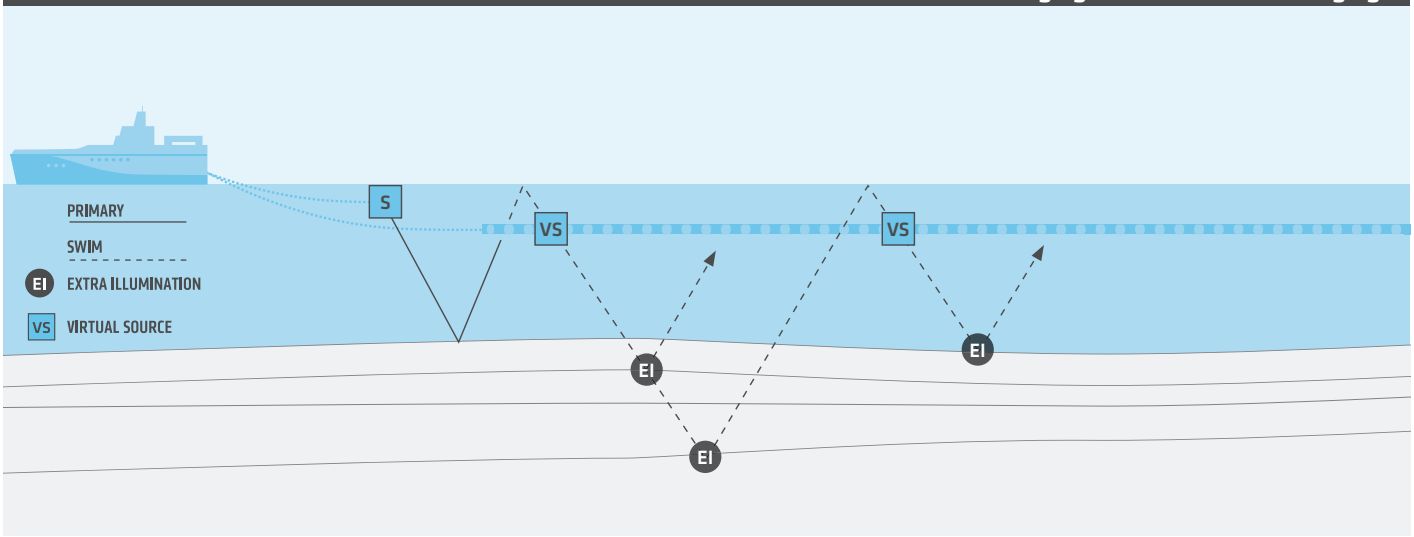
TechNote

PGS Imaging – Shallow Hazard Imaging



SWIM Away from the Shallow Hazards

Existing 3D seismic data is being processed by PGS in a new way to deliver impressive high resolution images for shallow hazard assessments. This saves time and money for oil and gas companies.

GeoStreamer Replacing Site Surveys

An innovative reprocessing sequence is applied to GeoStreamer dual-sensor data, even if originally acquired for exploration purposes, to deliver images that compare with those of dedicated site surveys. However, GeoStreamer SHAZ data is significantly richer in low frequencies meaning the spatial resolution is even better. This bespoke SHAZ workflow works particularly well in shallow and medium water depths and PGS is successfully delivering this product to E&P companies.

Prior to any drilling operation, site surveys need to be carried out to minimize the risk of harm to personnel and equipment, and to protect the natural environment. The objective of any such site survey is to identify all possible constraints and hazards from man-made, natural and geological features which may affect the operational or environmental integrity of a proposed drilling operation, and to allow appropriate operational practices to be put in place to mitigate any risks identified (OGP 2011, Report No. 373-18-1).

In addition to side scan sonar acoustic seabed imagery, various seismic surveys have traditionally been used to map out the overburden immediately beneath the seabed. The survey types can vary from conventional 3D seismic to ultra-high resolution 2D or 3Ds. In deeper water settings, conventional seismic surveys are typically used for shallow hazard evaluation by increasing the sampling rate to 2 ms and by reducing the bin spacing of the subsurface image compared to standard 3D imaging.

Minimizing Acquisition Footprints

In shallower water depths the lack of near offset information in conventional 3D seismic is a limiting factor, leading to the overburden often being imaged at high reflection angles and resulting in image gaps that are visible as significant acquisition footprints. Consequently conventional 3D seismic data has only seen very limited use for hazard evaluation in water depths of less than 500 m. PGS' dual-sensor GeoStreamer acquisition platform not only facilitates the recording of data both rich in low and high frequency information, but importantly it also yields direct access to the various seismic wavefield components that can be uniquely utilized to image the near

KEY BENEFITS

- Save time and money by avoiding acquiring dedicated site surveys, use existing GeoStreamer seismic data
- Off-the-shelf 3D regional scale high resolution images of the shallow overburden
- Improved resolution with data much richer in low frequencies than conventional site surveys

surface geology with Separated Wavefield Imaging (SWIM). By designing imaging workflows that combine both high-resolution 3D processing with SWIM, very detailed hazard analysis of potential drilling locations can be carried out using existing GeoStreamer data.

