Automated Boulder Mapping for Geohazard Assessment of Offshore Windfarm Sites

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The growing global demand for renewable energy is driving the rapid development of offshore windfarms. Most of these developments are in shallow water <60 m which is suitable for fixed piled, jacket, and gravity-based foundations. A particular concern in de-risking the construction phase is the accurate identification of surface and near-surface geohazards. In particular, the precise location and size of surface and buried boulders is essential for planning the placement of foundations and power export cables.

Boulders are common along the Atlantic continental shelves of Canada and the U.S. because poorly sorted glacial sediments are at or near the surface over much of the region. Here windfarms are either installed, planned or are in the early stages of feasibility assessments.

Once identified, boulders are avoided by adjusting the locations of bottom-founded structures. This is particularly important for piles that are typically driven 20 – 30 m into the seafloor and which are susceptible to boulder damage during piling. Avoidance is also preferred for cable routes, but where this is not possible boulders must be removed to clear a safe path.

Buried boulders are interpreted or ‘picked’ by skilled geoscientists using high resolution sub-bottom profile data. Surface boulders are ‘picked’ from high resolution digital side scan, multibeam or synthetic aperture sonar imagery. This is time-consuming work and in areas with large numbers of boulders or boulder clusters project budgets and timelines demand a faster, less expensive method of identification that still yields accurate locations and sizes.

Solutions for rapid boulder interpretation involve use of artificial intelligence techniques that remove much of the burden of manual ‘picking’ and satisfy sensitive timelines. Fugro has pioneered and proven the veracity of these automated techniques which have been successfully applied to several offshore boulder-rich windfarm site investigations.