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FRV *Scotia*

Cruise 0502S

REPORT

28 March to 6 April 2002

Personnel

P Fernandes	SIC 31 March – 6 April
C Hall	SIC 29-31 March
S Halewood	
E Armstrong	
P Copland	29-31 March
M Mathewson	
P Barkel	
M Burns	29-31 March

Objectives

1. To undertake a variety of trials and tests of the new Simrad SH80 multibeam sonar.
2. To test for acoustic interference between the new SH80 sonar and other acoustic instruments.
3. To verify working methods for the use of the Simrad ITI system on the pelagic trawl and compare these with a Scanmar based system.
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 five frequencies) and multibeam sonar data on fish schools to investigate the possibility of automatic species identification.
6. To investigate the possibility of collecting data on the ships ES60 echosounder.
7. To establish the towing characteristics of the ARIES sampler to attain level pitch at different speeds.
8. To determine the towing characteristics of the RCTV at different speeds, with and without variable angle depressors.
9. To test a new PC-based video archiving system.

Out-turn days per project: 10 days MF01T

Narrative

On Thursday 28 March *Scotia* sailed at 1000 hours and proceeded to the Buchan Deeps. During the next four days repeated tows were carried with the RCTV and ARIES. Tows were conducted at fixed wire lengths and at four set engine speeds, repeated on reciprocal courses to overcome tidal effects, with the towed body being allowed to settle to a steady depth and held for ten minutes during each block. Heel, pitch and depth loggers were attached to each frame. Before each ARIES deployment one of various combinations of tow-point, flotation and tail-fin angle was selected, while on the RCTV, depressors above and below the lateral rotors were pre-set to one of three angles-of-attack. A Simrad ITI temperature sensor was attached to the ARIES sampler during one of the deployments. On completion of the programmed speed trial, ARIES was towed in a standard oblique deployment to monitor the transmission of through-water data from the ITI sensor while it was moving laterally relative to the towing vessel. To test a PC-based video archiving system, TV images were digitised then compared with concurrently recorded VHS videotapes. During the latter half of the cruise, attempts were made to obtain video images of the PT160 trawl and ARIES. Some images of the trawl were recorded, but a ground-chain was seen to be fouling the net so the trial was discontinued. The ARIES sampler tows too steeply to enable the RCTV to be positioned within viewing range of its camera. Electrical power for the RCTV was supplied by a portable three-phase generator, though a trial was conducted to determine the possibility of using the ship's supply.

During the evenings, the PT160 trawl was towed, to allow testing and comparison of various acoustic sensors, including Scanmar, Simrad ITI and netsonde. The PT160 was swapped for a spare on 31 March as a heavy cod-end cover fitted to the original proved to be distorting the net. Preliminary trials of ship-borne acoustic systems were also conducted.

On Monday 1 April *Scotia* anchored in Aberdeen Bay for the transfer of personnel. P Copland and M Burns disembarked and P Fernandes joined the vessel at approximately 0800 hours. The vessel then made passage to Scapa Flow arriving at 1700 hours. Calibration of the echosounders then took place proceeding throughout the course of the night.

The following day *Scotia* followed a parallel cruise track pattern around Fair Isle to search for fish schools with which to test the new sonar. During the search, interference trials were carried out to test the operation of the sonar with other acoustic equipment. Three trawl hauls were carried out. An opportunity to deploy the RCTV was taken to observe the pelagic trawl which had performed strangely during the first trawl. Initially suspicion pointed to the use of new doors with sections cut out for ITI sensors, so these were changed. Inspection of the RCTV during the second trawl, however, revealed the problem to be due to warp entanglement. These difficulties were resolved and towards the end of the day two successful trawls were carried out on diffuse fish marks located near the bottom and herring was caught.

On Wednesday 3 April *Scotia* continued in its search and found some large midwater schools south west of Shetland. A number of passes were made over these before trawling. Despite shooting for over 1.5 hours absolutely nothing was seen entering the net on the netsonde and nothing was caught. The search was resumed in the hope of finding better targets.

