Cruise Report - LOIS Airborne Remote Sensing Programme

Vessel and Period

'Sea Vigil', 2nd August - 5th August - (SV2)

Location

Humber Estuary and plume

Personnel		**Responsibility**
from PML	A. Bale	Co-ordination and ground truth
	D. Plummer	Ground truth /filtration
from U. Southampton	G. Moore	Flight plan and aircraft liason
from UoP/PML	S. Hudson	UOR, spectral and underway data handling
from UoP (4th only)	K. Hammond	Profiling radiometer

Objective

To obtain measurements of the optical characteristics and water quality within the Humber Estuary during synchronous airborne CASI (Compact Airborne Spectral Imager) overflights for the development of algorithms and atmospheric corrections.

Introduction

This survey of the Humber Estuary was the second of a series of three, one-week survey periods during 1993 aimed at ground truthing spectral information obtained from airborne instruments. Intensive aerial observations of the lower estuary were undertaken by the NRA aircraft flying a CASI instrument to survey lines defined by PML (Figure 1) for this purpose. Concurrent in-water obsevations were made from 'Sea Vigil' on the same day and, for one of the survey lines, at the same instant. Because of the constraints imposed by accommodation on 'Seas Vigil', scientific operations were limited to day work and the scientific party stayed in hotel accommodation overnight.

Outline Report (times are BST)

Mon 2nd: The scientific party travelled to Hull arriving late pm and located the 'Sea Vigil'.

Tuesday 3rd: Scientific equipment was loaded from 08:30hr with the vessel along side and set up during the morning. The vessel then locked out of the marina at 10:00hr to test equipment and for trials of the Undulating Oceanographic Recorder (UOR). Experiments with various lengths of towing wire were performed. Operation of the UOR with the diving `shute`

removed from the UOR body greatly improved the near surface depth stabilility of the UOR compared with the previous cruise and the UOR was towed in this mode throughout the rest of the survey. With five metres of wire in the water the UOR body towed at a uniform depth of 2-3m. The first tow was commenced off South Killingholme and completed at the Spurn Light Float (see Table 1 for details).

Vertical profiles were carried out at the Spurn Light Float and off Bull Sand Fort. Scientific work was concluded at 15:45hrs and the Sea Vigil returned to Hull Marina and locked in at 1900:hrs.

On the strength of the high suspended solids concentrations within the lower estuary provided by the UOR, it was decided that the synchronous ship/aircraft measurements planned for the following day would be concentrated in the offshore region (line 3) centred on the Spurn Light Float (Figure 1) rather than at Spurn Head because suspended solids levels within the estuary were much higher than expected and in-water light measurements would have been impractical.

Wednesday 4th: Sailed at 08:30hrs in order to be off the Spurn Light Float by 11:00hrs to synchronise with the aircraft measurements. Underway surveying was started from South Killingholme along an axial track approximately following the main navigation channel; and making underway measurements on board the vessel of:-

salinity
temperature
chlorophyll fluorescence — logged by the on- board, 'QUBIT' system
suspended solids (unreliable) — along with time and position data
dissolved oxygen (not calibrated)

At half hourly intervals along this track water samples were taken from a pumped supply collecting water from 1m below surface for the determination of:

suspended solids (by gravimetry)
chlorophyll a (by subsequent acetone extraction)
particle size distribution (Malvern)
phytoplankton (Lugols Iodine -preserved)
salinity (by precision salinometer)
particle reflectance (SPECTRON SE590 Spectrometer)
PAR (Biospherics logged at 15 seconds frequency)

The UOR carried sensors for:

salinity
temperature
depth
fluorescence
light transmission
suspended solids
up and down welling light.

At Spurn Head the UOR tow was interrupted and the instrument brought to the surface (zero depth calibration) whilst vertical profiles were made.

