How one old-school scientist found the biggest oil field this year

By David Hunn, Houston Chronicle, December 30, 2016 Updated: December 31, 2016 6:41pm

SAN ANTONIO - The dirty dishes were waiting for Steve Keenan on a cool weekend morning in March. He had just finished breakfast - two eggs over easy, severely toasted bread, and crisp bacon - while his wife sat nearby, reading the Sunday paper. It was only 9 a.m. The phone rang.

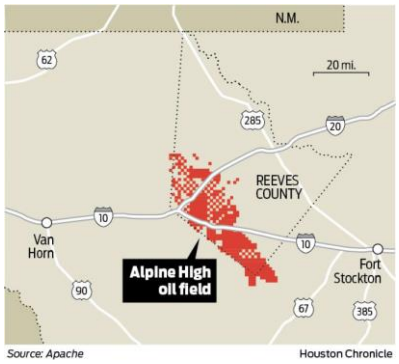
Keenan didn't recognize the number, but answered anyway, fearful something had gone wrong with a drilling rig or fracking crew that he oversaw as part of his job at the Houston oil company EOG Resources. A raspy voice barked out a name he didn't recognize: Steve Farris, chairman and chief executive of Apache Corp.

"How did you get this number?" Keenan asked.

Farris didn't answer. Instead, he got right to his point: Apache urgently needed to find oil and Keenan knew how to do it. Quit your job, Farris told him, come work for Apache and make the next big discovery. At the very least, Farris pleaded, come to Houston to talk about it.

Keenan was unconvinced.

"You're being unrealistic," Keenan responded. "Thinking I could just come there and find a big field. Do you know how long it takes to do that?"



Missing out

The year was 2014, and the oil boom was on. All around, exploration and production companies - including EOG - were cashing in. Apache wasn't.

Over a 60-year history, Apache had become one of the largest oil companies in Houston, discovering fields and drilling wells from Wyoming to Australia. But as the industry entered the 21st century, Apache had lost its appetite for risk, buying up cast-off properties from large companies and acquiring smaller firms squeezing oil from established fields.

That strategy worked for a while, doubling revenues between 2004 and 2010, but as the shale boom got underway, Apache found itself on the outside looking in. Production in its conventional holdings had stalled. It had not made a significant oil discovery in more than a decade and controlled precious little prime land in North American shale basins.

Apache's stock plunged by more than 30 percent between 2010 and 2014, even as the rest of the industry boomed. Farris knew Apache had to get back its swagger if it was to reverse its fortunes. It had to return to the business of risk, and it had to make a headline-grabbing find. Increasingly, his attention turned to Keenan.

"We needed a star," said Farris. "And he was a star."

Different ideas

Keenan, 61, is small and wiry, with unruly eyebrows, big round cheeks, and a crooked, mischievous grin. He works 60 hour weeks, with bags under his eyes to prove it. He rolls button-down shirt sleeves up over his elbows, wears baseball caps to the office and works out at the karate studio in his home every other night. He's a black belt.

Keenan grew up in Philadelphia, the son of a welder who was the son of a welder. He went to LaSalle University in Pennsylvania, then to Bowling Green State University in Ohio, where his master's thesis in geophysics focused on removing seismic "noise," or errant readings, using mathematical algorithms.

Just as he completed his master's in 1978, the oil and gas industry was expanding seismic testing to find new reservoirs. "I got numerous, numerous offers," Keenan recalled.

Over the next three decades, Keenan worked from offshore California to Europe's stormy North Sea, earning a reputation as a maverick who ignored conventional wisdom, did his own research, and found oil where no one thought it was. Keenan helped identify billion-barrel fields at Milne Point, in Alaska, and at Alba, off the coast of Scotland, as well as 100-million-barrel fields at Neptune and Trident in the Gulf of Mexico.

"If you want to find a new play, you're going to have to have a different idea," Keenan said. "And it's going to upset some people."

Keenan had a different idea in 2007, as he and his team at EOG focused on the Eagle Ford Shale in South Texas. The Eagle Ford cuts into the earth at an angle, bending down to the south and east. When layers of oil-soaked rock dip too low in the earth, they heat up and cook oil into natural gas. Keenan followed the formation toward the surface, where the earth was cooler and he could fracture rock to get at the oil.

The next year, Keenan and his team drilled one of the first horizontal oil wells in the Eagle Ford, proving they could get oil out of the play. Eagle Ford's crude reserves were later estimated at 5.2 billion barrels.

EOG, far ahead of the curve, leased more than 600,000 acres with little competition, said Gary Carson, one of the primary landmen lining up property in the Eagle Ford. The company spent just a few hundred dollars per acre, a fraction of the $35,000 companies paid a few years later. "It was an amazing episode, the most amazing episode of my professional career as a lawyer and landman," Carson said.

By the end of 2013, however, Keenan, felt stuck in his job. He couldn't imagine an accomplishment equal to Eagle Ford. At 58, he started talking about retirement. "What else was I going to do?" he said. "I really couldn't top that, as far as I could tell."

Then one Sunday morning, the phone rang.

Breakfast: the poach

"Who are you? What do you want?" Keenan asked the Apache CEO. He was suspicious, then skeptical. He didn't think Apache could change.

But Farris wouldn't get off the phone. And Keenan yearned to hunt again for the big find. He agreed to meet with Farris, who was about to retire, and the incoming CEO, John Christmann. Apache hired Keenan in April 2014, and Keenan opened a San Antonio office. Colleagues from EOG, including geologist Sara Reilly, 37, soon joined him. "I wanted to work for Steve again," she said.

