GXT 2013 – 2015 LabradorSPAN
Marine 2D Seismic, Gravity and Magnetic Survey

Project Description
for the
Canada-Newfoundland and Labrador Offshore Petroleum Board

January 2013

GX TECHNOLOGY

This is the Project Description for a 2D marine exploration program proposed by GXT for the Newfoundland and Labrador Sector during 2013 to 2015. The Appendix to this document contains a map of the proposed survey Project Area and additional information about the Project vessels.

1 Project Name

GXT 2013 – 2015 LabradorSPAN 2D Seismic, Gravity and Magnetic Survey

2 Type of Activity

GX Technology Canada Ltd. is proposing to conduct a 2-Dimensional (2D) (single streamer) marine geophysical survey to collect seismic, gravity and magnetic data in open (ice-free) waters. The planned program is a regional Basin Span survey to examine very deep geological formations in the Labrador Shelf region. It is planned to occur within the period June – November, 2013 to 2015.

3 Operator Information and Contacts

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GX Technology Canada Ltd. is a branch of ION Geophysical Corporation (ION), headquartered in Houston, Texas, a leading provider of geophysical technology, services and solutions for the global oil and gas industry. ION's ~1,000 employees operate from 23 offices in key petroleum centres throughout the United States, Canada, Latin America, Europe, Africa, Russia, China, and the Middle East. The company has a particular focus and experience working successfully in challenging environments including the Arctic, shallow/obstructed water and transition zones; and strong expertise in Basin Exploration, to help better assess the prospectivity of frontier basins. Corporate web site: www.iongeo.com .

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4 Purpose

This survey is part of GXT's Basin Span programs which GXT has conducted since 2002 in many frontier regions around the globe, including the Scotian Shelf, northwest Canada (Beaufort Sea), northeast Greenland, Alaska and Norway. GXT's Span surveys examine very broad and deep geological formations in and around basin areas using advanced geophysical techniques. They provide information on the geologic evolution, deep basin architecture, and the depositional and structural histories of an entire region. Surveying these ultra-deep formations allows for a better evaluation of the evolution of the geological basin areas, including identifying source rocks, migration pathways, and play types. These programs are not designed to identify specific potential drilling locations.

The objective of the LabradorSPAN survey is to assist the understanding of the formation of the Labrador Basin area in order to further assess the petroleum system on a broad basin-level scale (a Basin Span survey). It will enhance the understanding of the area's hydrocarbon development and potential, and assist future exploration activities. This will be a significant resource for companies interested in the area's hydrocarbon potential and for future development and licensing opportunities.

5 Location

The Project Area Map (see Appendix) shows the location of the Newfoundland and Labrador sector Project Area (i.e., the area within which all project activities will occur, including turns/line changes), coastlines, Canada's Exclusive Economic Zone (EEZ) and representative communities. As the map indicates, the Project Area is focused mainly on the Labrador Shelf and Slope, between approximately 61 degrees and 50.5 degrees North Latitude. Acquisition will not occur within the Nunatsiavut Zone (the Tidal Waters of the Labrador Inuit Settlement Area, as defined in the Labrador Inuit Land Claims Agreement). Part of the survey is within the "Ocean Areas Adjacent to the Zone" (as defined in Part 6.1.1 of the Agreement).

It is expected that in any program year a maximum of about 8500 line km could be acquired within the Newfoundland and Labrador offshore zone. These lines will be widely spaced (except where they cross in some locations), typically 50 km – 100 km apart, ranging within the Project Area. The western limit of the Project Area is about 22 km (at its closest) from the Labrador mainland, though in most areas it is greater than this (30-50 km). Water depths in the area range from approximately 100 m to 3,500 m. The communities closest to the Project Area are approximately 40 – 50 km

distant. No portion of the survey will be acquired within Gilbert Bay, Nain Bight or Hamilton Inlet. Survey lines will also avoid the Hawke Channel.

In addition to acquisition within the Newfoundland and Labrador sector, some of the lines in one or more years will extend into areas offshore of Nunavut and Greenland (permitted separately) and/or into international waters, beyond the EEZ boundary.

Nearly all of the proposed 2013-2015 Project is within the Study Area used for the recent *Strategic Environmental Assessment Labrador Shelf Offshore Area* (CNLOPB 2008).

6 Timing

The survey will occur between June and November each year, potentially from 2013 to 2015. The timing of the acquisition of specific lines within the Project Area in any year will depend on several factors, including the local weather, sea state, ice conditions in specific locations, commercial fish harvesting, and on the timing of Greenland / Nunavut parts of GXT's program.

7 Vessels

A single conventional seismic ship will be used for surveying, the 81–m M/V Norwegian-built *Harrier Explorer* (Figure 1; or an equivalent vessel, depending on the year), with part-time support as needed, from the 73-m Canadian-built GXT-owned *Polar Prince* (Figure 2), for re-supply, crew changes and refuelling. Although the survey is planned for ice-free waters, the *Polar Prince* is a medium-class Lloyds icebreaker, which allows for more operational flexibility and safety in more northerly waters. Both ships are fully MARPOL compliant, and have oil spill /pollution prevention and emergency response plans.

