

Survey data table

Specify	Description	Provided
Type of survey (2D, high resolution (3D), well testing, other)	2D Seismic Seabed sampling	Yes
Map of the area with all transect lines shown	Figure 1 Map of the NEG12 Licence Area with seismic survey lines, seabed sampling sites and protection zones. (Bellow)	Yes
Start and end dates for the survey	Start 15/08/2012 End 15/10/2012	Yes
Expected duration	Seismic = 2 Months Seabed sampling= 14 days	Yes
Duty cycle of operation (in hours/24 hours). Number of hours in the dark per 24 hours.	24 hour operations 15/08/2012= 8hrs of dark 15/10/2012=15 hours of dark	Yes
Intended use of icebreakers Will survey be carried out in ice?	Yes Ice is expected in considerable areas of proposed survey area.	Yes

Array Specifications

Specify	Description	Provided
Number and names of vessels towing airgun arrays.	1 seismic source vessel <i>M/V Akademik Shatiskiy</i>	Yes
For each vessel provide geometric layout of complete airgun array with individual volume specified (in PSI per airgun and in ³ per airgun).	See Figure II; Figure III and Table I. Pressure in equal in all guns and set to 2000 PSI	Yes
Size of total array (In ³ and PSI for the entire array)	Primarily 3350 in ³ (16 Guns) Optional 5025 in ³ (24 Guns)	Yes
Firing rate in shots/sec Will sub arrays fire simultaneously or alternate?	1/10s 25m per shot 5knt towing speed Single stream most likely scenario.	Yes
Operation speed of vessel in km/hour or knots	5 knots	Yes

Acoustic properties of the airgun array

Specify	Description	Provided
Far field pressure signature of total airgun output (provide figure)	Figure IV Spectrum for far field signature for 3350 in ³ array.	Yes
Frequency spectrum of the far field airgun signature (<u>broadband</u>) (provide figure)	Figure VI Frequency spectrum of produced signals	Yes
Source level (source factor) of airgun array on acoustic axis below array, given in all of the following units:		
dB re 1 μ Pa zero-peak	258 (5025 cu in) 254 (3350 cu in)	Yes
dB re 1 μ Pa peak-peak (<u>broadband</u>)	264 (5025 cu in) 260 (3350 cu in)	Yes
dB re 1 μ Pa rms (Over 90%* pulse duration) (<u>provide duration for rms calculation</u>) *as defined in Malme <i>et al.</i> , 1986; Blackwell <i>et al.</i> , 2004	241 db re 1 uPa rms	Yes
dB re: 1 μ Pa ² s. per pulse	235 db re. 1 μ Pa ²	Yes
Energy, joule/m ² per airgun pulse	Figure VII Cumulative energy flux per pulse	Yes
Signal duration. (Define how it is measured)	400msec (peak response over less than 30 msec)	Yes (see Figure IV and Figure V)

<p>Map showing modelled sound pressure levels (rms*), peak-peak and sound exposure levels ($\mu\text{Pa}^2\text{s}$) for the survey area and surroundings (to levels likely to affect marine mammals or nearest land)</p> <p>*Rms calculated by the 90% energy approach for derivation of the duration (Malme <i>et al.</i>, 1986; Blackwell <i>et al.</i>, 2004).</p>	<p>Refer to Appendix 1 noise modelling report.</p>	
<p>Provide description of the noise propagation model, including assumptions of sound speed profiles.</p>	<p>The noise propagation model was produced by a ray/beam tracing method called BELLHOP.</p> <p>Actual bathymetric data was used with assumptions of sediment types made using best available geological data.</p> <p>Ice cover was assumed and as specific details on type of ice roughness/smoothness is not available at present, smooth ice was presumed as a worst case scenario.</p> <p>Full details presented in Appendix 1 noise modelling report.</p>	

Specification of PAM system

Specify	Description	Provided
Number of hydrophones	4 wide band omni-directional hydrophones in a single array.	Yes
Threshold of the recording system	This is user defined	Yes
Sample rate of the recording system	Using an National Instruments card with an M-Audio interface the sample rate will be approximately 500 ksa/s.	Yes
Where will hydrophones be placed	A single stream will be deployed at approximately 150-200m from the stern and 8-12m depth.	Yes
Will there be duty cycling of recordings In that case when will the PAM system be used.	PAM recording will be undertaken in accordance with local guidance. At the very least it will be used to undertake pre-firing watches during periods of poor weather (more than sea state 3) and times of darkness.	Yes
Name of software	PAMguard Ishmael (as back-up)	Yes

