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 I Map of the SWG13 License Area with seismic survey lines, and protection zones. (Bellow)	Yes
Start and end dates for the survey	Start 01/06/2013 End 15/10/2013	Yes
Expected duration	Seismic = 2 Months (60 days) Seabed sampling= 2 Months	Yes
Duty cycle of operation (in hours/24 hours). Number of hours in the dark per 24 hours.	24 hour operations 01/06/2013= 3hrs of dark 15/10/2013=15 hours of dark	Yes
Intended use of icebreakers Will survey be carried out in ice?	No Ice is not 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 M/V *Akademik Shatiskiy* or equivalent	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; and Table I. Pressure is equal in all guns and set to 2000 PSI	Yes
Size of total array (In^3 and PSI for the entire array)	3680 in^3 (28 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 III Spectrum for far field signature for 3350 in3 array.	Yes
Frequency spectrum of the far field airgun signature (broadband) (provide figure)	Table II 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 µPa zero-peak	257 (3350 cu in)	Yes
dB re 1 µPa peak-peak (broadband)	263 (3350 cu in)	Yes
dB re 1 µPa rms (Over 90%* pulse duration) (provide duration for rms calculation) *as defined in Malme *et al.*, 1986; Blackwell *et al.*, 2004	238 db re 1 uPa rms (290s pulse duration for rms calculation)	Yes
dB re: 1 μPa^2s. per pulse	234 dB re. 1 μPa^2s	Yes
Energy, joule/m^2 per airgun pulse	Figure IV Cumulative energy flux per pulse	Yes
Signal duration. (Define how it is measured)	400msec (peak response over less than 30 msec)	Yes (see Figure III)
Map showing modelled sound pressure levels (rms*), peak-peak and sound	Refer to Appendix 1 noise	

exposure levels (µPa^{2}s) for the survey area and surroundings (to levels likely to affect marine mammals or nearest land) *Rms calculated by the 90% energy approach for derivation of the duration (Malme *et al*., 1986; Blackwell *et al.*, 2004).	modelling report.	
Provide description of the noise propagation model, including assumptions of sound speed profiles.	The noise propagation model was produced by a ray/beam tracing method called BELLHOP. Actual bathymetric data was used with assumptions of sediment types made using best available geological data. 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. Full details presented in Appendix 1 noise modelling report.	

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 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 detected.	Yes
Estimated range of accuracy, m.	Detection to within 50m depending on conditions	Yes

Figures:

