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Units record individually

Solo Nodes Combine for Seismic Choir

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A wide-bin 3-D seismic survey using the ZLand nodal seismic technology system to better understand a promising Monterey oil prospect near Santa Maria, Calif., was successfully completed last year.

AAPG member Dan Hollis, with contractor NodalSeismic, worked alongside counterpart Dana Brock, with survey client Underground Energy, to manage the operations.

Together they offer here a concise look at this advanced technology survey, reflecting on what was done, and why.

The survey used a set of new innovative tools and technology to significantly reduce the environmental impact of our work, as well as the manpower requirements and costs.

At the heart of the survey was a seismic recording unit known as a node, which is very different from conventional geophone recorders that are still used in most seismic surveys.

Geophones are connected together using miles of cabling, which is costly, prone to malfunctions and requires considerable manpower to set up in the field.

The node, however, is completely self-contained, drawing power from its own battery and recording seismic data to built-in flash memory.

To set up a node survey simply requires planting each node securely in the ground and activating it with a hand-held terminal.

Underground Energy worked with NodalSeismic to conduct the survey.

In only two days, the NodalSeismic team placed 2,700 nodes – one every 55 feet – along a 13-mile course in steep, deeply dissected terrain.

Two 30-ton trucks provided seismic vibrations for the nodes to record. Stopping at a node, the trucks lowered a hydraulic plate and vibrated it to send seismic waves deep into the ground.

As the vibration trucks shook the ground, nearby nodes recorded strength and direction of seismic waves as they reflected off underground strata, fluids, faults and other features.

The trucks left behind only a shallow footprint in the dirt road. This was easily repaired at the end of the survey.

High above the course, the mobile command station and GPS tower controlled the work done by the vibration trucks. At the station, the computer automatically triggered the vibrations made by the two trucks, while also marking the time of each vibration and nearest node.

Once the nodes are collected, this information guides engineers to the best slices of the seismic recordings to study.

For four days, the vibrator trucks made their way along the narrow winding road, stopping at 2,700 nodes. Afterward, NodalSeismic collected the nodes, moving them to its offices.

There, the team plugged each node into a specialized rack that downloaded the node's flash memory, recharged its battery and ran diagnostic tests.

Computers processed over a terabyte of raw seismic data representing nine million vibe sweep traces to create detailed visual cross sections revealing the underground features of the project site.

With a clear understanding of that geologic structure, Underground Energy can more quickly identify the most promising areas for drilling.