



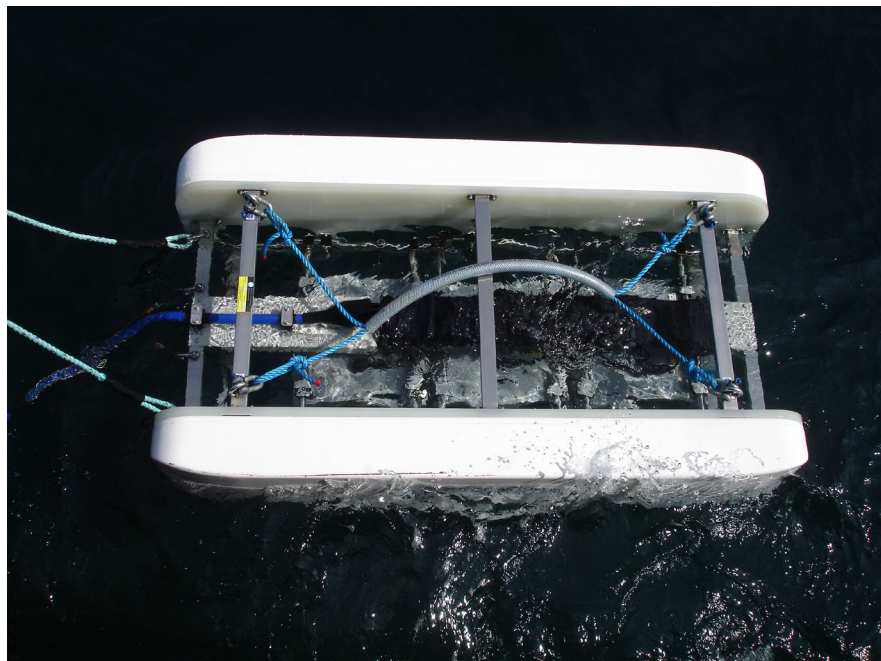
**British
Geological Survey**

NATURAL ENVIRONMENT RESEARCH COUNCIL

Surface Tow Boomer over Mingulay Reef

Marine Operations

Internal Report OR/13/033



BRITISH GEOLOGICAL SURVEY

MARINE OPERATIONS PROGRAMME

OPEN REPORT OR/13/033

Surface Tow Boomer over Mingulay Reef

David Wallis

The National Grid and other Ordnance Survey data are used with the permission of the Controller of Her Majesty's Stationery Office.
Licence No: 100017897/2005.

Keywords

Boomer, Mingulay

Front cover

BGS Surface Towed Boomer

Bibliographical reference

WALLIS, D. 2013. Surface Tow Boomer over Mingulay Reef. *British Geological Survey Internal Report*, OR/13/033. 34pp.

Copyright in materials derived from the British Geological Survey's work is owned by the Natural Environment Research Council (NERC) and/or the authority that commissioned the work. You may not copy or adapt this publication without first obtaining permission. Contact the BGS Intellectual Property Rights Section, British Geological Survey, Keyworth, e-mail ipr@bgs.ac.uk. You may quote extracts of a reasonable length without prior permission, provided a full acknowledgement is given of the source of the extract.

Maps and diagrams in this book use topography based on Ordnance Survey mapping.

Murchison House, Edinburgh British Geological Survey
2013

BRITISH GEOLOGICAL SURVEY

The full range of Survey publications is available from the BGS Sales Desks at Nottingham, Edinburgh and London; see contact details below or shop online at www.geologyshop.com

The London Information Office also maintains a reference collection of BGS publications including maps for consultation.

The Survey publishes an annual catalogue of its maps and other publications; this catalogue is available from any of the BGS Sales Desks.

The British Geological Survey carries out the geological survey of Great Britain and Northern Ireland (the latter as an agency service for the government of Northern Ireland), and of the surrounding continental shelf, as well as its basic research projects. It also undertakes programmes of British technical aid in geology in developing countries as arranged by the Department for International Development and other agencies.

The British Geological Survey is a component body of the Natural Environment Research Council.

