Model HD.S Drum capacity - 1500' of 1 1/2" SWR Line Pull - 16,000 lbs. at 140 FPM mid-drum
Anchor Windlass	Burrard Iron Works Ltd. Type D5 (Drum Type) Drum Capacity 90 FMS (520') of 1 1/8" SWR plus 15 FMS (90') of 1 1/8" chain
Anchors	2 - 1,000 lb. Danforth 1 - 300 lb. Danforth
Hook-up Winches	2 - 40 ton hydraulic 2 - 40 ton hand with 125' of 1 1/8" cable on each

ntcl

Attachment B: M/V Henry Christoffersen Specifications

Ship

Official Number	**347544**	Year Built	**1973**
Ship Name	**HENRY CHRISTOFFERSEN**	Year Rebuilt	**-**
Former Name	**-**	Port of Registry	**EDMONTON**
IMO Number	**8845559**	Registry Date	**1973 07 06**
		Certificate Expires	**2008 10 31**

General Statistics

Vessel Type	**TUG - OTHER**	Gross Tonnage	**783.18 t**
Net Tonnage	**382.19 t**	Construction Type	**CARVEL/FLUSH**
Ship Length	**45.23 m**	Construction Material	**STEEL**
Ship Breadth	**15.88 m**	Ship Depth	**2.68 m**

Tonnage determined by tabular method: No

Engine

Engine Description	**DIESEL**	Number of Engines	**4**
Propulsion Type	**SELF-PROPELLED**	Speed (knots)	**12.0**
Propulsion Method	**QUAD. SCREW**	Propulsion Power	**4500**
Unit of Power	**BRAKE HORSEPOWER**		

Attachment B: M/V Henry Christoffersen Specifications

Builder

Builder Name	**YARROWS LTD.,**
Address	**-**
	ESQUIMALT
Province	**BRITISH COLUMBIA**
Country	**CANADA**
Postal Code	**-**

Owner(s)

Owner Name	**NORTHERN TRANSPORTATION COMPANY LIMITED**
Address	**42003 MACKENZIE HWY SS 34**
	HAY RIVER
Province	**NORTHWEST TERRITORIES**
Country	**CANADA**
Postal Code	**X0E 0R9**
Number of Shares	**64**

Authorized Representative

Authorized Representative	**NORTHERN TRANSPORTATION COMPANY LIMITED**
Address	**42003 MACKENZIE HWY SS 34**
	HAY RIVER
Province	**NORTHWEST TERRITORIES**
Country	**CANADA**
Postal Code	**X0E 0R9**

Attachment C – Marine Mammal Monitoring and Mitigation Plan