Keenan's team started slowly, helping to improve existing wells and prospects, and operating other wells in the western half of West Texas' Permian Basin, called the Delaware. Keenan and chief geologist Roberto Alaniz, 67, a long-time colleague, had never worked in the Permian. But they liked the Delaware, with its deep underground basin that trapped organic material - the building blocks of oil - as seas rose and fell millions of years ago.

Keenan and Alaniz became intrigued by a section along a southern strip of Reeves County. The rest of the industry didn't think much of it. More than 100 wells had failed before Apache arrived, drilled by storied explorers like Oklahoma's Chesapeake Energy and Houston's Petrohawk Energy. Petrohawk once owned half the oil rights in the area, said Floyd Wilson, the company's former CEO and current chief executive of Halcon Resources, another Houston oil company. But it didn't know quite what it had. "We didn't even have a clue those plays were there," Wilson said.

The first zig

Oil companies largely avoided southern Reeves County. Most believed rock in that part of the Delaware was too deep and too hot to hold oil. In addition, as seas filled the basin millions of years ago, they deposited clay, which doesn't fracture well to let out oil and gas.

Keenan, meanwhile, was feeling the pressure of high expectations. "I knew I had the lifespan of a monarch butterfly," he said. "If we didn't find something soon, we'd just be swatted and kicked out."

In the fall of 2014, Keenan was looking at old, two-dimensional seismic surveys purchased from a data warehouse for next-to-nothing. In the 1970s and '80s, companies had mapped much of the Delaware, but the technology was two-dimensional, creating graphs that look like electrocardiograms. Today, with seismic imaging producing 3-D color maps of underground formations, many geologists consider 2-D surveys nearly worthless.

But Keenan saw something in the graph's peaks and valleys. Just as the lines hit the southern strip of Reeves County, they suddenly rose like an aberrant heartbeat. One section of the formation didn't seem deep at all.

Keenan's team bought all the 2-D seismic it could find - "I wanted every line I could get," Keenan said - and turned it into a map. The map showed southern Reeves was probably a shelf, above the deep Delaware Basin center, and cool enough for oil to collect.

The team needed to drill test wells, each costing $8 million or more, but the timing couldn't have been worse. Oil prices were tanking. Companies were cutting jobs by the tens of thousands. And Keenan was asking Apache for money to pursue a hunch.

"Imagine how that goes over," Keenan said. "You're taking a significant amount of your precious budget and putting it on a wild goose chase that no one believes in but you."

'It started adding up'

Apache approved the test wells, and, in the spring of 2015, began drilling. Some wells produced oil, others didn't. But each told Keenan more about the size and shape of the field. The company named it Alpine High.

After seven test wells and several weeks of drilling, however, Alpine High was still just a theory. The project's success had come down to a single well, Spanish Trail 55 1H. If it failed to strike oil, it meant Keenan and his team had misunderstood the geology - and cost Apache millions of dollars, just when it needed the money most.

In November 2015, the state approved the drilling of Spanish Trail, off County Road 318 on the edge of a lake outside the sleepy town of Balmorhea. Apache broke ground in January, drilling 10,767 feet below the surface, then turning 4,326 feet horizontally, according to state records.

One night a month later, a field report arrived in the inbox of Tim Samson, a 34-year-old geologist. Samson looked, then looked again. Spanish Trail had hit clear, sweet crude in a reservoir 2,000 feet thick more than a mile below the surface.

Apache found something else there, too - something Keenan won't talk about, for fear of revealing the secret of Alpine High. But, whatever it was, it told him every well in the play would strike oil.

In July, two of Keenan's top managers met him in his office. On his desk, Keenan had a tool called a planimeter, which is used to measure area, part of the equation to estimate oil and gas reserves. Chief reservoir engineer Chester Pieprzica, 39, and exploration manager Eric Vosburgh, 44, began gathering data: fluid properties, underground pressures, rock densities. Keenan called out numbers. Vosburgh and Pieprzica punched them into calculators, counting oil and gas volumes in the sprawling basin, section by section.

Five trillion cubic feet of gas. Then 25. Then 75. One billion barrels of oil. Then two. Then 3.

"It just started adding up," Pieprzica said. "And you get down to the end, you total them all up, and it's like, wow."

The three stopped. Five seconds of silence felt like a minute. Then they began to laugh. They had found the equivalent of 15 billion barrels of oil.

Four bottles

Apache announced Alpine High in September. It spans 350,000 acres in southern Reeves County, which the company leased for $1,300 an acre on average, far less than the $30,000 companies pay in other parts of the Permian.

If the field lives up to its billing, it could catapult Apache back into the top of American independent oil producers.

"How important is it? I'd say very important," said Andrew McConn, an analyst at the energy research firm Wood Mackenzie.

But many analysts and competitors still doubt that Apache could find so much oil when so many others failed. They say Apache's estimate of extracting 13 percent of the oil and gas is too high, especially with no service companies or pipelines yet in the remote area.

"The trick is to make this commercial," said University of Texas professor Mark Shuster, a former Shell Oil executive. "Like a lot of these announcements, there's a flurry of excitement, then as people dig into it, reality sets in. How are they going to make it work?"

Keenan is used to that question. He lined up four small glass bottles of oil, each representing different layers under Alpine High. Other major fields could be represented by just one of the bottles, Keenan said, "but this play, we've got them all stacked on top of one another."

Recovery won't be easy, Keenan admits. Apache is experimenting with well-placement and drilling. It will take another two years to get it right.

But for Keenan, Alpine High was the culmination of a lifetime looking for gas and oil - and a second life, all at once. He thought back to 2014, when retirement seemed likely and a phone call broke the quiet of a Sunday morning.

Farris had caught Keenan at the right time. After breakfast. When Keenan was hungry, again, to find oil.

END