British Geological Survey offices

Keyworth, Nottingham NG12 5GG

☎ 0115-936 3241 Fax 0115-936 3488
e-mail: sales@bgs.ac.uk
www.bgs.ac.uk
Shop online at: www.geologyshop.com

Murchison House, West Mains Road, Edinburgh EH9 3LA

☎ 0131-667 1000 Fax 0131-668 2683
e-mail: scotsales@bgs.ac.uk

London Information Office at the Natural History Museum (Earth Galleries), Exhibition Road, South Kensington, London SW7 2DE

☎ 020-7589 4090 Fax 020-7584 8270
☎ 020-7942 5344/45 email: bgs london@bgs.ac.uk

Forde House, Park Five Business Centre, Harrier Way, Sowton, Exeter, Devon EX2 7HU

☎ 01392-445271 Fax 01392-445371

Geological Survey of Northern Ireland, Colby House, Stranmillis Court, Belfast BT9 5BF

☎ 028-9038 8462 Fax 028-9038 8461

Maclean Building, Crowmarsh Gifford, Wallingford, Oxfordshire OX10 8BB

☎ 01491-838800 Fax 01491-692345

Columbus House, Greenmeadow Springs, Tongwynlais, Cardiff, CF15 7NE

☎ 029-2052 1962 Fax 029-2052 1963

Parent Body

Natural Environment Research Council, Polaris House, North Star Avenue, Swindon, Wiltshire SN2 1EU

☎ 01793-411500 Fax 01793-411501
www.nerc.ac.uk

Foreword

This report is the published product of a study by the British Geological Survey (BGS) and SAMS into the flora and structure of a small submarine reef offshore Mingulay in the Western Isles.

Acknowledgements

Many thanks should be given to the crew of the RV Calanus who gave able assistance to the operation. In addition, the following gave much help with the organisation and who will be required to process the data onshore.

Mr David Long, BGS

Dr John Howe, SAMS

Mr Julian Rickards, Applied Acoustic Engineering

Contents

Foreword	i
Acknowledgements	i
Contents	i
Summary	ii
1 Introduction	1
2 Narrative	1
2.1 Mobilisation	1
2.2 Survey	1
2.3 DE-Mobilisation	1
3 Navigation	1
4 Geophysical Survey Equipment	2
4.1 Equipment settings	2
5 Health & Safety	3
Introduction	3
5.1 Shipboard Operations	4
5.2 Safety Drills	4
5.3 Shipboard Safety Awareness	4
5.4 Deck Operations	5

5.5	Permit to Work	5
5.6	Bridge Work or Access.....	5
5.7	Basic Safety	6
5.8	BGS 10m Hydrophone (or EG&G 265 Hydrophone)	7
6	BGS MARINE RISK ASSESSMENT FORM.....	8
6.1	10m Hydrophone streamers for Surface Tow Boomer.....	8
6.2	<i>BGS Surface Tow Boomer (STB) (This also applies to AAE S-Boom, being a similar system).....</i>	<i>10</i>
6.3	BGS MARINE RISK ASSESMENT FORM	13
Appendix 1	Track Chart.....	16
Appendix 2	Daily Log	17
Appendix 3	Personnel	20
Appendix 4	Equipment Layback Diagram	21
Appendix 5	Line Seismic Tape Log	22
Glossary.....	Error! Bookmark not defined.	

Summary

This report describes a shallow seismic survey off the Western Isles over a reef with coral growth. It is the published product of a study by the British Geological Survey (BGS), SAMS Oban, LPGN Nantes, Heriot Watt Edinburgh and Rutgers USA into the longer term history of reef growth of a small submarine reef offshore Mingulay in the Western Isles. It was conducted using the RV Calanus from Dunstaffnage.

1 Introduction

This surface towed boomer shallow seismic survey took place over a period of 4 days during mid-July 2013, although only one day involved survey operations. The survey had been planned for a number of previous occasions and been postponed/cancelled due to external circumstance such as weather. The main object was to determine the thickness and extent of the coral layers which had built up over the reef using a new version of the traditional surface towed boomer system which the manufacturer had kindly lent the project for demonstration purposes.

2 Narrative

2.1 MOBILISATION

The equipment was collected together at BGS base in Edinburgh (the S-Boom catamaran having been sent up from AAE in Great Yarmouth) and loaded onto a hire van on Monday 15th July. On Tuesday 16th July the van was driven to SAMS in Dunstaffnage and the equipment loaded onboard the RV Calanus by 1700. By 1800 the equipment had been mobilised and secured and all was prepared for departure on the following day.

2.2 SURVEY

On 17th July the RV Calanus departed SAMS and set sail for the anchorage at Vatersay. As the vessel passed through the Sound of Mull, the S-Boom and hydrophone were deployed to run a test line over a small submarine slide. This allowed confirmation that the equipment was working correctly and gave the crew a chance to refine deployment methods in calm waters.

After an overnight anchorage at Vatersay the seismic lines were run during the 18th July, with occasional pauses to allow sampling of cores from the reef. None of the sampling is described in this report. By 1800 all the proposed lines had been run and the vessel returned to the anchorage overnight.

On 19th July the RV Calanus sailed back to SAMS with no time for any survey work.

2.3 DE-MOBILISATION

This occurred on Friday 19th July at SAMS between 1700 and 1800 and was followed by the van of equipment being driven back to BGS in Edinburgh.