The following day the search continued to the southern tip of Shetland in vain and so it was decided to return to the south western area where fish schools had been spotted the previous day. However, the schools did not reappear. After searching the area extensively it was decided to try the area immediately east of Fair Isle where sandeels had been located the previous year: this also proved fruitless. The decision was then made to return to the north Moray coast where trials of the towed equipment could be carried out and new searches for fish schools (sprat) could be carried out. A dummy target, consisting of weighted floats, was made for deployment the next day to test the sonar. En route, some herring marks were detected and a trawl haul was attempted although it failed to catch any fish as the ground was too rough to put the trawl close enough to the bottom.

On Friday 5 April in the early hours, the towed vehicles were tested in the deep Southern Trench. After a brief search revealed a lack of suitable targets the dummy target (weighted buoy) was deployed. Neither of the ships sonars were, however, able to detect the target. The buoy was recovered and a search for real targets resumed. An attempt was made to detect the anchor chain on a large navigation buoy: this also proved futile. The vessel resumed a search for fish schools, returning to Aberdeen on the morning of Saturday 6 April.

Results

1. SH80 Sonar

   i) The SH80 has a number of teething problems. Changing modes using the keyboard caused the system to freeze; use of the track ball was more reliable. No navigation input was available: a serial input was used and this caused severe problems when rebooting. Removal of the serial connection enabled the machine to reboot as normal and the navigation signals could then be obtained by connecting the serial line once the system had started. Further details are given in Appendix I.

   ii) It was not possible to test the new SH80 sonar to its full potential as no suitable targets were encountered. However, the RCTV proved to be a target which could be detected quite clearly, provided the drop keel was raised; if the drop keel was lowered the RCTV body could not be detected. For comparison, the ships long range sonar (SR240) was able to detect the RCTV with the keel lowered. This presents an obvious problem – the SH80 sonar is unlikely to detect targets behind the vessel with the keel lowered. Whether this extends to targets ahead of the vessel is unknown. On the one occasion that fish schools were seen, the sonar was unable to detect them, but these were very weak targets and the keel was lowered to enable echosounder data to be gathered. The dummy target of weighted floats could not be detected with either the keel lowered or raised, but again this was a small target.

   iii) More disturbing is the data storage facility on this sonar: there is no evidence of data on target location and trajectories being available to download. The only data storage facility seems to be a bitmap save facility which stores the entire sonar image. On balance this sonar seems to be nothing more than a well specified fishing sonar and has no clear advantage as a research tool over the ships SR240 sonar, other than being of a different (higher) frequency.

2. As the sonar had not yet been synchronised into the SSU it was not surprising that interference occurred between it and the 120 kHz echosounder. This interference could be reduced by selecting a lower frequency (the sonar frequency is selectable from 110-122 kHz). All other acoustic instruments were unaffected.

3. ITI System

   i) The system was deployed on all hauls using the temperature sensor: this gave the range and bearing to the vessel. However, no output could be obtained from the depth sensor (serial no 2884). Simultaneous observation with the Scanmar depth sensors enabled the trajectory of the net to be determined by combination of the two pieces of equipment.

ii) The new acquisition software worked very well, after initial PC installation problems; a dedicated PC is required on the bridge to run it. It is very easy to use and displays all the current sensor telegrams, making them available for logging at a single mouse click. All the parameters can be graphed individually including trawl positions. To move the data into another format for further analysis may be difficult however as it is stored in Microsoft Access format. A copy of the software has been left on a PC in the Scientific Office for evaluation.

iii) A Scanmar depth unit was permanently attached to the RCTV sampler during all the tow trials and worked throughout. An opportunity was taken to attach Scanmar and ITI height sensors onto the RCTV during a video collection run close to the seabed. Data files were collected during this for both systems. Cursory examination would suggest that the ITI was unreliable at heights of less than 10m while the Scanmar worked consistently throughout.

iv) An ITI height unit was fitted to the ARIES sampler inverted to the tow yoke and its output compared to the Scanmar depth unit. It worked well down to depths of around 50 m and then lost data. It was however able to give a very good indication of the position of the sampler in the water column. Note that the sampler was on fixed tow lengths and not being used in its normal mode.

v) On the PT160 trawl a comparison was made of a Scanmar depth unit, ITI height unit (inverted) and the depth as indicated on the FS3300 netsonde. There was excellent correlation between Scanmar and FS3300 allowing for an offset of around 5 m. The two sensors followed each other very well. The ITI although, apparently more erratic, followed the Scanmar very closely which is encouraging in view of the fact that it is a height unit deriving its depth from the surface reflection. Again positional data was obtained reliably. In a second trial ITI door and wing distance sensors were attached as well as height and temperature units. The PT160 was paid out to 75, 100 and 150m warp lengths at a speed of 4 knots. Only at 150 m (over 100 m depth) did the system begin to lose sensor data. Opportunities were taken to collect data on the vessels system as well as using the new ITI logging software.

vi) The ITI was unable to communicate successfully with the SR240 long range sonar. Strangely, however, the SR240 was able to give shoal position to the ITI although the logging software was unable to store this information.

