

**NATURAL ENVIRONMENT RESEARCH COUNCIL
(BRITISH ANTARCTIC SURVEY)**

APPLICATION FOR CONSENT TO CONDUCT MARINE SCIENTIFIC RESEARCH IN AREAS
UNDER NATIONAL JURISDICTION OF

Greenland (Denmark)

1. General information

Application Date 20/11/2013

1.1	Cruise name and/or number	RRS James Clark Ross Cruise JR302
1.2	Sponsoring institution. Name Address Name of Director	British Antarctic Survey, High Cross, Madingley Road, Cambridge CB3 0ET, UK Professor Jane Francis
1.3	Scientist in charge of the project. Name: Address Telephone Fax/Email/Telex	Dr Brian King National Oceanography Centre Southampton SO14 3ZH T: (44) 23 80596438 E: b.king@noc.ac.uk
1.4	Scientist(s) from, (name coastal state), involved in the planning of the project. Name(s) Address	
1.5	Submitting officer Name Address Telephone Fax/Email/Telex	Mr Chris Hindley (Ship Operations and Programme Manager) British Antarctic Survey, High Cross, Madingley Road, Cambridge CB3 0ET, UK + 44 1223 221497 +44 1223 362616 cjhh@bas.ac.uk No Telex

2. Description of project (Attach additional pages as necessary)

2.1 Nature of objectives of the project

This project is a Hydrographic section along the line designated 'AR07' in the CLIVAR/GOSHIP planning (AR07W and AR07E). It runs from Newfoundland across the Labrador Sea to Greenland, and then to the north-west UK. The cruise will also include a section from the main AR7 line up 20W to Iceland. This is a contribution to the international CLIVAR/Carbon repeat hydrography program

(http://www.go-ship.org/RefSecs/img/go-ship_map_3000.png).

Climate change will be studied by comparing the new data with historical measurements. In order to determine the ocean contribution to climate change, it is important that the section be completed from continent to continent, ending in shallow water (nominal 100 metres) at each end.

In accordance with UK and international CLIVAR data policy, all UK data from the cruise

will be made publicly and freely available.

This cruise also serves two other research projects. RAGNARoCC is a study on the fate of Greenhouse Gases in the ocean: Inorganic carbon, Methane, and Nitrous Oxide. We will make measurements of those parameters through the water column to assess the rate at which the ocean acts as a sink for these gasses to leave the atmosphere. OSNAP is a multi-national study of the Atlantic Overturning Circulation at the latitude of the sub-polar gyre. The line occupied by this cruise will be instrumented at a later stage with moorings to make time series measurements of ocean current, temperature and salinity.

On a subset of stations, filtered water samples will be analysed ashore at NOC to study phytoplankton community structure.

Floats may be deployed for the international Argo program.

2.2 Relevant previous or future research cruises

Future research cruises by international OSNAP partners (not yet scheduled) are planned along this line to deploy and maintain moored instruments.

2.3 Previously published research data relating to the project

NP Holliday et al., 2007, Retroflexion of part of the east Greenland current at Cape Farewell, DOI: 10.1029/2006GL029085

S. Bacon et al., 2002, A freshwater jet on the east Greenland shelf, DOI: 10.1029/2001JC000935

Holliday, N.P., S. L. Hughes, S. Bacon, A. Beszczynska-Möller, B. Hansen, A. Lavín, H. Loeng, K. A. Mork, S. Østerhus, T. Sherwin, W. Walczowski, 2008. Reversal of the 1960s - 1990s Freshening Trend in the northeast North Atlantic and Nordic Seas. Geophysical Research Letters, 35, L03614, DOI:10.1029/2007GL032675.

Hughes, S.L., Holliday, N.P., Colbourne, E., Ozhigin, V., Valdimarsson, H., Østerhus, S., Wiltshire, K., 2009. Comparison of in situ time-series of temperature with gridded sea-surface temperature data sets in the North Atlantic. ICES Journal of Marine Science, 66(7), 1467-1479

3. Methods and means to be used

3.1 Particulars of vessel

Name	RRS James Clark Ross
Nationality/Registry	British (Falkland Island Registration)
Owner	Natural Environment Research Council (NERC)
Operator	British Antarctic Survey
Length Overall	99.04m
Max. Draft	6.4m
Net /Gross Tonnage	Net: 1719 Tonnes Gross: 5732 Tonnes
Propulsion	Diesel Electric, Single Fixed Prop 8500 SHP
Cruising Speed	11.5 Kts Maximum speed: 16 kts
Call Sign	ZDLP
Method and capability of communication	Inmarsat: Voice 00870 374 033920 / Fax 374 033924 VOIP Telephone: +44 1223 221 725/6/8 Email: jrmaster@bas.ac.uk
Name of Master	Captain MJ Burgan
Number of crew	28
Number of Scientists	25

and Technicians	
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3.2 Aircraft or other craft to be used in the project

