Prince Madog cruise 34/03
20, 21 August 2003
POL Coastal Observatory cruise 11
REPORT

1. Objectives

1. At 53º 32´ N 3º 21.8´ W, half a mile west of the Mersey Bar Light Vessel –

To recover
a) A sea bed frame for a 600 kHz ADCP to measure the mean current profile, pressures and directional waves. A pressure recorder, a transmissometer / conductivity / temperature logger and a SeaBird MicroCAT are fitted to the frame.
b) A CEFAS SmartBuoy in a single point mooring with an Aanderaa temperature and conductivity logger at 10 m below the surface.

To deploy
c) A sea bed frame for a 600 kHz ADCP to measure the mean current profile, pressures and directional waves. A pressure recorder, a transmissometer / conductivity / temperature logger and a SeaBird MicroCAT are also fitted to the frame. In addition, a 1.2 MHz ADCP interfaced to a SeaBird MicroCAT (RS-485 interface) was fitted for trial purposes.
d) A CEFAS SmartBuoy in a single point mooring with an Aanderaa temperature and conductivity logger at 10 m below the surface.
e) A toroid with Orbcomm instrumentation in trial mode.

2. To conduct a CTD / LISST survey of 34 stations every 5 miles covering the eastern Irish Sea between the North Wales coast and Blackpool and the Lancashire coast and the Great Orme, to determine the effects of the rivers Dee, Mersey and Ribble on Liverpool Bay. To obtain calibration samples for salinity and for chlorophyll at selected stations.

2.1 Scientific personnel

R. Proctor
I. Andreu-Burillo
M. Burke
J.D Humphery
J.P. Pugh
M.J. Smithson
D. Sivyer (CEFAS)
A. Hammerstein (School of Ocean Sciences)

2.2 Ship's officers and crew

A.D. Price (Master)
I. Bosworth (Chief Officer)
A. Williams (Chief Engineer)
N. Holmes (Second Engineer)
T. Roberts (Bosun)
D.D. Williams (A.B.)
D. Lloyd Jones (A.B.)
E. Pritchard (Cook)

3. Narrative (times in GMT)

The SmartBuoy, Orbcomm toroid, anchor chain, sea-bed frame and instrumentation were loaded onto RV Prince Madog on the afternoon of 19 August 2003. (The SmartBuoy toroid was floated to the ship.) The ADCP frame was set up on the afterdeck and the tower fitted to the SmartBuoy toroid. The Orbcomm unit was powered up to check that the battery pack connections were correct and that the unit could be initialised. On confirming this, the GPS antenna was attached to the main unit to see if a position fix could be obtained, unfortunately after 30 or so minutes the unit was unable to get a position. This could be for two reasons, either we were in a GPS black spot, or the antenna / cable was faulty. As we were unsure where the fault lay it was decided to change the software, as the program relied on a position fix being found before an email was sent. The program was altered to look for a position fix and if none was found to send an email to that effect. The Orbcomm toroid was fitted out on the morning of 20th.

RV Prince Madog left Menai Bridge at 07:09 on 20 August. Recording of surface sampling and ADCP were switched on at 07:56, near Puffin Island. No windspeed is being recorded by the ENVIRO. Weather sunny, winds SW 3/4, very slight swell. The mooring site was reached at 10:38. The Orbcomm toroid was deployed at 10:39 and its anchor chain at 10:42. Two calibration CTD's (at 11:06 and 11:21) for the transmissometer and MicroCAT were required (as instrument wasn't in the water for long enough on first dip to carry out the transmissometer calibration). Surface water samples were collected. A calibration CTD for the RS-485 MicroCAT was not carried out as its blanking plug had been left behind at POL. A calibration dip will be carried out after recovery.

The weather had deteriorated a little, it had become cloudy and the wind increased slightly. The ADCP was released at 11:45, inboard by 11:52 and its ballast weight inboard by 12:02. The frame was covered in 'furry' growth. Some shuffling of the frames on deck was necessary. The new ADCP was deployed at 12:26. The SmartBuoy was deployed between 12:52 and 12:54. Recovery of the SmartBuoy and anchor chain was between 13:09 and 13:23. The SmartBuoy had a covering of slimey growth. The deck was tidied, completing the mooring work and both SmartBuoy and ADCP were pressure hosed to remove as much growth as possible. All objectives had been accomplished in an afternoon of intensive activity aided by the benign weather conditions.

