

‘Stealth seismic’ leaves no footprint

Technology Solves California Challenge

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

Seismic data acquisition programs typically present a spate of challenges.

In some instances, the technology being used in the field just doesn't measure up to the task at hand.

That's when it's time to regroup and go to Plan B, which can entail latching onto a whole new breed of acquisition technology.

This was the case in 2006 when Signal Hill, California-based Signal Hill Petroleum Inc. (SHPI) wanted to shoot a 3-D survey in the old Long Beach oil field, which sits smack-dab in the midst of what is best called a dense urban jungle.

Often referred to as Long Beach/Signal Hill, the giant field has kicked out more than one billion barrels of oil from Miocene and Pliocene-age rocks considered to be sourced by the Miocene-age Monterey. SHPI operates the majority of the field.

Modern seismic technology has not been applied to most of the Los Angeles Basin, according to Dave Slater, executive vice president and chief operating officer at SHPI.

“We had issues with cables, noise, vibrations, so we stopped after a couple of days and said this is not the way to do this; let’s do it right,” said AAPG member Dan Hollis, managing partner at NodalSeismic (nee Seismic Imaging Solutions, or SISCO), which is wholly owned by SHPI.

“We decided to build a crew from the ground up, and that’s when SISCO was formed,” he said. “But a cable system was never meant to work in Long Beach, so we waited to contract the [ZLand nodal seismic system](#) from FairfieldNodal. In the process, we dissolved SISCO to create NodalSeismic.”

Urban Action

Dense urban environments may never become just another day in the park for seismic data gatherers. Nodal technology, however, is a step in that direction.

The small, self-contained, battery-operated recording units can be temporarily secured to the ground – even covered with several inches of soil if necessary. Ordinarily sourced via vibroseis, they record continuously.

Troubleshooting is essentially history, mainly because the nodal systems ordinarily lack the cumbersome, break-prone cables that can create myriad problems during the course of data acquisition.

Additionally, nodes leave essentially no footprint, meaning they are about as green as can be – plus they are capable of providing superior quality data and economy of scale.

After contracting for the land node system, NodalSeismic conducted a 2-D survey at Long Beach, which was followed by a small 3-D pilot project. Then the company implemented a 22-square-mile 3-D program over the field beginning in January 2011.

Using its own newly acquired ZLand system of 6,000 channels, NodalSeismic got creative during the Long Beach 3-D program, actually taking some of the nodes to use simultaneously in the central coast area.

“You can break it apart to do many jobs with it,” Hollis said, “as long as you have enough channels.”

Given its geologic history of folding, thrusting and faulting, the highly complex Long Beach field might best be called a mess that’s been waiting for some top-of-the-line seismic data.

“Three-D is critical here and shows it’s more complicated than we imagined,” Hollis noted. “It showed SHPI new areas of interest in the Long Beach field.

“Based on having the 3-D in hand, the company bought a new drilling rig with deeper capability, and it’s going through a check-out now,” he said. “We’ll do a deep test based on the 3-D.”

Slater offered a succinct take on the nodal program.

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“Our ultimate objective with the seismic at the field,” he said, “is to get at the two billion barrels we think are still in place.”

Getting Into the Mix

Meanwhile, NodalSeismic has been busy in varied locales.

The group implemented a 4-D survey in the famed Barnett Shale for a major company client and has conducted a 3-D in the Eagle Ford for Sigma Energy Ventures, which is a joint venture that includes SHPI.

And California has additional needs for this technology.

Think Monterey Shale, which is one of the hot plays of the moment in the Golden State.

Besides being a prolific reservoir rock, the Monterey has sourced most of the oil in California. It's thought to contain perhaps as much as 300 billion barrels of oil in place.

Just don't call it a “shale,” say many folks.

The Monterey is a mix of rock types – it's basically a large deposit of diatomaceous material.

In what is known as the Opal A phase, it's low permeability unaltered dolomite. As pressure and temperature increase with depth, the Monterey becomes more brittle and fractured as it alters into cristobalite trypidymite, dubbed the Opal CT phase. It evolves into a quartz phase as lithification progresses.

Underground Energy in Santa Barbara is highly focused on the Monterey potential in California, particularly the central coast area.

When the company sought assistance to zero-in on the details of some of their acreage, NodalSeismic hit the scene with nodes on hand.

“We did a couple of two-and-a-half 2-D swaths, or what some call a wide bin 3-D, of about 20 square miles each,” Hollis said.

“Shooting a 2-D swath line in effect can generate a pseudo 3-D,” noted AAPG member David Hoyt, vice president of exploration and development at Underground Energy. “You get the opportunity to have to some effect a 3-D layout and shoot with very low impact – and it's very, very cost-effective.”

He emphasized they achieved almost a zero footprint. This jibes with the company's emphasis on being a “green” oil company.

Hollis commented on the less frequently discussed advantages of nodes.

“We’ve actually been preserving the passive data,” he said. “These things record 24/7, and I think analysis of that passive data is going to yield fantastic results – being able to improve velocity models, being able to monitor micro-earthquakes.”

In fact, NodalSeismic conducted a seismic hazard analysis for the Diablo Canyon nuclear power plant, where safety is paramount – particularly in earthquake country. The original site study was conducted in the 1970s.

A Fast Start

With its new seismic in hand, Underground Energy is wasting no time

On the Zaca prospect about seven miles from its Asphaltea project in the Santa Maria basin, the company has plans to drill five-to-seven wells between now and August, according to Hoyt. Depending on successes, a number of others could follow. The initial Zaca well was being spud at press time.

“There are a number of new structures we identified with our 2-D seismic that have remained undeveloped,” he said. “We control the leases on those particular structures.

“The field has produced 32 million barrels from about 60 wells that range in cumulative production from about 400,000 to over a billion-and-a-half barrels per well,” Hoyt said.

“Basically, it’s 11-degree-gravity oil,” he said, “and it comes out of the ground at a temperature about 175 degrees, so when it comes out it flows – it’s a very hot reservoir.”

Drilling depth to the Monterey will be in the 5,500 to 6,500-foot range. Hoyt emphasized they will be drilling vertical wells along with some deviated ones.

“We’ll stay in the conventional framework of Monterey development,” he said. “We think keeping it simple is a wiser, more efficient choice for economic gains.

“The Monterey has not turned out to be the quote-unquote resource play as envisioned, but more of a fractured quartz play enhanced by structure and stratigraphic pinchout,” Hoyt noted.

“We think it’s aligned to a structural-stratigraphic model, that it’s a conventional reservoir where you have to have a defined structural trap where the fractures are enhanced by folding and faulting.

“You need structure and/or stratigraphic closure to trap the Monterey effectively and commercially,” he emphasized.

The Driver

Hoyt added that the seismic program in central Santa Barbara County identified a number of large undrilled – and some drilled – new folds, or anticlines, with high structural relief, which he

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said they plan to drill in the next few years. Some of these folds have downdip wells productive in the Monterey as far back as the 1960s. The seismic data revealed geologic features such as four-way dip closures, hanging walls and more.

“We intend to use this tool not only in Santa Barbara County but in our other operations in California’s San Joaquin Basin and in Nevada,” Hoyt said.

Even with many success stories on record, land node systems technology for seismic data acquisition is in its infancy, relatively speaking, and Hollis predicted great potential.

“The possibilities it offers are amazing,” Hollis said. “We’re getting flooded with people interested in bids on projects, so we see good organic growth and are staffing up.

“The node system,” he emphasized, “is the driver for that.” (E)