At the Spurn Light Float we learned by Cell Phone that the aircraft had not taken off but was expected to be in the air by 14:00hrs. The tow was, therfore, continued to the outer extremity of the survey line at the 'Humber Buoy' where the UOR was recovered and data downloaded. Vertical profiles were made with the PRR 600 and the vessel hove to over lunch. The parameters measured during the vertical profiles were:-

light spectra	PRR 600
light penetration	Secchi disc

At13:05hr 'Sea Vigil' moved towards the Spun Light Float in order to coincide with the expected 14:00hr overflight; towing commenced at 13:18hrs and water sampling was continued at half hourly intervals. At the Spurn Light we learned that the aircraft was not yet airborne and wanted to know whether to take off as the weather was poor at Coventry and deteriorating. As the weather was still adequate off the Humber and the forecast for the following day was worse, we pursuaded the airborne party to proceed. We now expected the overflights at around 15:00hrs so we continued towing the undulator along transect 3 (Figure 1) towards the land. At 14:33hrs towing was suspended and a vertical profile was taken before returning to the vicinity of the Spurn Light Float in order to be on-station coincident with the overflights. At 14:50hrs the aircraft made a low level pass and then continued to fly the pre-planned flight lines (see appendices1 & 2). For the next 50 minutes Sea Vigil remained in the vicinity of the Spurn Light float making water quality measurements and taking regular vertical profiles with the PRR 600 system. Work at this station was concluded following two consecutive low level (2000 ft) overflights (opposite directions) and Sea Vigil then proceeded towards Hull. The weather deteriorated as we entered the estuary. The UOR was retrieved and water sampling ceased at Immingham Oil Terminal (IOT) at 18:12hrs. The vessel locked in at 19:15hrs and the scientific equipment was offloaded.

Thurs 5th Aug The scientific party returned to Plymouth.

Conclusions

The primary objective of synchronous ground truthing of airborne CASI overflights was successfully achieved. Water quality data derived during the survey work will be forwarded to BODC as computer files once the calibration work is completed. The data from this survey will be identified with the prefix: SV2.

Prepared by: Tony Bale

Table 1. Details of the UOR tows: 'Sea Vigil' H2; (times are GMT)

Tow	start time	date	start position	end time	end position
1	10:32:07	03/08	N 53° 36.7 W 0° 5.5	11:15:14	N 53° 33.5 E 0° 6.1
2	13:00:00	03/08	N 53° 33.5 E 0° 14.7	13:43:04	N 53° 33.9 E 0° 6.4
3	08:22:36	04/08	N 53° 41.5 W 0° 13.9	11:02:00	N 53° 35.9 E 0° 19.7
4	12:18:00	04/08	N 53° 36.3 E 0° 19.7	13:25:00	N53° 37.4 E 0° 10.6
5	15:35:34	04/08	N 53° 33.2 E 0° 13.1	17:13:47	N53° 38.2 E 0° 10.3

Table 2 Location and time of vertical profile stations (times are GMT)

file	Lat	Lon	date	comments	
P930803A	N 53° 33.72	E 0° 05.75	4/8	Bull Light Float	09:44hr
P930803B	36.90	22.08	4/8	Humber Light Float	11:06hr
P930803C	37.15	21.93	4/8	ditto	11:57hr
P930803D	37.35	21.87	4/8	ditto	12:04hr
P930803E	32.32	10.28	4/8		13:27hr
P930803F	33.29	13.89	4/8		13:51hr
P930803G	33.29	13.96	4/8		13:54hr
P930803H	34.08	14.29	4/8		14:07hr
P930803I	34.02	14.25	4/8		14:14hr
P930803J	33.88	14.16	4/8	over flight 1	14:26hr
P930803K	33.98	14.02	4/8	over flight 2	15:02hr
P930803L	33.08	14.01	4/8	over flight 3	15:21hr
P930803M	33.72	13.96	4/8	over flight 4	15:25hr