3 Navigation

This was conducted using differential GPS based on the IALA beacons and the navigation data string for the mainmast used as an input to the Coda DA4G seismic recording system. In addition the Hydrographic Surveyor provided a data file at the completion of the project with the ship mainmast locations for every ¼second during the survey. This secondary data file allows confirmation post-survey that positioning had been as desired.

During the survey lines the Hydrographic Surveyor also provided a helmsman display to the Bridge with the lines correctly marked and the sample data sites were logged as well.

4 Geophysical Survey Equipment

Applied Acoustic Engineering S-Boom (Surface Tow Boomer)

Sonar Equipment Services 10metre, 7 channel hydrophone

AAE High Voltage CSP2400D Power supply

CODA DA4G seismic recording system

BGS Anti-alias filter amplifier

4.1 EQUIPMENT SETTINGS

The seismic source was triggered every $\frac{1}{2}$ second at a power setting of 750 Joules. The data were recorded on the DA4G system for a length of 414ms. This followed an initial test line in the Sound of Mull with a 248ms record length.

5 Health & Safety

BGS Geoscience Resources and Facilities Directorate

Marine Operations and Engineering

Health and Safety at Sea

Guidance for Survey Operations

Project: Surface Tow Boomer on reef near Mingulay

Vessel: RV Calanus (SAMS, Dunstaffnage)

Prepared: David Wallis

BGS Team Leader: David Wallis

BGS Team: Wallis, Tsiligiannis

Introduction

This project is tasked with assisting in the survey of reef some 3 kilometres east of Mingulay by assessing the thickness of coral over the reef in water depths between 70 and 140 metres. The Calanus is available from SAMS at Dunstaffnage and the BGS team will be working to the direction of John Howe from SAMS.

The Risk Assessments for the equipment in use are given below and prior to any use of said equipment all operations will be thoroughly discussed with the personnel onboard with any final control of safety being under the control of the vessel Master.

5.1 SHIPBOARD OPERATIONS

Ships are a dangerous environment and due caution must be taken at all times when on board. Each operation and indeed each deployment of equipment is different. An operating procedure will be determined by the BGS Party Chief having regard to the circumstances obtaining at the time of operation and the personnel, which he has at his disposal, it will not necessarily be written down. However it is a BGS Health and Safety requirement that the general principles of operation for each item of equipment be written down and although no names or disciplines are put against some of the operations any untrained person operating equipment puts all in jeopardy. Similarly a trained and competent person acting without the authority and knowledge of the BGS Party Chief or other responsible person can be equally serious as operations are never quite the same from ship to ship, possibly also not the same from shift to shift on the same ship.

Please therefore be aware that any operation is never identical from day to day, even on the same vessel. Operational requirements, weather conditions and many other factors will continually change small details. All of this will be familiar to the person in charge of the shift who will ensure that any changes are made known to all on shift and at the changeover of shift if applicable.

For this cruise the BGS equipment being used is the Applied Acoustics AA300 Surface Tow Boomer, Hunttec Boomer arranges as a surface tow unit and BGS Mini Sparkarray. BGS will be responsible for all operations and they will be carried out in conjunction with the ship's personnel.

It is extremely important that oncoming personnel make themselves familiar with the operation as soon as possible after coming onboard and preferably before sailing. It may not be practicable to actually operate some of the equipment until the vessel leaves port.

Be flexible and helpful but do not compromise safety for any reason.

5.2 SAFETY DRILLS

The BGS Party Chief is responsible for ensuring that fire and emergency drills encompassing BGS personnel are carried out early on, in every cruise. Instruction via ship's officers in the practical application of fire-fighting and emergency equipment should be provided if necessary, as convenient. Supplementary safety notices may be issued.

These Drills are not a game, must be taken seriously, and all BGS staff are encouraged to assist each other and, more especially, others who may not have had as much exposure to these drills as we have had.

5.3 SHIPBOARD SAFETY AWARENESS

This is a reminder of some of the main safety issues in Marine Operations. They may be updated during the cruise by the BGS Party Chief with regard to the requirements or particulars of the vessel and at no time substitute for the vessel safety instructions which are to form part of these guidance notes.

BOARD OR LEAVE THE VESSEL ONLY BY AN AUTHORISED ACCESS.

5.4 DECK OPERATIONS

All deck operations on board a vessel must be considered as having a MEDIUM RISK attached to them, even after all precautions have been taken. This allows for the fact that the weather and other prevailing conditions can be subject to large fluctuations at short notice and the operation has to take care of this.

Always wear a harness and lifejacket for all operations conducted at or over the ship's side whether there is a rail present or not – this is a HIGH RISK situation.

