MULTI KLIENT INVEST AS
(A Wholly Owned Subsidiary of Petroleum Geo-Services ASA)

PROJECT DESCRIPTION FOR 2-D MARINE REGIONAL SEISMIC SURVEY NORTHEAST NEWFOUNDLAND SLOPE

Prepared For:
Canada-Newfoundland Offshore Petroleum Board

Prepared By:
RPS Energy (Halifax) & YOLO Environmental Inc**.**

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1. INTRODUCTION

Multi Klient Invest AS (MKI), a wholly owned subsidiary of Petroleum Geo-Services ASA (PGS) and TGS-NOPEC Geophysical Company ASA (TGS) have entered into a joint venture to conduct a regional marine 2-D (two-dimensional) seismic reflection survey. The survey involves an offshore region that encompasses portions of the Labrador Shelf Orphan Basin (east and west), Flemish Pass Basin and Jeanne d'Arc Basin of the northeast Newfoundland Slope in the Atlantic Ocean. The multi-year survey is proposed to commence in second quarter of 2012 for a six-year seismic program (2012-2017) (Figure **1**) between May 1 through until November 30 each year, on a seasonal basis. MKI has taken the lead role in the regulatory approval requirements. (The Operator).

This document is a project description, which is required to initiate the Federal Coordination Regulations process under the Canadian Environmental Assessment Act (CEAA) to which this Project is subject. The CEAA identifies a marine seismic survey with an output level of 275.79 kPa at a distance of one metre from the seismic energy sources (i.e. 228.69 dB re 1 µPa@1m) as a trigger for an environmental screening level of assessment. This project is not supported by federal funding. Federal lands are involved and administered by the C-NLOPB and thus the project requires approval through the Canada-Newfoundland Labrador Offshore Petroleum Board (C-NLOPB) as the responsible authority under the CEAA. The C-NLOPB is assisted by expert departments.

The purpose of the project description is to identify the basic features of the Project to be assessed under the CEAA, as well as potentially affected areas. This project description is provided to federal departments with potential decision-making responsibility under the CEAA Responsible Authorities (RAs) or expert knowledge relevant to the evaluation of potential project impacts. The Project Description is also a component of the environmental assessment that will be conducted by MKI after the RAs determine the scope of the project and factors to be assessed under the CEAA.

This Project Description, as directed under the C-NLOPB Geophysical, Geological, Environmental and Geotechnical Program Guidelines (2011), is intended to provide information on MKI's Geophysical Program. A screening level environmental assessment will be prepared from the C-NLOPB scoping document at least 90 days prior to planned start of operations. RPS Energy and YOLO Environmental Inc. prepared this Project Description document on behalf of MKI.

