Cruise Report

Celtic Explorer Cruise 0716
June 19-25 2007

Time-series observations at the PAP observatory

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Contents

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Ship-side

1.	Cirran Flanagan	Master
2.	Basil Murphy	Chief Officer
3.	Brandon McGovern	2nd Officer
4.	Chris Blackburn	Chief Engineer
5.	Robert Kirby	2nd Engineer
6.	John Barry	Gear Superintendent
7.	Patrick O'Driscoll	Technician
8.	Paul Wray	ETO
9.	Gerard Carty	Bosun
10.	Stephen Lantry	Bosun's mate
11.	Alec Carty	AB
12.	Thomas Grealy	AB
13.	Philip O'Driscol	AB
14.	James Moran	Chief Cook
15.	Joseph Murrin	Asst. Cook

Itinerary

Sailed Galway	1840h GMT on 19th June 2007
Arrived PAP site	0910h on 21st June
Departed PAP	2320h on 23rd June
Arrive Galway	1300h on 25th June

Objectives

The main objective of this very short cruise was to refurbish the PAP observatory (NE Atlantic), a long term study site at which a variety of observations have been made over the past 20 years with increasing levels of intensity and sophistication.
In addition to this a small number of other observations were made and samples collected. In order to increase public awareness of observational oceanography film interviews were carried out and a daily web diary maintained.

Narrative

Celtic Explorer slipped her moorings exactly on schedule and proceeded to the PAP site at about 10knots in moderate seas. During the entire occupation of the site the weather remained good and no time was lost to this. During the 2 ½ days at the site, almost all of the objectives were met with considerable success and we left the site with a major new mooring deployed and sending some of the data back in real time to NOC. This will be recovered in September 2008. In addition, a sediment trap was successfully recovered, all traps having worked perfectly since July 2006 and a replacement mooring was deployed. A *Bathysnap* time lapse benthic camera system was successfully deployed but the only major failure was to recover the *Bathysnap* deployed at the site in July 2006.

Reports

CTD

CTD profiles were obtained with a Seabird Sbe 911 unit with a 24 bottle rosette. In total 12 CTD profiles were obtained, 4 deep casts for both Sbe Microcat calibration and acoustic release tests, 3 to 2500 m in a triangle around the PAP site, and 5 in support of near surface bottle sample measurements (see Table 1). During the first CTD profile made, a problem became apparent when unrealistic temperature and salinity values were registered, most notably in salinity. The sensor was changed and at the 2nd attempt values were still not realistic. Subsequent investigations revealed that incorrect calibration coefficients for the temperature sensor had been input to the CTD configuration file at a time prior to the survey, leading to both incorrect temperature readings and the spurious salinity values. The calibration coefficients were corrected and the CTD performed well thereafter. The correct calibration data was not available on board for re-processing the raw data from the first cast and this will have to be undertaken post cruise to enable Microcat calibration

An initial view of the CTD data has revealed that it is very clean with no obvious irregularities in any measurements. Deep casts indicated the presence of all the known water masses that occupy the region. A triangle of casts down to 2500 m was made overnight with the PAP1 mooring at the centre of the triangle of side length ~15 km. This was undertaken essentially as a student exercise to estimate dynamic heights and geostrophic currents. It will enable the geostrophic flow through a small (~100 km^2) volume at\the PAP site which will be compared to the underway ADCP data collected.

During the final CTD profile made (to ~4700 m, 5050 m wire out) problems were encountered with the winch. During the heave, the winch behaved erratically, stopping and then speeding to large speeds without control from the winch driver. After some tests, it was decided to bring in the CTD using manual controls. The problem still persisted, however, and no more CTD casts were attempted (although none were scheduled), and it is recommended that none are in following surveys until the problem is rectified.

Table 1. CTD Station list with rosette bottle number and samples taken.

Sta #	Rosette No	Pres (db)	Salts	Nuts	Chl	Co2	Phyto	Comments
0716_001	1	3215	836	x	x			taps open
0716_001	2	3215						taps open
0716_001	3	3215						taps open
0716_001	4	2734	837	x	x			taps open
0716_001	5	2734						taps open
0716_001	6	2734						taps open
0716_001	7	1325	838	x	x			taps open
0716_001	8	474	839	x	x			taps open
0716_001	9	18	840	x	x			taps open
0716_002	1	267	841	x	x		x	
0716_002	2	197	842	x	x		x	
0716_002	3	165	843	x	x		x	
0716_002	4	121	844	x	x		x	
0716_002	5	89	845	x	x		x	
0716_002	6	60.2	846	x	x		x	
0716_002	7	30	847	x	x		x	
0716_002	8	11	848	x	x		x	
0716_002	9	4.5	849	x	x		x	
0716_003	1	4728						For deep water
0716_003	2	4728						
0716_004	1	304						Samples for Micro
0716_004	2	304						
0716_004	3	304						jammed
0716_004	4	40						jammed
0716_004	5	30	850	x	x			
0716_004	6	20	851	x	x			
0716_004	7	16						
0716_004	8	16	852	x	x			
0716_004	9	11						
0716_004	14	11						
0716_004	15	11						
0716_004	16	11						
0716_004	17	11	853	x	x			
0716_004	18	7	854	x	x			
0716_004	19	7						didn't trigger
0716_005	1	40	855	x	x			repeat of sta #4
0716_005	2	5						jammed bottles
0716_010	1	38	856	x	x			Samples for Micro
0716_010	2	32	857	x	x			
0716_010	3	21	858	x	x			
0716_010	4	15	859	x	x			

0716_010	5	15						
0716_010	6	15						
0716_010	7	15						
0716_010	8	15						
0716_010	9	15						
0716_010	14	15						
0716_010	15	15						
0716_010	16	15						
0716_010	17	11	1004	x	x			
0716_010	18	6	1005	x	x			
0716_012	1	2507	1006					
0716_012	2	2035	1007					
0716_012	3	1185	1008					
0716_016	1	38	1009					
0716_016	2	32	1010					
0716_017	1	39			x			
0716_017	2	35			x			
0716_017	3	30			x			To estimate DCM
0716_017	4	25			x			for snatcher
0716_017	5	21			x			Samples not
0716_017	6	16			x			retained
0716_017	7	11			x			
0716_017	8	6.6			x			
0716_021	1	289						Samples for Micro
0716_021	2	289						
0716_021	3	289	1011	x	x			
0716_021	4	289						
0716_021	5	289						
0716_021	6	49	1012	x	x			
0716_021	7	49				3		
0716_021	8	31	1013	x	x	1		
0716_021	9	31				2		
0716_021	14	14	1014	x	x	1		
0716_021	15	14				1		
0716_021	16	14				1		
0716_021	17	14						
0716_021	18	14						
0716_021	19	14						

Martin White

Vessel Mounted ADCP

A vessel mounted narrowband 75kHz ADCP was run throughout the duration of the survey. Data quality appeared good, from initial visual inspection, with good data down to depths of 700-750 m reached. The data will be processed at NUI, Galway for residual currents as well as for comparison to the CTD data and also for vertical backscatter as a proxy for zooplankton distribution.