The deck operation is dangerous if proper care is not exercised. Become fully conversant with the techniques of each operation, which emergency or control switches operate each item of equipment, which winches operate each wire and when and which cables carry power, hydraulic fluid or air. Ensure that it is safe to go on to the deck and always be aware of a safe place to move to if necessary. Do not walk over loose ropes or cables and never step into loops of cable or a serious leg injury, or worse, could result. Inform the BGS Party Chief of any additional safety precautions you wish to be taken or any you see being ignored.

5.5 PERMIT TO WORK

Onboard all vessels there is a requirement to inform the Bridge when any operation not normally carried out as part of the ongoing survey operation is required. Such work usually involves repair to, or modification of, equipment and may involve use of soldering, welding equipment, grinders, high voltage, etc. It is important that a permit to work be obtained and to ensure that any fire alarms or detectors are isolated for the period of work. Upon completion of the work the permit must also be signed off.

5.6 BRIDGE WORK OR ACCESS

The Bridge is not normally 'open access' to BGS and proper protocol should be observed to gain admission. This is likely to be informal but don't assume you have a right to be there. On this survey there is only a limited amount of accommodation, including the helmsman's position and BGS personnel are instructed to keep well out of the helmsman's way, especially when manoeuvring near shore.

Normally considered to be the safest position on the vessel it nevertheless has potential dangers, as it is the place where a large amount of ship motion can occur. Delicate and important equipment cannot simply be grabbed to avoid falling and can itself break free with the momentum of the ship's roll if not properly secured.

The range of equipment housed and operated in this environment is generally electrical and associated with the navigation/positioning, data recording, survey control and general ship management.

Activities centre on the station keeping and provision of site data/information to the deck and routine maintenance of navigation and recording equipment.

No information regarding the operation or data collected may be passed at any time other than through officially approved channels.

5.7 BASIC SAFETY

All BGS personnel have undertaken a 1 day 'Personal survival Training' course to cover survival at sea. All deck work at sea will be carried out wearing a lifejacket. Whilst the vessel is alongside the only access and egress from the vessel will be by way of the gangway.

During mobilisation, demobilisation and operations mobile phone use will be prohibited unless a necessary part of the process.

5.8 BGS 10M HYDROPHONE (OR EG&G 265 HYDROPHONE)

Description and Safe System of Operation

5.8.1 System Description

The 10m streamer has a 10m active section and 20 m tail rope giving an overall length of 30 m. Note only the 10m hydrophone will be used on this project. (The EG&G 265 is of similar dimensions so the same safety physical constraints apply.)

Each active section comprises of a series of hydrophones enclosed in a plastic boot material. The void of the active section boot is filled with Kerosene.

5.8.2 Sensor Deployment

Streamer deployment should always be carried out by, or under the supervision of, experienced personnel and only after clearance has been received from the helmsman.

The streamer, which is easily handled by one person, is normally deployed rope first through a fairlead attached to the top of a boom. Two persons should be used at the deployment position and one on the cable reel for both deployment and to deck recovery.

After a streamer is deployed over the ship's side the cable is paid out from the deployment reel to required length and then held while the cable reel is secured. After securing, the connection from cable reel to deck lead is made up.

Deployment is carried out at 3-4 knots and recovery at a reduced speed of 3 knots normal, operational speed is at 4.5 knots.

5.8.3 Routine Operation

In routine operation the streamers are deployed to the shortest acceptably functioning length. Adjustments are made to the tow length depending on sea state and direction of the swell with respect to the vessel's heading. Great care should be exercised when operating in areas where there may be fixed fishing gear.

5.8.4 Hazards

Manual handling of equipment on moving vessel, moving cables and trapped limbs when boom is operated. Dislodging of towing pole may occur if not properly secured and the equipment gets entangled. Snagging the hydrophone may affect the ability of the vessel to manoeuvre.

6 BGS MARINE RISK ASSESSMENT FORM

6.1 10M HYDROPHONE STREAMERS FOR SURFACE TOW BOOMER

Project Code and name Project NEE4602S (Task 01), Mingulay		RA Number BGSMO/13/35	Month July	Year 2013
Risk Assessment for: Deployment 10m Hydrophone streamers (for Surface Tow Boomer)		Name of Vessel and Cruise No: R/V Calanus		
		Person responsible for work assessed: Authorised Survey staff and ship's crew		
Brief description of activity: (Please state normal duration of activity and attach diagram if appropriate) Deployment and recovery of BGS 10m Hydrophone streamer (Surface Tow Boomer). Deployment and recovery carried out by hand hauling.				
Main equipment involved: Hydrophone		Personnel at risk: BGS operators Helmsman		
How could this activity: a) Affect the safety of the ship? Streamer fouling propeller		a) Have an effect on environmental pollution? Loss of equipment, Jet A1 oil		
Signature of assessor: David Wallis Date:		Signature of Project Leader: David Wallis Date:		