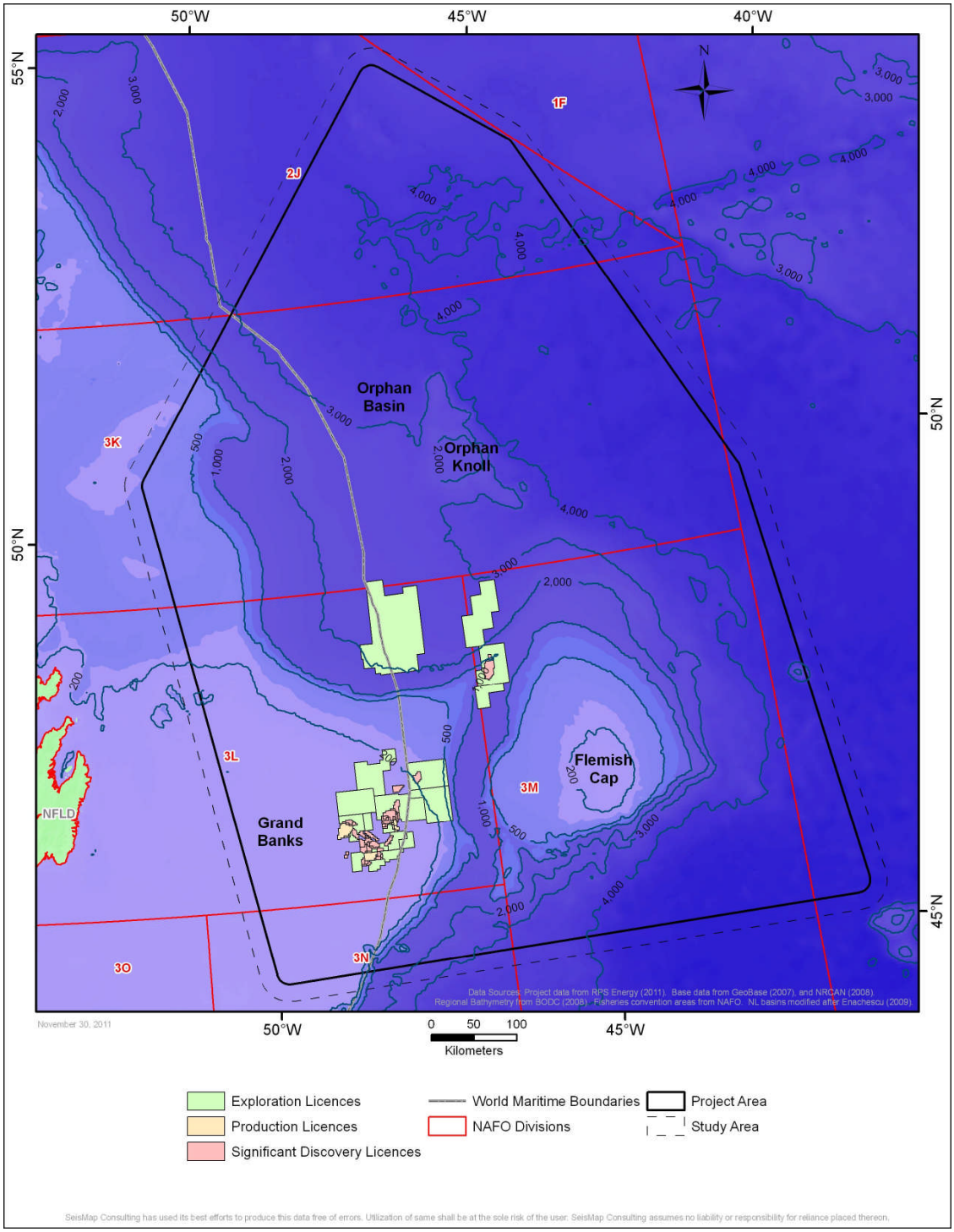

Figure **1**. 2-D Regional Seismic Survey Study Area

1.1 PROPONENT CONTACT INFORMATION

Operator and Work Authorization Applicant

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1.2 REGULATORY CONTEXT

In accordance with its mandate under the Canada-Newfoundland Atlantic Accord Implementation Acts, the C-NLOPB may issue an Authorization to Conduct a Geophysical Program to allow MKI to carry out the seismic survey program described herein. Offshore geophysical surveys (including geohazard surveys) on federal lands are subject to screening under the CEAA. In addition, Section 19.1 (a) of the CEAA's Inclusion List Regulations identifies those projects relating to seismic surveys for which a screening level of assessment is required. Under Part II Oil and Gas Projects, physical activities that require an authorization referred to in paragraph 138(1)(b) of the Canada-Newfoundland Atlantic Accord Implementation Act relate to a marine or freshwater seismic survey during which the air pressure measured at a distance of 1 m from the seismic energy source is greater than 275.79 kPa (40 psi) requires completion of an environmental assessment.

The C-NLOPB is the designated federal representative mandated under the Atlantic Accord Implementation Acts as well as the CEAA. The C-NLOPB acts as the federal environmental assessment coordinator in this context. Because seismic survey activities have the potential to affect seabirds, marine mammals, and fish and fisheries, both Fisheries and Oceans Canada (DFO) and Environment Canada (EC) are the primary federal agencies with interests and expertise in the environmental aspects of the proposed program. Relevant government regulations and guidelines to be reviewed during the issues scoping process will include:

- Canada-Newfoundland Atlantic Accord Implementation Acts;
- CEAA;
- Fisheries Act;
- Oceans Act;
- Migratory Birds Convention Act and Regulations;
- Canadian Environmental Protection Act;
- Committee on Endangered Wildlife in Canada (COSEWIC);
- Species at Risk Act (SARA);
- Navigable Waters Act;

- Canada Shipping Act;
- Offshore Waste Treatment Guidelines (NEB et al. 2010); and
- Geophysical, Geological, Environmental, and Geotechnical Program Guidelines, (C-NLOPB 2011)

Specific C-NLOPB Guidelines relevant to this Project is the Geophysical, Geological, Environmental and Geotechnical Program Guidelines (C-NLOPB 2011) and the Offshore Waste Treatment Guidelines (NEB et al. 2010).

The Statement of Canadian Practice on Mitigation of Seismic Noise in the Marine Environment (DFO 2007) is integrated verbatim into the above referenced C-NLOPB guidelines.

1.3 CANADA- NEWFOUNDLAND AND LABRADOR BENEFITS

MKI as the proponent and their partner TGS are committed to benefits for Canadian companies with emphasis on organizations from Newfoundland and Labrador. A benefits plan is being finalized for MKI, which will govern all company operations in the future with its guiding principles as follows:

> Companies from Canada, and Newfoundland and Labrador in particular, will be given full and fair opportunity to provide goods and services to MKI; MKI must make decisions based on what optimizes value to its projects. Value to MKI will be quantified through vendor impact on project economics, product and/or service quality, timing, vendor experience and reputation and other similar metrics.