4. All four echosounder frequencies were calibrated. In the case of the 38, 120 and 200 kHz, the calibrations were very good and values were in line with those expected. The 18 kHz transducer proved more difficult to calibrate due to the uncertainty in locating the sphere and the rather low measured NASC. The new calibration programme proved to be problematic once again: targets could not be collected from the left uppermost sector.

5. Multifrequency data were collected on herring targets located close to the bottom. These were identified with two trawl hauls and will contribute to the labs multifrequency echogram library. Some more interesting targets were detected in midwater on one occasion but these proved impossible to identify using the trawl.

6. Data were successfully collected from the ships ES60 echosounder, but data collection did reduce the ping rate. Bearing this in mind and the fact that the transducer would have to be calibrated it is unlikely that this system will be used to collect data for multifrequency species identification. The exercise was, however, useful to assess the potential to gather data from fishing vessels.

7. The sampling efficiency of the nosecone of the ARIES sampler, for a given payload of instruments and housings, was affected by the pitch angle of the towed body at different tow speeds. The pitch angle was determined by each of three parameters:

a) the position of the tow-point (towing ahead of the nominal mid-tow point caused the tail to become heavy and the sampler to tow nose-up);
b) the angle-of-attack of the tail-fin (increasing the angle increased the down-force acting on the fin causing the sampler to tow nose-up);
c) the amount of flotation at the tail – reducing the flotation caused the sampler to tow nose-up.

For the current payload, over a range of speeds from 2 to 4 knots, variations in the pitch-angle were minimised (to within three degrees of horizontal) if the following three conditions were met:

a) the tow-yoke was attached to the middle tow-point;
b) the tail-fin was set to position 12; and
c) two flotation packages were used at the tail-end.

8. A depressor was attached to the top of the RCTV frame, 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 by a locking tilt mechanism prior to each deployment. A single depressor on top of the RCTV will provide additional down-force but will also produce a turning moment about the tow-point, causing the tail of the RCTV to drop. Ideally, a second depressor, at the same angle as the upper device, should be attached to the base of the RCTV frame, to double the effective down-force and produce an upward turning moment to counteract the first. During one tow, a second depressor was attached to the frame beneath the lower lateral rotor, but the available space limited this to one fixed angle only. The results are summarised below and indicate that a double depressor at 15 degrees is most effective at increasing the nominal running depth, without unduly affecting the stability of the platform. The permanent fitting of an adjustable device on the base of the RCTV will be investigated.

Depressor angle (degrees) (1 or 2 fins)		Pitch range (degrees)	Engine speed during block 45 rpm (nom 2 kts)	50 rpm (2.5 kts)	55 rpm (3 kts)	60 rpm (4 kts)
1	2		Average depth during block (m)	(m)	(m)	(m)
0		-5 to -8	47	46	43	36
10		-4 to –5	47	42	39	34
15		-4	XX	XX	38	36
	15	-6 to –8	65	55	52	43

XX = lower speeds not achieved due to local tidal conditions

9. Only a limited number of digitised images were captured, but they compared favourably with VHS tapes, and proved faster to reproduce and view.