Specification of PAM system

Species covered	Samples at frequencies up to 200kHz so all cetacean acoustic signals recordable.	Yes
Estimated range of accuracy, m.	50m depending on conditions	Yes

Figures:

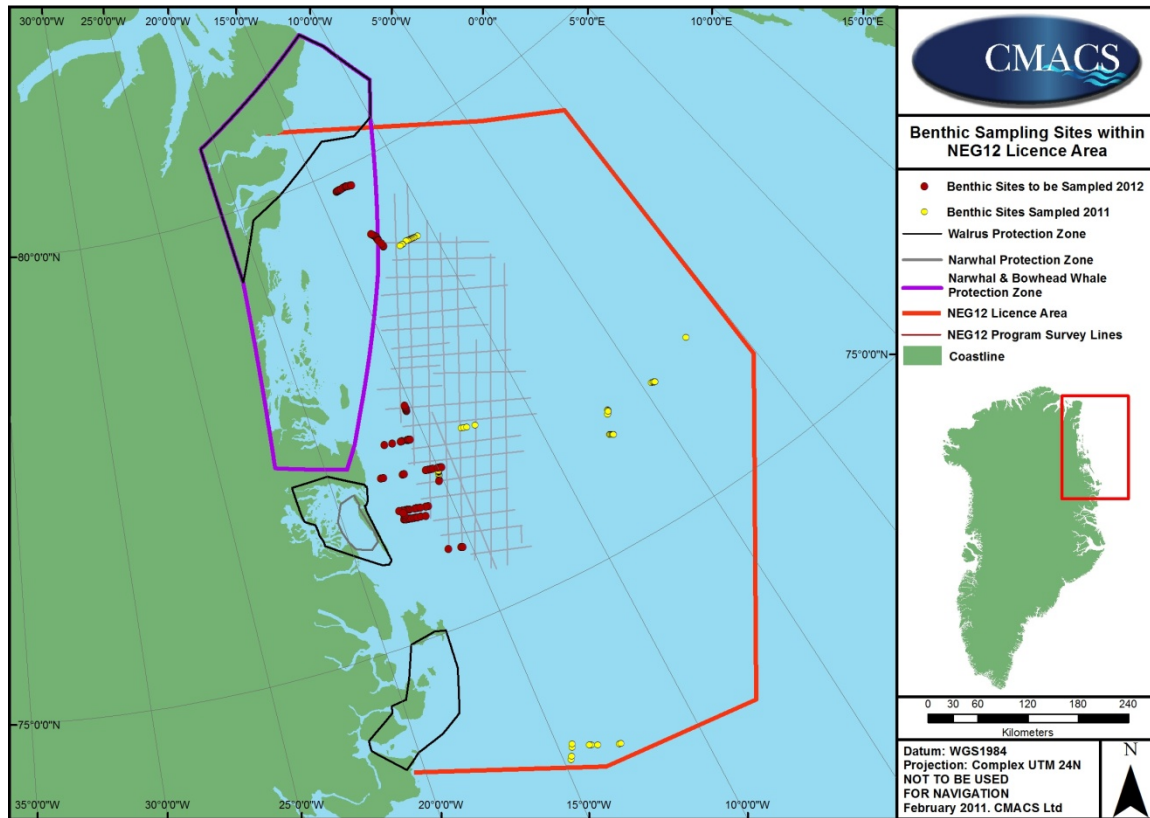
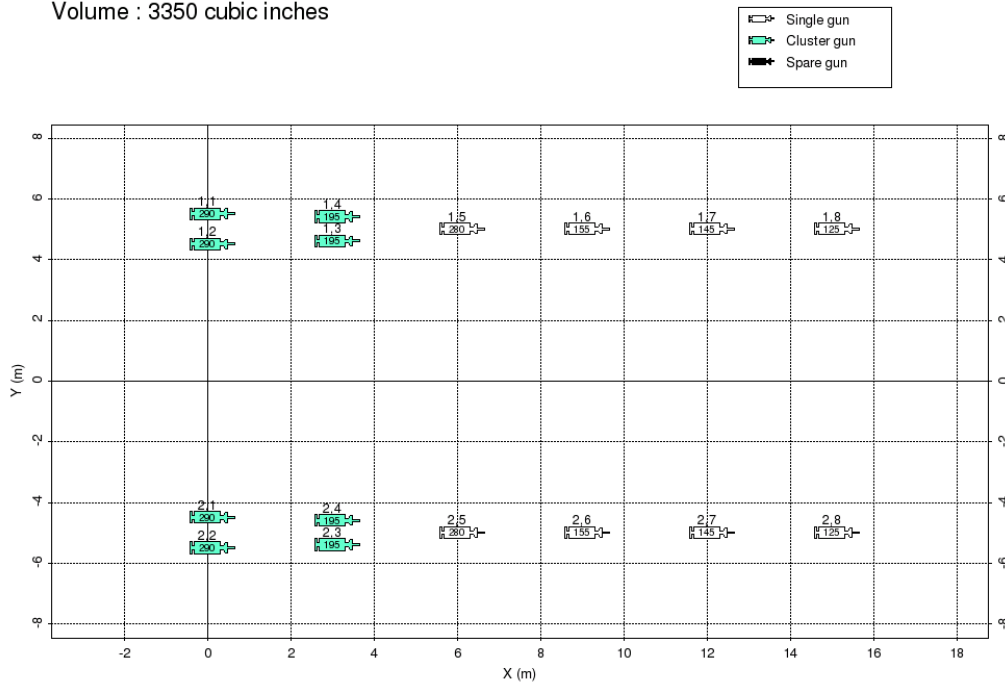