PERIODIC REVIEW

Date	Comments	Signature
12.06.02	Reviewed from prepared for RRS James Clark Ross JR76 cruise 2002	Dave Smith
16/07/02	Reviewed from RRS Discovery Cruise D265	Colin Brett
16/07/03	Reviewed from RRS Discovery Cruise D273	Colin Brett
26.07.04	Reviewed from RV Prince Madog Cruise 03/03 – Bristol Channel	Dave Smith
04.02.09	Reviewed from RRS CEFAS Endeavour, East Anglia 2008	Dave Wallis
24.02.11	Reviewed from Calanus, Loch Linhe, 2010	Dave Wallis
03.07.13	Reviewed from Calanus, 2011	Dave Wallis

Activity	Potential hazard effect	Initial Rating			Control measures in Place	Residual Rating		
		H	L	R		H	L	R
Deployment/recovery of Hydrophone	Frame/umbilical fouling propeller	2	2	4	• Operation to be carried out by experienced personnel • Detailed procedure to be agreed on the vessel before first deployment. • Vessel to maintain slow forward motion at all times • Good deck/Bridge communication arrangement proved prior to activity • All personnel to wear PPE including hard hats	2	1	2
Towing hydrophone	Snagging on obstruction, mounting breaking free.	2	3	6	Ensure the hydrophone towing pole is securely fixed to the vessel. Watch kept on hydrophone and deck/Bridge communication arrangement proved prior and during activity.	2	2	4

6.2 BGS SURFACE TOW BOOMER (STB) (THIS ALSO APPLIES TO AAE S-BOOM, BEING A SIMILAR SYSTEM)

6.2.1 Description and Safe System of Operation

This system utilises High Voltage (HV) electricity and as such can be dangerous. The following strict procedures are to be observed. The system must be installed and operated by authorised personnel only. These personnel are listed on page 9 of these notes.

6.2.2 Overview

The full system comprises of a towed catamaran incorporating a 'boomer plate', (transducer), HV power supply, a short hydrophone streamer and inboard recording equipment. Only the towed boomer and HV power supply and its operation are considered in this document. The system uses an Applied Acoustics CSP-D (2400) HV power supply. This is a latest generation power supply, running from a standard 13 Amp supply, is virtually silent in operation and has an inbuilt safety standard such that it could be run in the laboratory alongside any other piece of electronic recording equipment.

6.2.3 The Surface Tow Boomer

This is the acoustic energy source and is towed behind the vessel, up to 5 m astern and floats on the surface. The acoustic energy is generated by discharging HV DC directly into the boomer plate. The STB will always be towed directly behind the vessel. The STB is deployed and recovered at minimum vessel speed, sufficient to ensure that it always trails astern. The normal operational tow speed is 4-5 knots. The following operational procedure will apply:

- a. Handling of the STB must only be carried out by trained, authorised personnel, or personnel under the direct supervision of trained personnel.

It is the responsibility of the authorised engineer/HV operator to satisfy himself that HV is isolated from the STB prior to deployment/retrieval of the Boomer.

No person is to handle the STB until cleared to do so by the HV operator.

It is the responsibility of the Party Chief to ensure that the STB tow is secure and that all spare cable is safely stowed in a tidy manner. Where the cable to the STB crosses the deck it must be protected by reinforced hose or similarly or cordoned off.

6.2.4 HV Power Supply

The HV power supply is an Applied Acoustics CSP-D (2400). This is a latest generation HV power supply, runs from a standard 13Amp supply, is virtually silent in operation and has a very high level of inbuilt safety features. All main controls are on the front panel including a range of power outputs are available, these are switch selected. The smart/fast charge button is located on the rear panel.

The HV is operated by a key switch. The power supply will be mounted in the laboratory.

When not in use the power supply should be switched off and the power cables disconnected. The shift designated HV operator should hold all switch keys.

Whilst the unit itself is intrinsically safe it must be remembered that the output is High Voltage and as such is extremely dangerous.

The installation of the power supply, connection of the STB into the HV breakout box and the operation of the system must be carried out by authorised personnel only.

6.2.5 Switch On Procedure

Once the STB has been deployed the HV power supply will be activated as follows:

The HV operator is to visually check the STB is in the water and ready for operation, only limited testing of the plate can be done on the deck.

1. Set required trigger rate into the power supply.
2. At the power supply check the power output setting is as required
3. Check local/remote is switched to local operation.
4. Connect mains cable and switch on.
5. Use key to switch on HV available and remove the key.
6. Manually test fire the system.
7. Observe system operating correctly.