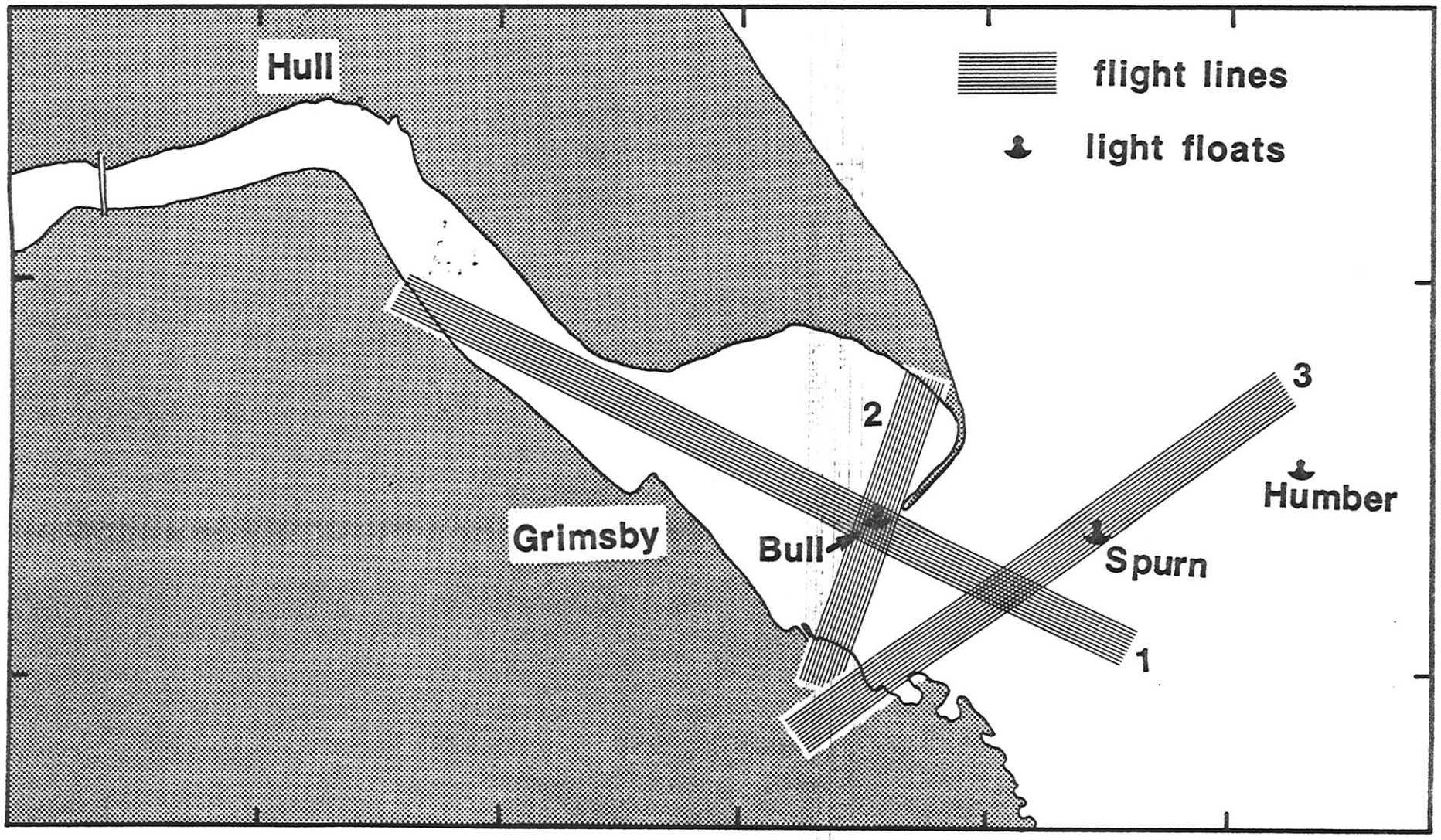
Hull
Grimsby
flight lines
light floats
Bull
Spurn
Humber
1
2
3
53° 40' N
53° 30' N
0° 20' W
0° 10' W
0° 00'
0° 10' E
0° 20' E

Figure 1

Appendix 1

August 6, 1993 Plymouth Marine Laboratory

Tel 0752 - 222772

Dear Sarah,

Here are the flight details for the Humber. There is some latitude in the observations. Please let me know what you want to vary. I have assumed for all this that the CASI has a 35° field of view. I'm sure that ITRES/ NRA have a adequate knowledge of the saturation radiances for this flight. These is no problem is some of the bands saturate over land - we are only planning to use the land data for navigation. There may be some sun-glint to the edges of some transects, but this is unavoidable if were are to get concurrent sampling.
I may be working at home tomorrow (Thurs) do feel free to contact me there. Just to remind to the number is 0363-82602.
Gerald

a. Flight Lines

1. Axial Survey

Location	Easting	Northing
North Kilingholme Haven	[5]16710	[4]20385
Chequer No 3 Buoy	[5]45792□	[4]06354

Passes over Bull Sand Fort at [5]37044,[4]09209. Almost centre of image.