The ships will use low-sulphur marine diesel fuel (~1,000,000 L within Canadian waters by both ships) each year. They will require normal ships' supplies/provisions. Re-supply, re-fuelling and transfers of personnel we be done offshore using the *Polar Prince* and suitable area ports, such as Goose Bay or Nuuk, Greenland. No helicopter or other support vessel use is expected. Existing port infrastructure will be used for this Project.

MV Harrier Explorer
- Norwegian built, Panama registered
- owned by Harrier Navigation
- operated by Seabird Exploration
- 81 m LOA, 5.8 m draft

MV Polar Prince
(former Canadian Coast Guard icebreaker *Sir Humphrey Gilbert*)
- Lloyds Class 100A Medium Duty Ice Breaker (Canadian Shipping Act: Arctic Class 1+)
- Canadian built, Canada registered
- Certification: DNV & SOLAS
- owned by GXT Canada (since 2009)
- 72.5 m LOA, 5 m draft

Additional information about the ships is included in the Appendix to this Project Description.

Figure 1: Seismic source ship *Harrier Explorer*


Figure 2: Support ship *Polar Prince*

8 Other Survey Components/Equipment

Source Array. The sound source to be used for this deep basin survey is a 6300 cu.in. array comprising 36 airguns ranging from 100 to 250 cu. in. in 4 sub-arrays (Figure 3), operating at 2000 psi. It will be deployed at a depth of between 8 and 11 m. Additional information is provided in the Appendix to this Project Description.

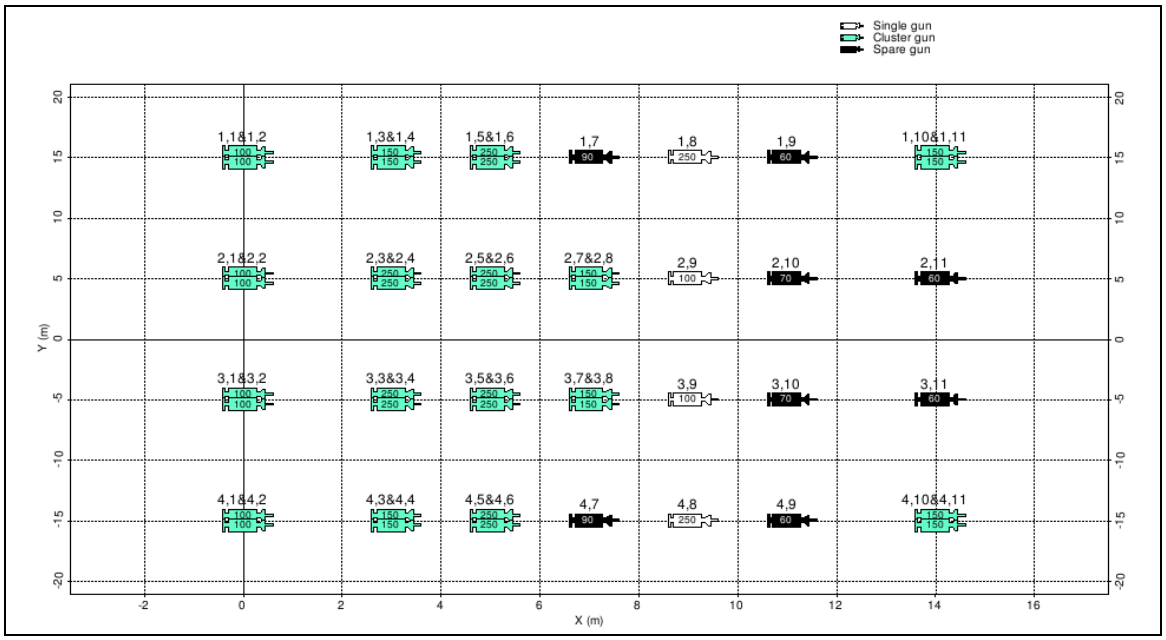


Figure 3: Array Geometry

Seismic Streamer. The seismic hydrophone streamer will be deployed at 9 to 15 m depth, and will be up to 9 km long. It is a solid-core (gel) DigiSTREAMER Integrated Data Acquisition System manufactured by GXT parent company ION Geophysical, which will receive the reflected signals from the bottom and transfer the data to an on-board processing system. The streamer will have DigiBird units (also manufactured by ION) attached at least every 300 m to maintain correct streamer depth and positioning.

The streamer will be made up of up to 90 Solid Active Streamer Sections, each 100 m in length. Streamer sections will contain a non-liquid fill to reduce self-noise properties and provide consistent buoyancy. A stress-member chassis of non-magnetic Vectran® will provide high-tensile strength and predictable elongation for long tow configurations, such as that used for this survey.

Other. Gravity and magnetic data will be collected (passively), using an UltraSys™ marine gravity meter system consisting of a LaCoste and Romberg Marine Gravity meter, which has been modified by ZLS Corporation to upgrade the optical beam position sensor to a capacitive inductance sensor. The meter has also been sealed with a dry nitrogen atmosphere to negate pressure differential and moisture effects.

9 Methodology & Logistics

Method. The approach for this program is to use a conventional seismic ship, the *Harrier Explorer* (described above) towing an airgun array and single 9-km hydrophone streamer over widely spaced survey lines, working in ice-free marine areas, supported by the vessel *Polar Prince*, which also has icebreaking capabilities. The seismic ship will also collect gravity and magnetic data at the same time using passive on-board systems. The program is part of a larger Labrador Shelf / Southern Baffin Bay / Davis Strait basin-wide Span investigation, part of which is also being permitted (for 2013) through the Greenland regulator (the Bureau of Minerals and Petroleum). Within the Newfoundland and Labrador sector, 2D survey acquisition is planned to occur within the period June to November 2013 - 2015.