Martin White

Zooplankton

6 Vertical profiles of 200-0 m were conducted at the PAP site using the NOCS WP2 Zooplankton net (200 μm mesh).

Sampling protocol

Zooplankton hauls were conducted after dark between 11pm and 1 am for two principle reasons; firstly because zooplankton undergo vertical migration to the surface at night and any vertical profile of the surface 0-200 m at this time would catch the highest abundance of Zooplankton possible; secondly because the darkness minimises the chance of 'net avoidance' by the Zooplankton.

The WP2 net was attached to a winch and the lid for the collecting bucket was secured tightly. The net was then lowered into the water using the winch to a depth of 200m. The net was then hauled to the surface at a rate of 0.2 m/s, catching Zooplankton on its way to the surface. Once on the surface, the net was suspended over the side of the ship and the outside of the net was hosed down with seawater to make sure all captured Zooplankton slid down the inside of the net and entered the collecting bucket. The collecting bucket was then opened into a large white bucket cleaned with seawater. Comments and observations were made on the full catch and then the catch was transferred into 2L glass jars using a plastic funnel. Once in the jars, more observations were made on the faunal groups present and photos and video footage were taken of the living specimens. Following this, latex gloves and protective eyewear were worn and 10% formalin was added to preserve the samples. The jars were then gently shaken to distribute the formalin throughout the jar. The jars were labelled appropriately with date, station/series number, depth and mesh size. Samples will be returned to NOCS and analysed for species abundance and diversity.

A list of the station and series number and a short description of the catch is presented. For starting and ending times and Latitude and Longitude coordinates of each Zooplankton haul please see the Station list in this cruise report.

Table 2

Date	Station/Series	Sea conditions	Zooplankton observations
21/06/07	0716_007	Moderate seas, Garr fish (up to 0.5 m long) seen in surface waters	4 small fish caught Chaetognaths, Small polychaetes, euphausiids, copepods, ostracods, pteropods.
22/06/07	0716_008	Moderate seas, Garr fish (up to 0.5 m long) seen in surface waters	Chaetognaths, Small polychaetes, euphausiids, copepods, ostracods, pteropods.
	0716_013	Calm sea, no fish seen in surface waters	Chaetognaths, Small polychaetes, euphausiids, copepods, ostracods, pteropods.
	0716_014	Calm sea, no fish seen in surface waters	1 pipe fish (with eggs) caught and returned to the sea. Chaetognaths, Small polychaetes, euphausiids, ostracods, pteropods.
23/06/07	0716_025	Moderate-calm seas. Some Garr fish seen in surface waters.	1 pipe fish caught and returned to the sea. 2 large red copepods. Chaetognaths, Small polychaetes, euphausiids, copepods, ostracods, pteropods.
	0716_026	Moderate-calm seas. Some Garr fish seen in surface waters.	1 ctenophore (4cm) and captured on video. Chaetognaths, Small polychaetes, euphausiids, copepods, ostracods, pteropods.

Kate Larkin, Triona McGrath, Mark Stinchcombe, Corinne Pebody, Deirdre Duggan, Caroline Heaney, Ludwig, Sergio Balzano, Richard Lampitt, Martin Agis.

Microbiology

The aim of this cruise was to study the photosynthetic pico-eukaryote community. Indeed, this community, along the cyanobacteria, is potentially the main contributor to the primary production in oceans.

Therefore, we sampled a vertical profile where the fluorescence profile was the highest, namely between 5 and 40m. Samples have been collected for the community composition analysis by clone library construction and FISH analysis as well as samples for pigment analysis.

In parallel, two microcosm experiments have been conducted. The purpose of the first one was to measure the primary production using a tracer element (hydrogen carbonate labelled with ^{13}C). The second one aims to open another black box concerning this community by performing an enrichment experiment by mixing surface water (15m) with deep seawater (200m). This will help to start to better understand how the populations of this community respond to mixing events and then explain their temporal evolution.

Finally, tests using new systems to concentrate cells from large volumes have been done. Also, samples have been collected to test for the best way to analyse the community composition and structure with as less as possible biases: untreated seawater, concentrated seawater with cell traps, cells harvested on filter from pre-filtrated seawater.

Samples have also been collected to isolate new marine pico-eukaryotes: one new class -Chrysophyceae- and one new genus of a poorly known class for which there is currently only one culture - of the Prasinophyceae Clade VIIA.These studies complement previous studies done at PAP during Discovery cruise 306 (2006).

Ludwig Jardillier

Marine Snow

In my PhD I'm investigating the anaerobic activities taking place in aggregates and the microorganisms involved in those processes; I joined therefore the cruise in order to collect marine flocs.

The *snatcher* or marine snow catcher is a device able to sample 100L SW and allowing the collection of marine particles. The device consists in a cylinder divided into two detachable sections, both provided with lids that close mechanically when hit by a messenger. Once the Seawater was collected, the Snatcher stayed on deck for 2-3 hours to allow the particles to sink to the bottom. Afterwards the top 95L were drained off whereas the bottom section of the snatcher containing aggregates and the remaining 5L of SW was disconnected.

3 snatcher deployments were conducted during the present cruise, the *snatcher* was deployed below the seasonal thermocline, at the base of the chlorophyll maximum where the highest concentration of marine aggregates was previously reported on the PAP during June (Lampitt et al. 1993).

Table 3. Snow catcher deployments

Date	Station	Collection Depth	Comments
22/06/07	0716_009	40m	Few microaggregates collected
23/06/07	0716_018	25m	Failure in the bottom section disconnection
23/06/07	0716_022	30m	Few microaggregates collected

The overall amount of particles collected was very few and their diameter ranged between 100 and 300µm. Particles were isolated in 1mL vials and frozen for future molecular analysis (PCR on the 16S rRNA in order to investigate the archeal and bacterial composition).

Sergio Balzano

Chemical analyses

Inorganic nutrients
Inorganic nutrients were sampled by the CTD rosette (Table 1), mainly to allow the ISUS to be calibrated, but also to provide some background information for the microbiology work. A sterilin pot was rinsed three times and then filled two thirds with water. This was then frozen for transport back to NOCS. The nutrients will be analysed at NOCS using a Skalar SanPlus Autoanalyser for nitrate, nitrite, phosphate and silicate.

Salts:
Samples were taken for salinity from the niskins on the CTD and these will be used to calibrate the salinity sensor on the CTD. These were in glass bottles which were rinsed three times and then filled up to the neck. The bottle opening, the lid and the plastic stopper inside the lid were dried off with a piece of tissue before the lid was closed and the sample stored for analysis back at NOCS. For a complete list of samples, please see figure 1.

