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FRV *Scotia*

Cruise 0601S

REPORT

2-6 April 2001

Personnel

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Objectives

1. To establish working protocols for range changing on the Simrad EK500 with the new Simrad Synchronisation Unit.
2. To undertake a variety of trials and tests of the Simrad SF950 multibeam sonar.
3. To establish working methods for the use of the Simrad ITI system on the pelagic trawl including communication to the Simrad SR240 and EK500 sonar systems.
4. To calibrate all three EK500 transducers (38, 120 and 200 kHz) and the 18 kHz EA500 transducer with and without the new calibrate programme for comparative purposes.
5. To collect multifrequency data (at four frequencies) and multibeam sonar data on fish schools to investigate the possibility of automatic species identification.
6. To establish which of the Scanmar transducers (hull mounted or drop keel) is the more sensitive.
7. To test the CTD winch in waters deeper than 250 m.
8. To test the new steel netsonde wire.
9. To establish the tail-fin angle of the OCEAN sampler required to attain level towing at different speeds.
10. To monitor water-flow-rates inside the net cones of the ARIES and OCEAN samplers.
11. To determine the efficiency of flow measurements insider the RCTV.
12. To undertake further sea trials using the Bran and Luebbe AA3 nutrient analyser with representatives from the instrument manufacturer.

Out-turn days per project: 5 days MF01T

Narrative

Monday 2 April

The ship departed Aberdeen on schedule at 1000 hours. Soon after leaving Aberdeen harbour a safety drill was carried out, followed by a short scientific briefing. The RCTV was then deployed to determine the efficiency of the variable angle depressor and the effect on pitch angle. A total of eight deployments were successfully carried out. This exercise was completed late in the evening. During the afternoon some of the acoustic equipment was tested. A termination to the new steel netsonde wire was completed and tested. The new version of EKConfig software was successfully installed and now works as specified (remote control of EK500 and download of EK500 settings). The SF950 short range sonar was confirmed as being successfully deployed and retracted using the proper [automatic] mechanism. The Scanmar unit on the drop keel was tested and found to be faulty. In the evening, after the RCTV deployments had been completed, passage was made to Loch Eribol to find a suitable calibration site. The weather deteriorated throughout the course of the night.

Tuesday 3 April

The ship arrived at Loch Eribol at 0800 hours in extremely high winds (southerly force 9). The anchor was dropped in the southern end of the loch and preparations were made for the calibration of the echosounders. However, significant ship motion due to the high winds made calibration extremely difficult. Despite prolonged attempts, the sphere could not be positioned under the echosounder. An alternative method was then attempted, whereby the sphere was suspended directly beneath the transducer by attaching the lines to the transducer mounting bolts under the drop keel. This proved to be much more effective, and although the sphere was still subject to the ships motion, there were occasions (on a five minute period) where it could be located in the beam. The new calibration programme was therefore run for a period of 3.5 hours. Following this, data were collected using the standard software for comparison. The calibration exercise was completed at 2000 hours. The ship then proceeded to the Southern Trenches of the Moray Firth to continue with other objectives which required deeper water and some shelter from forecasted high south-westerly winds. During the passage the nutrient analyser was tested during a baseline run principally to compare traces produced using a modified photometer and software changes, versus an unmodified photometer with the original software.

Wednesday 4 April

The first part of the day was spent testing the towed apparatus in the deep water of the Southern Trenches. Two passes were made with the RCTV and eight with the OCEAN sampler. This exercise was completed at 1800 hours. During these tests the Simrad SF950 was operated to determine whether it was in good working order. Although some of the previous problems with the SF950 have been solved, a number persist. In the evening, the PT154 trawl was shot with a suite of ITI sensors (height, spread and depth). The ITI was able to communicate with the SR240 long range sonar successfully but it was not possible to establish communication with the EK500 echosounder. The small trawl performed against all expectations and two baskets of fish were caught; these contained mostly medium sized herring, but also sprat and haddock. After the trawl the hydro winch was tested in automatic deployment mode to various depths and at various speeds. In the early hours of the following morning, the ship steamed at full speed to test further modifications to the autoanalyser.