The CTD survey commenced with station 1 at 13:55, followed by stations 10, 2 – 9, 11 – 34 finishing at 12:30 on 21st. Water bottle samples were taken at each station, for salinity calibration. Water bottle samples were taken at the surface at stations 1, 5-9, and 11 for chlorophyll and nutrient(N) calibration. Weather worsened during early hours of 21st, wind increasing to westerly force 6. Frequent dousing of the CTD deck. Surface sampling was switched off at 13:21. RV Prince Madog was alongside at Menai Bridge at 14:05.

All of the mooring objectives were accomplished and all 34 CTD sites visited. The area was in general well-mixed vertically, only stations 1 (2nd and 3rd visits), 11, 14, 15, 17-19, 28 and 30 showed signs of stratification. Surface temperatures varied between 16.45 and 18.94ºC and salinities between 32.16 and 33.97.

4. Moorings (times in GMT)

4.1 The set up of the recovered instruments was as follows:

a) Mean ADCP 600 kHz RDI 2390; battery case 0068
Mode 1: 100 pings every 10 minutes (velocity standard deviation 0.007 m s^{-1}).
35 x 1 m bins (2.65 – 36.65 m above the bed).
Beam co-ordinates - speeds, correlation, echo intensity, % good.
Sound velocity calculated from temperature, depth and salinity of 32.
Fitted with a pressure sensor and 2 x 256 Mb memory; hourly wave recording enabled.
Clock set at 13:36 on 21 July 2003, delayed start at 08:00 on 24 July 2003, power disconnected at 21:58 on 20 August 2003. ADCP clock had jumped 1 hour between ensembles 3417 and 3418, 2 ensembles missing. RDI are aware of this problem.

Aanderaa pressure recorder BPR 1357: 10 minute sampling, Clock set at 22:19:30 on 22 July 2003, started 22:30 on 22 July, 2003; first reading at 22:30:49 on 22 July 2003, last reading at 23:50:46 on 20 August 2003; 21099 words. Clock is 1 s slow

25 cm Sea-Tech Transmissometer, ST637, recording in Aanderaa logger (RCM7 11820 /DSU 3735) fitted with temperature and conductivity sensors: 10 minute sampling, Clock set at 19:57:15 on 22 July 2003, started at 20:00 on 22 July 2003.
Air readings between 20:30 & 21:20 on 22 July and blocked path readings between 21:30 & 22:20 on 22 July 2003.
Last reading at 00:50:08 on 21 August 2003. Clock is 16 s slow. Last reading consisted of 220 (should be 6) words, total number of words is 43913 (should be about 25000). This has happened before with a (different) Sea-Tech transmissometer interfaced to an (different) Aanderaa logger and is thought to be a problem with the WS Ocean interface board. The output signal from the Sea-Tech transmissometers has been deteriorating over time and we now have only two working loggers. Consideration of replacement instruments for the Sea-Tech transmissometers should be regarded as a priority

SeaBird MicroCAT temperature, conductivity recorder (37IM29828-2081 – ID02). Reference depth was set to 25m. Clock set at 07:56:00 on 24 July 2003.
Pre-deployment calibration dip on CTD 1, 10-second sampling started at 10:50 on 24 July 2003. Into water (surface) at 10:52, on bottom between 11:00 and 11:10).
Restarted at 12:00 on 24 July 2003, 10-minute sampling, last reading at 12:50 on 20 August 2003.
Post-recovery calibration dip on CTD 13, Station 11, 10-second sampling, started at 21:00:00 on 20 August 2003, last reading at 21:29:50 on 20 August 2003.

The frame, D3, was fitted with two Benthos releases, 3A (s/n 40266), 5A (s/n 44056), and a spooler with 200 m of rope for recovery of the ballast weight.

b) SmartBuoy Mooring. Aanderaa current meter RCM7 9631 / DSU 3925 without fin at 10 m below the surface to log temperature and conductivity: 10 minute samples.
Clock set at 16:51:10 on 23 July 2003, started at 17:10 on 23 July 2003. Battery flat on recovery, 2.4 V on load, 5.0 V open circuit. 15945 words. Good data to 23:50 on 5 August 2003. Clock is correct.