None

3.3 Particulars of methods and scientific instruments (increase table size if needed)

Types of samples and data	Methods to be used	Instruments to be used
Temperature-Salinity-Dissolved Oxygen profiles Full water depth	Instruments lowered from ship on conducting hydrographic wire; continuous recording in vertical; horizontal spacing between 3 and 30 nautical miles, depending on water depth	SeaBird 911 CTD
Seawater samples	24 water samples at each CTD station for chemical analysis onboard ship.	10- or 20-litre 'Niskin' water bottles. Chemical analysers for: dissolved oxygen; dissolved organic and inorganic nutrients; CFCs; SF6; carbon system parameters (TCO ₂ , pCO ₂ , Total Alkalinity); Other greenhouse gasses (CH ₄ , N ₂ O), Noble gas ratios and stable isotopes of dissolved oxygen by MIMS (Membrane Inlet Mass Spectrometry)
Water velocity profiles	Acoustic Doppler Current Profiler attached to CTD package	Lowered Acoustic Doppler Current Profiler 150kHz; 300kHz.
Water velocity underway	Ship-mounted Acoustic Doppler Current Profiler. Continuous underway.	Vessel-mounted Acoustic Doppler Current Profiler 75kHz; 150kHz;
Surface meteorology	Continuous underway sampling	Research ship meteorology instruments. (air pressure; wet/dry temperature; wind speed/direction)
Surface temperature, salinity, CO ₂ , CH ₄ , N ₂ O	Continuous underway sampling from surface pumped seawater supply	Surface thermosalinograph; surface pCO ₂ , CH ₄ , N ₂ O
Water depth	Echo sounder	Simrad EA600/EM120
Air sampling	Pumped air sample	Determination of pCO ₂ for interpretation of water column data
Temperature-salinity profiles in upper 2000 metres	Deployment of floats for the international Argo program	Argo floats
Filtered water samples, phytoplankton community	Low-vacuum filtration of water samples collected via	Filtration racks

structure	CTD, oven dried and stored until analysis back at NOC using Light and Scanning Electron Microscopy	
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3.4 Indicate whether harmful substances will be used

No

3.5 Indicate whether drilling will be carried out

No

3.6 Indicate whether explosives will be used

No

4. Installations and equipment

Details of installations and equipment (dates of laying, servicing, recovery; exact locations and depth):

No moored installations or equipment

5. Geographical areas

5.1 Indicate geographical areas in which the project is to be conducted (with reference in latitude and longitude)

Latitude 52N to 63N Longitude 55W to 5W

5.2 Attach chart (s) at an appropriate scale showing the geographical areas of the intended work and, as far as practicable, the positions of intended stations, the tracks of survey lines, and the locations of installations and equipment.

Chart attached

6. Dates

6.1 Expected dates of first entry into and final departure from research area by the research vessel:

Entry: 30 May 2014 Departure 28 June 2014	
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6.2 Indicate if multiple entry is expected Yes/No

No

Dates if known

7. Port Calls

7.1 Dates and names of intended ports of call in (Name of coastal state)

No port call planned

7.2 Any special logistical requirements at ports of call

7.3 Name(s) and Address/Contact details of shipping agent (if known)

8. Participation

8.1 Extent to which (name of coastal state),

will be enabled to participate or to be represented in the research project.

One berth for an observer from each coastal state is offered in accordance with UNCLOS Art 249 (1a).

8.2 Proposed dates and ports for embarkation/disembarkation

Embark 30 May 2014 St John's, Canada
Disembark 17 July 2014 Immingham, UK

9. Access to data, samples and research results

For (name of coastal state)

9.1 Expected dates of submission of preliminary reports which should include the expected dates of submission of the final results.

Six months after completion of Cruise

9.2 Proposed means for access to data and samples

All data will be publicly and freely available at the CLIVAR data centres, accessible by internet. This is the recommended means of access for users of the data in Greenland

In addition, copies of data will be provided on data CD/DVD to any address requested in Greenland.

9.3 Proposed means to provide the assessment of data, samples and research results or provide assistance in their assessment or interpretation

Cruise report in National Oceanography Centre Cruise Report series.

