Advancing Exploration, Production through OBN Technology

Acquisition completed on largest ultra-long offset deepwater OBN survey in the U.S. GoM.

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Ocean-bottom node (OBN) acquisitions have been in the industry since the early 1990s, beginning in the North Sea. Growing in popularity in the 2000s, this marine technology played a significant role in seismic observation focused on small production projects. OBN acquisition provides much cleaner seismic signal than conventional narrow-azimuth streamer surveys with focus on 4-D with unmatched repeatability. By the early 2010s, OBN technology became more reliable, flexible and affordable to take on larger scale acquisitions. In 2019, acquisition was completed on the industry's first and largest ultra-long offset deepwater multiclient OBN survey (the Amendment) in the U.S. Gulf of Mexico (GoM) reaching maximum depths of 2,070 m. The Amendment survey covers 118 OCS blocks utilizing offsets out to 40,000 m.

Deployment of nodes began in early May with the firing of 1.6 million shots, and recovery of the nodes was completed in August 2019. The crew consisted of two ROVs laying out nodes in a 1-km by 1-km grid and three source vessels to record the active node patch. This four-month survey was conducted without any HSE recordable incidents.

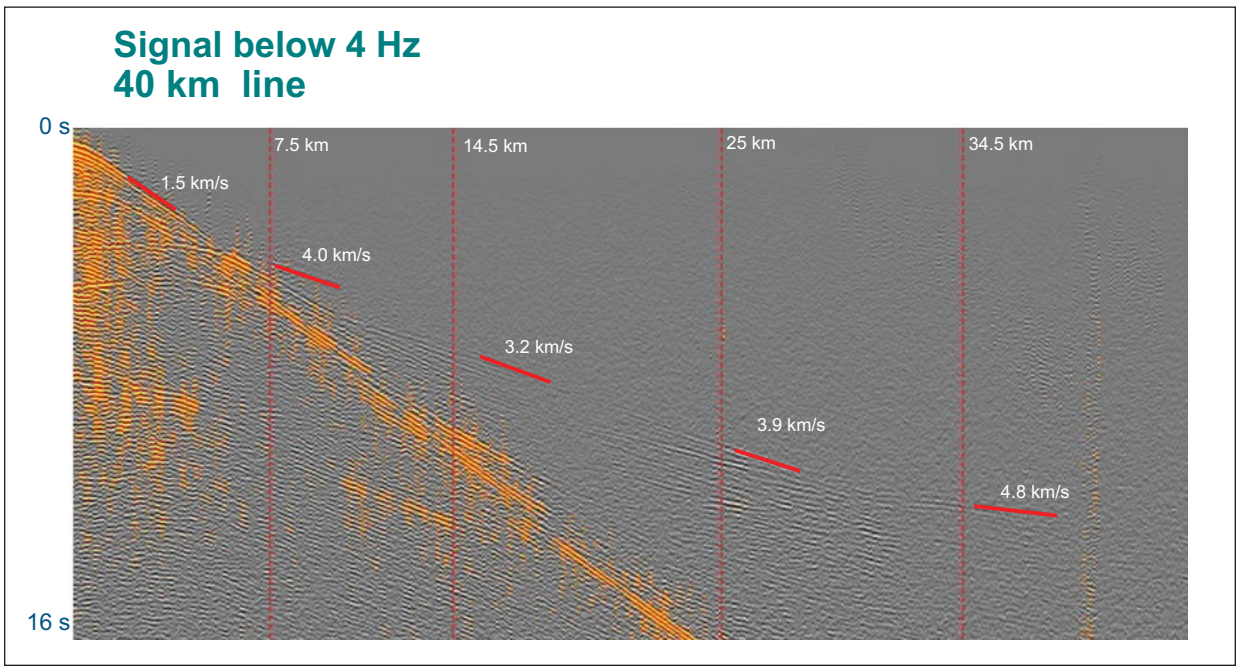
Simultaneous operations were recognized as a challenge during the mobilization hazard identification review. The crew went around 14 fixed structures and three "slow-moving" assets (wave gliders). For each fixed structure the communication between the offshore installation manager and the crew was essential for the close passes; on average eight close passes were acquired per fixed structure, so the crew executed over 110 close passes. As for the slow-moving assets, the crew was communicating with the wave glider coordinator out of California to prevent collision paths.

The Amendment survey was designed with a receiver carpet of 2,700 sq km and a 50-m by 100-m shot carpet of 8,000 sq km. The nominal offset is 40 km and the max-min offset range is 20 km in the shot halo. This full azimuth dense shot project was designed to deliver a dataset that is suitable for both full-waveform inversion (FWI) velocity and seismic imaging updates. The source volume was a 501 cu in. air gun used to record signal down to 1.5 Hz at 20 km offset. In production shots the larger source was used for stability reasons and to acquire low frequency signal below 3 Hz to give FWI more reliable signal for velocity model building.

One of the primary objectives for this large deepwater exploration scale survey is to improve illumination of targets, especially in subsalt basins. This is obtained by a very dense and large offset shot grid that allows ray paths to travel, reflect and refract deeper with the salt flanks interfaces. With the improved subsalt refractions diving waves easily reach to the Louann Salt, the predominant "mother" salt in deepwater GoM.

We expect significant uplift in data quality over existing data. The uplift will come from the unprecedented sampling of azimuths and ultralong offsets. This will be a challenge for the preprocessing in terms of deghosting, demultiple and other pre-imaging steps. This is a step change in the application of refraction FWI to improve velocity model building and we are expecting the increased coverage of the subsurface will result in subsalt events for reflection FWI and multi-arrival tomography.

To find out more about OBN offerings from TGS, visit booth 2138. ■



The image is a shot line from a single node; the data have been filtered to max 4 Hz. The data show refracted signals up to 40 km. (Image courtesy of TGS)