6.2.6 Switch off Procedure

It is essential that no attempt to start recovering the STB be made until the HV operator has confirmed it is safe to do so.

1. Switch off system on the power supply.
2. At the power supply, check remote/local is at local.
3. Check HV available switch is off.
4. Switch mains power off and disconnect the mains cable.

Whilst the first action at '1' shuts the system down and leaves it safe but the full sequence must be completed before starting to recover the STB.

6.2.7 Emergency Shutdown

The removal of trigger line/signal will stop the system firing, whilst switch off on the front panel will remove power.

6.2.8 Summary of Hazards

High voltage electricity, awkward manual handling of STB over aft of ship involving manual handling and potential to fall off the vessel.

6.2.9 Summary of Ship Requirement

Deployment/recovery:	Speed 1-3 knots through the water, straight course
Towing:	Speed 4-4.5 knots
Turning:	This will be done with caution whilst the helmsman is watching the cables to ensure no entanglement with obstacles in the water or with the outboard propeller.

6.2.10 Authorised STB HV Operators – BGS Personnel

Full operator/engineer for complete installation, operation and maintenance of the system and for training others in the routine operation: D. Wallis

Signed:

Date:

6.3 BGS MARINE RISK ASSESMENT FORM

Project Code and name Project NEE4602S(Task01), Mingulay	RA Number BGSMO/13/35	Month July	Year 2013
--	---------------------------------	---------------	--------------

Risk Assessment for: Operation of BGS Surface Tow Boomer System		Name of Vessel and Cruise No: RV Calanus
		Person responsible for work assessed: Authorised Survey staff
Brief description of activity: (Please state normal duration of activity and attach diagram if appropriate) Deployment, operation and recovery of BGS surface tow boomer system. System comprises a towed catamaran, a High Voltage power supply, short hydrophone streamer and laboratory recording equipment. Deployment/recovery takes a few minutes each time.		
Main equipment involved: Towed Catamaran HV Power supply Short Towed Hydrophone Recording equipment	Personnel at risk: BGS Operators Ship's crew	
How could this activity: a) Affect the safety of the boat? Boomer/cable fouling ship's propeller	a) Have an effect on environmental pollution? Loss of equipment	
Signature of assessor: Michael Wilson Date:	Signature of Project Leader: Date:	

PERIODIC REVIEW

Date	Comments	Signature
June 02	Originally carried out for project BGS 02/03 Clyde Area	Colin Brett
26.07.04	Reviewed from RV Prince Madog Cruise 03/03- Bristol Channel	Dave Smith
19.03.07	Reviewed from 'Kommador Iona' BGS2007_1 Montrose Bay	Dave Smith
28.08.08	Reviewed for RV Cefas Endeavour	Michael Wilson
19.02.09	New RA form implemented	Michael Wilson
24.02.11	Reviewed from Loch Fitty project, March 2009	Dave Wallis
03.07.13	Reviewed from Calanus, 2011	Dave Wallis

Activity	Potential hazard effect	Initial Rating			Control measures in Place	Residual Rating		
		H	L	R		H	L	R
Deployment/recovery of towed catamaran	Awkward manual handling of catamaran over ship's rail.	2	2	4	- Operation to be carried out by experienced personnel - Detailed procedure to be agreed on the vessel before first deployment. - All personnel to wear PPE including hard hats	2	1	2
	Catamaran/tow cable fouling propeller	2	2	4	- Vessel to maintain slow forward motion at all times - Good deck/Bridge communication arrangement proved prior to activity	2	1	2
	High Voltage	3	2	6	- High voltage equipment to be operated by authorised personnel only. - The catamaran is not to be handled without clear confirmation from the shift designated HV operator that it is safe to do so.	3	1	3
Installation of power supply	Moving equipment on moving vessel	2	2	4	- All equipment to be installed by experienced personnel - All equipment to be secured in position prior to sailing	2	1	2
	Electric shock	3	1	3	All equipment to be installed in an electrically safe manner in accordance with manufacturers specification	3	1	3

Activity	Potential hazard effect	Initial Rating			Control measures in Place	Residual Rating		
		H	L	R		H	L	R
Routine operation	High Voltage	3	2	6	- HV power supply to be operated by designated personnel only to an agreed procedure. - HV cable crossing deck to be protected. - Non essential personnel to stay clear of the working deck during operations.	3	1	3
	Tow cable fouling ship's propeller	2	2	4	Vessel to maintain forward motion at all times Regular inspection of towed equipment by BGS watchkeeper	2	1	2

Appendix 1 Track Chart

No track chart is available. It must be created during post-processing.