Reports posted on NOC website

Scientific papers in internationally available scientific journals (eg Journal of Physical Oceanography and equivalent)

9.4 Proposed means of making research results internationally available

Reports posted on NOC website

Scientific papers in internationally available scientific journals (eg Journal of Physical Oceanography and equivalent)

10. COMPLETE THE FOLLOWING TABLE - SEPARATE PAGE FOR EACH COASTAL STATE:

Name of Coastal State Greenland

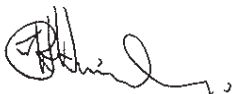
Port Calls/Dates None planned

SCIENTIFIC EQUIPMENT

Indicate "YES" or "NO" and Distance from Coastal Baseline

List Scientific Work by Function eg: Magnetometry Gravity, Diving, Seismic, Bathymetry, Seabed Sampling, Trawling, Echo Sounding, Water Sampling U/W T.V.: Moored and Towed instrument	Water Column Incl. Sediment Sampling on the Seabed	Fisheries Research within Fishing Limits	Research Concerning the Natural Resources of the Continental Shelf or its Physical Characteristics	Distance from Coast	
				Within 12 NM	Between 12 - 200 NM
Bathymetry	No	No	No	Yes (0 to 12)	Yes (12 to 200)
CTD	Yes	No	No	Yes (0 to 12)	Yes (12 to 200)
Water samples on station and underway	Yes	No	No	Yes (0 to 12)	Yes (12 to 200)
Water velocity by Acoustic Doppler Current Profiler on station and underway	Yes	No	No	Yes (0 to 12)	Yes (12 to 200)
Air sampling	No	No	No	Yes (0 to 12)	Yes (12 to 200)
Deploy Argo floats List other Equipment	Yes	No	No	No	Yes (12 to 200)

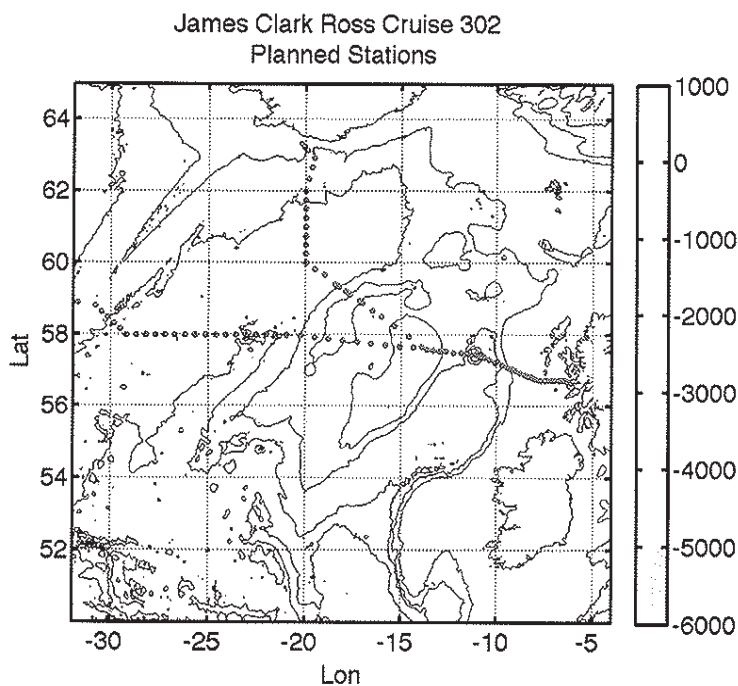
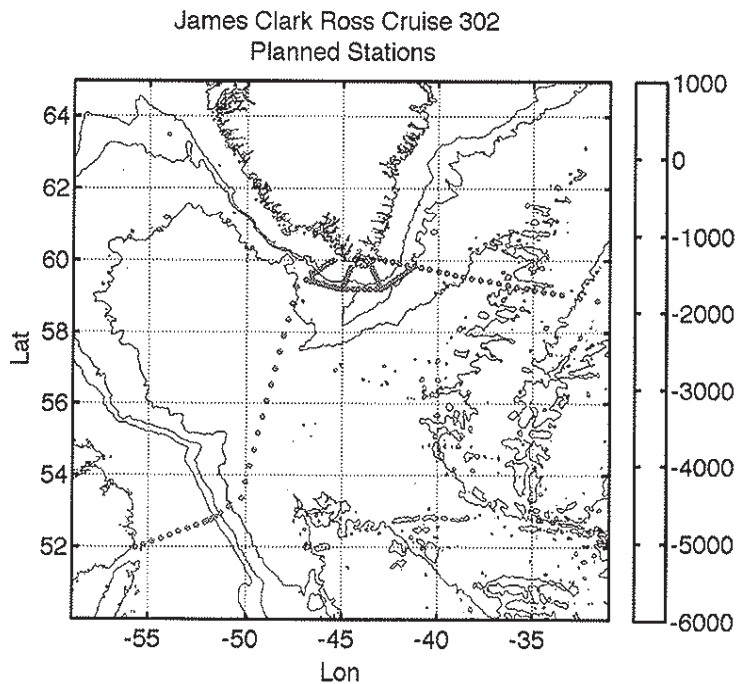
Signed on behalf of the Principal Scientist (See Section 1.3 above)