1.4 STAKEHOLDER CONSULTATION

MKI as the proponent and their partner TGS recognise the importance of communications to keep stakeholders informed about its proposed program and to obtain valuable input that may serve to contribute to the Project's overall success. A focused environmental assessment requires a process of scoping to define the components and activities that are to be considered in the assessment, to identify the key environmental issues, and to set the spatial and temporal boundaries of the assessment. Candidates for stakeholder consultations are well established in the environmental assessment arena of Newfoundland and Labrador and include:

- Fisheries and Oceans Canada
- Transport Canada
- Environment Canada/Canadian Wildlife Service
- Fish, Food and Allied Workers
- One Ocean
- Ocean Choice Limited
- Groundfish Enterprise Allocation Council

- Clearwater Seafoods
- Icewater Seafoods
- Association of Seafood Producers

Other interest groups and stakeholders may also be identified during the consultation process.

2. PROJECT DESCRIPTION

2.1 PROJECT NAME AND LOCATION

The official Project name is Northeast Newfoundland Slope 2-D Geophysical Survey Project. The study area is defined by the following coordinates:

North – 54° 54.5' N
East – 40° 50.7' W
West – 51° 50.0 ' W
South – 45° 0.0' N

All lines are within the C-NLOPB jurisdiction and are outside the Canada 12 mile nautical limit.

2.2 PROJECT OVERVIEW

MKI as the proponent and their partner TGS propose to conduct an offshore regional two-dimensional (2-D) seismic reflection survey in the Labrador Basin, Orphan Basin, Flemish Basin and Jeanne d'Arc Basin over the next six years (2012 to 2017) in the jurisdiction the C-NLOPB, totalling approximately 40,000 km. No survey lines will enter the waters within 12 nautical miles of the coast of Newfoundland and Labrador.

The proposed project is a regional survey designed to provide a better understanding of the offshore geology of the northeast Newfoundland Slope region and to use this information to introduce new exploration opportunities to the industry. This information will be used to determine the regional extent of geological formations. This program is being used to develop geological concepts and is not the basis of an exploration drilling program, as the survey line spacing is much too coarse for that purpose.

The proposed survey season is May through November each year. Each program will be about 50 to 70 days in duration. The exact dates will depend on the location, weather conditions, and vessel availability. Based on previous work in Newfoundland and Labrador, weather usually allows productive recording until approximately mid-October. It is expected that work might be able to continue as late in the year as November.

Although the proposed survey vessel is an ice-class vessel (1A1 Ice C), data will not be acquired in areas of pack ice. The survey data will be acquired such that ice-free areas are surveyed first (i.e., the southern portion of the survey area) then, as the season progresses, the vessel will move north.

The vessel will be at sea and operate continuously (i.e. 24-hour operations) during survey operations. Seismic vessels typically operate on a 5/6-week crew change schedule, which will be maintained for this project. Crew changes will be made via port call.

MKI will provide updates to the C-NLOPB on the timing of Project activities as soon as they are determined. Given the length of this Project timeframe, MKI has committed to the periodic review of the EA Report, including proposed mitigation and proposed monitoring to ensure on-going validity and applicability of this assessment.

Although the environmental assessment has not been completed to fully address environmental mitigations for the planned geophysical surveys, it is anticipated that a marine mammal observer and fisheries liaison officer will form a component of the operational crew. Furthermore, procedures will be implemented to minimize effects on the local marine ecosystem; for example, “soft-starts” or “ramp-ups” industry standard procedures of the air gun arrays will be implemented.

The energy source will be a single airgun array system. A soft start approach would occur at the beginning of a new line within the perimeter or at the start of operations anywhere within the program area. **Table 1** summarises the survey acquisition parameters.

Table 1. Known Seismic Survey Parameters

Total Planned Program km	Approx 40,000 km multi year program
Number and Length of Streamers	1 x Geostreamer; 8 – 10 km
Group Interval	12 groups per section; 12.5 m
Shot Interval	25m
Airgun Array	4135 cu in
Airgun Operating Pressure	138 to 172bar (2000 psi)
Firing Pressure	2000 psi
Hydrophones	Dual sensor
Recording Time	10 seconds
Source Array Tow Depth	9 m
Vessel Speed	4.5 knots while shooting, 10 knots in transit
Turning Radius	10 to 12 km

2.3 PROJECT ACTIVITY AREA

The Project Activity Area encompasses the geographic area within which MKI expects to undertake the 2D seismic survey and associated activities within the next six years. As depicted in Figure **1**.

