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Shadows, combination of synthetic aperture sonar and forward looking gap-filler. Results in shallow water in Portsmouth during spring 2008.

SHADOWS is a new Sonar system developed by IXSEA SAS. It is composed of a synthetic aperture side-scan sonar and a forward looking sonar and uses a very precise INS. It is imaging at 300m or 10 times the altitude on each side with a 15cm constant resolution and is filling the gap at nadir with 'side scan like' images with comparable resolution. It produces a real time georeferenced mosaic using the position provided by the INS. The working speed is 5 knots.

The synthetic aperture sonar algorithm uses INS data combined with the Displaced Phase Center Algorithm (DPC). Differences between INS and DPC navigations can be used to compute a topography profile of the ground.
The post processing and real-time modes differ on the weight given between INS and DPC, and on the approximations to be done. The real-time beam-forming algorithm used is the time-domain fast factorized back projection which can be pushed to an exact back projection in the post processing mode.

The forward-looking sonar uses a patented "sectorized emission" architecture. The images are side-scan-like, i.e. we see echoes and shadows as on the sides. The geometry of the antennas is calculated to maximize the contrast on images and to minimize the noise and interferences. The real-time algorithm can be customized to make some incoherent integration on several pings increasing the contrast but slightly decreasing the resolution. A post processing algorithm can also provide an animation on a specific contact on the floor.

All the images are presented on a georeferenced map and can be visualized in the NASA World Wind interface. The data can also be imported in the IXSEA web contact analyser which allows doing some detection, classification and post processing work a selected contact images.

This system is particularly efficient in shallow water. In this paper, we show some results obtained during sea trials in Portsmouth and La Ciotat Bay. We explored different configurations with several water depths. The results we obtained allows us to claim that even in very shallow water the swath can be greater than 10 times the altitude of the fish.