Natural Environment Research Council

Institute of Oceanographic Sciences
Crossway, Taunton, Somerset. TA1 2DW

PROVISIONAL CRUISE REPORT

VESSEL: RV Frederick Russell
Cruise No 81/14 Second leg

CRUISE LOCATION: West Solent

CRUISE PERIOD: 14-22 October 1981

PERSONNEL:

D N Langhorne (Principal Scientist)	14-21 October
A D Heathershaw	14-21 October
R A Haine	14-18 October
G P Le Good	14-22 October
E J Moore	14-22 October
D J Corns (Mrs)	14-22 October
A A Read	14-18 October
P D Thorne	14-21 October
A P Salkield	18-21 October

OBJECTIVES:

a) To conduct boundary layer flow measurements on the different gravel bedform types in the West Solent.

b) To study gravel movement using underwater TV, a sediment trap and an acoustic probe to record self generated noise (see appendix).

c) If time and environment conditions permitted, to conduct preliminary observations of gravel movement under waves.

The cruise was part of a DoE Commission. Project S26.

PROCEDURE AND METHODS:

a) Trisponder remote stations were set up on the yacht club staging at the entrance to Lymington river (43485E, 93528N). and in the roof of the hut at the end of Yarmouth Pier (43543E, 90002N).

b) It was intended to operate two boundary layer flow rigs simultaneously with the ship anchored by three anchors. On the first day this proved to be unsatisfactory and for the remainder of the cruise a single rig was used. Owing to the limited lifting ability of the Hiab crane, the rig was deployed from the stern anchor. In addition, because the rig was deployed astern of the ship, it was not possible to locate its position using a traversing echo sounder as intended.

c) Mid-water tidal flow data were obtained using a Braystoke direct reading current meter.

EQUIPMENT PERFORMANCE:

a) Trisponder - good.

b) Boundary layer rig - the design of the rig proved to be good. Six Otts flow sensors were mounted on the vertical mast at heights 10, 25, 40, 65, 100, 180 cm above the bed. These instruments were reliable and only failed to provide good data when fouled by drifting weed. Turbulence data were obtained from 2 E/M flow sensors for the period 19-20 October. In order to study gravel movement it was necessary to position the underwater TV camera within 50 cm of the bed. Underwater lighting was required. Using pan and tilt, care had to be taken not to influence the flow reaching the flow sensors and cause gravel to move.

Owing to the difficulties of operating two bottom rigs, no data was obtained from the second rig which incorporated a sediment trap.

For performance of the self generate noise probe, see Appendix.

c) Bedform measurement and rig positioning: Trials were conducted using a traversing echo sounder transducer mounted on a taut wire running from bow to stern beneath the water surface. The wire was tensioned using 4 x 50 kg lead weights and sag on the wire was minimised by adding floatation to the transducer carriage. Good results were obtained by moving the transducer at fixed intervals (1 m) along the taut wire.

SHIP PERFORMANCE: The ship provided adequate accommodation, laboratory space, deck space and winch facilities. It was not possible to deploy the bottom rigs over the Port side using the hydrographic davit and Hiab crane because of the limitations of their safe working loads. Winch tensions of up to 8 tonnes were experienced when the large rig was dragged sideways across the sea bed when the ship swung away from the lowering position. For these reasons the large rig was deployed from the stern; this prevented the use of a stern anchor. Without the use of a stern anchor the ship swung and it was therefore not possible to use two rigs. Using one rig the swing of the ship was usually acceptable, but a period of a flood tide (East going) was lost on 17 October when opposing NE winds of Force 7 occurred.

It was not possible to position the rig with reference to the gravel bedforms using the taut wire/echo sounding system because the rig was deployed from the stern.