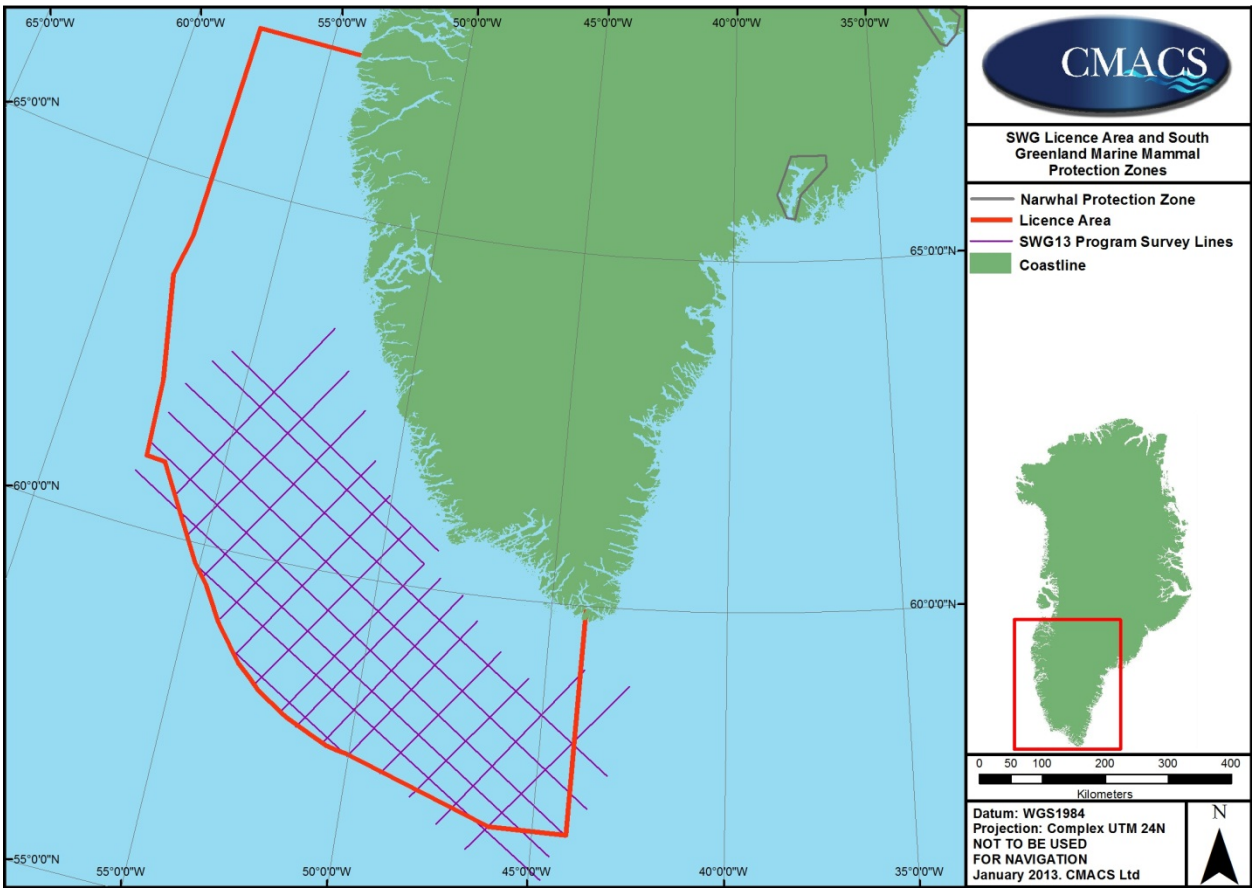

Figure I Map of the SWG13 License Area with seismic survey lines and protection zones.

