

Edmonton Journal

Wave of the future in oilpatch?; Technology developed by Edmonton company uses high-speed, pulsing water to force thousands of barrels of extra oil out of the ground

Sat Jan 3 2009
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Section: Business
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Source: The Edmonton Journal

Illustrations: Colour Photo: Larry Wong, the Journal / Brett Davidson, president and CEO of Wavefront Energy and Environmental Services Inc., says the company's pulsating water injection device, above, produced an additional 14,500 barrels of oil, worth \$1.2 million, during a year-long test with one firm.

Scientists know that earthquakes cause rivers to rise and oilfields to produce more. But how do you duplicate the power of such waves of energy, which move through the ground at 100 metres a second? Wavefront, a local high-tech firm, uses water pulsing at speeds of one-tenth to one-hundredth of a second to flush oil from older reservoirs.

"We're putting something like a heart into rocks in the ground, because if you look at our simulator, the pulse shape is exactly the way a heart beats," says retired University of Alberta physicist Tim Spanos, a co-founder of the company.

And the results have been amazing.

In a just-concluded, year-long test with an international oil company in Alberta, three Wavefront injectors were used in six wells to produce an additional 14,500 barrels of oil.

And that got the attention of the oilpatch, says president Brett Davidson.

"Here's the math. We charge \$36,000 for the use of each (pulsing injector) tool for a year. It cost this oil company about \$235,000 to license the tools and have them installed by a service rig. Their net return was \$1.2 million," he said.

"We're a trend-setter. No one else has done this. When Tim and I formed the company 10 years ago people said, 'I don't believe it, I don't believe your results, it's too simple.' But we have stayed focused," Davidson said.

After years of testing, the company had eight units in the ground a year ago.

"By the end of January we should pass the 100 mark, and then we'll aim for 1,000. It is all because of results like those 14,500 extra barrels." There are 200,000 injector wells in North America, and Wavefront's 10-year goal is to have 20,000 units in place.

The company won't sell its technology, preferring to lease it, and thus maintain a cash flow.

"That's our strategy, we aren't playing games by giving discounts. Everyone pays the same \$36,000 fee for use every year." At this phase of the company's growth, Davidson is keen to build a story

of success. "We have to understand the reservoir we are putting this tool into. You cannot afford to have poor results," he said.

After years of development, beginning in the heavy oil region around Lloydminster, Davidson says he hopes the hiccups are all history.

Despite current low oil prices, he says there is no better time to implement Wavefront technology.

"Oil was at \$12 a barrel when we started, and companies now are calling us routinely to discuss our product." The stainless-steel body of the device, which varies to match differing pipe sizes, is made in Edmonton. The electrical solenoid that opens and closes the valve is made to order by a Rochester, N.Y., firm. The unit costs \$6,000 to build, and is designed to last five years.

"But we did an autopsy on a unit we had in Oklahoma for over three years and it was in perfect condition. There was no wear. The water which flows around it acts as a lubricant, and cools the solenoid. We were pleasantly surprised," he said.

The rugged device is designed to be used right out of the box. It sits on the injection tubing and is the first thing in the well.

The physics behind Wavefront's technology is Spanos' life work. Davidson says the firm and its oilfield tool have "breathed life into Tim's equations and brought that work to industry." Spanos uses the example of a balloon to explain pulsing, the most efficient way to move fluids through capillaries in the body -- and through the earth.

"Think of a balloon with holes in it. You are blowing it up, but if you stop, it just goes back to the way it was; but every time you breathe into it, it stays up and expands." The idea works the same underground, where constant pulsing slowly builds an even pressure.

Today, oil firms use a water-flood system to enhance oil production, pumping water down to push the oil to another well, where it can be pumped out. But much like a river flowing to the area of least resistance, the water usually flows into fingers or channels.

"They might get 35 per cent of the oil before it breaks

through, and then they get nothing but water," he said.

Wavefront moves the water through as a front -- an even line of pressure. It can thus recover as much as 90 per cent of the oil, much of it as an emulsion.

Wavefront's device responds to the porosity of the reservoir. The more porous the rock and the closer to the surface it is, the slower the pulses. Starting at a tenth of a second, the device can go up to a hundredth of a second for deep, tight formations.

A giant blue whale's heart beats three times a minute, while a tiny hummingbird's heart beats at one-hundredth of a second.

"But they have the same pattern; you always have to cycle back so you can do it again," just as the human heart has its systolic and diastolic stages -- when blood is pumped, and then pressure is reduced to allow the heart's chambers to fill.

Davidson says his company is well-financed and ready to grow quickly. Research and development to date has involved making the tool simpler, and linking units together for horizontal wells.

"That's exciting for us. We can now put 10 tools in a 1,000-metre-long string separated by pipe -- a daisy chain. The controllers can fire all at the same time or differently to match the porosity. A lot of fields are being drilled horizontally today, and they will all need secondary production in the future," he said.

"We think the market is huge. And with an 80-per-cent return to us each year, this is very lucrative." Oil firms are very keen to try the technology, says vice-president Tor Meling. "For the companies I talk to, the upside is too compelling" to ignore.

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