Prince Madog cruise 35/02
12,13 December 2002
POL Coastal Observatory cruise 4
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 and pressures. 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.
c) A CEFAS Datawell directional wave recorder (single point mooring). This recovery was necessary to change a section of the mooring and to change the sampling scheme to record statistics only so that the logger would last 6 months.

To deploy
d) A sea bed frame for a 600 kHz ADCP to measure the mean current profile and pressures. A pressure recorder, a transmissometer / conductivity / temperature logger and a SeaBird MicroCat are also fitted to the frame.
e) A sea bed frame for a 600 kHz ADCP (recovery 'a') to measure the mean current profile, pressures and directional waves.
f) A CEFAS SmartBuoy in a single point mooring with an Aanderaa temperature and conductivity logger at 10 m below the surface.
g) A CEFAS Datawell directional wave recorder (recovery 'c'), single point mooring.

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 suspended sediment at all stations and for chlorophyll at selected stations.

2. Scientific personnel

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3. Narrative (times in GMT)

The SmartBuoy and mooring, sea-bed frames and instrumentation were loaded onto RV Prince Madog on the afternoon of 11 December. (The SmartBuoy toroid was rolled down the walkway.) The mean ADCP frame was set-up on the afterdeck and the tower fitted to the SmartBuoy toroid. Conditions were disagreeable since a strong, cold wind from the east funnelled along the Menai Strait.

RV Prince Madog left Menai Bridge at 08.00 on 12 December. Recording of surface sampling was switched on at 08:59, near Puffin Island, section 6. The ship's ADCP was still out of action. Given the strong easterly winds of the previous few days the sea state was surprisingly benign and good progress was made. No good underway transmissometer data were recorded until the mooring site was reached because of a blockage in the water flow past the sensor. Two lengths of spooler rope were streamed during the passage to remove all twists and kinks.

The mooring site, 53º 32′ N 3º 21.8′ W, was reached at 11.45 - details of the moored instrumentation and of the positions are given in Section 4 and Tables 1 and 2. A CTD profile was first recorded to calibrate the recording transmissometer. The SmartBuoy and directional wave buoy were visible. At 12.18 the directional wave recorder was hooked by backing up the ship and brought aboard. However, during the recovery of the mooring the rubber cord went under the ship and snagged. The ship's hull was swept with a wire, which was pulled in. This parted the polypropelene at the bottom of the wave buoy mooring and consequently the scrap chain anchor was lost. The rubber cord remained fast. Engaging the ship's propeller had no effect; moving the rudder suggested that the rubber cord might be caught on this. The rubber cord was now attached to the main winch and, with the deck cleared, pulled until it parted, just above the bottom clamp, at 13.40. The ship's propeller and rudder were tested and appeared fine. During this two trawl floats came to the surface and were recovered, together with the rubber cord clamp and a short length of polypropelene. Since the anchor and polypropelene had been lost and the bottom section of rubber cord might have been damaged the buoy could not be redeployed. Arrangements were made for these parts to be couriered from Lowestoft to Menai Bridge on Friday so that the buoy could be deployed on Saturday, extending a School of Ocean Sciences trip to recover an ADCP in Conwy Bay.

The ADCP release was fired at 14.12 and against expectations (in view of the problems experienced with spoolers on the previous two cruises) it immediately came to the surface. Together with its ballast weight it was recovered by 14.40. In contrast to the two previous occasions there was very little fouling – even the transmissometer window appeared clean. The replacement ADCP was deployed at 15.30.

The SmartBuoy was prepared and deployed anchor first between 16.42 and 16.51, in time for the 17.00 NAS-2E measurement. Mooring work was now suspended because it was dark, to allow adequate rest for the crew and because the next day's forecast was satisfactory, with resumption planned for 10.00 the next morning. The CTD survey (the LISST was now set to record for each profile) began with a profile at the mooring site. Because it was near high water the next station was 10 followed by 2 - 9, 11 – 17, 28 -26, 18 - 20. The cast at station 9 (the mooring site) was recorded at midnight, to coincide with the SmartBuoy recording cycle.

After station 20, at 08:55 on 13 December, the spatial CTD survey was interrupted to complete the mooring work, although another CTD was recorded at the mooring site (station 1/9). During the night data from the recovered ADCP had been downloaded (it took only 20 minutes at a baud rate of 56 kbytes) and the waves commands uploaded. This ADCP, to trial the directional wave software, was deployed at 10:31. The SmartBuoy was recovered between 10:49 when the buoy stray line was grappled as the ship backed up to the buoy and 11:00 when the anchor clump was on deck. The spatial CTD survey recommenced with stations 21 – 25 and 32 – 34. The survey finished at 16:28, surface sampling was switched off at 17:10 and RV Prince Madog docked at Menai Bridge at 17:50.

The next day (14 December) RV Prince Madog departed Menai Bridge at 08:12. The directional wave buoy was deployed between 13:23 and 13:26 and the ship berthed at Menai Bridge at 17:06.

All of the mooring objectives were accomplished and 31 out of 34 CTD sites visited (sites 29, 30 and 31 were missed).

4. Moorings (times in GMT)

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

a) Mean 600 kHz ADCP, 2390
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).
Earth co-ordinates - speeds, correlation, echo intensity, % good.
Sound velocity calculated from temperature, depth and salinity of 32.
Fitted with a pressure sensor.
Delayed start 19:10 on 12 November 2002. Last scan was at 23:20 on 12 December, 2002. The clock was 45 seconds fast.