Thursday 5 April

In the early hours of the morning the Aries sampler was deployed in the deep waters of the Southern Trenches to monitor the flow rates inside and outside the net cones; this was completed by mid morning. A small survey was then conducted in the area around the Southern Trenches to search for fish traces suitable for trawling. A total of four trawls were carried out with the PT160 throughout the course of the day, testing the ITI system and identifying the multifrequency acoustic traces. Trawl catches were composed of clupeiods, mostly sprat, but also small herring. Towards the end of the day the fish layers broke up into small schools. These were examined using the SF950 short range sonar and digital video images of the sonar screen were taken. In the evening, a number of tows with the Aries sampler were repeated. In the early hours of Friday morning the ship made passage at high speed back to Aberdeen whilst undertaking final testing of the autoanalyser. The vessel returned to Aberdeen on the morning of Friday 6 April.

Results

1. A procedure for changing ranges on the Simrad EK500 with the new SSU was successfully established. Instructions are available as a word document (RangeChange.doc) and require the use of an excel spreadsheet (Range ChangePings.xls). The procedure requires that the user notes the time when changing the ping rate on the SSU. This time is then entered into the spreadsheet and the number of pings required to change the current log interval are then calculated. This information is then entered into a range change script on the EKconfig programme and the range is then changed on the EK500 using this script. The system is not elegant but achieves the objective of changing the range without disrupting the survey data series.

2. The SF950 multibeam sonar was used to detect clupeiod schools quite successfully. One and a half hours of digital video footage was taken to demonstrate the instruments features and outstanding defects. Training of the sonar head (rotation) has in the past been associated with false retention of school position in the beam. At the very start of the train (rotation), the schools do stay with the beam for a brief moment, but are soon repositioned in the correct location. In this and many other respects the sonar now works very well. However, a few shortcomings remain: the position (latitude and longitude) still freezes after two to three minutes; a noise ring occurs between 150 and 200 m range when using the automatic gain control (AGC); the 'down' light remains on when the unit has fully retracted; the manual is inconsistent with some of the features on the instrument; and, more importantly, it was not possible to find, never mind run, the associated data collection and analysis software (SODAPS).

3. The ITI system was deployed on four hauls using the depth, height, temperature and wing spread sensors. All units had been checked by Simrad and were fully charged. On the first deployment there was no output from the depth sensor (serial no. 2884). All other sensors communicated with ship. Simultaneous observation with the Simrad FS 903 netsonde system enabled certain net parameters to be compared with the information sent by the ITI sensors. The height unit consistently underestimated the opening of the gear, and the clearance (headline to bottom) was rarely available. The wing spread sensors appeared to give good data, however, a direct comparison was not available due to sensor position. Trawl position appeared to be reasonably accurate and was confirmed by calculations of the ships position and the amount of warp out. The instrument set-up menus are not intuitive and are difficult to use. A detailed operating protocol is being written at present to try to give adequate information for the inexperienced operator. Data were successfully collected by the bridge PC and the ITI was able to communicate successfully with the SR240 long range sonar. The unit could not be made to communicate with the EK500 echosounder.

4. The prevailing weather proved too severe to allow for calibration of all frequencies, despite seeking shelter in Loch Eribol which is ordinarily a suitably calm site. Nonetheless a successful calibration of the 38 kHz transducer was carried out using a new method where the sphere was attached directly beneath the unit under the drop keel. The new calibration programme was evaluated. Preliminary indications are that this programme has some data collection problems.

5. Multifrequency data were collected on schools of clupeiods. These were identified with five trawl hauls and will contribute to the labs multifrequency echogram library.

6. The Scanmar transducer was installed on the drop keel prior to sailing and wiring was terminated as far as the transducer connection room. The only test done at this point was to operate the switch between drop keel and the hull transducer firstly measuring the switch output impedance level for the hull transducer and then for the drop keel unit. Both read 98 Kohms, which is exactly the correct manufacturers level. The system was tested with the OCEAN sampler using a depth sensor. The hull transducer worked perfectly. When switching to the drop keel unit however, no signal was received despite the Scanmar cabinet indicating, with a Green LED, that a good transducer cable was connected. Attempts to source the problem included physically metering all

wiring, checking all connections in the switches, and finally removing the switches all together and wiring the drop keel directly to the Scanmar cabinet. The results were unchanged. The only conclusion that can be drawn is that the new transducer is faulty and should be returned to the suppliers for evaluation.