MKI acknowledges that the scope of the Project to be assessed in the EA Report extends over several years, during which time the regulatory, biophysical, and socio-economic environment may change from that assessed in this report. MKI will periodically review the EA Report, as directed by the C-NLOPB, for current applicability, will continue stakeholder consultations, and will work with regulatory authorities to ensure that the EA remains fit for purpose.

2.4 ALTERNATIVES TO THE PROJECT & ALTERNATIVES FOR THE PROJECT

2.4.1 Alternatives to the Project

Alternatives to the Project are defined as functionally different ways of achieving the same end [Canadian Environmental Assessment (CEA) Agency 1997]. The one alternative to the proposed seismic Program is the 'do nothing' scenario. In the case that the project does not proceed, the mitigated impacts of seismic operations on the environment will of course not occur; however, the environment will not necessarily maintain its current baseline condition as impacts from fishing and vessel activity (*i.e.,* ice breakers, cargo vessels, cruise ships, and other research vessels), waste materials, sedimentation, fall-out of atmospheric pollutants, discharge of ballast waters, etc. will still take place.

The 'no-go alternative' would also mean that the renewed interest in exploration in this area would cease, or at least be significantly set back, as geologists would not have the information required to map the subsurface in this area. This would consequently mean that the potential to assess the hydrocarbon potential of this area would not proceed, along with the assessment of opportunity for further subsurface exploration and drilling programs. Ultimately, the project not proceeding in this case would effectively preclude the potential to evaluate the area's offshore hydrocarbon resources. This would result in the removal of future potential business, royalty, and tax revenue sources and the data would not exist for future knowledge and research.

It would also lead to significant reduction in direct employment opportunities on the vessel and the opportunity to collect biological observation information.

2.4.2 Alternative Means for the Project

Alternative means for the Project are defined as methods of similar technical character or methods that are functionally the same (CEA Agency 1997). Alternative means for carrying out this project include variations in technology, project schedule, and location.

2.4.3 Alternatives to Survey Method

Airgun arrays are the most common, environmentally responsible, and practical energy sources for marine geophysical surveys (Richardson *et al.* 1995). Noise pulses with high peak levels are produced; however, each pulse is short, limiting total energy. Richardson *et al*. (1995) also indicated that pulses from airgun arrays generally decrease in intensity, but increase in duration further away from the site. Sleeve exploders and gas guns have similar effects to airguns. Although marine vibrators produce lower instantaneous pressure than airguns, the total acoustic energy transmitted is similar due to the extended duration of the signal. Marine vibrators are also in their infancy and are not a practical alternative. Marine vibrators cannot substitute for the airgun array in seismic surveys as they provide a lower output at low frequencies.

There are few alternatives for the proposed survey methodology that would provide the information required to assess the area's submarine hydrocarbon resources.

Exploration and production companies would not accept alternatives for their purposes. Airborne electromagnetic and magnetic (aeromag) surveys are valuable tools, but do not provide the level of detail required for precise resource assessments.

The compressed air array proposed for the current survey uses a proven technology and program design that is standard throughout many parts of the world. It has been used successfully on many occasions over the past several years on the Scotian Shelf, the west coast of Newfoundland, the Gulf of St. Lawrence, the Grand Banks, and the Labrador Shelf and Slope. Because of its reliability for data acquisition, the history of use in similar areas, and the available information related to its minimal environmental impacts, the compressed air technology proposed by MKI is the preferred alternative.

2.4.4 Alternatives to Program Timing

The proposed program is scheduled to occur between May and November 2012 to 2017. Specific timing of the program will depend on a variety of factors, including ice conditions, weather conditions, timing, and sensitivities associated with biological and socio-economic constraints. For example, mitigation options to minimize potential impacts can potentially include modification of the operations schedule within specific areas, and the survey plan has been developed on this basis.

2.5 PROJECT COMPONENTS

The components of a 2-D survey include a seismic vessel, the source towed array (air source units); the receiver (hydrophone) towed array; a support chase/picket vessel, helicopter, and a shorebase.

2.5.1 Seismic Vessel

The program is proposed to be conducted with a dedicated seismic research vessel, the M/V Sanco Spirit, which was purpose built in 2009 (Figure **2**).

Figure **2**. Survey Vessel M/V Sanco Spirit

The vessel will have equipment, systems, and protocols in place for prevention of pollution by oil, sewage, and garbage in accordance with international standards and certification authorities, specifically the Arctic Shipping Pollution Prevention Act (ASPPA) and Arctic Shipping Pollution Prevention Regulations (ASPPR). These regulations require that the survey vessel possess an Arctic Pollution Prevention Certificate. The vessel will be subject to pre-survey audits by the operator in the port of mobilization prior to survey commencement. Transport Canada (TC) will conduct a Safety Inspection of the vessel in accordance with the issuing of the Coasting Trade License to operate in Canada.