Logistics. As described above, the operations will consist of the single seismic ship (the *Harrier Explorer*) equipped with gravity and magnetic instruments and towing a sound source (airgun) array (at 8 to 11 m depth) and a 9-km hydrophone streamer (at approximately 9 to 15 m depth), and a support ship (the *Polar Prince*), as needed for re-supply, crew changes and refueling. Each year the survey will follow planned pre-plot seismic lines , with an aim of acquiring up to approximately 8,500 km of seismic data (full fold) each year in Canadian and/or international waters.

The lines will be acquired in the most efficient manner practical, which will likely result in acquisition that crosses the maritime EEZ boundaries between Greenland and Canada on some lines. Typically the vessel will have a 6-km run-in to the start of a seismic line and a 4 to 5-km run-out at the end of a line. The ship will travel at approximately 9 km/hr when in acquisition mode.

The seismic vessel will aim to operate continuously, though typically about 60% of the time is spent in production with the remainder of the time for line changes, standby, maintenance and/or other technical operations.

Crew changes will be every 4 - 5 weeks in a nearby port (e.g. Nuuk, Greenland, or Goose Bay, NL). Smaller 2 - 3 person transfers maybe conducted using the *Polar Prince*. Refuelling logistics will be every 4 weeks and the fuel transfers will take place offshore utilizing the *Polar Prince*, or else in the ports of Nuuk and Goose Bay NL.

GXT’s program logistics in Greenland will be supported by a ships agent from NL, and by Royal Arctic Logistics A/S, in Nuuk.

10 Environmental Protection and Monitoring

The 2008 *Strategic Environmental Assessment Labrador Shelf Offshore Area* provides a comprehensive description and strategic assessment of petroleum-related seismic exploration on the Labrador Shelf, which includes the great majority of GXT's proposed Project Area. As that SEA discusses, important Valued Ecological Components (VECs) within the Project Area environment include fish (especially SARA-protected wolfish (sp.)), commercial fisheries (mainly for snow crab, northern shrimp, and some groundfish species, such as Greenland halibut and cod), marine mammals (including humpback and fin whales), seabirds (mainly associated with coastal areas, including listed species, such as Harlequin Duck and Barrow's Goldeneye) and other special areas (e.g. the Hawk Channel, protected areas and potential protected/conservation areas, which the Project will avoid). Because the survey does not come close to any shorelines, it is would not be expected to interact with coastal VECs such as Important Birds Areas, or traditional aboriginal resource use.

In terms of mitigations, the survey will observe the applicable mitigations and practices contained in the "Statement of Canadian Practice with respect to the Mitigation of Seismic Sound in the Marine Environment" in order to minimize impacts on life in the oceans. GXT expects to include biological and resource experts (Marine Mammal Observer / Fisheries Liaison Officer) to represent and assist with marine mammal, seabird, fisheries matters, and Nunatsuiavut interests.

As noted above, both ships are fully MARPOL compliant, and have oil spill /pollution prevention certificates and local emergency response plans. These include the following:

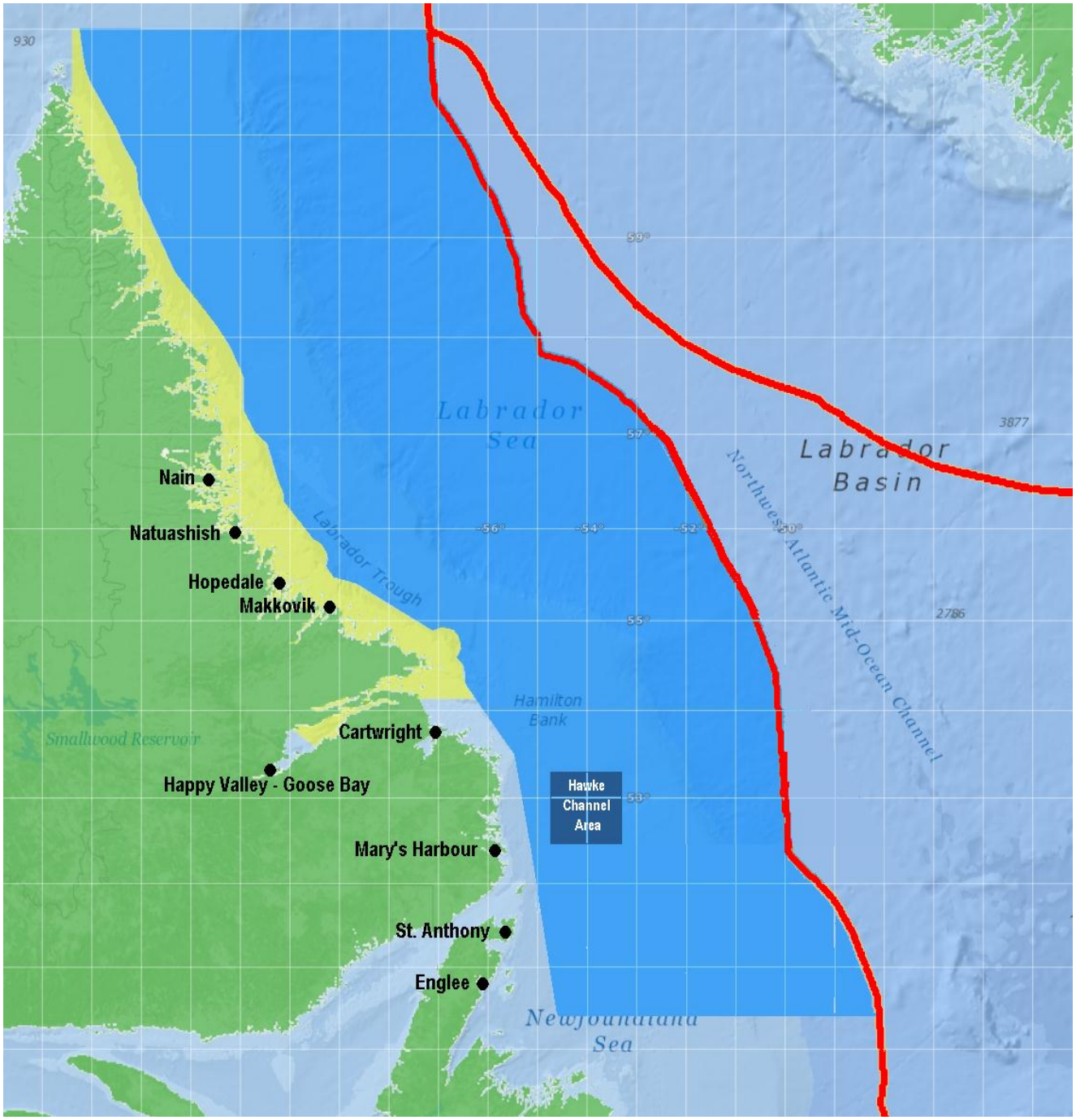
- International Air Pollution Prevention Certificates
- Shipboard Oil Pollution Emergency Plans (SOPEP)
- International Oil Pollution Prevention Certificates (IOPP)
- Certificate of Compliance for Shipboard Incinerators
- International Sewage Pollution Prevention Certificates

Both ships will also have all required Protection and Indemnity (P&I) insurance.

Although regional ice conditions can generate potential impacts of the environment on marine projects, given the LabradorSPAN Project timing and the availability of the icebreaker support ship, this is not expected to be an issue for the survey.

Appendix

1. **Project Area Map**
2. **Ship Information: *Harrier Explorer***
3. **Ship Information: *Polar Prince***
4. **Seismic Array Additional Information**



Project Area Map: NL Project Area (blue), EEZ Limit (red) and Nunatsiavut Marine Zone (yellow)

Harrier Explorer Vessel Information

SeaBird Exploration

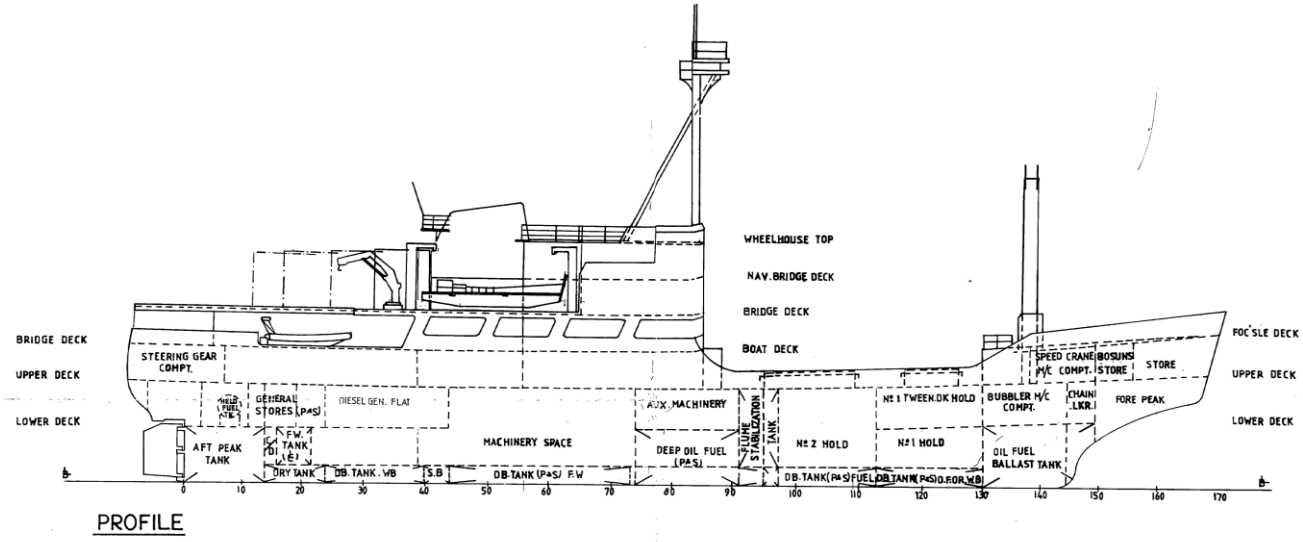
Name:	M/V Harrier Explorer
Call Sign:	3EIE3
Flag:	Panama
Type:	Seismic Survey Vessel
Built:	1979
Converted:	SUPPLY-SOURCE/2D Netherlands 2007
Home port:	Panama
Owner:	Harrier Navigation Company Ltd.
Classification:	Research Vessel
Length overall:	81.26 metres
Beam:	18.3 metres
Draft:	5.8 metres
Gross Tonnage:	4009
Net Tonnage:	996
Cruising Speed:	10.5 knots
Cruising Range:	23000 nautical miles
Fuel Capacity:	1260 m^3 - (FO/HFO)
Fuel Consumption:	15.5 ton/day in 2D op
Fresh water capacity:	336 m^3
Fresh water consumption:	10 - 12 m^3/day