Appendix 2 Daily Log

Daily Summary Log

Date: 16/July/2013

JD: 197

Time	
1030	Depart for Dunstaffnage laboratory
1430	Arrive Dunstaffnage; commence mobilisation onboard Calanus
1745	Depart Dunstaffnage
1800	Hotel Oban Bay overnight.

Daily Summary Log

Date: 17/July/2012

JD: 198

Time	
0900	Join Calanus at Dunstaffnage
0915	Depart Dunstaffnage for Mingulay
1145	Hydrophone streamed behind Calanus. S-Boom deployed successfully
1206	SOL Test line in Sound of Mull over slide.
1240	EOL Test Line
1300	All equipment onboard, steaming for Mingulay
2000	At Anchor off Vatersay

Daily Summary Log**Date: 18/July/2012****JD: 199**

Time	
0600	Vessel wakes up. Breakfast. Steaming for Mingulay reef.
0725	S-Boom, hydrophone deployed
0735	SOL 2013-7-line01 (line 12 on planning) No fix marks on Coda, Nav not recorded on Coda for no apparent reason.
0748	EOL line01
0754	SOL line02. Fix 3. (line 6 on planning). Coda now fixing and recording Nav data.
0808	EOL line02. Fix 9 CMG 37
0813	SOL line03. Fix 13. (line 16 on planning)
0823	EOL line03. Fix 17. CMG 7
0829	SOL line04. Fix 21. (line 4 on planning).
0848	EOL line04. Fix 30. CMG 290
0855	Hydrophone inboard and short haul boomer for grab sampling.
0945	Hydrophone redeployed
0948	SOL line05. Fix 61. (line 2 on planning).
1003	EOL line05. Fix 67. CMG 112
1006	SOL line06. Fix 69 (line 7 on planning).
1020	EOL line06. Fix 76. CMG 290
1024	SOL line07. Fix 79. (line 3 on planning).
1034	EOL line07. Fix 83. CMG 126
1037	SOL line08. Fix 85. (line 1 on planning).
1044	EOL line08. Fix 88. CMG 20
1055	SOL line09. Fix 94. (line 5 on planning).
1115	EOL line09. Fix 103. CMG 87
1125	SOL line10. Fix 109. (line 8 on planning).
1222	EOL line10. Fix 138. CMG 255
1228	SOL line11. Fix 140. (line 15 on planning).
1239	EOL line11. Fix 144. CMG 160
1245	SOL line12. Fix 147. (Rerun line11).
1255	EOL line12. CMG 325
1305	SOL line13. Fix 157. (line14 on planning)
1313	EOL line13. Fix 161. CMG 142

Daily Summary Log**Date: 18/July/2012****JD: 199**

Time	
1318	SOL line14. Fix 164. (line 13 on planning)
1328	EOL line14. Fix 168. CMG142
1335	Hydrophone onboard. S-Boom short haul. Grab Sampling.
1500	Hydrophone redeployed.
1507	SOL line15. Fix 218. (line 11 offset)
1525	EOL line15. Fix 227. CMG 160
1533	SOL line16. Fix 231. (New ad hoc line)
1555	EOL line16. Fix 242. CMG 50
1600	Hydrophone onboard
1640	Hydrophone redeployed
1649	SOL line17. Fix 269. (New line)
1657	EOL line17. Fix 272. CMG 320
1705	S-Boom and hydrophone onboard. Steaming for overnight anchorage.
1815	At anchor. Vatersay.

Daily Summary Log**Date: 19/July/2012****JD: 200**

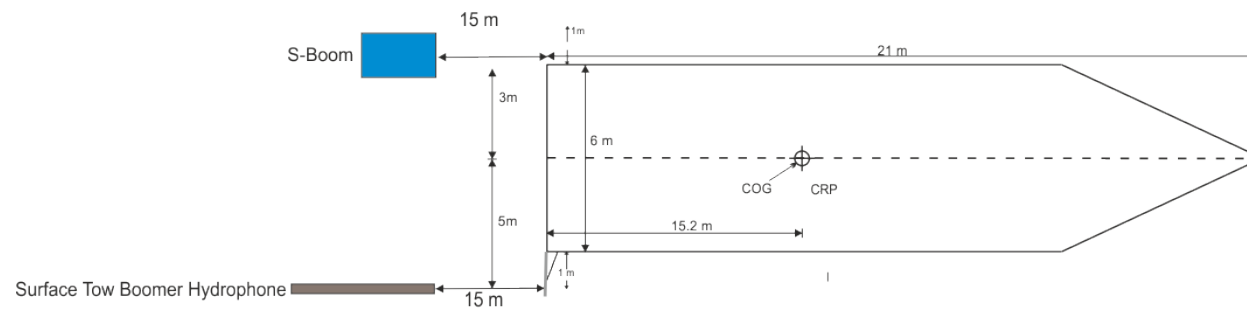
Time	
0600	Vessel wakes up. Breakfast. Steaming for Dunstaffnage.
0700	Demobilising. Writing up data and backing to Tough Drive.
1600	Approaching Dunstaffnage