Chlorophyll:
Chlorophyll samples were taken to calibrate the fluorometer, but also to add some background information for the microbiology and marine snow work. Water was taken from the niskin bottles into 500ml plastic bottles, which were rinsed once before the sample was taken. This volume was then filtered through a GF/F filter. The filter was folded into quarters, wrapped in tin foil, put inside a small bag and the bag labelled with the cast number, date, bottle number and depth. They were then frozen ready for transport back to NOCS where they will be analysed. For a complete list of chlorophyll samples, please see figure 1.

CO_2:
CO2 samples were collected in triplicate according to the protocol provided by IFM-Geomar. Saturated mercuric chloride solution was made up a day in advance (7g in 100ml milliQ) and was shaken regularly. Care was taken to use gloves and wash hands thoroughly after any handling of mercuric chloride. Water samples were collected from the Niskin bottles from the CTD dip on station 0716-021. Samples were taken out of the Niskin bottles before any other samples were taken to avoid contamination by gaseous exchange. Using the tubing provided, each sample bottle was rinsed with water equivalent to half the bottle volume. The bottle was then filled from the bottom and overflowed again by half its volume. Excess water was removed to provide a head space of 1% or 2.5 cm. 100µl of mercuric chloride was added and the bottle carefully sealed. The sealing system

provided for the samples was very difficult to operate and grateful thanks go to all the sampling team, Kate Larkin, Triona McGrath, and particularly Steve Smith. Please note that the plastic rings provided by IFM-Geomar Kiel to secure the glass stoppers and bottles containing the seawater for CO_2 measurements was a relatively difficult and time consuming protocol to use at sea. The samples will be returned to IFM- Geomar for processing. For details of CO_2 samples see table 1.

Mark Stinchcombe and Corinne Pebody

Observatory sensors and collectors

ISUS:
The Mbari ISUS nitrate sensor (serial number 059) was set-up at the National Oceanography Centre, Southampton (NOCS) before it was freighted to the ship for the cruise. The schedule uploaded onto it for the mooring was timed to take readings for 20 seconds every two hours on the even hours GMT. On board the sensor was switched to continuous recording mode so it could be attached to the CTD frame for a calibration dip. This dip was done on station number 0716_002. The data was downloaded, the memory erased and the data plotted up. This showed a sensible profile, though the sensor would need calibrating back at NOC to get exact values. Following this successful calibration dip, the ISUS was set up for scheduled mode. This was confirmed by leaving it attached to a laptop for a few hours to check it was still taking samples every two hours. When this was confirmed, it was successfully fitted to the mooring frame and the mooring deployed on the 22nd June 2007.

SAMI CO2 sensor
The SAMI was delivered pre programmed from Sunburst Sensors to operate every two hours. The sensor was working on delivery but unfortunately had been programmed by Sunburst Sensors to sample on the odd hours GMT. All other biogeochemical sensors (NAS/ISUS/Fluorometer) were synchronised to sample on the even hours. It was decided not to re-programme the other sensors to the odd hour because the telemetry was already pre-programmed to transmit on the odd hours. The SAMI was attached to the frame using a mount manufactured on board. It was deployed on the sensor frame at 30m and will log the data to be downloaded and processed by Sunburst Sensors on recovery in 2008.

Wetlabs Fluorometer:
The Wetlabs fluorometer (Serial number FLNTUSB-270 (PAP 2007)) was set-up to run continuously first of all. This was because it was going to be clamped to the CTD frame for a calibration dip. This dip was station number 0716_002 and was completed successfully. Originally there were some worries about the pressure sensor on the fluorometer as when we plotted up the data using the calibration equation provided (Pressure = (Output x 0.059) + - 21.35), there were some definite errors. We got around this by producing our own calibration equation by plotting the pressure data from the CTD's bottle stops against the pressure data from the fluorometers pressure sensor. After doing this we were able to get a decent profile of chlorophyll within the water column for this calibration dip with a relatively shallow and broad DCM peaking at ~ 20 m. Once this was shown to be working, the fluorometer setup was changed to sample for 20 seconds

every two hours on the even hours GMT, just like for the ISUS. This was confirmed by keeping it attached to a laptop for a few hours after start up to see if the sampling took place. When this was confirmed, it was successfully fitted to the mooring frame and the mooring was deployed on the 22nd June 2007.

NAS-3X:
The EnviroTech NAS-3X wet chemistry nitrate sensor (Serial number 2677) was originally set-up at NOCS. A macro was written to allow it to sample twice a day. The macro would run for a week before returning to the beginning again, repeating the sequence for as long as was required. Once a week the instrument would calibrate itself using a set of two on board standards, one at approximately 5μM and the other at approximately 10μM. On the ship, there was no calibration dip for the NAS. Instead it was switched on to check it worked. The macro was uploaded and a wash cycle was run, taking a small sample from each reagent and washing it through the system. Each of the separate scripts from the macro were tested as well, the sample script and the standard script. This data was downloaded, the memory erased and then the instrument was programmed to start its sampling at 00:00 hours on the 22nd June 2007. The sample line and cadmium column waste line were kept in small pots of MilliQ water to prevent air bubbles getting into the system. The NAS did take a sample at 00:00 hours, and once fixed to the mooring frame it was watched as it took a sample at 12:00 hours as well. The mooring was then deployed on the 22nd June 2007.

SBE 37
All of the SBE's (Microcat, Seabird) deployed on this cruise were Imp's for use on the PAP1 telemetry mooring. All of the instruments were sent from NOC, most of them were serviced and calibrated at NOC with the remainder being serviced and calibrated at Seabird. New batteries were installed on board prior to deployment.
Before deployment all of them were set up to sample at 10 seconds for a function test down to 3500m, the test was successful, with all of them having full data sets.
They were then set up to sample at 30 minute intervals, on the hour and half hour. This set up was for final deployment so the sampling is synchronized with the telemetry transmissions.

RCM11
There are a total of 2 RCM11's (Anderaa Recording Current Meter) on this array, both on PAP3. They were both serviced and calibrated at NOC before shipping. New batteries were installed on board prior to deployment.
Before deployment they were both set up to sample continuously for a function test down to 4600m, the test was successful, with both having full data sets.
They were then set up to sample at 30 minute intervals for final deployment.

RCM8

Two RCM8's were recovered from the PAP3 mooring. Both of them were downloaded and both contained full data sets. They were in good mechanical condition. These will now be returned to NOC where a full post deployment calibration will be performed on the instruments.

Sediment traps

Three sediment traps were recovered and three more were deployed. The three sent out from NOC were all serviced and checked prior to shipping. After they were filled on board the batteries were changed so a new set was available for deployment only. The three that were recovered were all in good condition. One sediment trap (4700 m) had turned upside down (inverted) on recovery so that the final sample was lost as it was still under the sediment trap funnel (see 'Diary of Mooring events' Sat 23rd June entry p.19 for more details). All other bottles from all deployments were recovered successfully. The three deployed were at depths of 3000, 3050 and 4700m (100mab) with timing schedule as in table 4 for all traps.