DailyFreshwater Maker/Production:	2 x ENWA MT 20TSRH / 18m³ / day
Endurance:	Cruising: 90 days; Seismic: 60 days
Accommodation:	47 persons
Propulsion	Nohab F212V-D720 Twin pitch propellers 2 x 1960KW
Main Engines / Generators:	2 Main Engines A/E 1: AvK, 460 kW A/E 2: AvK, 390 kW A/E 3: Leroy Somers / Partner Alternators, 424 kW Shaft generators: 2 X Siemens, 810 kW each
Propeller:	Ulstein
Bow Thruster:	2x Bow - Ulstein AS 90TV 370KW 1x Aft - Ulstein AS150TV 590KW
Cranes:	1x Z-Martine AS 1600-50 SWL 5t /16m 1x Palfinger PK-10500M SWL 0.984t / 9.6m
Incinerator:	1x TeamTec OGS 4000 / Capacity 500 kW
GMDSS:	A3
Additional radio sets:	3 x NAVICO AXIS -250 20 x Motorola G0 340 1 x Dittel FSG-2T 9 (Portable Helicopter VHF)
Radars:	1 Furuno S – Band FAR 2117 1 Furuno X – Band FAR 2137S
GPS Navigator:	2 x Furuno GP – 150
Gyro Compass: Bridge Gyro Compass: Autopilot:	Cassens & Plath Type III SIMRAD Robertson RGSC 12 Robertson AP9 MK3 Compass repeater - Tokimec
Speed Log:	1xFuruno DS80
Echo sounder:	1x Skipper GDS-101
Navtex/weather fax:	1x Furuno NX 700
Weather station	Shore Connection
Video Monitoring system:	CCTV – Radio Holland
Internal telephone/PA:	Vingtor VMP 430 / Vingtor VMP 603
Inmarsat C:	1x Furuno – FELCOM 15 1x Sailor DT-4646E
Data Modem:	Vsat GIS/MTN 320kbs
Norsat C	

Helideck	CAP 437, BSL D 5-1 and HCA req. for Offshore Helidecks. Maximum “D” value: 20.9 (single rotor) Maximum take-off weight: 12.8 t

Life Boat:	None
Life Rafts:	6 x 25 persons
MOB raft	1 x 6 persons
Rescue Boat:	1 x 12 man (Jet boat) Norsafe “Magnum 750”
Work Boat	1 x 6 man Norpower 22
Emergency radios:	3 Sailor RT - 2048
Life Boat radios:	GMDSS – Marconi Marine - 3
Fire pump:	2 - 120m³/h 10Bar
Emergency fire pump:	1
Fire Extinguisher:	75
CO2 System:	1
Streamer reel fire fighting:	FM200 Foam System
Storage reel fire fighting:	FM200 Foam System
Fire suits (BA-sets):	2 x Draaeger 2 x Unitor
Air compressor:	1
Smoke hoods:	47 x Sundstrom SR77-2
Line thrower:	Pains Wessex - 3
Survival suits:	64 Sterns and Viking
Life vests:	113
Life rings:	15
Work floating vest:	18 Crewsaver
Gas monitor:	1 Drager, 1 MSA , HL 2
Medical Equipment:	Complete Hospital
Resuscitators:	2

Polar Prince Vessel Information



GENERAL VESSEL PARTICULARS

Built: 1959
Major refit 1985

Owners: GX Technology Canada Ltd. Calgary Alberta
Flag: Canada
Certification: Transport Canada Marine Safety & DNV
Length: 67.06 m
Breadth: 15 m
Draft: 5 m
Freeboard: 1.6 m
Gross Tonnage: 2152 Tonnes
Net Tonnage: 613 Tonnes
Cruising Speed: 11 kts
Max. Speed: 14.5 kts
Compliment: 52 souls
Helicopter flight deck with retractable hanger