The survey vessel will comply with all applicable regulations concerning management of waste and discharges of materials into the marine environment. The vessel has a ballast water management plan. The International Maritime Organization (IMO; http://www.imo.org/) is the United Nations specialized agency with responsibility for the safety of shipping and the prevention of marine pollution by ships. Canada became a member of the IMO in 1948.

Vessel speed will be approximately 4.5 knots when the survey gear is deployed, similar to trawling fishing vessels. The airguns are discharged every 25 m, or about once every 10 to 16 seconds. Typical survey vessels are capable of cruising at 10 knots while in transit (with gear onboard). During the survey, the ship sails along a predefined track (line). The time to traverse one of these lines depends on the size of the survey area but is typically less than a 24 hour period. Upon reaching the end of the line the vessel will typically take several hours to turn onto the next line to be surveyed. It is estimated that the survey vessel will require a turning radius of 12km outside the identified survey area. Seismic operations can generally continue up to a sea state of 4 - 5, or wave heights of about 3 m.

2.5.2 2-D Seismic Survey Towed Array

For the 2-D surveys, typical ships are usually about 60 to 90 m long and tow a single source array 100 to 200 m behind the ship. Each source array is about 20 m long and 24 m wide. Following 100 to 200 m behind the source array is a single streamer between 8 and 10 km long. A tail buoy with radar reflectors is attached at the end of each streamer. At the end of the track, the ship will take two to three hours to turn around and start along another track. Spacing between lines depends on the objectives of the survey.

The seismic air guns for the 2011 program are Sercel – G Gun 2. The guns have a working pressure of 2000 psi and the typical array is a single source array made up of 6 subarrays. The survey parameters for the program are shown below in **Table 2**.

Table 2. Sercel – G Gun 2 Seismic Survey Parameters

Effective volume of standard array(s)	4135 cu in
Maximum number of sub-arrays	3
Standard array depth(s)	9 m
Position of depth transducers	Front and tail of sub-array
Working pressure	2000 psi

Type of firing sensors	Pressure activated
Type of firing synchroniser unit	RTS BigShot
Timing resolution	0.1ms ms
Timing accuracy	+/- 1.0ms
Air compressors capacity	Neuman & Esser, 2200 cfm each
Number of air compressors	2

The individual source unit volumes range from 45 cu. in. to 250 cu. in. The 4135 cu. in. array configuration is shown in Figure 3.

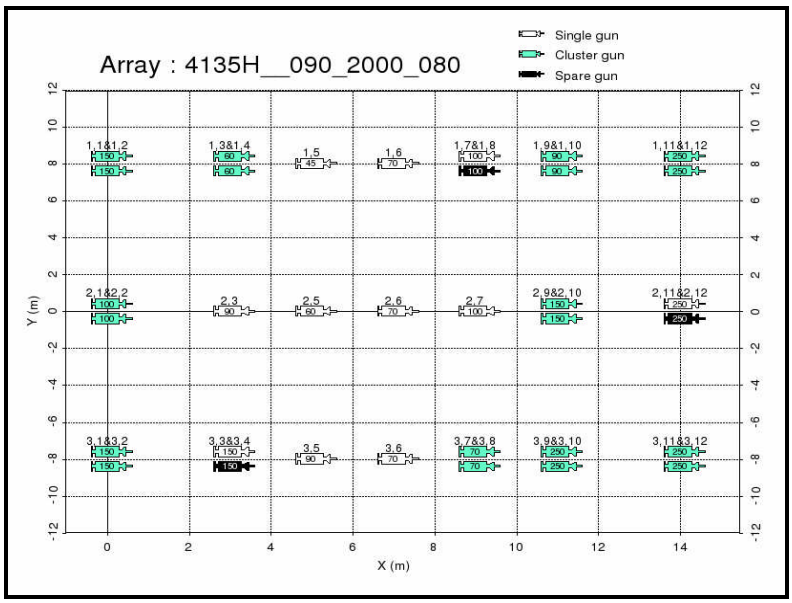

Figure 3. Array Configuration Top View,
(i.e. Positive Y Denotes Starboard).

2.5.3 Streamer

The vessel utilizes the PGS GeoStreamer® which is a dual sensor solid streamer. Solid streamers are less sensitive to weather-related noise than liquid streamers and further minimize the environmental impact of fluid loss from breaks or tears in conventional fluid filled streamers. Technical specification of the streamer system is provided in **Table 3**.

