

EXPERIENCES OF CONDUCTING MULTI-BEAM SURVEYS AROUND THE ANTARCTIC PENINSULA

Hydrography on Ice

In 2005 HMS *Endurance* was fitted with a Kongsberg Maritime EM710 multibeam echosounder, and the author finally had the excuse he needed to go and visit the ship whilst on task and provide training on data collection and processing methods associated with the multibeam system – whilst taking the opportunity to experience surveying in the breathtaking Antarctic wilderness.

The United Kingdom Hydrographic Office (UKHO) Bathymetric Centre of Expertise consists of a number of experienced hydrographic specialists with a broad experience of collecting and analysing swath bathymetry data for commercial, military and academic purposes. The Centre of Expertise is based within the UKHO's Bathymetric Data Centre, who are responsible for the assessment and quality assurance of bathymetric data supplied by the Royal Navy, UK Civil Hydrographic Programme contractors and other third party suppliers. The Centre of Expertise regularly provides on-board advice to the Royal Navy, government bodies, port authorities and foreign hydrographic offices / services / navies. This work often takes the CoE staff to far flung parts of the world, but when the opportunity arose to spend some time with the crew of HMS *Endurance* whilst deployed in Antarctica, I felt obliged to volunteer for this arduous assignment (and fight my way to the front of the queue!).

HMS *Endurance*

HMS *Endurance* is the UK Royal Navy's Ice Patrol ship. One of her many tasks is the systematic survey of Antarctic waters and the Falklands / South Georgia region. The ship is a Class 1 Icebreaker, and was built in Norway in 1990. She was originally named MV *Polar Circle*, until the Royal Navy purchased her in 1991 and she was subsequently renamed.

Endurance's mission is – To patrol and survey the Antarctic and South Atlantic, maintaining Sovereign Presence with Defence Diplomacy and supporting the global community of Antarctica. The ship works closely with the UKHO, Foreign Office, British Antarctic Survey (BAS) and the Meteorological Office.

In order to fulfil the wide variety of tasks to serve the many interests of the above organisations, the ship is truly a multi-role platform. Part survey ship, part aircraft carrier (well, helicopter anyway!), part flag bearer and part supply vessel, the crew constantly shift their efforts to undertake the multiple roles – often simultaneously.

Work Package for January 2006

I met the ship on the 2nd January in Mare Harbour in the Falkland Islands, having joined an RAF trooping flight from Brize Norton in the UK. I was fortunate to be travelling with Rick Read, Multibeam Manager of Flagship Training, and we were tasked with working together to help train the surveyors on-board in the use of their processing software. Although due to sail on the 3rd, we were actually delayed for a week due to engine problems. This delay proved to be advantageous to our aims, as we had a captive audience for the training without the distractions to the surveyors inherent with being at sea and having a thousand other things to do (such is Navy life!).

Before leaving the Falklands I was able to assist in some magnetic observations on Sapper Hill overlooking Stanley. This was an entirely new experience for me, and it was interesting to see some of the different tasks that the crew of *Endurance* routinely undertakes as part of their Work Packages.

The ship has been given an extensive area to survey in the vicinity of Antarctic Sound and the Erebus and Terror Gulf (named after the ships of the James Clark Ross expeditions from 1839 to 1843). Although largely un-surveyed, the area has recently become the haunt of a large number of cruise ships. Therefore, there is great potential for one of the cruise ships finding an uncharted feature (the hard way), and the environmental and human cost could be high. Improving the navigational knowledge of the area is therefore a very high priority for all parties concerned.

The area defined by the UKHO's HMOI (Hydrography, Meteorology and Oceanographic Instruction) will actually take a number of months to complete due to its size and complexity, and ranges in depths from 700m to 0m. When we first arrived the area was largely obstructed by ice, and the going was extremely slow, especially as the days were largely spent conducting the various flying operations required to deploy the BAS teams and their equipment. After a week or so the ice had cleared significantly (due to wind direction and balmy 7°C temperatures).

Surveying in the Ice

Trying to conduct a systematic survey amongst 4/10ths ice is certainly an unusual occupation. Being an icebreaker, the ship is obviously strong enough to hit some ice, but only 'first year' ice, which should be no thicker than 1m proud of the sea surface. However, experience from the January survey period – the first time the multi-beam had been used in the ice – showed that hitting ice caused considerable or complete degradation in performance of the sonar. It was often 30 seconds or so before the multibeam recovered and was able to track the seabed again. Hitting ice and surveying are mutually exclusive! Also throw into the equation that much of the area that *Endurance* is working in is entirely un-surveyed. You can only plan the area that you intend to work in, then give it your best shot. Straight survey lines

are certainly not worth attempting! The ship therefore has to adopt a 'mow the lawn' approach, whilst keeping a constant look ahead for a clear(ish) route – both by looking out of the window and by using the ice radar mounted on the bow. The ship can then return to the same area later on in the hope that the ice flows have moved on.

Possible Volcanic Vent

Whilst collecting data just outside of the survey area during flying operations, the multi-beam picked up what proved to be a very unusual feature in 600m of water. The small vent-like feature was on the side of a sea mount which rises from 600m depth to 20m below the surface, and repeated passes over the feature showed a great deal of unusual water column activity (visible thanks to the new SIS software). Initial thoughts were that the apparent plume was thermal in nature, but extensive trawls with the SVP+T probe and deploying a number of XBTs failed to show a significant temperature rise other than at the surface (2o C higher than the ambient).

Further consultation with the UK's National Oceanographic Centre and the USA's Woods Hole Oceanographic Institution has shown that the plume is likely to be visible to the sonar due to high gas content rather than thermal properties. They have also confirmed that based on the evidence this would appear to be a genuine and significant find.

Search for the Wreck of *The Antarctic*

Whilst surveying in the region, *Endurance* also spent some time using the multibeam to search for the wreck of The Antarctic. The ship sank in the ice during Otto Nordenskjöld's Swedish / Norwegian joint expedition to the Antarctic Peninsula in 1904, and is thought to be lying in about 600m of water to the South of Paulet Island. The search for the wreck was instigated by marine archaeologist David Mearns of Blue Water Recoveries. A number of promising contacts were found in the search area, and will be investigated with a drop camera at a later date (hopefully by *Endurance* on her next work package in the area). The fact that the sonar was able to reliably detect 1m high features on the otherwise flat seabed in 600m of water was good news in itself. Also, the area was mainly clear of iceberg scours, which hopefully means the wreck may still be intact. It was interesting to note that icebergs were scraping the seabed down to depths of 450m!

Return to Port

Of course the fun and hard work had to end at some point, and following a brief visit to the Argentinean base on the peninsula, we sailed north back across Drake's Passage on route to Ushuaia in Argentina – claimed to be the world's most southerly city. Our route also took us to the west of Cape Horn, allowing us to leave the cape to port on our approach to Ushuaia.

The visit to Ushuaia was significant, as this was the first RN vessel to enter the port since the Falklands Conflict in 1982. The visit was marked by a UK/Argentine wreath laying ceremony in the town, and proved the importance of *Endurance's* ambassadorial role.

At this point we had to leave the ship, and whilst keen to get home, it was with regret that we had to bring the experience to an end. I would like to extend a personal thank you to the Captain and Crew of HMS *Endurance* for allowing me to join them during their work package. I hope the training was useful but not so successful that another visit is not needed next season!