



As the regulatory requirement to assess reservoirs and lakes expands to include smaller bodies of water, HR Wallingford has developed a remote control boat which is able to collect hydrometric data quickly, simply, safely and accurately.

The ARC-Boat employs a sophisticated SonTek (a Xylem company) M9 Acoustic Doppler Profiler (ADP®) which is a 5-beam depth sounding device that scans the reservoir bed as the boat is guided across the water's surface. Recorded data are analysed by SonTek Hydrosurveyor software to produce accurate depth measurement in addition to 3-D maps of the entire water body. With a small amount of post-processing in GIS or 3D CAD, an accurate water volume can be determined.

Craig Goff, a reservoir Supervising Panel Engineer and dam specialist at HR Wallingford has used the ARC-Boat in a trial project to assess five reservoirs and says "This new method offers tremendous advantages over traditional manned boat techniques because it is faster, safer, more environmentally friendly and involves fewer staff and resources. All of this combines to mean that it saves a great deal of time and money. This is particularly important because the Flood and Water Management Act 2010 will necessitate the volumetric assessment of many water bodies that have previously been below the threshold and therefore outside of the ambit of the Reservoirs Act 1975."

Reservoir regulations

As a result of residential and industrial development in recent decades, the levels of risk associated with many UK reservoirs have changed, and the Flood and Water Management Act 2010 has amended the Reservoirs Act 1975 to bring a more risk-based approach to reservoir regulation. The 2010 Act seeks to achieve this by:

1. reducing the capacity at which a reservoir will be regulated from 25,000m³ to 10,000m³
2. requiring all Undertakers with reservoirs over 10,000m³ to register their reservoirs with the Environment Agency
3. ensuring that only those reservoirs assessed as high risk are subject to full regulation

The reservoir sections of the 2010 Act are dependent upon on the development of secondary legislation which is likely to specify the reservoir capacity above which water bodies will be regulated. However, irrespective of the content of this secondary legislation, the Flood and Water Management Act 2010 has clearly generated an urgent need for reservoir assessment and the application of the ARC-Boat for reservoir bathymetry is therefore propitious.

Technology

The ARC-Boat has been designed with a V-shaped hull to give optimal manoeuvrability and minimal air entrainment beneath the ADP, ensuring high quality data collection. The robust and reliable design, including grab handles fitted to the upper deck, mean that the boat can be launched from the most difficult locations and a unique detachable bow means that the ARC-Boat can easily be transported in an average sized car.

The SonTek M9 is a 9 beam acoustic Doppler profiler, using 5 beams at any one moment for depth measurements from a wide footprint on the water bed. This means that the time spent 'driving' the boat is minimised in comparison with single beam instruments. Importantly, the M9 is able to operate in depths ranging from 15cm to over 40m.

The boat employs industry standard remote control with a minimum range in excess of 200m and Bluetooth communications provide data transmission to an onshore laptop.

Data Management

HydroSurveyor™ is a system designed to collect bathymetric, water column velocity profile, and acoustic bottom tracking data as part of a hydrographic survey. The two key components of the system are the HydroSurveyor™ Acoustic Doppler Profiler (ADP®) platform, and the powerful, yet user-friendly, data collection software.

With the HydroSurveyor™ platform, SonTek is able to offer an exclusive 5-beam depth sounding device, with built-in navigation, full water column velocity (currents) profiling, full

compensation for speed of sound (with the CastAway-CTD), and integrated positioning solution.

Trial Results

Craig Goff is extremely pleased with the results of the initial trials on five reservoirs in southern England. He says: “The M9 performed very well, running from 8am to 4.30pm each day on a single set of batteries. We were able to conduct the surveys much faster than has ever been possible before, without the health and safety risks of putting staff over water and the environmental risks of diesel powered larger survey boats. Most importantly, however, we were able to produce high quality accurate data for a modest price and our client was very pleased with the results.”

Applications for the ARC-Boat

In addition to the smaller reservoirs that will have to be surveyed, larger reservoirs will be able to take advantage of the new technology to assist in operations such as the creation of sedimentation models. These models inform strategies to prevent capacity depletion and to extend the lives of reservoirs through flushing, excavation, dredging etc. Similarly, ARC-Boat surveys can be employed around submerged hydropower or draw off pipe intakes to assess sedimentation levels – a vitally important role because sediment can seriously damage turbines, or influence operation of scour pipes or water supply draw off pipes from reservoirs.

Summary

As a result of the Flood and Water Management Act 2010, the owners of small reservoirs will need to prove whether their water bodies are affected by the amended Reservoirs Act 1975, by determining an accurate volume figure for their reservoirs. Typically, this will include landowners, farmers and organisations such as the National Trust. However, the development of the ARC-Boat with the M9 and the latest HydroSueveyor™ software mean that such work is now faster, safer and significantly lower cost. This is good news for the owners of smaller reservoirs for whom any survey cost is a new cost.