Table 4: Sediment trap schedule for all traps.

Sample code	Open Date at 1200h	Julian Day Open	Julian Day Mid-day	Interval days
XXXXVI-A-1	01/07/07	181.5	188.5	14
XXXXVI-A-2	15/07/07	195.5	202.5	14
XXXXVI-A-3	29/07/07	209.5	216.5	14
XXXXVI-A-4	12/08/07	223.5	230.5	14
XXXXVI-A-5	26/08/07	237.5	244.5	14
XXXXVI-A-6	09/09/07	251.5	262	21
XXXXVI-A-7	30/09/07	272.5	290	35
XXXXVI-A-8	04/11/07	307.5	342.5	70
XXXXVI-A-9	13/01/08	12.5	47.5	70
XXXXVI-A-10	23/03/08	82.5	89.5	14
XXXXVI-A-11	06/04/08	96.5	103.5	14
XXXXVI-A-12	20/04/08	110.5	117.5	14
XXXXVI-A-13	04/05/08	124.5	131.5	14
XXXXVI-A-14	18/05/08	138.5	145.5	14
XXXXVI-A-15	01/06/08	152.5	159.5	14
XXXXVI-A-16	15/06/08	166.5	173.5	14
XXXXVI-A-17	29/06/08	180.5	187.5	14
XXXXVI-A-18	13/07/08	194.5	201.5	14
XXXXVI-A-19	27/07/08	208.5	215.5	14
XXXXVI-A-20	10/08/08	222.5	229.5	14
XXXXVI-A-21	24/08/08	236.5	250.5	28
Final move to open hole	21/09/08	264.5		-

Richard Lampitt, Mark Stinchcombe, Kate Larkin, Rob McLachlan & Corinne Pebody

Mooring technology

The main mooring objectives were:

1. Deploy the PAP1 telemetry mooring.
2. Deploy the PAP3 sediment trap mooring.
3. Deploy the Bathysnap lander.
4. Recover the 2006 PAP3 sediment trap mooring.
5. Recover the 2006 Bathysnap lander.

The PAP1 telemetry mooring is a newly designed system developed and built by engineers within the National Marine Facilities Division at the NOC.
This type of mooring allows the data collected by the instrumentation to be transmitted back to the NOC via satellite, real time.

The mooring design is an "S" tether configuration allowing the mooring to better withstand the extremes of the environment it is in.
The main surface buoy is a Toroid type buoy. Housed at the top of the buoy frame is stainless steel pressure housing with a Perspex dome, it is here that the electronics that control the telemetry is kept. Beneath this, lower in the buoy frame, there is another stainless steel housing containing the battery that powers the telemetry electronics. On the sides of the buoy frame there are four solar panels that keep the battery charged.
Beneath the buoy is 30 meters of chain with a conducting cable running along side. The chain is there to take the loads that the mooring will experience and the cable is a vehicle for the data.

Attached to the bottom of the chain is the instrument frame, again this was designed by NOC engineers. Within the frame there are five different instruments;

1. The NAS, nitrate analyser.
2. The ISUS, nitrate analyser.
3. The SAMI, carbon dioxide concentration.
4. The fluorometer, fluorescence measurements (indirect chlorophyll).
5. SBE 37, conductivity, temperature and pressure.

Also within the frame are two Kiel designed modems, these are connected to the ISUS and to the Fluorometer to allow their data to be part of the telemetry system and thus be transmitted back to the NOC.

Coming out of the bottom of the frame is a 10mm jacketed wire, 1000 meters long. The wire has a moulded under water termination that can stand the loads the mooring will experience whilst still being insulated from the sea water and thus allowing the data stream to travel un-hindered. Along the wire, at pre-determined points, there are eleven SBE 37 CTDs. all of these have built in modems allowing their data to be part of the telemetry system.

Deck operations.

The winches used for mooring operations are net drums. These winches easily accommodated our wire and ropes. The recovery and deployment method was to use the main aft "A" frame with a block attached to a wire coming from one of the winches. This method allows the block to be raised and lowered when required.

The stopping off of the mooring wires to insert instrumentation and buoyancy in to the mooring utilized a snap hook and chain secured to the deck.

To help control the wires whilst they are being deployed we used the hydraulic rams that come out of the deck and out of the aft pedestals. These work really well by preventing the wires from moving around too much and getting caught in places they shouldn't.
They were also used to help slip releases and buoyancy out by taking turns around them and holding the load or letting the load out as was needed.

As the moorings were anchor last deployments we used the ships launching technique. This was a solid wooden platform that the anchor was lowered on to, at the forward end the winch hook was attached so when the anchor launch was due we simply lifted up on the winch and tipped the anchor over.

The CTD winch has a heave compensator that is really effective and is simple in its design. It works by using powerful springs that react very quickly to any movement of the ship. It is the first compensator that I have seen that actually works and it is by far the simplest design.

Mooring numbers.

MOORINGS RECOVERED

Mrg.No	Mrg.ID	Deployed	Recovered
2006/	PAP3	DISCOVERY	CE 716

MOORINGS DEPLOYED

Mrg.No	Mrg.ID	Deployed	Recovery
2007/	PAP3	CE 716	2008
2007/	PAP1	CE 716	2008
2007/	BATHYSNAP	CE 716	2008

Diary of mooring events

Monday 18th June
Started mobilization at 16:00 using the ships crane, all went well and we were all loaded at 20:00.

Tuesday 19th June
We wound on all of the DOMS mooring ropes and wires, putting a protective tarpaulin layer between the ropes and the steel wire ropes.
We assembled the surface toroid, connecting up all the leads and securing them, and connecting the 5/8" chain to the shackle point.
We unboxed all the instrumentation and secured everything ready for sea. The Seabirds had new batteries installed and were tested and all was fine ID numbers were assigned from 40 to 51.
We put new batteries in to the RCM11's and tested them and all was found to be OK.
We attended the ship safety and familiarization meeting and had to produce our passport, ENG1 and Sea Survival Certificates.
`We checked that the instrument frame clamps fit on to the CTD frame and they do with a little rubber and tape.
The mooring diagrams were updated.
We sailed at 19:30 local time.

Wednesday 20th June
We wound on PAP3 (sediment trap mooring). We then made up all the glass spheres for all the moorings including the Bathysnap.
We assembled all of the Bathysnap ropes, swivels and buoys ready for deployment.
We assembled the billings float with recovery line for PAP3.
We started to look at adding the SAMI instrument frame in to the DOMS mooring. This was not expected but we may be able to put it beneath the ½ meter chain under the existing instrument frame.
The acoustic releases were readied for the wire test and the Seabirds were set up ready for the calibration dip and the deck units were put on charge.
We had a meeting today where Richard came up with a plan of attack, it goes as follows-

- Thursday 08:00 – CTD cast to calibrate all Seabirds to 3500m
- When this is done another CTD cast with the Wet-labs and the ISUS to 300m
- Then another CTD to wire test the releases to 5000m
- Friday 08:00 – deploy DOMS mooring
- Recover Bathysnap
- 17:00 recover PAP3
- deploy Bathysnap
- Saturday 08:00 – deploy PAP3

Thursday 21st June
We started the day with a CTD cast to 3500m; this was to calibrate all 12 of the Microcats. The cast was successful with all of the Microcats having full data sets.