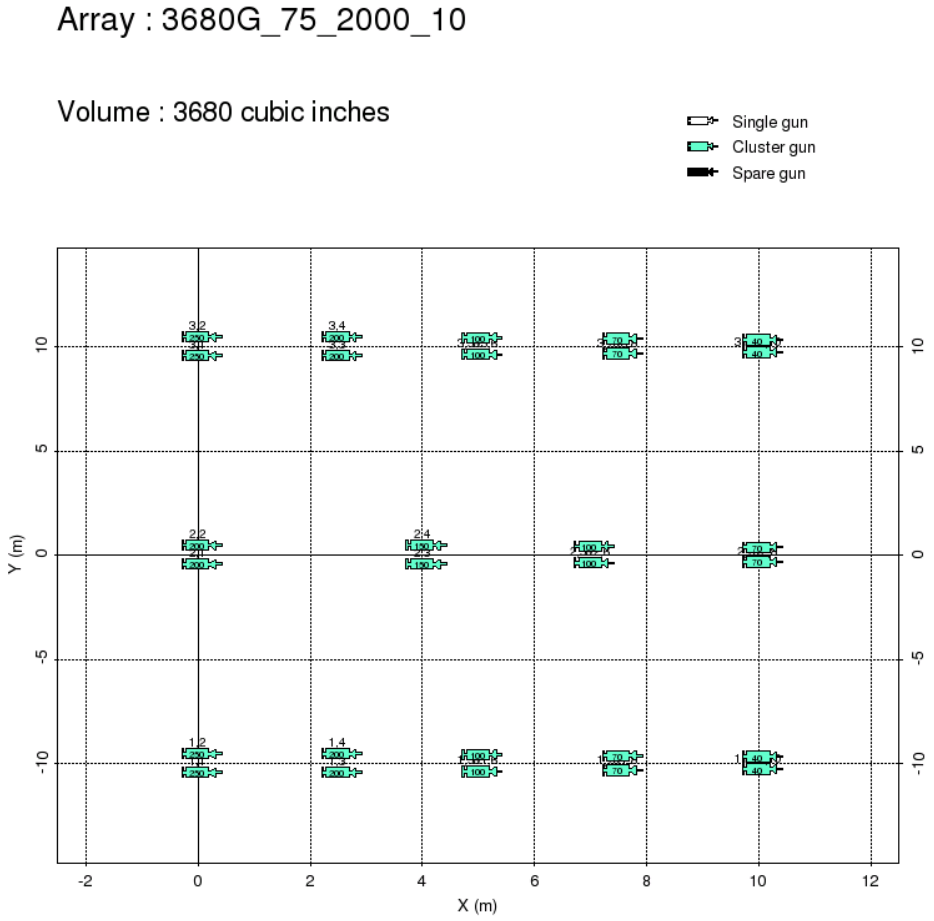

Figure II Gun layout for the 3680 in^3 array.

Table I Individual gun volumes

String 1		String 2		String 3	
Gun	Volume (in^3)	Gun	Volume (in^3)	Gun	Volume (in^3)
1.1	250	2.1	200	3.1	250
1.2	250	2.2	200	3.2	250
1.3	200	2.3	150	3.3	200
1.4	200	2.4	150	3.4	200
1.5	100	2.5	100	3.5	100
1.6	100	2.6	100	3.6	100
1.7	70	2.7	70	3.7	70
1.8	70	2.8	70	3.8	70
1.9	40			3.9	40
1.10	40			3.10	40

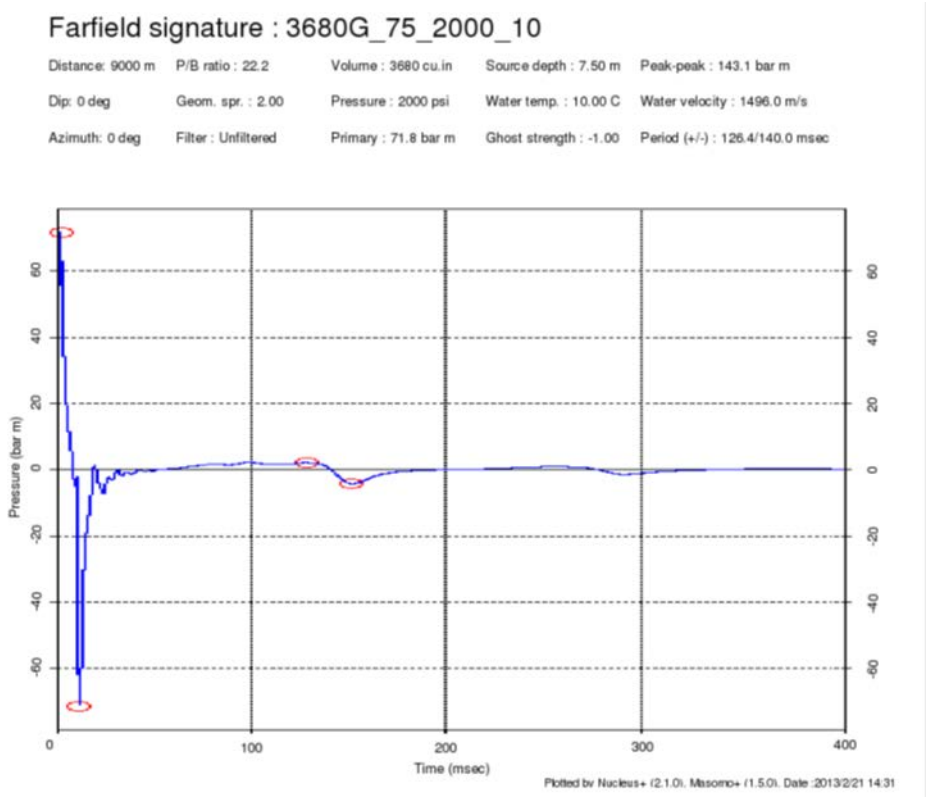

Figure III Spectrum for far field signature for 3350 in^3 array.