Figure I Map of the NEG12 Licence Area with seismic survey lines, seabed sampling sites and protection zones.

Array : 3350BLX_00_2000_05

Volume : 3350 cubic inches

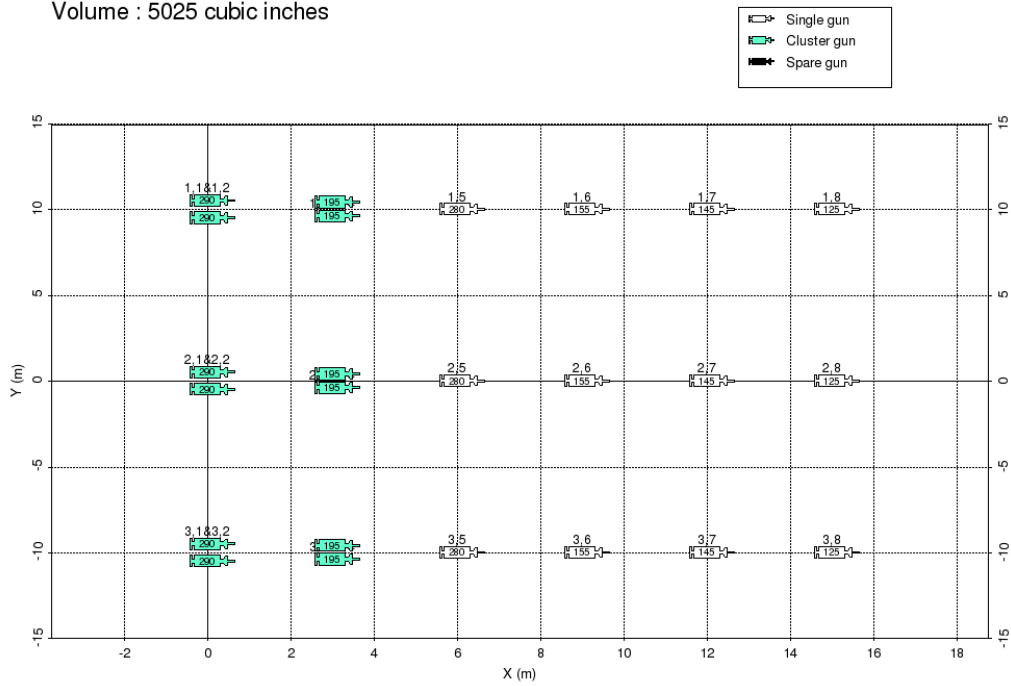


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Figure II Gun layout for the 3350 in³ array.