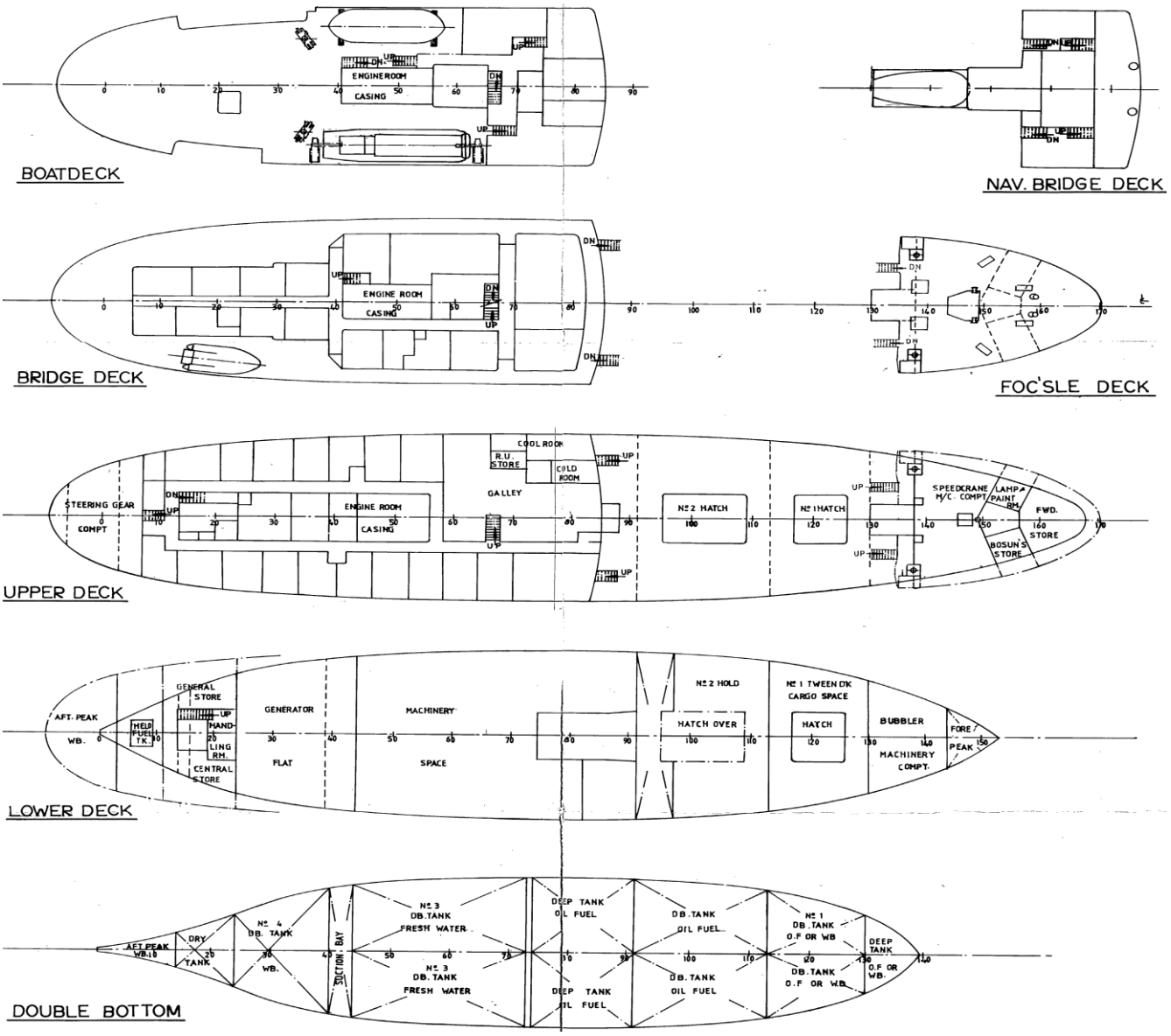
CARGO:

Hold 1: 427.84 m^3 Hatch 1: 5.5 x 3.5 m
Hold 2: 473 m^3 Hatch 2: 5.5 x 5.5 m
Hatch covers: MacGregor patent folding covers

ENGINEERING:

Propulsion: Diesel Electric driving 2 fixed pitch propellers
Power: 3820 k Watts (5123 hp)

Engines: 4 Morse-Fairbanks 38 D 8 1/8 Diesels
Service Generators: 3 Caterpillar 3408
Emergency Generators: Deutz A6 M816
Bubbler: Caterpillar 3512 DI
Steering: Single rudder mounted between propellers
Bubbler system can be used as a bow thruster



CAPACITY:

DIESEL OIL CAPACITIES	
COMPARTMENT	98% FULL CUBIC METERS
FWD. DEEP TANK	99.87
NO. 1 DOUBLE BOTTOM (P)	26.93
NO. 1 DOUBLE BOTTOM (S)	26.93

NO. 2 DOUBLE BOTTOM (P)	50.32
NO. 2 DOUBLE BOTTOM (S)	50.32
FLUME TANK UPPER	75.86
FLUME TANK LOWER	69.02
DEEP TANK (P)	131.62
DEEP TANK (S)	132.3
SETTLING TANK (P)	16.93
SETTLING TANK (S)	16.25
EMERGENCY GEN. TANK	0.47
F.O. DAY TANK (P)	2.32
F.O. DAY TANK (S)	2.32
TOTAL	701.46

WATER BALLAST CAPACITIES	
COMPARTMENT	100% FULL CUBIC METERS
FORE PEAK	60.37
FWD DEEP TANK	101.91
NO. 1 DOUBLE BOTTOM (P)	27.5
NO. 1 DOUBLE BOTTOM (S)	27.5
FLUME TANK UPPER	77.41
FLUME TANK LOWER	70.43
NO. 4 DOUBLE BOTTOM	50.74
AFT PEAK	80.76
TOTAL	496.62

FRESH WATER CAPACITIES	
COMPARTMENT	100% FULL CUBIC METERS
FLUME TANK UPPER	77.41
FLUME TANK LOWER	70.43
NO. 3 DOUBLE BOTTOM (P)	71.92
NO. 3 DOUBLE BOTTOM (S)	71.92
WB TANK AFT	16.82
NO. 4 DOUBLE BOTTOM	50.74
TOTAL	359.24