Table II: SPLpeak-peak values for the different frequency bands for the 3680 cubic inch airgun array.

			3680 cubic inches
Frequency band	Representative frequency	Frequency range of band	$SPL_{peak-peak}$ [dB re. 1 µPa @ 1 m]
1	25 Hz	1 Hz – 37 Hz	248 dB
2	50 Hz	37 Hz – 75 Hz	252 dB
3	100 Hz	75 Hz – 150 Hz	248 dB
4	200 Hz	150 Hz – 300 Hz	250 dB
5	400 Hz	300 Hz – 500 Hz	244 dB
6	600 Hz	500 Hz – 700 Hz	234 dB
7	800 Hz	700 Hz – 900 Hz	228 dB
8	1000 Hz	900 Hz – 1000 Hz	217 dB
9	Broadband	1 Hz – 1000 Hz	263 dB

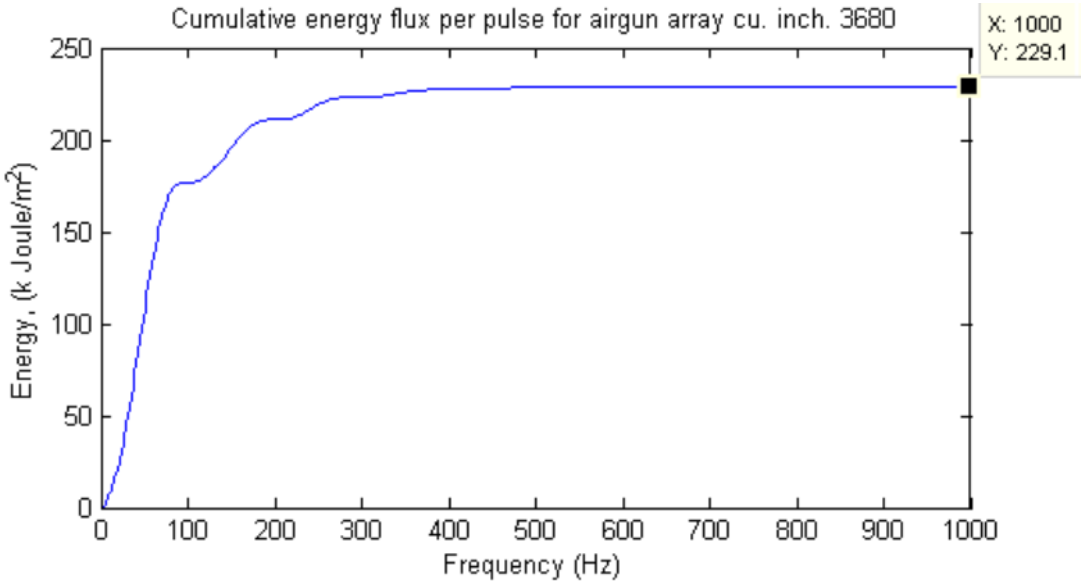

Figure IV Cumulative energy flux per pulse for airgun array 3680 cubic inches.

Additional information requested

- The target depth (m below the seabed) for the survey will be between 500 and 10,000m.
- Transect line spacing will be between 31 and 66km
- Expected continuous duration of the survey is two months (60 days)
- A total of one hydrophone streamer will be used (spacing therefore n/a)
- Streamer cable will be fluid filled
- The depth at which the streamer will be towed is between 8 and 12m