We then carried out a second CTD cast to 300m; this was to calibrate the ISUS and the Wetlabs instruments. This was also successful with both instruments having full data sets.
We then attached the three releases and the two RCM11's to the CTD frame, this was sent down to 4600m; two of the releases fired OK (SN's 184 and 255, both 661), but the third. SN 252 (861) had failed.
We tested all of the telemetry parts, assembled the 30m of chain, the instrument frame, the 10mm wire and all the modems and leads. It all went together well.
We then had to try and find some way of clamping the SAMI instrument to the instrument frame. Working with the ships engineers we came up with a solution; we could use parts from the Bathysnap frame to make clamps. This would mean that we would rely on recovering the Bathysnap that is already out, so it was decided that we would recover the Bathysnap first thing in the morning and if we get it back OK then we can use the parts to make clamps.

Friday 22nd June

Dave got up exceptionally early and released the Bathysnap at 06:00, Dave has shown, once again, that he is working well above his current grade. Unfortunately the Bathysnap release would not give consistent ranges, the release command was sent a number of times and a look out was kept, this was repeated for a number of hours, as well as maneuvering the ship, we also turned the echo sounder off and tried both of the deck units we have with us. Eventually it was decided we should move on with the program.
Overnight the release that had failed (SN252, 861) was wire tested again to 4700m; it failed again. It is worth noting that it releases fine on deck.
New clamps were made for the SAMI sensor and this was fitted in to the instrument frame. The rest of the frame was assembled and the Microcats were set up for deployment.
The PAP1 DOMS mooring was then deployed, starting at 14:25 and finishing at 18:07. All went very well, with no problems. The release was watched down using the deck unit. It has become apparent that un-plugging the Bathysnap was a mistake as it now needs to be opened up in a dark room.
The release SN 252 (861) that has now failed twice will be sent down on the CTD once again.

Saturday 23rd June

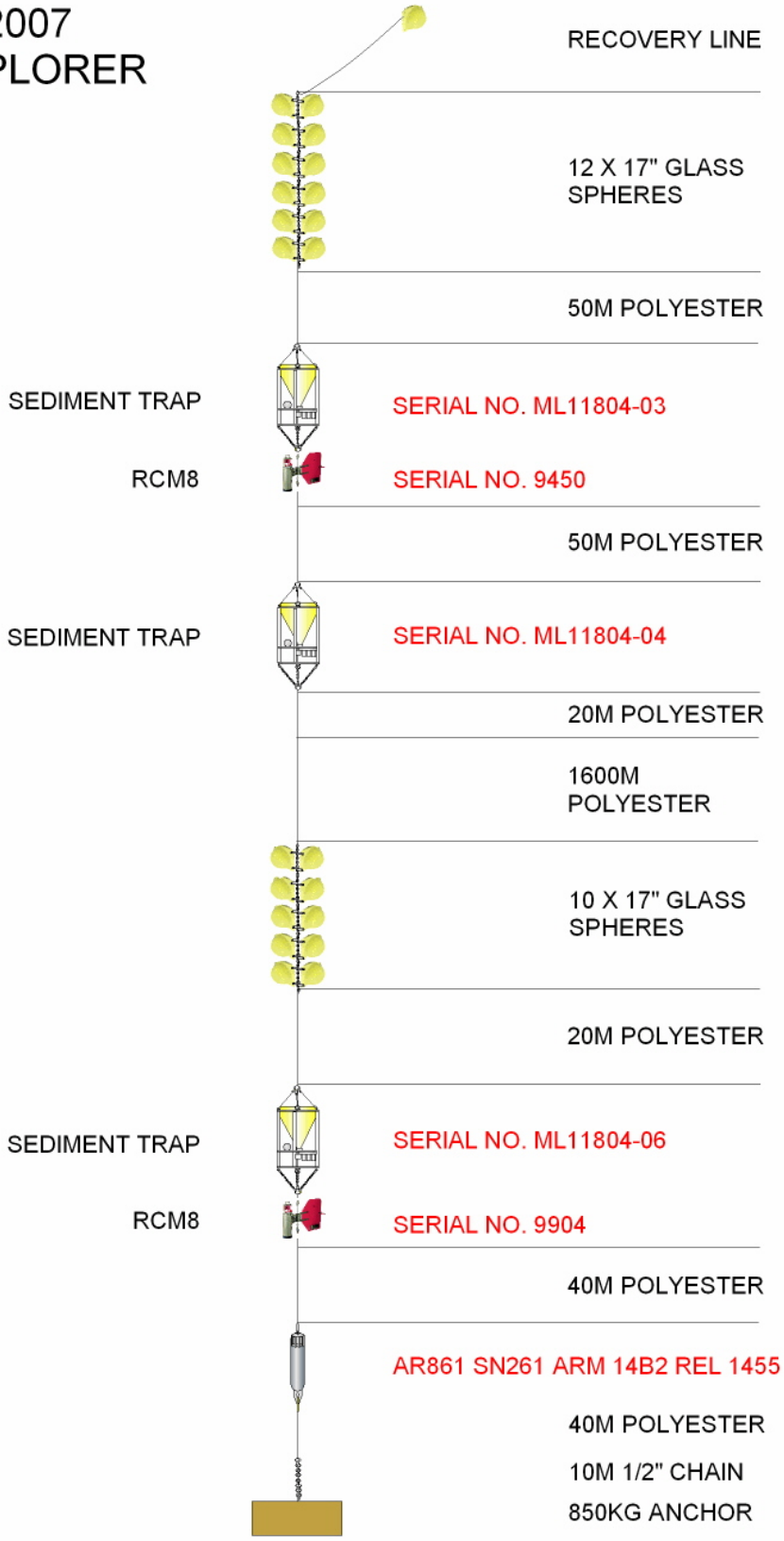
News has come in from NOC indicating that the PAP1 telemetry mooring is doing well: all twelve of the Microcats that are on the 10mm diameter wire are all transmitting data. Unfortunately, none of the sensors in the instrument frame are transmitting. The instruments that are not transmitting are the ISUS, the Wetlabs and the Microcat. They should, however, be logging all the data anyway.
Acoustic release SN252 (861) that has failed twice was deployed on the CTD to 1500m and fired OK.
We then tried to establish communication with the PAP3 release; we could not get any reliable ranges so the release command was sent repeatedly. We moved position and tried again, still no consistent ranges were received. We then moved back directly over the mooring position and sent the release command a number of times, still no good ranges but the mooring had surfaced and was spotted.
We then commenced recovery of the mooring, apart from a tangle near the bottom pack of spheres causing the sediment trap to be recovered up side down, all went well.
We then readied everything for the PAP3 deployment, Richard raised concerns over the new sediment trap bridles, why change them when we have a reliable system?