Aanderaa pressure recorder BPR 445: 10 minute sampling, started 16:10 on 12 November, 2002. The first reading was at 16:10:48 and the last at 16:30:58 on 17 December, 2002. The file contains 25431 words.

25 cm Sea-Tech Transmissometer, ST637, recording in Aanderaa logger (RCM 11817) fitted with temperature and conductivity sensors: 10 minute sampling, started at 16:40 on 12 November 2002. The last reading was at 12:40:26 on 17 December, 2002. The file contains 30318 words. The transmissometer data looks bad, as it was for this combination of instruments at the end of the August / September deployment.

SeaBird MicroCat temperature, conductivity recorder, (37IM29828-2081, ID=02): 10 minute sampling was started at 12:00:10 on 13 November, 2002. The last reading was at 05:40:10 on 13 December, 2002. The record size was 4283.

The frame, D6, was fitted with two Benthos releases, 1B, 5A, and a spooler for recovery of the ballast weight. The frame surfaced immediately when the first release was fired. There was no growth on the frame.

b) SmartBuoy Mooring. Aanderaa current meter RCM8 10526 without fin at 10 m below the surface to log temperature and conductivity: 10 minute samples.
Started at 16:30 12 November. The last reading was nominally at 16:50:00 on 6 December, 2002. The file contains 20904 words. The battery was flat on recovery

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.

c) Directional wave buoy.
The bottom section of the mooring was lost during the recovery (see narrative).

Table 1. Recovered mooring positions and times.

	Latitude (N)	Longitude (W)	Water Depth (m)	Deployment Time	Deployment Date	Water Depth (m)	Recovery Time	Recovery Date
Mean ADCP	53º 32.045´	3º 21.748´	24	14:05	13/11	24	14:12	12/12/02
SmartBuoy	53º 31.932´	3º 22.080´	26	14:51	13/11	24	10:49	13/12/02
Wave buoy	53º 31.905´	3º 21.909´	26	15:47	13/11	24	12:18	12/12/02

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

d) Mean 600 kHz ADCP, 2391
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).
Earth co-ordinates - speeds, correlation, echo intensity, % good.
Sound velocity calculated from temperature, depth and salinity of 32.
Fitted with a pressure sensor.
Battery case 0250
Started at 19:00 on 11 December 2002.

Aanderaa pressure recorder BPR 1357: 10 minute sampling, started 17:10 on 11 December, 2002 The initial time stamp failed to record.

25 cm Sea-Tech Transmissometer, ST556, recording in Aanderaa logger (RCM 11818) fitted with temperature and conductivity sensors: 10 minute sampling, started at 18:50 on 11 December. Air readings at 08:30 & 08:40 12 December and blocked path readings from 08:50 – 09:20 12 December.

SeaBird MicroCat temperature, conductivity recorder (37IM29828-2010 – ID01): 10 minute sampling was started at 12:00 on 12 December 2002. The reference depth was set to 25 m.

The frame, D4, was fitted with two Benthos releases, 7A, 8A, and a spooler for recovery of the ballast weight.

e) ADCP 2390
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).
Earth co-ordinates - speeds, correlation, echo intensity, % good.
Sound velocity calculated from temperature, depth and salinity of 32.

Fitted with a pressure sensor and 512Mb of memory; wave recording enabled
Battery case 3036
Started at 05:00 on 12 December 2002.

f) SmartBuoyMooring. Aanderaa current meter RCM7 9631 without fin at 10 m below the surface to log temperature and conductivity: 10 minute samples.
Started at 18.30 on 11 December 2002.

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.

g) Directional wave recorder
Standard wave buoy mooring.

Table 2. Deployed mooring positions and times.

	Latitude (N)	Longitude (W)	Water Depth (m)	Deployment Time	Deployment Date
Mean ADCP	53º 31.995′	3º 21.670′	26	15:30	12/12/02
Waves ADCP	53º 31.991′	3º 21.352′	23	10:31	13/12/02
SmartBuoy	53º 31.917′	3º 22.452′	28	16:51	12/12/02
Wave buoy	53º 31.886′	3º 22.281′	25	13:26	14/12/02

5. CTD

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 2 m above the bed. Two water bottles were fired near the bed and one or two near the surface. Near bed and near surface water samples were filtered for suspended sediment determination. The other near bed bottle was used for reversing thermometer readings and a water sample for salinity determination back at the School of Ocean Sciences. 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. LISST 100 particle size profiles were recorded on all except the first CTD profile. Copies of the Sea-Bird binary files were taken off for processing at BODC / POL.

Table 3. Nominal CTD positions.

Site	Latitude (N)	Longitude (W)	Visited on this cruise	Chlorophyll & nutrients
1	53º 32′	3º 21.8′	yes (twice)	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	yes
11	53º 27′	3º 21.8′	yes	yes

Site	Latitude (N)	Longitude (W)	Visited on this cruise
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′	no
30	53º 42	3º 55.4′	no
31	53º 37′	3º 55.4′	no
32	53º 32′	3º 55.4′	yes
33	53º 27′	3º 55.4′	yes
34	53º 22′	3º 55.4′	yes

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, 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 08:59 on 12 December, at 53° 18.935' N 4° 02.330'W, until 17:10 on 13 December, at 53° 17.208' N 4° 03.642' W, with a gap between 19:57 and 20:37, inclusive, on 12 December. The transmissometer data were incorrect until 13:00 on 12 December. Copies of the data were taken off the ship as comma separated variable ASCII files.

Acknowledgements
The assistance of the Captain, Steve Duckworth, officers, bosun, Phil Jones, and crew contributed greatly to the success of the cruise.