

# Finding places for seismometers in a land of oil and gas

Earthquake data network to help provide answers

By David Hunn and Lydia DePillis | March 2, 2017 | Updated: March 5, 2017 4:39pm

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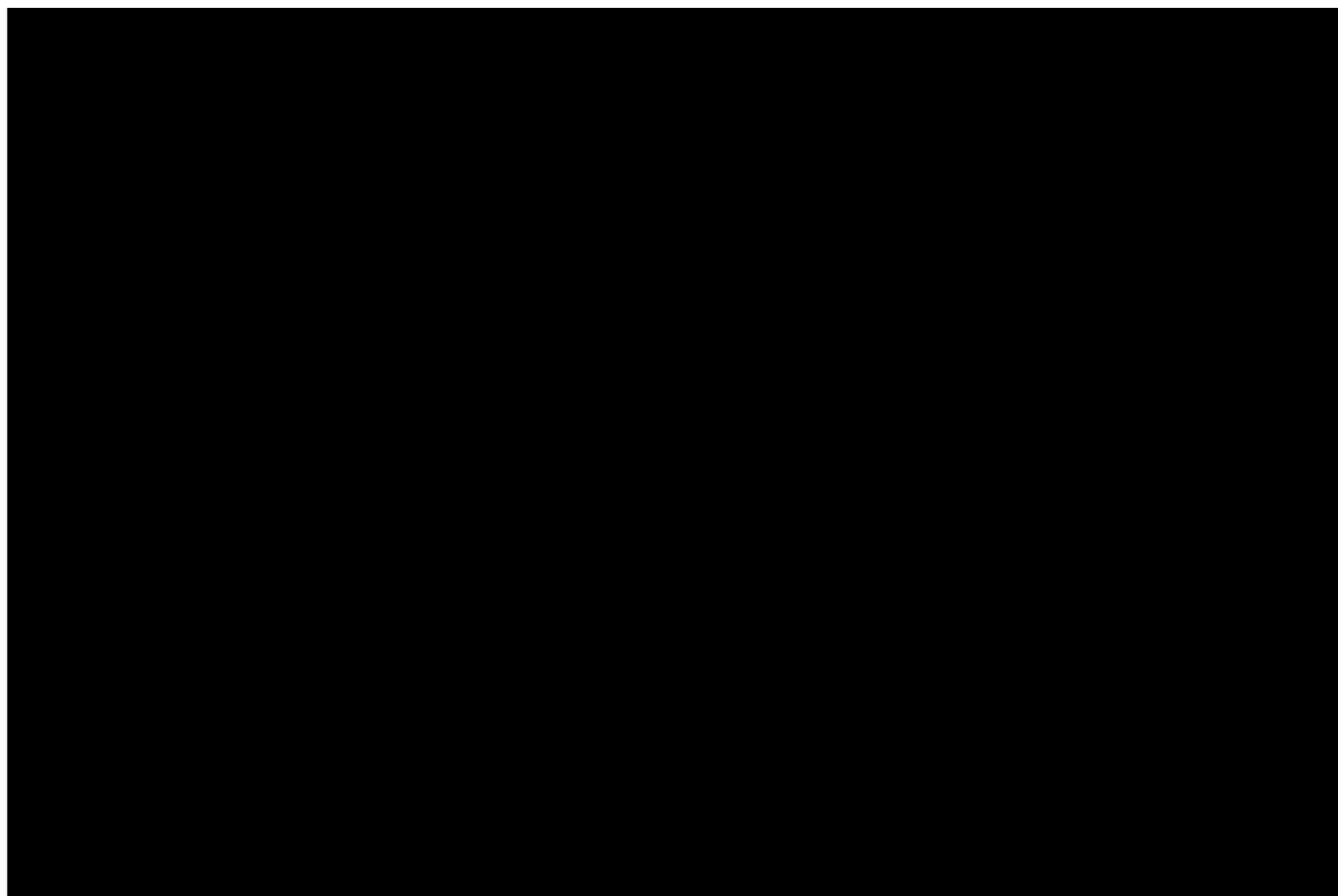


IMAGE 3 OF 3

Scientists from the University of Texas and a contractor, Nanometrics, install a seismometer on a hillside owned by Sul Ross University in Alpine, Texas. (Lydia DePillis/Houston Chronicle)



DEL RIO – The state of Texas wants to stick a seismometer on Terry Hill's ranch, right next to his deer blind.