The NAS nutrient analyser had not been fitted to the buoy because of instrument failure.

Water sampler recovered, collected 28 samples as programmed.

Loggers still working on recovery with moderate biofouling. The telemetered data suggested biofouling had started 1 week previously.

The single point mooring was composed mainly of ½" long link chain, marked by a 1.8 m diameter toroid and anchored by a 1 tonne clump of scrap chain.

Table 1. Recovered mooring positions and times.

	Latitude (N)	Longitude (W)	Water Depth(m)	Recovery Time	Date
SmartBuoy	53º 32.216′	3º 22.037′	24.0	13:09	20/08/03
ADCP	53º 32.169′	3º 21.963′	22.0	11:45	20/08/03

4.2 The set up of the deployed instruments was as follows:

c) Mean ADCP 600 kHz RDI 2391; battery case 3036
Mode 1: 100 pings every 10 minutes (velocity standard deviation 0.007 m s^{-1}).
35 x 1 m bins (2.65 – 36.65 m above the bed).
Beam co-ordinates - speeds, correlation, echo intensity, % good.
Sound velocity calculated from temperature, depth and salinity of 32.
Fitted with a pressure sensor and 2 x 512 Mb memory; hourly wave recording enabled.
Clock set at 14:09:00 on 19 August 2003. Delayed start at 06:00 on 20 August 2003.

Aanderaa pressure recorder BPR 445 / DSU 8123: clock set at 13:19:20 on 19 August 2003, 10 minute sampling, started at 13:30 on 19 August 2003. First reading at 13:30:47.

25 cm Sea-Tech Transmissometer, ST557, recording in Aanderaa logger (RCM7 11814/ DSU 9107) fitted with temperature and conductivity sensors: Clock set at 16:58:30 on 19 August 2003. 10 minute sampling, started at 17:00 on 19 August 2003. Air readings between 17:30 and 20:50 on 19 August 2003. Blocked path readings between 21:00 on 19 August 2003 and 05:50 on 20 August 2003.

SeaBird MicroCAT temperature, conductivity recorder with pressure sensor (37IM29828-2506 – ID03):
Pre-deployment calibration dip CTD 1, 30-second sampling, started at 11:00 on 20 August 2003, in water at 11:23, on surface at 11:33.

Mean ADCP 1.2 MHz RDI 0572, battery case 0250 interfaced to SeaBird MicroCAT (37SM32218-2991 – ID01; RS485 interface).
Mode 1: 100 pings every 10 minutes (velocity standard deviation 0.007 m s^{-1})
60 x 0.5 m bins (1.1 – 31.6 m above the bed)
Beam co-ordinates - speeds, correlation, echo intensity, % good.
Sound velocity calculated from temperature, depth and salinity of 32.
Fitted with 2 x 85 Mb memory. The MicroCAT is polled by the ADCP at the start of each ensemble and its data stored within the ADCP. Because of mechanical constraints the 1.2 MHz ADCP was rotated 45° with respect to the 600 kHz ADCP.

The frame, D2, was fitted with two Benthos releases, 7A (s/n 44041), 8A (s/n 44059), and a spooler with 200 m of rope for recovery of the ballast weight.

d) SmartBuoy Mooring. Aanderaa current meter RCM7 9959 / DSU 8125 without fin at 10 m below the surface to log temperature and conductivity.
Clock set at 13:34:20 on 19 August 2003. 10 minute sampling, started at 13:40 on 19 August 2003.

The NAS nutrient analyser was fitted to the buoy, calibrated on the 14 August and set running standards at 12:00 14 August, last standard at 11:00 20 August 2003.

Water sampler WMS programmed to start at 00:00 21 August 2003. Loggers were working from 08:00 on 20 August 2003.