CARGO CAPACITIES	CUBIC METERS
NO. 1 TWEEN DECKS	246.47
NO. 1 HOLD	181.37
NO. 2 HOLD	473
TOTAL	900.84

MISC TANKS	
COMPARTMENT	98% FULL CUBIC METERS
HELICOPTER FUEL TANK	5.15
LUBE OIL 218 GAL (P)	0.97
LUBE OIL 1050 GAL (P)	4.62
LUBE OIL 1050 GAL (S)	4.62
LUBE OIL 314 GAL (P)	1.36
LUBE OIL 314 GAL (S)	1.36
BUBBLER DAY TANK	2.04
TOTAL	20.12

STORES & PROVISIONS	
COMPARTMENT	CUBIC METERS
COOL ROOMS (UPPER DK)	26.96
COLD ROOM (UPPER DK)	14.27
HANDLING ROOM (LOWER DK)	6.37
GENERATOR (P) (LOWER DK)	61.11
CENTRAL STORE (S) (LOWER DK)	78.64
R.O. STORE (UPPER DK)	7.25
LAMP-PAINT RM. (UPPER DK)	22.43
BOSUN'S STORE (UPPER DK)	22.43
FWD STORE	61.5
TOTAL	300.96

NAVIGATION ELECTRONICS:

GYRO COMPASS: Sperry mark 37 mod D and mark 37 mod D E
Magnetic compass
GPS: Trimble Navigation NT 200D GPS
Furuno GPS Navigator GP-150
Full GMDSS suite for sea area A3
AIS: JRC JHC 182
RADAR: S band: Sperry Rascar -29 CP
X band: Sperry 4016 X-59 CP
ARPA: Sperry Rascar

LIFTING GEAR:

HIAB 180 Seacrane mounted between hatch No. 1 and hatch No. 2 SWL 10 – 1 Tonne
HIAB 180 Seacrane mounted on stbd boat deck SWL 10 – 1 Tonne
Tugger winch port side aft of No. 2 hatch

GROUND TACKLE:

Forward windlass: two 2T Byers Improved anchors
Aft windlass: 0.5 T Byers Improved anchor on wire rope
Spare anchor: 2T Byers Improved anchor

Seismic Array Additional Information

General Specifications	
Size of total array (in^3 and PSI for the entire array)	Total volume: 6300 in^3. The array consists of four sub-arrays, with a nominal firing pressure of 2000 PSI.
Firing rate in shots/sec	Maximum shot rate of two per minute given a 22 second Rec length. The arrays will fire four sub arrays on each shot.
Far field pressure signature of total airgun output	See Figure A below
Frequency spectrum of the far field airgun signature (broadband) (provide figure)	See Figure B below.
Source level (source factor) of airgun array on acoustic axis below array	
dB re 1 μPa peak-peak (broadband)	264.3 dB re 1 μPa
dB re 1 μPa rms (Over 90%* pulse duration) *as defined in Malme *et al.*, 1986; Blackwell *et al.*, 2004	242.3 dB re 1 μPa (duration is 0.1788 s)
dB re: 1 μPa^2s. per pulse	235.3 dB re 1 μPa^2s

