

# Ping DSP – Evaluation of Shallow Water Bathymetry and Object Detection Capability.

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**Key words:** GNSS/GPS; Hydrography; Positioning; Interferometry; backscatter; object detection

## SUMMARY

Phase Differencing Bathymetry Sonars (PDBS) are the most recent advancement in technology that combine SSS and MBES functions into a single sonar system that is capable of imaging and mapping the seafloor. The Ping DSP's 3DSS-IDX-450 is one of the advanced PDBS. The basic idea behind interferometry is to directly estimate the angle of arrival of an incoming plane wave as a range function using the differential phase across the array elements. The recently developed CAATI algorithm integrated in the 3DSS-IDX-450 determines numerous plane wave arrival angles and amplitudes from the backscatter data collected using a tiny linear array. The 3DSS-IDX-450 from Ping DSP was purchased by the Royal Navy for use in ASV/USV and AUV operations, shallow water mapping and imaging (bathymetry and object detection), and other naval operations especially ASV/USV and AUVs surveys.

Bathymetric uncertainty and object detection tests were conducted at Cawsand Bay (a suitable area for reference surface analysis with an existing pre-calibrated 0.5m cube). Both systems achieved the

standard of IHO Order 1a for bathymetric uncertainty. However, the 3DSS-IDX-450 performed

comparatively less accurate at the nadir.

The error of the nadir performance of the 3DSS-IDX-450 was 0.428m (M.B. data) and 0.513m (3D data) compared to 0.306m of the Norbit iWBMS at its nadir. The 3DSS-IDX-450 did not meet the overall IHO Special Order because its bathymetric ability deteriorated quickly with high uncertainty on the outer beams above 140° (32m range) in shallow water. It, however, performed better in the middle from 20°-140°. The Norbit iWBMS performed better in the outer beams, up to about 155°. The overall depth uncertainty for Norbit iWBMS was 0.042m and 0.11m (95% c.l.) for

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3DSS-IDX-450.

During this testing, the 3DSSTM Sonar could effectively detect seabed targets in shallow water (2 – 6.5m depth below CD). The 3DSS-IDX-450 Sonar was highly efficient (100%) in distinguishing the midwater target, including the mooring cable and the anchor, which is one of its primary capabilities.

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