CJ H Hindley – Ship Operations and Programme Manager,

British Antarctic Survey (See Section 1.5 above)

Provisional station positions for RRS James Clark Ross Cruise 302



Cruise JR302 provisional track plot. Upper panel shows western sections to be completed first. Lower panel shows eastern sections.

The work will start near Canada (station 1) in the upper panel, and cross the Labrador Sea ending at station 38. A series of sections will be worked around the southern tip of Greenland (stations 39 to 83), before heading east on the 'AR7E'

section (stations 84 to 152). The remaining section from the junction point (station 135) up to Iceland (stations 170 to 197) will be occupied last. Station positions are nominal. Actual positions will be chosen depending on time, weather or other operational requirements.

Provisional station list for RRS James Clark Ross Cruise 302

Station ID	Lat (°N)	Lat min	Lon (°W)	Lon min	Comment
1	52	0.00	55	42.00	Start
2	52	5.25	55	15.00	
3	52	10.50	54	48.00	
4	52	15.75	54	21.00	
5	52	21.00	53	54.00	
6	52	26.25	53	27.00	
7	52	31.50	53	0.00	
8	52	36.75	52	33.00	
9	52	42.00	52	6.00	
10	52	44.28	51	58.50	
11	52	46.50	51	51.00	
12	52	48.78	51	43.50	
13	52	51.12	51	35.82	
14	52	51.12	51	35.82	
15	52	57.48	51	18.00	
16	53	8.52	50	52.02	
17	53	22.80	50	15.60	
18	53	49.94	50	2.60	
19	54	17.08	49	49.60	
20	54	44.22	49	36.60	
21	55	11.35	49	23.59	
22	55	38.49	49	10.59	
23	56	5.63	48	57.59	
24	56	32.77	48	44.59	
25	56	59.91	48	31.59	
26	57	27.05	48	18.59	
27	57	54.18	48	5.58	
28	58	21.32	47	52.58	
29	58	48.46	47	39.58	
30	59	15.60	47	26.58	
31	59	27.48	46	57.72	
32	59	35.94	46	36.96	
33	59	40.98	46	24.48	
34	59	46.08	46	12.00	
35	59	49.44	46	3.60	
36	59	52.96	45	52.40	
37	59	56.48	45	41.20	
38	60	0.00	45	30.00	
39	59	48.60	44	36.00	
40	59	42.50	44	41.00	
41	59	36.40	44	46.00	
42	59	30.30	44	51.00	

43	59	24.20	44	56.00	
44	59	18.10	45	1.00	
45	59	12.00	45	6.00	
46	59	13.94	45	19.97	
47	59	15.87	45	33.93	
48	59	17.81	45	47.90	
49	59	19.74	46	1.86	
50	59	21.67	46	15.83	
51	59	23.61	46	29.79	
52	59	25.55	46	43.76	
53	59	27.48	46	57.72	
54	59	12.00	45	6.00	
55	59	12.00	44	48.00	
56	59	12.00	44	30.00	
57	59	12.00	44	12.00	
58	59	12.00	43	54.00	
59	59	12.00	43	36.00	
60	59	12.00	43	18.00	
61	59	12.00	43	0.00	
62	59	16.50	43	3.75	
63	59	21.00	43	7.50	
64	59	25.50	43	11.25	
65	59	30.00	43	15.00	
66	59	34.50	43	18.75	
67	59	39.00	43	22.50	
68	59	43.50	43	26.25	
69	59	48.00	43	30.00	
70	60	3.00	43	6.00	
71	59	59.10	42	49.50	
72	59	56.88	42	26.40	
73	59	54.66	42	3.30	
74	59	52.44	41	40.20	
75	59	50.22	41	17.10	
76	59	45.44	41	29.96	
77	59	40.67	41	42.82	
78	59	35.89	41	55.69	
79	59	31.11	42	8.55	
80	59	26.33	42	21.41	
81	59	21.56	42	34.27	
82	59	16.78	42	47.14	
83	59	12.00	43	0.00	
84	59	50.22	41	17.10	Start of AR7E
85	59	48.00	40	54.00	
86	59	45.00	40	27.48	
87	59	42.00	40	0.96	
88	59	39.00	39	34.44	
89	59	36.00	39	7.92	
90	59	33.00	38	41.40	
91	59	30.00	38	15.00	
92	59	27.34	37	46.64	
93	59	24.67	37	18.28	
94	59	22.01	36	49.91	
95	59	19.34	36	21.55	