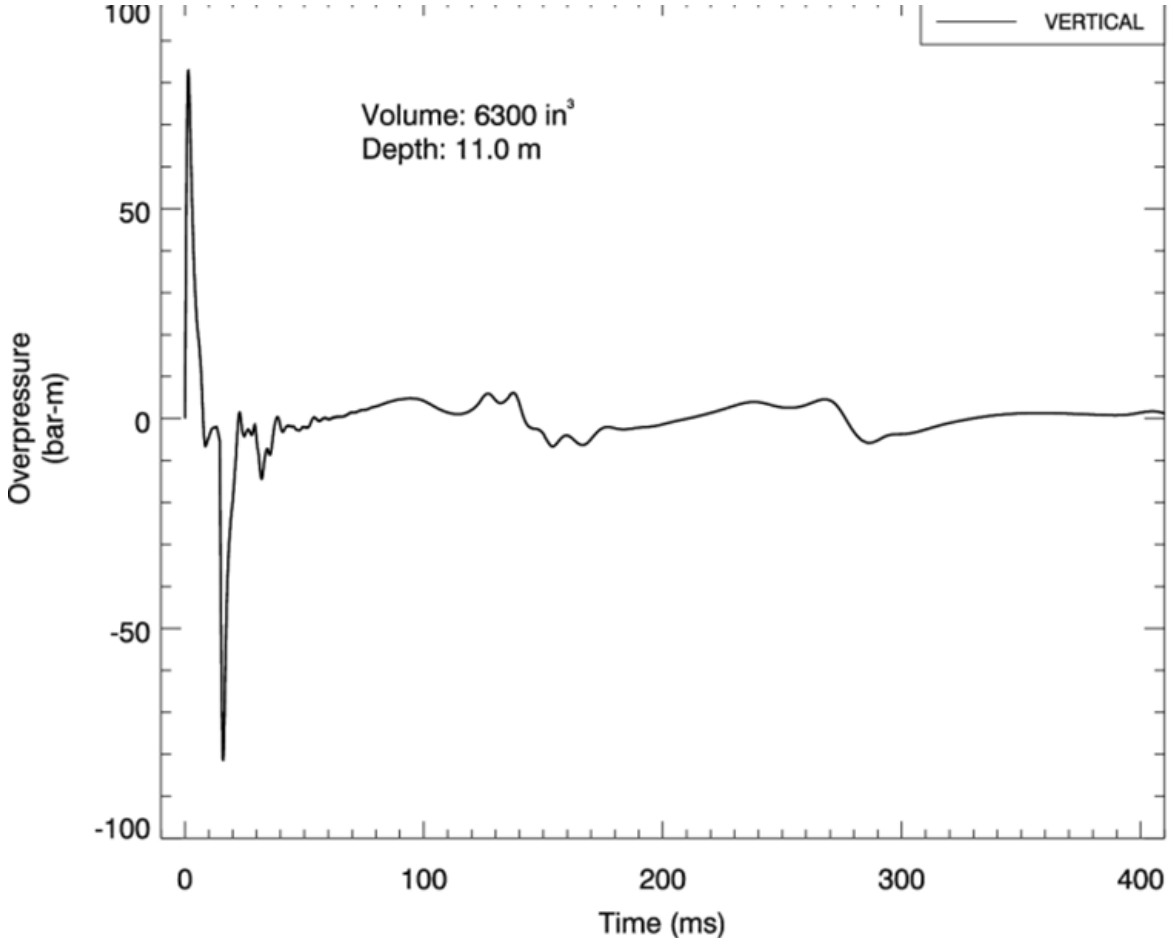


Figure A: 6300 in^3 airgun array far-field pressure signature

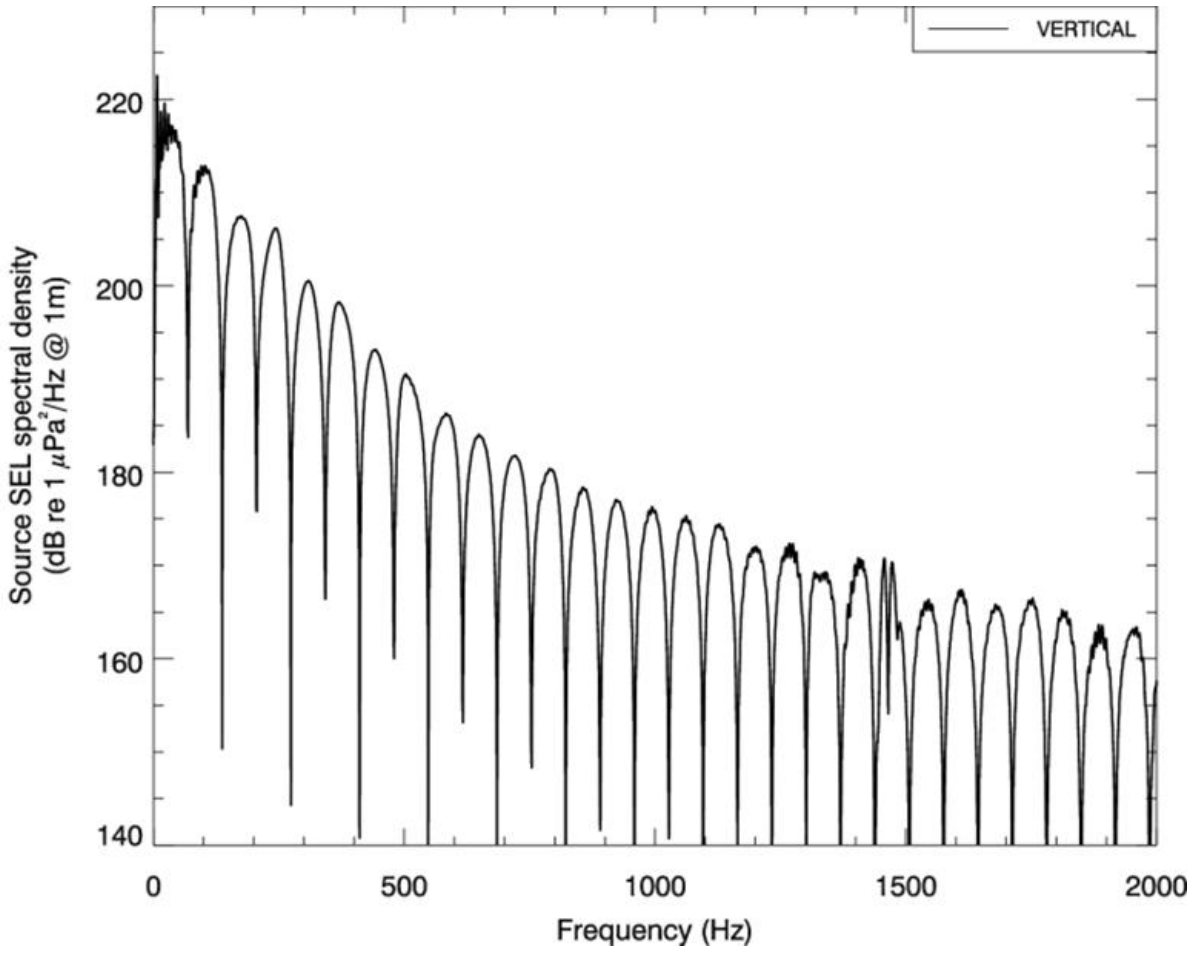


Figure B: 6300 in^3 airgun array frequency spectrum (right) including the surface ghost