Table 3. PGS GeoStreamer® Specification

Skin material	Polyurethane
Outside diameter	62mm cm
Length of each group	12.5m m
Streamer set-up	Typical 1 x 8,000m to 10,000m
Manufacture and type of hydrophones	Hydrophones: Teledyne T-2BX or equivalent, Velocity Sensors: PGS confidential (Mark III)
Type of array (*e.g.,* linear, binomial)	Linear
Number of hydrophones per group/distance apart	Hydrophones: 12 per 12.5m, Velocity Sensors: PGS confidential

Coupling between phones and pre-amp	Capacitive
Sensitivity of near and far group at 1/P to recorder	20V/Bar
Bandwidth over which above sensitivities apply	Specified at 100Hz
Availability of shore-side spares if required	Pool system
Manufacturer and type of depth controller and compass	ION DigiCourse 5011

Regardless of the exact nature, all seismic surveys share the same basic concept. Seismic airguns send sound waves through the water, and formations beneath the seafloor reflect the sound waves back to hydrophone streamers trailing behind the vessel (Figure **4**).

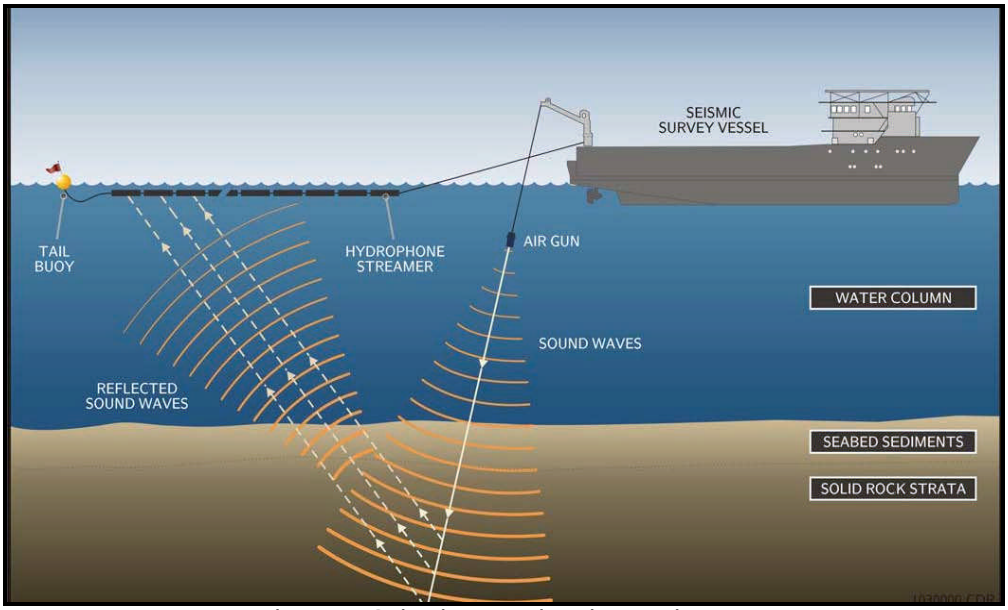

Figure **4**. Seismic Vessel and Towed Array

The energy source will be a dual air source array system. An air source unit is essentially a stainless steel cylinder charged with high-pressure air. Despite the term, no explosive devices are incorporated. The firing of an air source generates an oscillating bubble in the surrounding water. At the time of firing, the pressure of the air inside the cylinder far exceeds the outside pressure in the surrounding water. This difference in pressure causes a bubble to rapidly expand in the water around the air source. The seismic signal is a popping sound created when air is released forcefully into the water column. It is this initial bubble expansion that generates the relatively broadband seismic pulse. The produced broadband source level for a typical array is about 252 dB re 1 µPa-m, with the highest energies falling between 10 to 100 Hz.

About 30 minutes prior to arriving at the start of a line, the airgun array is slowly brought up to a specified power, a ramp-up procedure referred to as a “soft start”. This procedure is an environmental protection measure to permit marine animals opportunity to temporarily vacate that area if the sound levels are perceived as a disturbance. A soft start approach would occur at the beginning of a new line within the perimeter or at the

start of operations anywhere within the program area. This approach is discussed in greater detail below. Vessels towing streamers have reduced manoeuvrability when the equipment is deployed. MKI will include a 10 km vessel turn-around perimeter around the survey area.

For each air source unit, the amplitude (or loudness) of the seismic signal is a function of the volume and pressure of the air inside the cylinder and the cylinder's depth under the water surface. The larger the cylinder volume and the higher the internal air pressure, the louder the sound. The individual source unit volumes can range from 70 cu. in. to 290 cu. in. The larger source units are positioned at the front of the array with progressively smaller volumes to the back of the array.