Appendix 3 Personnel

David Wallis	BGS team leader electronic engineer
Apostolos Tsiligiannis	BGS junior electronic engineer
Mary Elliot	PhD supervisor
Melanie Douarin	PhD Student
Philip Crump	Hydrographic Surveyor
Juan Moreno	Post-Doctorate research assistant
Norman Smith	Calanus captain
Paddy Lewtas	Calanus Engineer
John Keeney	Calanus Mate
Norrie Black	Calanus cook

Appendix 4 Equipment Layback Diagram

BGS Layback Diagram



KEY

- COG Mainmast
- CRP GPS Common Reference Position (CRP)

RV Calanus - Survey BGS2013/07

Appendix 5 Line Seismic Tape Log

BGS Marine Operations Seismic Log									
CODA DA200									
									
Project: 2013/7			Area: Mingulay			Sheet: 1 of 2			
Recording Format: CODA DA4G			Client: BGS			Tape:			
Coda	Seismic Source		Power Source	Sampling Frequency (kHz)	Sample s per shot	Sweep (msec)	Firing Rate (sec)	Hydrophone	Filters HP & Antialias
DA4G	S-Boom		CSP2400 D	12.1	5009	414	0.5	SES10m 7Ch	450-4500
Date	Time (GMT)	Line No	Power Setting	Ext Delay (msec)	Ping Number	File on Tape		Comments	
17/07	1206	SoM1	750J	0	n/a	170713.120647		248ms/3009 samples. Equipment test.	
	1240								
18/07	0735	Line01	750J	0	n/a	180713.073531.cod		2013-7-line1 Fix 1	
	0748							No fix marks	
18/07	0754	Line02	750J	0	n/a	180713.075406.cod		SOL Fix 3	
	0808							EOL Fix 9	
18/07	0813	Line03	750J	0	n/a	180713.081331.cod		SOL Fix 13	
	0823							EOL Fix 17	
18/07	0829	Line04	750J	0	n/a	180713.082922.cod		SOL Fix 21	
	0848							EOL Fix 30	
18/07	0948	Line05	750J	0	n/a	180713.094822.cod		SOL Fix 60	
	1003							EOL Fix 67	
18/07	1006	Line06	750J	0	n/a	180713.100608.cod		SOL Fix 69	
	1020							EOL Fix 75	

18/07	1024	Line07	750J	0	n/a	180713.102442.cod	SOL Fix 79
	1034						EOL Fix 83
18/07	1037	Line08	750J	0	n/a	180713.103735.cod	SOL Fix 85
	1044						EOL Fix 88
18/07	1055	Line09	750J	0	n/a	180713.105531.cod	SOL Fix 94
	1115						EOL Fix 103
18/07	1125	Line10	750J	0	n/a	180713.112558.cod	SOL Fix 109
	1222						EOL Fix 137
18/07	1228	Line11	750J	0	n/a	180713.122822.cod	SOL Fix 140
	1239						EOL Fix 143
18/07	1245	Line12	750J	0	n/a	180713.124549.cod	SOL Fix 147
	1255						EOL Fix 152

BGS Marine Operations Seismic Log									
CODA DA200									
Project: 2013/7			Area: Mingulay			Sheet: 2 of 2			
Recording Format: CODA DA4G			Client: BGS			Tape:			
Coda	Seismic Source		Power Source	Sampling Frequency (kHz)	Sample s per shot	Sweep (msec)	Firing Rate (sec)	Hydrophone	Filters HP & Antialias
DA4G	S-Boom		CSP2400 D	12.1	5009	414	0.5	SES10m 7Ch	450-4500
Date	Time (GMT)	Line No	Power Setting	Ext Delay (msec)	Ping Number	File on Tape		Comments	
18/07	1305	Line13	750J	0	n/a	180713. 130522.cod		SOL Fix 157	
	1313							EOL Fix 161	

18/07	1318	Line14	750J	0	n/a	180713.131834.cod	SOL Fix 164
	1328						EOL Fix 168
18/07	1507	Line15	750J	0	n/a	180713.150655.cod	SOL Fix 218
	1525						EOL Fix 227
18/07	1532	Line16	750J	0	n/a	180713.153257.cod	SOL Fix 231
	1555						EOL Fix 242
18/07	1649	Line17	750J	0	n/a	180713.164945.cod	SOL Fix 269
	1657						EOL Fix 272