The single point mooring was composed mainly of ½" long link chain, marked by a 1.8 m diameter toroid and anchored by a ½ tonne clump of scrap chain.

e) Orbcomm toroid. Orbcomm unit, battery pack and GPS aerial. Anchored by ½ tonne clump of scrap chain. Switched on at 10:39 20 August 2003, set up to send GPS position by e-mail every 3 hours.

Table 2. Deployed mooring positions and times.

	Latitude (N)	Longitude (W)	Water Depth (m)	Deployment Time	Deployment Date
ADCP	53º 32.151′	3º 21.745′	22.5	1226	20/08/03
SmartBuoy	53º 32.084′	3º 22.000′	23.1	1254	20/08/03
Orbcomm toroid	53º 31.960′	3º 21.315′	21.4	1042	20/08/03

5. CTD

Table 3. Nominal CTD positions.

Site	Latitude (N)	Longitude (W)	Visited on this cruise	Chlorophyll & nutrients
1	53º 32′	3º 21.8′	yes	yes
2	53º 37′	3º 13.4′	yes	
3	53º 42′	3º 13.4′	yes	
4	53º 47′	3º 13.4′	yes	
5	53º 52′	3º 21.8′	yes	yes
6	53º 47′	3º 21.8′	yes	yes
7	53º 42′	3º 21.8′	yes	yes
8	53º 37′	3º 21.8′	yes	yes
9	53º 32′	3º 21.8′	yes	yes
10	53º 27′	3º 13.4′	yes	
11	53º 27′	3º 21.8′	yes	yes
12	53º 27′	3º 30.2′	yes	
13	53º 32′	3º 30.2′	yes	
14	53º 37′	3º 30.2′	yes	
15	53º 42′	3º 30.2′	yes	
16	53º 47′	3º 30.2′	yes	
17	53º 47′	3º 38.6′	yes	
18	53º 42′	3º 38.6′	yes	
19	53º 37′	3º 38.6′	yes	
20	53º 32′	3º 38.6′	yes	

21	53º 27′	3º 38.6′	yes
22	53º 23′	3º 38.6′	yes
23	53º 23′	3º 47.0′	yes
24	53º 27′	3º 47.0′	yes
25	53º 32′	3º 47.0′	yes
26	53º 37′	3º 47.0′	yes
27	53º 42′	3º 47.0′	yes
28	53º 47′	3º 47.0′	yes
29	53º 47′	3º 55.4′	yes
30	53º 42	3º 55.4′	yes
31	53º 37′	3º 55.4′	yes
32	53º 32′	3º 55.4′	yes
33	53º 27′	3º 55.4′	yes
34	53º 22′	3º 55.4′	yes

The Sea-Bird 911 CTD recorded temperature, conductivity, transmittance and fluorescence at 24 Hz. Since the frame was fitted with an altimeter measurements were taken to within 3 m above the bed. One water bottle was fired near the surface. Water samples from the second near surface bottle were filtered for chlorophyll and suspended sediment determination and some filtrate was preserved with mercuric chloride for nutrient determination. A LISST-25 particle sizer was fitted to the CTD and its data logged on the Sea-Bird data logging system. Copies of the Sea-Bird binary files were taken off for processing at BODC / POL.

6. Surface sampling

The intake for the surface sampling system is located underneath RV Prince Madog, at about 3 m below sea level. The parameters recorded every minute by the WS Oceans system are: Date, Solar Radiation (W m^{-2}), PAR (µmols / m^2s), Air Temperature (ºC), Relative Humidity, Relative Wind Speed (m s^{-1}), Relative Wind Direction (º) – zero indicates wind on the bow (Note: the windspeed recorder was not working on this trip), Transmissance, Hull Temperature (ºC), Barometric Pressure (mbar), Fluorescence, Turbidity, Salinity, Minimum Air Temp (ºC), Maximum Air Temp (ºC), Wind Gust (m s^{-1}), GPS Time, Latitude, Longitude, Barometric Pressure Minimum (mbar), Barometric Pressure Maximum (mbar), Conductivity sensor water temperature (ºC).

Data were recorded from 07:56 on 20 August at Puffin Island, until 13:21 on 21 August, at Puffin Island. The series is complete. Copies of the data were taken off the ship as an Excel file, along with a copy of the ship's navigation data.

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