2.5.4 Marine Mammal Safety Zone and Ramp-up Procedure

MKI will implement a 500 m safety zone monitoring program for whale species at risk during survey data acquisition. The airguns will be shut down every time an endangered whale enters the defined safety zone. An environmental observer, trained for marine mammal observations, will watch for marine mammals from the bridge of the seismic vessel throughout the survey. Safety zones for marine mammals are commonly defined by the areas within which specific sound level thresholds are exceeded. These have been quantified by the US National Marine Fisheries Service (NMFS) (NMFS 2000). NMFS policy regarding exposure of marine mammals to high-level sounds is that whales should not be exposed to impulse sounds exceeding 180 dB re 1µPa (rms). These sound levels are the received levels above which, in the view of a panel of bioacoustics specialists convened by NMFS, one cannot be certain that there will be no injurious effects, auditory or otherwise, to marine mammals.

The *Statement of Canadian Practice for Mitigation of Seismic Noise in the Marine Environment* (DFO 2008) provides guidance to the seismic program, as stipulated in the scoping document. This DFO document aims to formalize and standardize the mitigation measures used in Canada with respect to the conduct of seismic surveys in the marine environment. It is based on a DFO-sponsored peer review by Canadian and international experts. MKI will adhere to the mitigation measures outlined in the *Statement of Canadian Practice on the Mitigation of Seismic Noise in the Marine Environment*, to the extent reasonably practical.

2.5.5 Logistical Support

Details of logistical operations to support the subject geophysical program will largely depend on seismic acquisition company, season, and weather.

Helicopters

The larger seismic vessels are usually equipped with a helicopter platform and helicopters are often used for crew changes, and can be used in case of medical and other emergencies and re-supply. In some cases, survey contractors may prefer to come to shore for crew changes and re-supply (if required).

Helicopters may or may not be utilized depending on type of helicopter available and seismic vessel procured. For the duration of the seismic program, it is possible that the fleet of helicopters available out of St John's will be Sikorsky S-92's only. The

implication of this is that many of the seismic vessels currently available on the market are not capable of allowing S-92's to land on their helideck. Super Pumas or equivalent are the only type of helicopter potentially available that are approved for landing on the helidecks of the anticipated seismic vessels.

Shore Base

MKI will use shore facilities in St. John's, NL. During a short operational program, re-supply may not be needed. No new shorebase facilities will be established as part of this Project. However a shore based MKI representative will be located in St. John's, Newfoundland for the duration of the project.

Support Vessels

The primary functions of support boats are to provide supplies for the seismic vessel and to assist in emergency situations (including oil spills). At least one support vessel will be utilized for the duration of the proposed seismic survey.

Seismic vessels are recognized as having restricted manoeuvrability and, in this respect, under marine sailing directions, they have priority over vessels that are not similarly restricted. In areas where poor charting, or the presence of other vessels, may pose a potential problem to the survey operation, the support boats will ensure that other vessels do not cross over, or otherwise interfere with, the towed equipment. The support boats may also check that the way ahead of the survey vessel is clear of obstructions, such as uncharted shallow water and fishing equipment. The seismic vessel, or the support vessel, carries a Fisheries Liaison Observer to make communication with the fisheries in order to ensure that seismic activity does not interfere with the fishermen.

2.6 EMISSIONS AND WASTE DISCHARGES

The vessels and towed array will generate underwater noise. The vessels also generate atmospheric, light, liquid, and solid emissions. Discharges and emissions from this program will be similar to those of any standard marine vessel. These emissions and discharges are described below.

2.6.1 Noise Emissions

The firing of an air source generates an oscillating bubble in the surrounding water. At the time of firing, the pressure of the air inside the cylinder far exceeds the outside pressure in the surrounding water. This difference in pressure causes a bubble to rapidly expand in the water around the air source. It is this initial bubble expansion that generates the relatively broadband seismic pulse.

Sound decreases with distance from the source. This is referred to as transmission loss and it is influenced by geometric spreading loss and attenuation. Pressure measured at some distance away for the air source array is determined by using the model of spherical and cylindrical spreading. Sound travels out in a progressively large area from the sound source in all directions. There are many factors that contribute to decay a sound wave, including frequency and local conditions such as water temperature, water depth, and bottom conditions.

2.6.2 Atmospheric Emissions

Atmospheric emissions will result from vessel and equipment exhaust. These emissions are minor and will be reduced through best management practices and preventative maintenance procedures. These include properly maintaining and routinely inspecting ship equipment, controlling vapour loss from fuel tanks, and avoiding engine idling when not in use. Emissions from ship engines and onboard equipment will comply with the Air Pollution Control Regulations (*Newfoundland and Labrador Environmental Protection Act*) and the Ambient Air Quality Objectives (*Canadian Environmental Protection Act*).