7. The hydro winch was tested in the deep waters of the Southern Trenches using a weight of 126 kg. The ships crew seem confident that the unit is much more controllable using the automatic winching system than before. However, a leak in the winch hydraulic system prevented any further tests from being carried out.

8. The new steel netsonde cable was wound onto the starboard winch prior to the cruise. Termination of the transducer end was carried out on passage to Loch Erribol using a cold cast system. A steel ring was used as a strain relief and there was no evidence of the cable creeping through this even after five hauls with tensions of up to 0.4 tonnes being applied. However, the cable clamp in the transducer head is slipping, this is probably an indication of the crew lifting the unit by the cable. The new modified cable block situated above the gilson winches would appear to be ideal.

9. The angle-of-attack of the tail-fin of the OCEAN plankton sampler may be adjusted to alter the towing angle of the sampler, thus affecting the sampling efficiency of the nose-cone. Tows were conducted using a fixed wire length and 3 fin-angles (represented by locking-hole positions in the tail assembly) to determine the effect of altering the fin-angle on the pitch and flow-meter. Each deployment was conducted in blocks at four fixed engine speeds, repeated over reciprocal courses to overcome tidal effects, with the sampler being allowed to settle to a steady depth and held for five minutes during each block. Pitch, depth and flow loggers were attached to the OCEAN frame. The results indicate that the central position (with the fin at mid-angle) minimises variations in pitch (to within 2° of horizontal) for tow-speeds ranging from 1 to 4.5 knots.

10. Tow trials were repeated with the ARIES plankton sampler. Flow-rates measured by an externally mounted, self-recording flow-meter were compared with the flow-sensors mounted inside each of the nose-cones of the two samplers. While the results indicate that the internal and external flow-rates change consistently with tow speed, the calibrations of the sampler flow-meters need to be verified. Reliable operation of the OCEAN flowmeter is highly dependent on sampler pitch angle.

11. A depressor was attached to the top of the RCTV, above the upper lateral rotor, with the intention of providing additional down-force to extend the diving range of the RCTV. The angle-of-attack of the depressor was adjusted on a locking tilt mechanism prior to each deployment. Tows were conducted at a fixed wire length and three depressor angles to determine the effect on the steady-state towing depth. Each deployment was conducted in blocks at four fixed engine speeds, repeated over reciprocal courses to overcome tidal effects, with the RCTV being allowed to settle to a steady depth and held for five minutes during each block. Pitch, depth and flow loggers were attached to the RCTV frame. The results (summarised in the table below) indicate that the depressor angle has little effect on the pitch angle of the RCTV, but increases the steady-state depth by up to 40%. This suggests that a depressor, which may be adjusted during the deployment, would serve to increase the diving range of the RCTV, without unduly affecting the towing stability.

Depressor angle (degrees)	Pitch range (degrees)	Ship speed during block 45 rpm	50 rpm	55 rpm	60 rpm
		Average depth during block (m)	(m)	(m)	(m)
0	-7 to -8	50	44	48	40
10	-8 to -9	70	52	73	49
20	-7 to -8	65	47	63	48

12. Accurate real-time speed measurements are required during gear observation trials, but the complex structure of the RCTV and the water-flows around the drive rotors reduce the effectiveness of standard flow-meters mounted inside the RCTV frame. Attempts were made to mount a flow-meter outside the frame, but in practice this would render the meters vulnerable to damage during deployment and recovery, and would be likely to foul on the net during a tow. A retractable flow-meter is required, for which further tests are planned.

13. During the cruise the Bran and Luebbe AA3 nutrient analyser was set up in a containerised laboratory and following exhaustive investigations it was concluded that the probable primary cause of the interference seen during previous *Scotia* cruises was due to low frequency vibration. As a result of the investigative work, which relied on excellent cooperation with the instrument manufacturers, the photometer, which is part of the digital colorimetric detection system, will be returned to Germany for modification. It is anticipated that the modifications to the photometer combined with software upgrading will allow the AA3 to be commissioned for the analysis of nutrients at sea.

P Fernandes
17 April 2001

Seen in draft: P Ramsay, Master, FRV *Scotia*