



NERC Centre for Doctoral Training in Oil & Gas (2017 start)

Project Title: Optimising the value of near-surface seismic reflection data

Host institution: University of Southampton

Supervisor 1: Prof Tim Henstock

Supervisor 2: Dr Mark Vardy

Additional Supervisor (s):

Project description: While seismic methods to investigate depths from several hundred m to km depth beneath the seabed have advanced significantly over the past 20 years, the techniques used to investigate the shallowest 100-200m largely remain very basic. In this project we will adapt techniques from conventional exploration to address the challenges of investigating the shallow subsurface at sub-metre resolution. We will apply a combination of prestack depth migration and post-stack and prestack waveform inversion to multi-offset high-resolution seismic data with three main aims: Deriving high quality structural images of the near surface; estimating physical properties of the near surface and interpreting those properties in terms of parameters that are relevant to engineering within the marine environment; determining error bounds on our estimates of the physical properties. We will do this using a combination of standard industry software such as ProMAX and custom codes to address particular aspects of the problem such as accounting for streamer geometry with sufficient accuracy, waveform inversion, and determining error bounds on the physical property estimates. We will work initially with existing datasets collected in a range of environments and water depths (from 10m to ~200m), although we will expect to collect at least one dedicated dataset with the involvement of the student, probably after ~2 years of the project.

CDT Research theme(s): Environmental impact and regulation – this project would directly address the impacts of surface infrastructure, both at the time of planning/installation and decommissioning. We are also due to collect a dataset in summer 2017 that is directly linked to Carbon Storage monitoring, which will be an ideal test case for applying the techniques developed during the project.

Research context: Henstock and Vardy have been working with sub-m resolution multichannel seismic reflection data for more than 10 years. This has enabled us to develop many of the individual elements required for the success of this project. See for example: Pinson et al., *Geophysics*, 73, 2008, G19-G28; Vardy and Henstock, *Geophysics*, 75, 2010, S211-S218; Vardy, 2015 *Near Surface Geophysics* 13 (2), 143-154. The survey industry is only recently starting to work with equipment suitable for high quality imaging of the shallow near surface, so we would expect the project outcomes to be broadly applicable.

Research costs: During the initial phases of the project the main costs will be for computing and attendance at appropriate conferences. There will be costs of travel and potentially vessel hire to collect a dedicated dataset, however we would cover those costs outwith the RTSG if necessary.

Career routes: This project would provide excellent training for a range of careers working with and applying seismic data, ranging from advanced seismic processing to using the insight gained during the PhD in a conventional industry career.