2.6.3 Liquid Emissions

Ballast water is stored in dedicated ballast tanks to improve vessel stability. No oil will be present in these tanks or in any discharged ballast/preload water. If oil is suspected to be in the water, it will be tested and, if necessary, treated to ensure that oil concentrations in the discharge do not exceed 15 mg/L as required by the MARPOL 73/78 (International Convention for the Prevention of Pollution from Ships, 1973, and the Protocol of 1978 related thereto), IMO and the Offshore Waste Treatment Guidelines (OWTG) (NEB *et al.* 2010).

The OWTG were developed specifically for the treatment and control of waste generated by petroleum operations related to exploration and production on Canada's offshore areas. Bilge water often contains oil and grease that originate in the engine room and machinery spaces. Before discharge, bilge water is treated in accordance with MARPOL 73/78, IMO and OWTG, using an oil/water separator. The extracted water is tested to ensure that the discharges contain no more than 15 mg/L of oil.

MKI will implement best practices to maintain equipment and avoid release of flotation fluid. Further, the contracted seismic vessel is equipped with solid-streamer technology, as this type of streamer is not reliant on flotation fluid to achieve a neutral ballast state, thus eliminating the risk of an accidental spill.

2.6.4 Solid Waste

All solid waste will be transferred to shore and disposed of at an approved facility. Any hazardous materials (*e.g.,* oily rags) will be handled separately in hazardous materials containers. Sanitary and food wastes will be macerated to a particle size of 6 mm or less and then discharged as per the OWTG.

2.6.5 Light Emissions

The survey vessel will carry operational, navigation, and warning lights. Working areas will be illuminated with floodlights as required for compliance with occupational health and safety standards and will be fully equipped with emergency lighting. If a helideck is present, it will be floodlit and have omni-directional guidance lights with an average illumination intensity of between 20 and 25 candelas. Hazards in the vicinity of the helideck will also have omni-directional hazard lighting. Lighting will comply with relevant offshore standards/regulations, including TC's *Guidelines Respecting Helicopter Facilities on Ships.* MKI will adhere to the CWS Leach's Storm Petrel Program.

2.7 POTENTIAL MALFUNCTIONS AND ACCIDENTAL EVENTS

There are unplanned situations that may be encountered during seismic operations. Potential hazards are addressed during site-specific planning as part of emergency response planning. Procedures are developed by MKI to ensure that such events are managed in a safe and environmentally sound manner. MKI have policies, plans, and procedures to prevent or mitigate effects of malfunctions and accidents. These policies, plans, and procedures will be located on the seismic vessel, and with the MKI shore representative in St. John's NL. During seismic surveys, there will be limited amounts of marine fuel and lube oil onboard that could potentially be spilled to the ocean. All of the vessels involved in the survey will use diesel fuel. The fuel capacity of seismic ships can range up to 1,550 t for large 3-D vessel. Any accidental spill will be reported to the C-NLOPB immediately.

The contracted vessel is equipped with solid-streamer technology, as this type of streamer is not reliant on flotation fluid to achieve a neutral ballast state, thus eliminating the risk of an accidental spill from a damaged streamer.

Other accidental events could include damage or loss of seismic equipment, entanglement of seismic equipment with fishing gear, and vessel collisions. Best management practices and communications will be used on the survey vessel to avoid equipment loss or damage. Gear will be retrieved from the water if wave heights reach or exceed unacceptable limits. In case of severe weather, the vessel may return to shore until conditions improve. A trained Fisheries Liaison Observer will be onboard during the seismic program to liaise with fishers who may have gear deployed in the Project Activity Area, in order to ensure effective and ongoing communication and avoid unnecessary gear conflicts and possible vessel collisions. Entanglement of marine mammals in seismic equipment is not likely since streamers have no tangle gear and marine mammals are expected to avoid the vessel during operations. The trained onboard Environmental Observer will keep watch for marine mammals during the survey program.

2.8 SETTING OF ENVIRONMENTAL COMPONENTS

A number of environmental assessment studies have already been performed in the area, which will be key references to the environmental assessment (EA) submitted by MKI. The biophysical environment of this area has been described in several recent screening environmental assessments for seismic and drilling programs and there are two other seismic projects in the planning stages at this point within this region. The strategic environmental assessment (SEA) prepared in 2003 for the Orphan Basin is dated, as typically these SEAs have a life span of five years.

The existing environment descriptions of the biophysical resources will be based on the current environmental assessments and updated science reviews.

It is anticipated that the valued ecosystem components will include but not limited to Marine Birds, Marine Fish, Marine Fish Habitat, Marine Mammals, Sea Turtles, Species at Risk, Special Places, Other Resources Users, such as Commercial Fisheries, Petroleum Industry, and Marine Traffic.