Array : 5025BLX_00_2000_10

Volume : 5025 cubic inches



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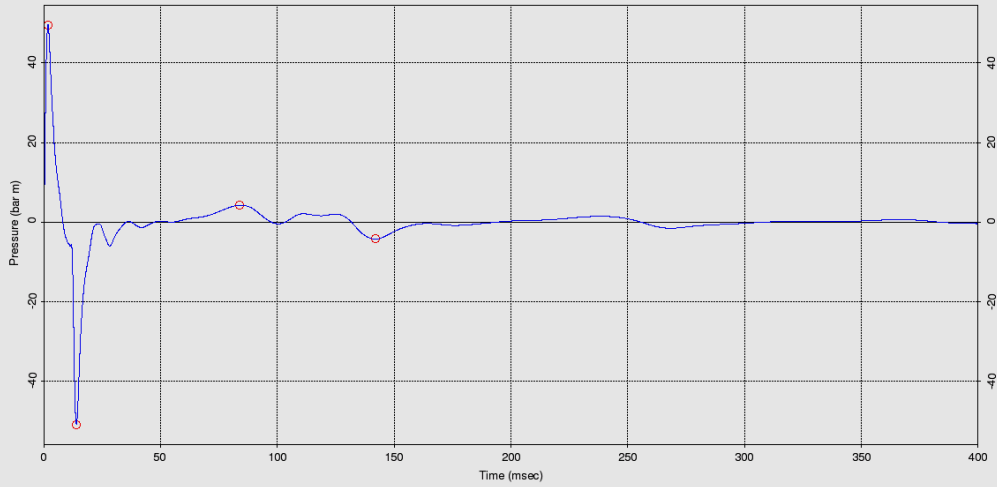
Figure III Gun layout for the 5025 in³ array.

Table I Individual gun volumes

Gun	Volume (in ³)
String 1 (3350 in ³ and 5025 in ³)	
1.1	290
1.2	290
1.3	195
1.4	195
1.5	280
1.6	155
1.7	145
1.8	125
String 2 (3350 in ³ and 5025 in ³)	
2.1	290
2.2	290
2.3	195
2.4	195
2.5	280
2.6	155
2.7	145
2.8	125
String 3 (5025 in ³ only)	
3.1	290
3.2	290
3.3	195
3.4	195
3.5	280
3.6	155
3.7	145
3.8	125

Farfield signature : 3350BLX_00_2000_05

Distance: 9000 m	P/B ratio: 11.8	Volume : 3350 cu.in	Water temp. : 5.00 C	Peak-peak : 100.4 bar m
Dip: 0 deg	Geom. spr. : 2.00	Pressure : 2000 psi	Source depth : 9.00 m	Water velocity : 1470.9 m/s
Azimuth: 0 deg	Filter: Unfiltered	Primary : 49.6 bar m	Ghost strength : -1.00	Period (+/-) : 82.1/128.0 msec

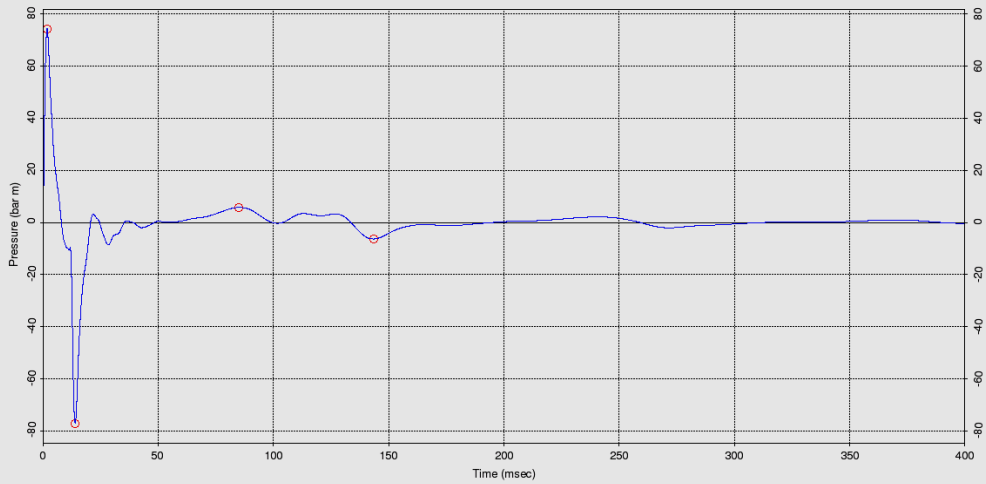


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Figure IV Spectrum for far field signature for 3350 in³ array.