96	59	16.68	35	53.19	
97	59	14.02	35	24.83	
98	59	11.35	34	56.47	
99	59	8.69	34	28.10	
100	59	6.02	33	59.74	
101	59	3.36	33	31.38	
102	58	58.26	32	36.90	
103	58	53.16	31	42.42	
104	58	48.00	30	48.00	
105	58	38.40	30	28.80	
106	58	28.80	30	9.60	
107	58	19.20	29	50.40	
108	58	9.60	29	31.20	
109	58	0.00	29	12.00	
110	58	0.00	28	42.00	
111	58	0.00	28	12.00	
112	58	0.00	27	42.00	
113	58	0.00	27	12.00	
114	58	0.00	26	41.00	
115	58	0.00	26	10.00	
116	58	0.00	25	39.00	
117	58	0.00	25	8.00	
118	58	0.00	24	37.00	
119	58	0.00	24	6.00	
120	58	0.00	23	35.00	
121	58	0.00	23	4.00	
122	58	0.00	22	33.00	
123	58	0.00	22	2.00	
124	58	0.00	21	31.00	
125	58	0.00	21	0.00	
126	57	57.60	20	15.60	
127	57	55.20	19	31.20	
128	57	52.80	18	46.80	
129	57	50.40	18	2.40	
130	57	48.00	17	18.00	
131	57	45.60	16	33.60	
132	57	43.20	15	49.20	
133	57	40.80	15	4.80	
134	57	38.40	14	20.40	
135	57	34.98	13	37.98	Junction point
136	57	34.02	13	19.98	
137	57	33.00	13	0.00	
138	57	32.52	12	52.02	
139	57	31.98	12	37.98	
140	57	30.48	12	15.00	
141	57	29.52	11	51.00	
142	57	28.98	11	31.98	
143	57	28.02	11	19.02	
144	57	27.00	11	4.98	
145	57	24.00	10	52.02	
146	57	22.02	10	40.02	
147	57	18.00	10	22.98	
148	57	13.98	10	3.00	

149	57	9.00	9	42.00	
150	57	6.00	9	25.02	
151	57	3.00	9	13.02	
152	57	0.00	9	0.00	
153	56	57.00	8	46.98	
154	56	52.98	8	30.00	
155	56	50.22	8	19.98	
156	56	48.48	8	10.02	
157	56	46.98	8	0.00	
158	56	45.48	7	49.98	
159	56	43.98	7	40.02	
160	56	43.98	7	30.00	
161	56	43.98	7	19.98	
162	56	43.98	7	10.02	
163	56	43.98	7	0.00	
164	56	43.98	6	45.00	
165	56	43.98	6	36.00	
166	56	43.98	6	27.00	
167	56	42.48	6	22.02	
168	56	40.98	6	16.98	
169	56	40.02	6	7.98	End of OSNAP line
170	57	40.02	13	54.00	Side section to Iceland
171	57	57.00	14	34.98	
172	58	15.00	15	19.98	
173	58	30.00	16	0.00	
174	58	40.02	16	30.00	
175	58	52.98	17	0.00	
176	58	57.00	17	10.98	
177	59	7.02	17	40.02	
178	59	12.00	17	52.98	
179	59	19.98	18	13.98	
180	59	24.48	18	25.50	
181	59	40.02	19	0.00	
182	59	49.98	19	30.00	
183	60	0.00	20	0.00	
184	60	15.00	20	0.00	
185	60	30.00	20	0.00	
186	60	45.00	20	0.00	
187	61	0.00	20	0.00	
188	61	15.00	20	0.00	
189	61	30.00	20	0.00	
190	61	45.00	20	0.00	
191	62	0.00	20	0.00	
192	62	19.98	19	49.98	
193	62	40.02	19	40.02	
194	62	55.02	19	33.00	
195	63	7.98	19	55.02	
196	63	12.96	20	4.02	
197	63	19.02	20	12.96	End near Iceland