10. Miscellaneous

i) The ships SR240 long range sonar has synchronisation problems: when operated it took precedence over all other acoustic systems and the echosounders ping rates were drastically reduced.

ii) The Scantrol fishmeter electronic fish measuring board was used with reasonable success. Software for this system was loaded onto a laptop to allow data collection. An attempt to interface the laboratories POLS balance was made but an RS 422C to RS 232-interface adapter needs to be provided before this can be achieved.

iii) The port netsonde system (plastic cable), was used initially but failed at the end of the first tow. Existing damage was found at about 200m from the head and repaired. The steel netsonde cable was used on the remaining tows. A steel netsonde mounting bar, as used on commercial vessels, was installed to avoid the netsonde unit twisting on the net during shooting. This needs some fine-tuning in terms of best attachment/release method but seems promising and does not effect gear performance.

iv) After connection of the ES60 to the serial navigation system a navigation alarm on one of the bridge plotters led to a closer investigation of the system. It would appear that the output was overloaded as it had 2 Microplots and a feed to the Sonar container attached to it. It was discovered that the feed in the container was feeding and EM950, EK500, Roxann PC and SH80. A buffer box was installed to reduce this load but it is suggested that additional isolated NMEA ports be made available in the void space as well as a unit in the container to allow distribution as required.

Suggested action for FRV *Scotia*

1. Verify status of the ITI depth sensor. This sensor failed to work on trials last year and has failed once again this year.
2. Ensure SIMRAD incorporate the new SH80 sonar into the SSU.
3. Investigate the synchronisation of the SR240 sonar.
4. Investigate communication between the ITI system and the SR240 sonar (particularly from ITI to SR240).
5. Ensure that SIMRAD enable communication between the ITI system and the new SH80 sonar.
6. Although the ITI log speed was available it did not appear to be implemented and the system seemed to use the manual input in preference. The software could not find the log telegram which may explain the inability to show time to target. This should be investigated by SIMRAD.
7. Review NMEA buffered output in void space. Currently there is insufficient output for existing systems never mind future installations.

8. The winch parameters for the port netsonde are apparently inaccurate with regard to wire on winch. This may lead to inadequate deployment of wire at times. Contact Phil Copland for details.
9. Examine HiPAP system – the computer system would not come on line.
10. Examine FS3300 netsonde head (port side), there is a missing locating pin which allows the head to rotate in the housing.
11. Examine printer drivers on ships office PCs. Currently all tables in MSWord are printed erroneously (as solid black lines).

P Fernandes, C Hall and P Copland
26 April 2002

Seen in draft: P Ramsay, Master, FRV Scotia

APPENDIX I: INITIAL PROBLEMS EXPERIENCED WITH THE SH80 SONAR

Error: When changing screen modes from Mode 1 to Mode 4 using the control panel buttons we found that the system hung up.

Outcome: Required to be restarted twice and then Mode buttons all appeared to work correctly. On restart the system remembered all the system settings that we'd entered previously.

Error: No Navigation or vessel speed appearing on system. We connected Ship's navigation to system via an NMEA-0183 cable through Com 4 (Grey cable labelled with white Com 4 Dymo label). Gyro connection appeared working and already connected up through Com 3. The system control panel is connected via Com port 1.

Outcome: Navigation and vessel speed seen to be updating and working well. Control panel powers up and works well.

Error: After rebooting system we lost control of the trackball and the mouse wandered all over the system screen. The rest of the control panel had locked up with it's power Led flashing. The system displayed a Red Internal error Initialising Com port 4.

Outcome: On checking the Com port settings it appeared that Nav was still set to Com port 4 and the Control panel was set for Com port 1 as normal. After unplugging the Nav from Com port 4 we regained control of the Track ball but the Control panel remained locked. After rebooting the system with the Nav disconnected from Com 4 we found that the system came up with everything working fine. Reconnecting the Nav to Com 4 now after reboot gives us Nav and speed with no further problems. SO SYSTEM MUST BE BOOTED UP WITH COM 4 DISCONNECTED FROM NAV TO WORK CORRECTLY.

Error: Whilst in 180/Audio mode and altering the Horizontal & Vertical ranges a 'Winscon' error developed and open an error log in the Windows 2000 Desktop. The Sonar screen shut down to the Windows Environment.

Outcome: After confirming the error log window we clicked on the SH80 Icon and the system started up and continued working as normal with no further repeats of this error.

Error: It was noticed whilst using the system that there was a mismatch between the Control Panel Led indicator of the Transducer Pole/Stalk position and the position displayed on the Sonar display. Ie Medium on the Control panel but Up on the Sonar screen.

Outcome: The control panel buttons responded when pressed and the Sonar screen updated and indicated the change in cm's out but the difference remained the same. ie Down on the Control Panel and Medium on the Sonar display. We rebooted the system and the problem appears to be solved and hasn't occurred again.