RESULTS: Reliable boundary layer flow measurements and TV observations of sediment movement were obtained for most of the cruise. The results were normally only interrupted by drifting weed. Turbulence data was obtained from E/M flow sensors for the last two days of the cruise. The results are summarised as follows:

DATE	AREA BEDFORM TYPE	TIME (BST)	EBB/FLOOD TIDE	TIDAL RANGE
16 Oct	Flat bed gravel	1239-1305	Flood	4.5 m
		1410-1840	Ebb	4.5 m
		1939-2315	Flood	4.4 m
17/18 Oct	Long wave length gravel	0833-1008	Flood	4.2 m
		1409-1940	Ebb	4.2 m
		2035-0100	Flood	4.0 m
18 Oct	Short wave length gravel	0850-1349	Flood	3.7 m
		1458-1953	Ebb	3.7 m
19/20 Oct	Flat bed gravel	0914-1530	Flood	3.1 m
		1738-1837	Ebb	3.1 m
		2242-0346	Flood	2.9 m

RESULTS:
(Contd)

DATE	AREA BEDFORM	TIME (BST)	EBB/FLOOD TIDE	TIDAL RANGE
20 Oct	Transition zone sand/gravel	1043-1501	Flood	2.4 m
	Long wavelength gravel	1721-2200	Ebb	2.4 m

ITINERARY:

6.10.81 Equipment delivered to ship at Plymouth.

14.10.81 IOS Staff travelled to Plymouth. Set up equipment onboard. 2100 sailed for West Solent.

15.10.81 0915 arrived West Solent. Set up Trisponder remote stations. Anchored with three anchors in gravel area. 1400 recovered anchors (two bow anchors fouled by power cable, stern anchor caught on heavy chain). 1830 anchors cleared, moored to mooring buoy.

16.10.81 0630 anchored in flat bed gravel area.
0915 started logging boundary layer flow data.
1005 two bottom rigs tangled. Both rigs recovered.
1239 large rig redeployed.
2315 studies completed.

17.10.81 0710 anchored in area of long wave length gravel waves.
0833 started boundary layer flow measurements.
0100 studies completed.

18.10.81 0630 anchored in area of short wave length gravel waves.
0850 started boundary layer flow measurements.
1953 studies completed.

19.10.81 0700 anchored in flat bed gravel area.
0914 started boundary layer flow measurements.
0346 studies completed.

20.10.81 0630 anchored in transition area between long wave length and flat bed gravel.
1043 started boundary layer flow measurements.
1550 reanchored ship in area of long wave length gravel.
1721 started observations.
2200 studies completed.

21.10.81 0730 recovered Trisponder remote stations.
1145 landed IOS staff at Yarmouth Pier to return to Taunton. Ship on passage to Plymouth.
2150 arrived Plymouth.

22.10.81 Off loaded equipment and returned to Taunton.

PREPARED BY: (D N LANGHORNE)

APPROVED BY: (K R DYER)

DATE: 18 Nov 1981

APPENDIX: Self Generated Noise

OBJECTIVE: Bedload transport of mixed gravel sizes acts as a broadband acoustic source, which if sufficiently intense registers above ambient noise, and can be utilised to detect gravel movement. This "self generated acoustic noise" was to be monitored and compared with visual observations of gravel movement, to ascertain the possibility of detecting the threshold of gravel movement and estimating, in broad term, the quantity of material moving from the acoustic information obtained.

PROCEDURE AND METHODS: The approach adopted was to mount a directional hydrophone 30 cm above the seabed and "listen" to the gravel moving along the bed. The maximum receiving sensitivity of the hydrophone was directed towards an area on the seabed which was simultaneously observed with an underwater TV camera. A low noise amplifier increased the hydrophone signal level before driving it through the cable to the head electronics, where a threshold detector registered gravel movement. Digital recordings of the detector output was conducted using a data logger.

RESULTS: On site visual observations of gravel movement using the underwater TV camera correlated with increased signal levels detected by the hydrophone. Preliminary comparisons of video recordings of the pebble movement and digitised logger data gave encouraging results which indicate that self generated noise can be used to detect the threshold of gravel movement, and broadly estimate the quantity of mobile material.