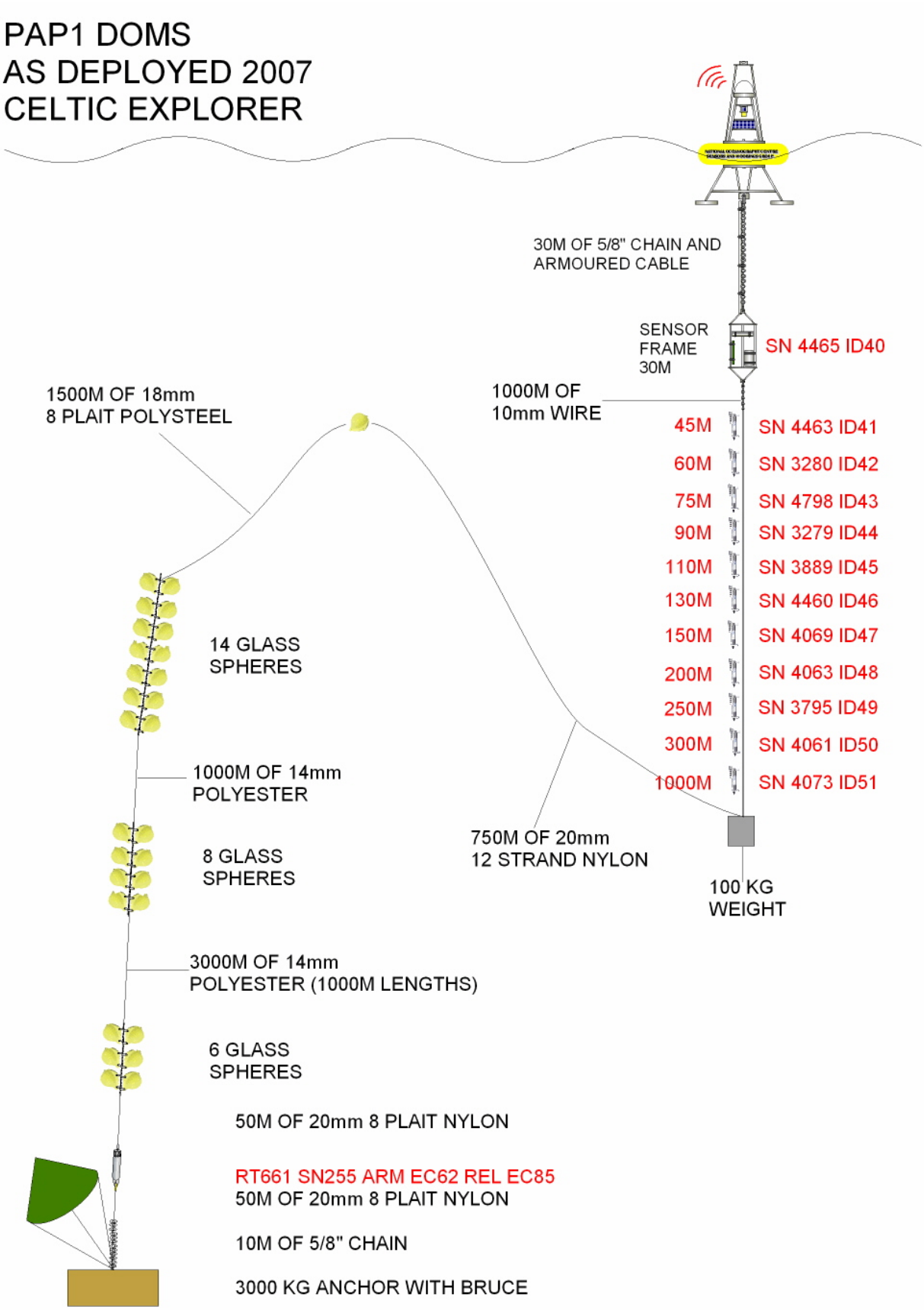
The PAP3 deployment started at 13:20 and all went well. We had to tow for around 30 minutes before dropping the anchor at 14:55. All went well with very little leakage from the sediment trap bottles.
We then serviced and installed new batteries in to the release that was recovered from PAP3, SN261 (861).
This was shackled to the CTD frame along with SN252 that has failed twice and worked once to 2500m.
Both releases on the frame had fired.
We started putting the Bathysnap together again and got ready for deployment. Dave managed to successfully get the camera working again, Dave, once again saving the day.
Whilst we were doing this we tried to communicate with the 2006 Bathysnap, again we were unsuccessful, sending the release command a number of times and waiting and watching.
We deployed the Bathysnap at 21:25 using the Sea Catch release hook, all went well.

Sunday 24th June

We started packing away all of the remaining kit as we headed back in.
The ISUS, Wetlabs Fluorometer and Microcat on the biogeochemical sensor frame at 30 m were transmitting near real-time data via telemetry for 24 hours.

PAP3 TO RECOVER 2007 CELTIC EXPLORER




PAP1 DOMS
AS DEPLOYED 2007
CELTIC EXPLORER
30M OF 5/8" CHAIN AND
ARMOURED CABLE
SENSOR
FRAME
30M
SN 4465 ID40
1000M OF
10mm WIRE
45M
SN 4463 ID41
60M
SN 3280 ID42
75M
SN 4798 ID43
90M
SN 3279 ID44
110M
SN 3889 ID45
130M
SN 4460 ID46
150M
SN 4069 ID47
200M
SN 4063 ID48
250M
SN 3795 ID49
300M
SN 4061 ID50
1000M
SN 4073 ID51
1500M OF 18mm
8 PLAIT POLYSTEEL
14 GLASS
SPHERES
1000M OF 14mm
POLYESTER
8 GLASS
SPHERES
3000M OF 14mm
POLYESTER (1000M LENGTHS)
6 GLASS
SPHERES
750M OF 20mm
12 STRAND NYLON
100 KG
WEIGHT
50M OF 20mm 8 PLAIT NYLON
RT661 SN255 ARM EC62 REL EC85
50M OF 20mm 8 PLAIT NYLON
10M OF 5/8" CHAIN
3000 KG ANCHOR WITH BRUCE

PAP3 AS DEPLOYED 2007 CELTIC EXPLORER

RECOVERY LINE

BILLINGS FLOAT WITH LIGHT SNE03051

15M POLYPROP

12 X 17" GLASS SPHERES

50M POLYESTER

SEDIMENT TRAP 11804-07

RCM11 423

50M POLYESTER

SEDIMENT TRAP 11262-06

525+525+550M POLYESTER

10 X 17" GLASS SPHERES

50M POLYESTER

SEDIMENT TRAP 1516 OLD TYPE 21 BOTTLE

RCM11 419

50M POLYESTER

RT661 SN184 ARM EC52 REL EC85

45M POLYESTER

10M 1/2" CHAIN

850KG ANCHOR

BATHY - SNAP
AS DEPLOYED 2007
CELTIC EXPLORER

10M RECOVERY LINE

10M ROPE

50M ROPE

BATHY - SNAP FRAME
AR861 SN261
ARM 14B2
REL 1455

As can be seen from the diary of events acoustic release SN252 had failed the wire test twice before working at 1500m and then 4600m.