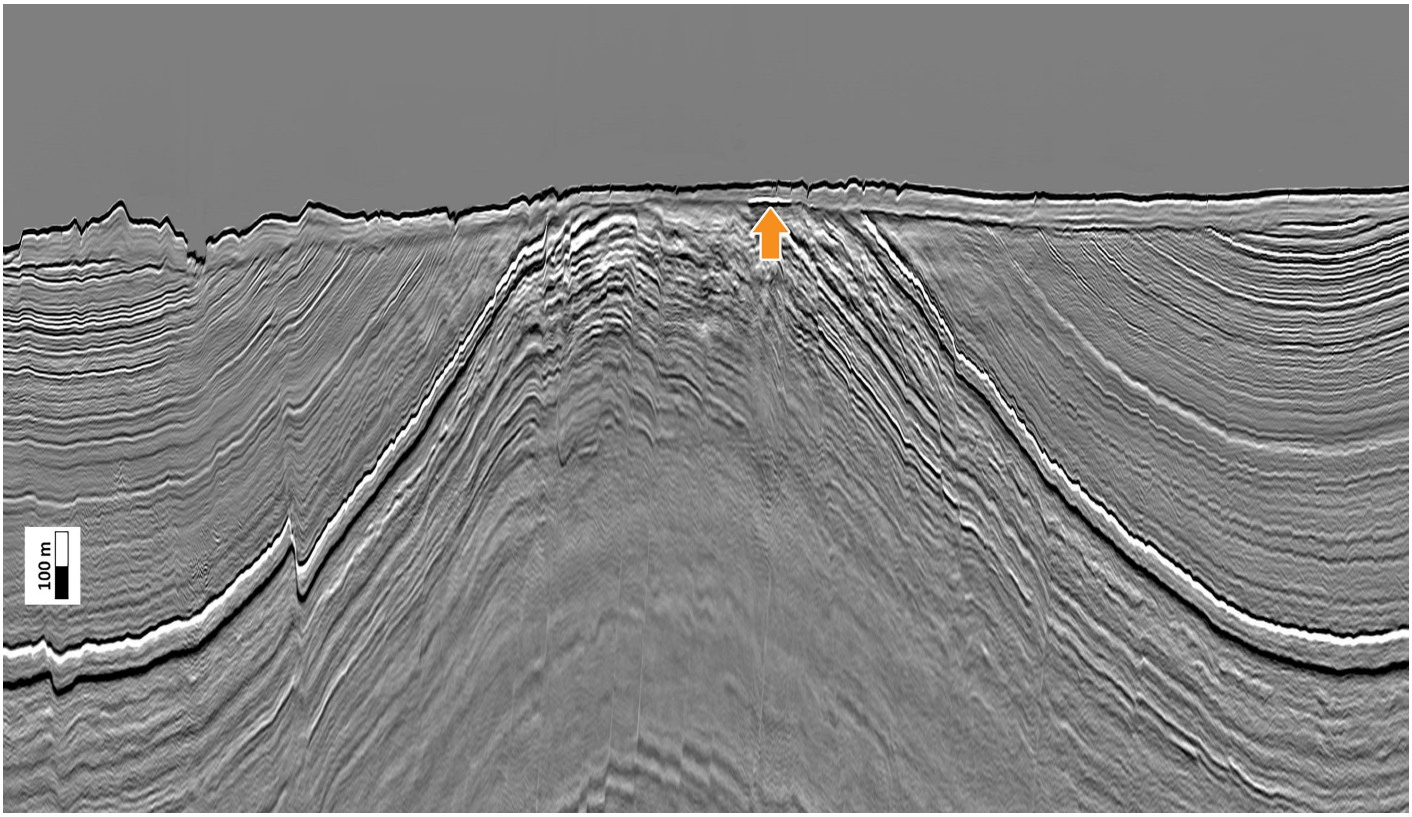
Reprocessing to Image Small Structures

SHAZ processing aims to produce high resolution images of the overburden by processing at a 2 ms sampling rate and on a dense image grid of 6.25 x 6.25 m. The velocity model for the shallow subsurface is built using a robust FWI workflow enabling very detailed velocity estimation to ensure accurate imaging of very small geological structures. Both primaries and SWIM (i.e. multiple) volumes are intelligently merged to what can be considered a full wavefield image of the very shallow overburden.

Availability of Low Frequencies for Better Resolution

The bespoke SHAZ workflow results in seismic images characterized by very stable and compact wavelets all the way from 2 to ~225 Hz in both shallow water (30-40 m) and medium water depth (~500 m) settings. The seismic resolution at the high-frequency end of the spectrum achieved with SHAZ processing of GeoStreamer seismic compares very favorably with that of dedicated site surveys, however GeoStreamer SHAZ data tends to be significantly richer in low frequencies. This additional 1-2 octaves of low frequency content result in a much shorter wavelet which improves the spatial resolution of the SHAZ volumes.

The figure shows an example of the stunning results achieved with GeoStreamer full wavefield SHAZ processing in relatively shallow waters using an original exploration style survey that was acquired using very wide spreads of receiver cables and large sail line separation.



Crossline example from the Barents Sea showing superior resolution with GeoStreamer full wavefield SHAZ imaging and revealing shallow gas hazards in the area (arrow).