Farfield signature : 5025BLX_00_2000_10

Distance: 9000 m	P/B ratio: 12.5	Volume : 5025 cu.in	Water temp. : 5.00 C	Peak-peak : 151.5 bar m
Dip: 0 deg	Geom. spr. : 2.00	Pressure : 2000 psi	Source depth : 9.00 m	Water velocity : 1470.9 m/s
Azimuth: 0 deg	Filter: Unfiltered	Primary : 74.3 bar m	Ghost strength : -1.00	Period (+/-) : 83.1/129.5 msec



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Figure V Spectrum for far field signature for 5025 in³ array

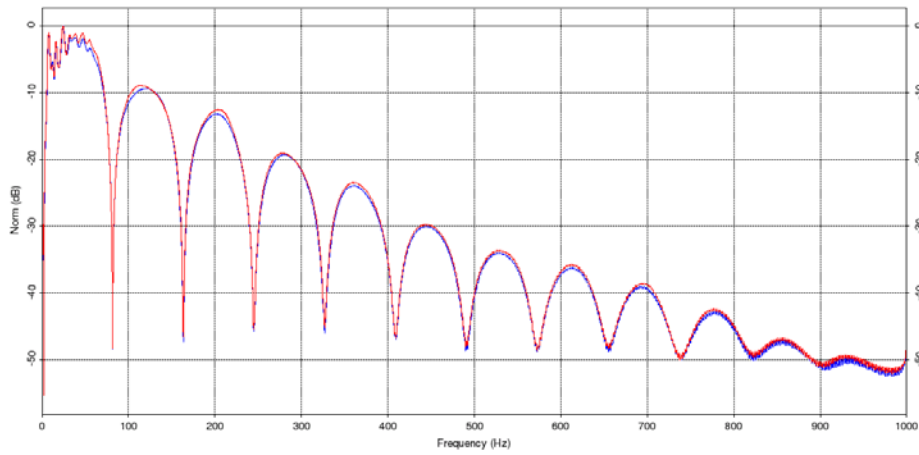
Signature comparison

Farfield signature : 3350BLX_00_2000_05

Farfield signature : 5025BLX_00_2000_10

Distance: 9000 m Dip: 0 deg Azimuth: 0 deg Geosp: 2

Distance: 9000 m Dip: 0 deg Azimuth: 0 deg Geosp: 2



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Figure VI Frequency spectrum of produced signals

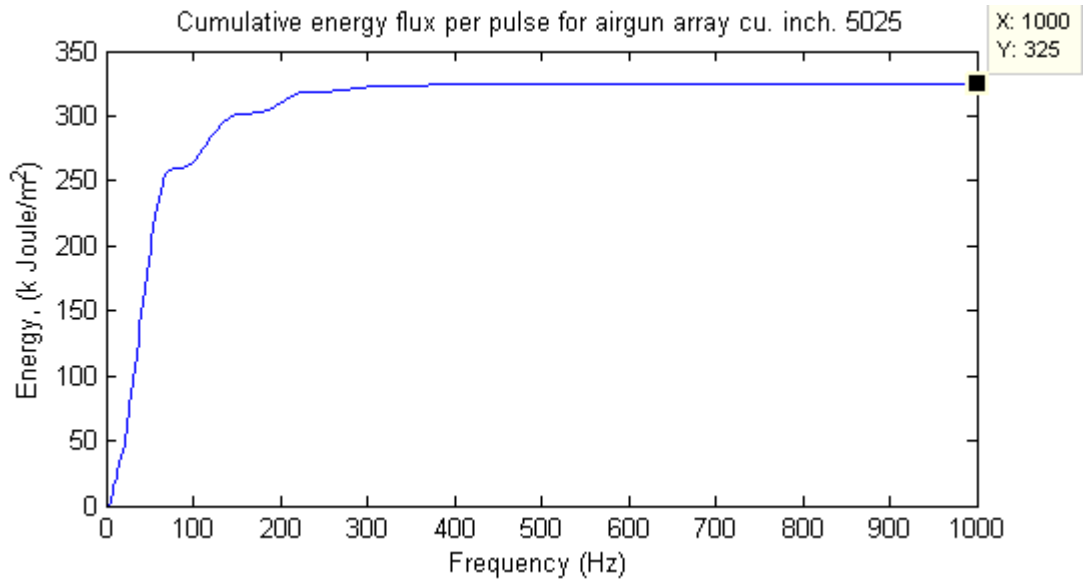


Figure VII Cumulative energy flux per pulse