Serial No	Type	Previous Location	Current Location	Date Deployed	Position		Water Depth	Serviced	New Batts	Bench tested	Wire tested	Depth tested
					Lat	Long						
184	RT661	NOC	PAP3	23/6/07	48 58.56	16 27.74	5000	Y	Y	Y	Y	4600
255	RT661	NOC	PAP1	22/6/07	49 0.98	16 24.12	5000	Y	Y	Y	Y	4600
252	AR861	NOC	CE	N/A			N/A	Y	Y	Y	Y	4600
261	AR861	PAP3	BATHY	23/6/07	49 0.27	16 28.00	5000	Y	Y	Y	Y	4600

Light

Only one light was used on this cruise and it was serviced and checked prior to shipping, new batteries were installed prior to deployment on PAP3.

Rob McLachlan, Chris Crowe and Dave Childs

Outreach and training

Despite its short duration, this cruise represented one of the first opportunities to capture live footage of long-term time-series moorings being deployed into the open ocean. A team member, Martin Agis (Océanopolis), was dedicated to the filming and recording of the science and deployments. This footage will form the basis for a future short film on deep-ocean observatories. A cruise diary was also set up on land by members of the EUR-OCEANS team (Ivo Grigorov). This was specifically designed for secondary school aged children to allow them to see and learn about cruises in real time. Each day, members of the scientific team wrote diary entries that were sent by email and uploaded onto the website. Photos and interviews with the scientists were also uploaded so that the students could see live action from the ship. The cruise diary was successful, despite the broadband internet connection to the ship being lost for most of the trip, as connection to the satellite occurred 4 times daily. 3 students from Galway were also on board for the cruise as a learning and training initiative by the NUI, Galway. In the future, these training events could broaden to include teachers to widen the educational impact.

The survey also included a training program for three students (two 3rd year and one 4th year BSc) from NUI, Galway, under the guidance of Dr.Martin White (Earth and Ocean Sciences), taking an ideal opportunity to watch and participate in the PAP activities. The students were guided in the use of the CTD and the underway ADCP, as well as obtaining experience in sampling techniques from the CTD rosette sampler. In addition, the two 3rd year students collected data for final year research BSc degree projects. The help and co-operation of the NOC scientists in these activities is most appreciated.

Martin Agis, Kate Larkin and Martin White

Ship facilities and support

Much of the success of this cruise can be attributed to the excellent facilities available and the highly effective support from all members of the ship-side community. All on-board equipment worked flawlessly and was very well maintained including a high level of cleanliness both on deck and in the accommodation and recreational areas.
The only malfunction and disappointment but one which is not a ship-side failure was the internet communication system. It states in the ship description issued to users that broadband is available on board. It does not state that this is only available in coastal waters and in spite of repeated attempts by the technical officer to rectify the situation we were without this facility. This was particularly unfortunate as one of the scientific complement was on board specifically for the purpose of developing our outreach abilities and had hoped to provide daily interviews and web casts to the public. If the ship is to be used in future, one would expect this service to be available and if it is not available one would hope to be informed of this well in advance of the cruise.

Rob McLachlan and Richard Lampitt

Acknowledgements

The PSO would like to acknowledge the tremendous support given by the ship side during this cruise. These thanks are warmly extended to all components including the deck hands, engineers, bridge officers and the galley staff. The “can-do” attitude by all of these is an example from which we can all learn and I look forward to further collaboration in the future.

