

# GHOSTREAMER X PILOT SUCCESSFUL - SO WHAT'S NEXT?

Completion of the GeoStreamer X pilot survey proves that PGS' novel marine seismic strategy for upgraded acquisition in any geological regime is practical, efficient and within reach.



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GeoStreamer X employs multisensor broadband technology with wide-tow sources, longer offsets, and multi-azimuth illumination. Although imaging of the first GeoStreamer X in the Viking Graben has only started, everything suggests that the exploration program will deliver accurate velocity models, high-resolution images, and reliable AVO attributes, all the factors required to meet the demand for more dependable subsurface insight at reduced cost and turnaround.

The pioneering source and streamer configuration used on the Viking Graben is just one variant of this acquisition solution. It can be tailored for every geological challenge and applied in multi-azimuth mode from a single Ramform streamer vessel. Common denominators are superior data quality, lower cost and faster turnaround. These are provided by multi-sources for improved spatial sampling and efficiency; wide-tow sources for optimal near offset coverage and AVO; longer offsets for reliable velocity model building; and cost-effective multi-azimuth illumination acquisition; resulting in rapid turnaround from acquisition to final image.

### Wide-Tow Sources for Near Offsets, Accurate AVO, and Efficiency

Wider towing of seismic source arrays has recently become operationally feasible. During 2019, total source separations of up to 250 m from a single acquisition vessel have been successfully tested by PGS and will

be deployed in 2020 programs. Total separation of 400 m is within reach. Modified towing solutions now also enable wide-tow source arrays in close to zero distance from the streamer front ends. Negative offsets, with sources over the streamer front sections, can also be provided.

Distributing wide-tow multi-sources along the front of a streamer spread provides geophysical benefits, mainly by improving the near-offset coverage. Towed streamer surveys with a standard source set up, in front of the center streamers, may not provide the near-offset/near-angle coverage required for AVO analysis. Wide-tow sources are especially relevant for shallow targets in shallow water environments, such as the Barents Sea.

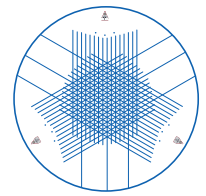
Towing multi-sources wider can also provide efficiency gains. As the distance from the outer streamers to the nearest sources is reduced, wide-tow sources enable wider streamer spreads and increased lateral data coverage, improving turnaround, without sacrificing near offsets.

### Accurate Velocity Models and High-Resolution Images

With smart receiver and source towing, the recording of ultra-high-density data for imaging can be combined with a velocity survey for full-waveform inversion (FWI). This approach was successfully applied on a PGS-TGS JV in the Barents Sea in 2018. The program employed a high-density 16 x 56.25 m streamer spread with a triple-source set-up, resulting in an acquisition bin size of 6.25m x 9.375m. Three of the 16 streamers were configured with 10 km long streamer tails providing extra-long offsets for FWI. Read more about this novel two-in-one configuration and the quality uplifts created by accurate velocity model building and high-resolution imaging in our Barents Sea Case Study ([www.pgs.com/hammerfest](http://www.pgs.com/hammerfest)).

### GeoStreamer X Proof of Pilot

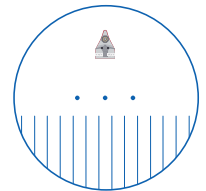
The Viking Graben was selected for a GeoStreamer X pilot project starting



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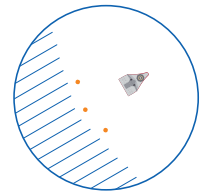
### Offset- and Azimuth-rich Data

Timely delivery of images that illuminate complex subsurface geology.



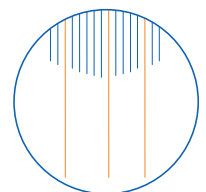
### Acquisition Efficiency

Ramform, large spreads, and wide-tow sources for larger sail line separations to reduce turnaround.



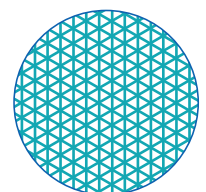
### Accurate AVO Analysis

Wide-tow sources also improve near-offset sampling.



### Reliable Velocity Model Building

Extra long streamers provide long offsets for even more accurate FWI.



### Dense Sampling for High Resolution Images

Multisensor, towed-streamer acquisition using multiple sources combined with high-density receiver spreads.





The Viking Graben survey used the widest-ever source separation towed by a single streamer vessel on a commercial project.

in September 2019. This is a mature exploration area with several fields and discoveries, where key exploration and field development objectives suffer from illumination and resolution challenges associated with injectites, v-brights, and thin chalk layers deposited on top of the main reservoir targets.

The GeoStreamer X pilot was designed to address these imaging challenges. Following the two-in-one success recipe from the Barents Sea (above), Ramform Vanguard towed a 12 x 85m high-density multisensor spread with two deep-towed, 10 km long streamer tails, and a wide-tow triple source with 225 m separation between outer source arrays. This was the widest-ever source separation towed by a single streamer vessel on a commercial project.

Two acquisition directions were acquired, complementary to existing GeoStreamer multiclient data coverage. The three data sets combined form the basis for a robust and efficient rich-azimuth acquisition and imaging solution. Enabled by the wide-tow source configuration, the additio-

nal azimuths were acquired with a flexible sail-line separation optimizing the balance between geology-driven near-offset requirements and productivity.

### Planning New GeoStreamer X Projects

GeoStreamer X represents a flexible acquisition and processing solution that can be tailored to address very different subsurface imaging challenges. In northern Europe and especially on the Norwegian Continental Shelf (NCS), where a lot of high-quality GeoStreamer data already exists, it is particularly applicable. Unlike ocean bottom seismic techniques, such as OBN, in many geographical locations, only one streamer vessel is required to produce multi-azimuth high-resolution imaging, improving efficiency and turnaround.

Future NCS surveys will typically target areas in the North Sea where challenges associated with injectites, v-brights and subtle traps demand upgraded illumination. Exploration in the Barents Sea will also benefit from the GeoStreamer X concept. Survey

design projects to optimize illumination around salt structures, e.g. in the Nordkapp Basin, have shown promising results.

GeoStreamer X is also applicable outside of this region, for even more complex and deeper targets. PGS concept studies for pre-salt exploration in Brazil have resulted in fit-for-purpose towed multi-azimuth geometries with 20 km effective offsets for FWI and improved imaging of deep reservoir targets. An extra source vessel would provide the ultra-long offset using a continuous long offset approach.

### Faster, Cheaper, and Smarter So Far

PGS has promised an effective and more efficient route to improved reservoir illumination than nodes, and the completion of the Viking Graben pilot in just eight weeks is an important first step in meeting that promise. For exploration teams, faster access to data is really what counts and delivery of the first GeoStreamer X data is scheduled before next Easter. Roll on 2020!