Extreme Swath Survey: The Dead Sea

A future article in Hydro international will describe our recent multi-beam survey of the Dead Sea. This brief overview extols the virtues of renting a complete multi-beam system as opposed to owning one. The survey presented extreme challenges, overcome by the readiness of manufacturers to venture into unknown waters.

Since 2001 we have been mapping Israelâ€™s Mediterranean offshore using my 96-kHz EM1002 multi-beam. The Dead Sea had always been a desired target, but there were excessive problems in transferring the ship, and the systemâ€™s high-frequency attenuation. After reading about ELACâ€™s Seabeam 1050 used in our area by the Turkish Navy, and realising that its portable 50-kHz variant (the 1055) could be mounted on our vessel, the R/V Tuglit, we rented for the first time.

Our approach to ELAC Nautik was met with interest. Although transducers are designed for expected oceanic and freshwater sound speeds, the engineers figured that the system would work by instructing the firmware that the angle between the transducers was 30Â° instead of 38Â°. Half the engineers were sceptical.

Because the survey was for research, Coda Octopus provided an F-180 attitude and positioning system without cost. It worked splendidly and forced us to consider an upgrade of our EM1002â€™s own six-year-old MRU. In anticipation of sound speeds in excess of 1,800m/sec, CARIS provided modifications to permit later analysis.
Our first hurdle was my fault and totally unexpected. Our AML (Applied Microsystems Ltd) CTD/SV had originally been ordered with â€˜tweakingâ€™ to accommodate the freshwater Sea of Galilee, the hot, salty eastern Mediterranean and northern Red Seas, and the much hotter and saltier Dead Sea. I little realised that â€˜tweakingâ€™ to 1,567m/sec was insufficient. After Boris Schulze of ELAC had installed the equipment in mid-December we discovered that we had no idea of the sound speed or its structure.

Despite the holidays (Hanukkah, Christmas, Id al Fitr and then Eastern Orthodox Christmas), numerous calls to AML resulted in a work-around. First we tried lengthening the transmission path of our SV probe. AML engineers gave many reasons why this wouldnâ€™t work, but it worked and showed high speeds: over 1,770m/sec without calibration. But a direct measurement was required, as no equation gives sound speed for NaCl concentrations above 30% with additional metallic salts.
AML dispatched to us its direct readout industrial SV2000 probe for the range 500-2000 m/sec. Attaching this to our CTD/SV, which measured temperature and pressure (depth), and spooling out over 300 m of CAT5 LAN cable, we recorded speeds between 1,798 and 1,814m/sec on numerous profiles in this very inhomogeneous, terminal lake.

Finally the multi-beam was happy, despite high refraction leaving a data gap at nadir. Over a three-week period, the Jordanian and Israeli halves of this inland sea at -422m were mapped, hindered by unseasonably high winds producing whitecaps in water of density 1.4g/cc. Co-operation from the Jordanian Navy and scientists from Al Balqaâ€™ Applied University was excellent. The rental gave us positive experience with new software suites. Data acquisition was with ELACâ€™s Windows-based Hydrostar, and near real-time QC utilised the ELAC HDP suite. We were also introduced to HYPACK for navigational control and planning.

We look forward to renting a higher-frequency system for the Sea of Galilee in 2008.