2. Transaxial Survey

Location	Easting	Northing
KilnSea	[5]41034	[4]15539
Oil Depot	[5]32500	[4]02000

Passes over Bull Sand Fort at [5]37044,[4]09209. To south of image.

3. Humber Approach Survey
NB Location of start changed to Oil Depot (above) cellnet call to Sarah C.

Location	Easting	Northing
Caravan Park	[5]32542	[4]05902
Humber Buoy	[5]56387	[4]13559

b. Flying Order

We aim to be on station around Bull Sand Fort to make concurrent in water optical measurements between 11:00 and 12:00 BST.
This is the suggested flying order and heights

Line	Height	Priority
Axial-1	10,000ft	1 Survey
Transaxial-2	10,000ft	1 Survey
Transaxial-2	5,000ft	2 Atmos Corr
Transaxial-2	2,000ft	3 Atmos Corr
Axial-1	5,000ft	2 Atmos Corr
Humber Approach-3	10,000ft	2 Survey
Humber Approach-3	5,000ft	3 Atmos Corr

The priorities indicate parts that can be dropped if desperate - CASI / Aircraft problems.
Since this is an atmospheric correction flight and you may need to vary the actual hights flown can you please note the actual height.

c. Band Set

Can you get as near as possible and let me know the actual figures.

Band	NRA	PML	
1	427.4-469.1	433-453	SW/2
2	476.1-504.1	480-500	SW/3
3	511.1-528.6	500-520	SW/4
4	541.0-558.6	545-565	SW/5
5	595.7-602.7	610-636	Oz/UOR
6	632.9-641.8	637-660	
7	659.5-668.4	660-680	SW/6
8	672.0-684.5	680-685	Chl Flr
9	688.0-696.9	690-710	Flr Base
10	700.5-713.0	716-740	Water Abs
11	745.1-755.8	745.1-755.8	SW/7
12	839.9-868.6	845-885	SW/8

Appendix 2 - Flight 109

Project NRA Page 1 of 2

Tape number 1 Targets/Sites Humber Date 4/3/93

35° lens

INSTRUMENT LOG

TAKE OFF 13:05 (GMT)

TIME	FILE	LINE #	MODE A/E	INT TIME	COMMENTS	REVIEW
Using CASI, Trimble and aux only no IR or video data						
Everything seems ok, defined new band set for PML						
13:20:42	1	TEST	A	100	line scans	
13:21:20	EOF					
13:35:26	2	3	A	200	ALT - 5000 1.3	
					AS - 100	
					HDG - 248	
					the data is saturating so the line will be	
14:03:37	EOF				repeated 8.0	
14:06:11	3	3	A	150	ALT - 5000	
					AS - 104	
14:13:42					HDG 062	
14:21:59	4	3	A	100	ALT - 5000	
					AS - 104	
					HDG - 298	
					no saturation, a little cloud shadowing	
14:32:48	EOF				great gimbal structures 27	
14:25:15	5	2	A	100	ALT - 5000	
					AS - 104	
14:39:12	EOF				HDG - 041 4	
14:44:38	6	2	A	100	ALT - 2000	
					AS - 100	
14:50:47	EOF				HDG - 225 6	

06/08 '93 13:22 0278 452985 NRA WESSEX ←→ PML 003

INSTRUMENT LOG

TIME	FILE	LINE #	MODE A/E	INT TIME	COMMENTS	REVIEW
15:01:09	7	1	A	100	ALT - 6000	
					AS - 109	
15:11:15					HDG - 124	
15:17:28	8	3	A	100	ALT - 2000	
					AS 104	
15:23:20	inf				HDG - 070 22	
15:25:10	9	3	A	100	ALT - 2000	
					AS - 104	
15:33:10	end				HDG - 259 8	
Everything seemed to work OK except the tracks stated ok then could not lock. will look in to it.						
Landing		17:15				
					1.27 G BYTE	
					1.27×10^9 BY	
					1.27×10^3 M BYTE	
					approximately 1000 HD Floppy disks for the last days work.	

06/08 '93 13:23 0278 452985 NRA MESSEX →→ PML 004