Station list

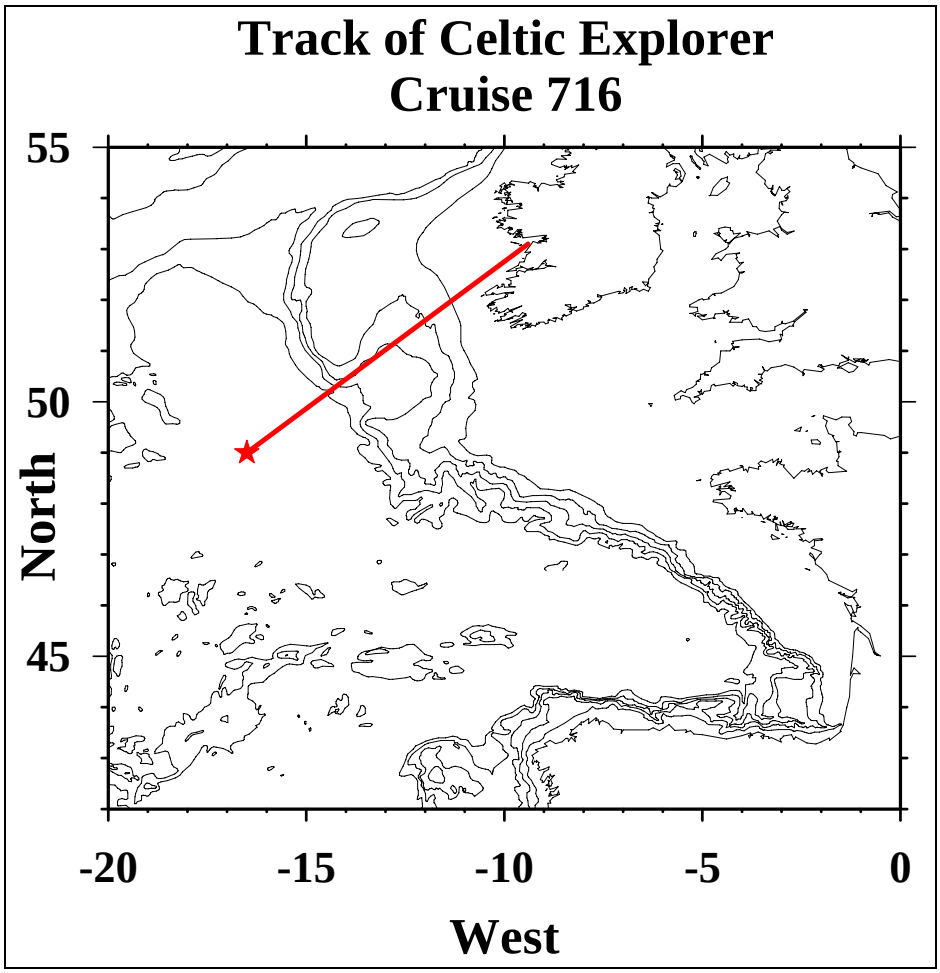
All times are GMT

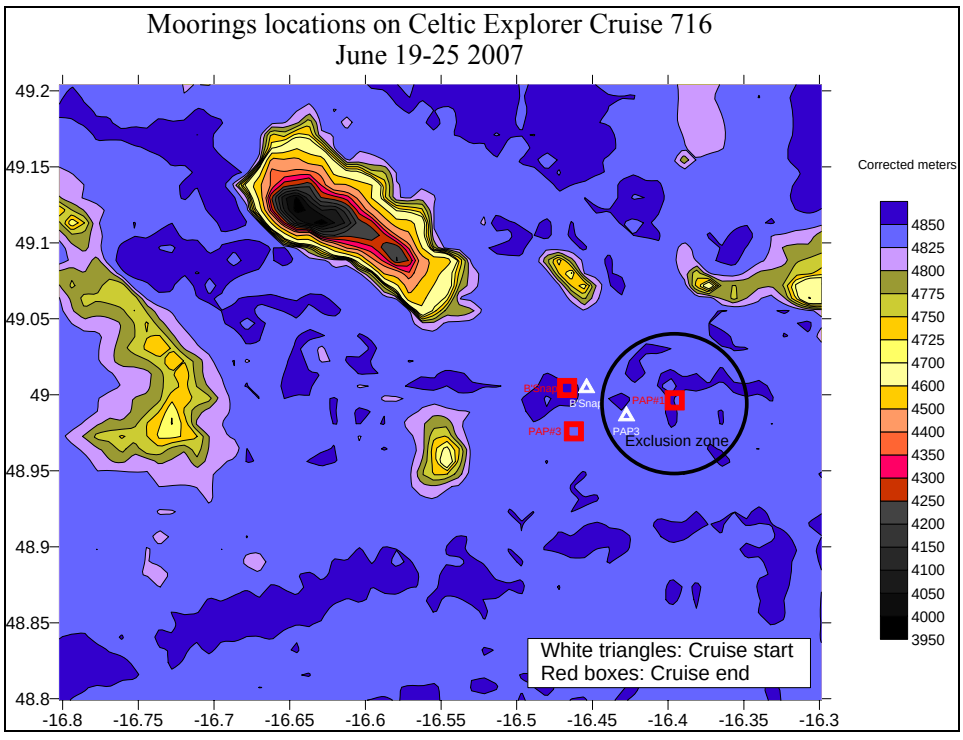
		Time						Start Position				End Position				Comments
Station	Date	Start	End	Water depth		Activity	Sample depths m	North		West		North		West		
		GMT	GMT	Uncorr (m)				Deg	Min	Deg	Min	Deg	Min	Deg	Min	
				start	end											
0716_001	21/06/2007	12:35		4840		CTD for Microcat calibration to 3300m	3300 to 10	48	59.94	16	30.12					Drain taps open.
0716_002		13:48	14:17	4840		CTD for Fluor. and Isus cal. to 300m	300 to 10	48	59.95	16	30.12					
0716_003		14:52	18:00	4840		CTD for acoustic release test to 4700m	4700	48	59.95	16	30.11					1 release failed to fire
0716_004		18:24		4840		CTD for microbial sampling	304 to 7	48	59.95	16	30.12					2 bottles failed
0716_005		19:40	19:49	4842		CTD for microbial sampling	40 to 5	48	59.95	16	30.11					
0716_006		20:04	23:00	4840		CTD for acoustic release test	4700	48	59.95	16	30.12					Release failed to fire again
0716_007		23:40	00:10			200micron zooplankton net	200 to 0									

0716_008	22/06/2007	00:20	00:55			200micron zooplankton net	200 to 0									
0716_009		03:00	03:40			Snatcher	40	48	59.90	16	30.10					
						Attempt to recover Bathysnap		49	0.27	16	27.23					Initial contact and conf. of release but then no subsequent ranges and no sight on surface.
0716_010		12:28	12:43			CTD to 40m	38 to 15	49	0.13	16	27.27					
0716_011		14:25	18:07	4840	4842	Deploy PAP#1 (DOM)	1000 to 30	48	55.23	16	18.40	49	1.0	16	24.1	SAMI sampling on odd hours (GMT), ISUS and fluorimeter on even.
0716_012		20:29	22:10	4842		CTD to 2500m	2507 to 1185	49	5.09	16	24.06	49	5.1	16	24.1	For Martin White. Faulty release re-tested and fired at 2470m
0716_013		22:20				200micron zooplankton net	200 to 0	49	5.00	16	24.00					
0716_014			23:30			200micron zooplankton net	200 to 0									
0716_015	23/06/2007	01:04	02:38	4839		CTD to 2500m		48	54.99	16	18.00	48	55.0	16	18.0	For Martin White
0716_016		03:45	04:31	4840		CTD to 2500m	2475 to 1999	48	54.99	16	30.01	48	55.0	16	30.0	For Martin White
0716_017		07:15	07:30	4842		CTD to 40m	39 to 6	48	59.16	16	25.05					For Sergio Balzano

0716_018		08:30				Snatcher	25									
0716_019		09:54	11:05	4843		Recover PAP#3 (ST mooring)		48	59.16	16	25.65					
0716_020		13:20	14:55	4810	4841	Deploy PAP#3 (ST mooring)		48	58.48	16	32.36	48	58.6	16	27.7	
0716_021		15:20	18:30			CTD to 4700m (release test, Micros and CO2)		48	58.60	16	30.70					Both releases fired
0716_022		19:15				Snatcher	30	49	0.00	16	27.40					
						Further attempts to recover Bathysnap										
0716_023		21:10	21:25			Deploy Bathysnap		49	0.10	16	27.30	49	0.270	16	28.0	6 flashes at 2 minute intervals witnessed from 2100h then anticipated every 8 hours.
0716_024		22:20				30 micron zooplankton net	100 to 0									
0716_025						200micron zooplankton net	200 to 0									
0716_026			23:20			200micron zooplankton net	200 to 0									

Charts


Track of Celtic Explorer
Cruise 716
55
50
45
North
-20
-15
-10
-5
0
West


Moorings locations on Celtic Explorer Cruise 716
June 19-25 2007
49.2
49.15
49.1
49.05
49
48.95
48.9
48.85
48.8
-16.8
-16.75
-16.7
-16.65
-16.6
-16.55
-16.5
-16.45
-16.4
-16.35
-16.3
Corrected meters
4850
4825
4800
4775
4750
4725
4700
4600
4500
4400
4350
4300
4250
4200
4150
4100
4050
4000
3950
PAP3
Exclusion zone
White triangles: Cruise start
Red boxes: Cruise end