Hill, a fourth generation Texan born and raised in this Rio Grande outpost, understands the significance. He receives a few thousand dollars in oil and gas royalties a year, yet the findings of the earthquake sensor could dramatically alter the industry that helps pay his bills.

"I don't know what this is, or what it's gonna do," said Hill, 66, "but I hope it will be helpful."

Hill is among the landowners allowing the state to piece together one of the largest networks of seismometers in the United States with the aim of settling a debate that has wide implications for the future of fossil fuels. The network, stretching from New



Mexico to Louisiana and Oklahoma to the Gulf, will collect data that may determine whether modern oil and gas production is responsible for an exponential rise in the number earthquakes in Texas and other energy producing states.

Scientists say it's clear there's a connection: Oil and gas operations pump billions of barrels of water deep into the earth every year, pressuring faults underground.

Politicians, industry leaders and officials of the Texas Railroad Commission, which regulates the oil and gas industry, have steadfastly argued that there is little proof, if any, of such a connection.

Texas Railroad Commissioner Ryan Sitton called suggestions that oil and gas operations cause earthquakes "a bunch of suppositions, barely even hypotheses."

"The scientist in me hesitates to make any statements that sound conclusive until we have more tests and results to back these up," said Sitton, a mechanical engineer who founded the Pasadena-based oil and gas consultancy Pinnacle Advanced Reliability Technologies.

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But nearly everyone agrees that getting those results is critical. Texas airports, hospitals and highways weren't built to withstand earthquakes. And if scientists find that oil and gas operations are indeed causing them, regulators could be forced to curtail key activities in the industry. Companies would have to adapt, at a cost of untold millions of dollars, with repercussions echoing into oil fields nationwide.

The state Legislature has appropriated \$4.5 million, with the oil and gas industry contributing another \$1.2 million to support research seeking to answer why tremors, which shook the state barely once a year for more than a century, now arrive by the dozens. Over the past 18 months, the Bureau of Economic Geology at the University of Texas, which is leading the project, has purchased equipment, hired staff, gathered industry experts, and charted a course for 55 additional seismometers, triple the number installed in Texas.

"The oil and gas companies realize that they need to be part of this solution," said Ellen Rathje, a civil engineering professor at UT and a principal researcher on the project. "They need to understand it better. Because there's a connection."

Several hurdles remain for the seismometer network dubbed TexNet. The Legislature hasn't funded the program beyond this year. Scientists will need unparalleled cooperation from industry and regulators to understand the findings. And UT scientists still need permission from a few dozen Texas ranchers and landowners to put seismometers on their property.

Hill, who agreed in January to take the seismometer, is happy to have it. TexNet will install the device in March, the 26th installation, with 29 left to go.

"Nobody owns the land," said Hill, sitting at a Dairy Queen in Del Rio. "We're just

taking care of it for God."

### ***Just a coincidence?***

Late on the evening of Oct. 30, 2008, the first of 10 earthquakes hit Irving, just south of the Dallas Fort Worth International Airport. They were relatively small, registering magnitudes between 2.5 and 3.0 on the Richter Scale, and did little damage. But they shook the region for more than a day, startled locals - the quakes were the first felt in the area in modern times - and ignited a public debate in Texas.

Oil and gas operations were on the verge of a transformation then. Companies had discovered horizontal drilling and hydraulic fracturing, which pumps water into wells under such pressure that the shale bedrock fractures, releasing microscopic beads of oil and gas. U.S. oil production, which had dropped by nearly half over the previous two decades to less than 5 million barrels a day, began to rise again.

The Barnett oil field, surrounding Dallas, was ground zero. By the end of 2008, companies had drilled and fracked thousands of horizontal wells there.

In the days following those first quakes, oil and gas outfits fervently denied that the tremors had anything to do with operations.

Horizontal drilling and fracking spread across the state and country, almost doubling U.S. oil production and turning the country into a key global producer.

Meanwhile, Texas, which used to get one or two noticeable quakes - 3.0 and above - each year, has averaged 12 since 2008. In 2015, 22 roiled the state.

Scientists noticed that oil and gas companies were dumping more and more waste water underground each year. And that rise tracked remarkably close to the increase in earthquakes.

TexNet has identified four Texas areas with such a rise in seismic activity they merit deeper study. And each of those areas - around Dallas, the Central Texas city of Snyder, the West Texas city of Pecos, and south of San Antonio, in the Eagle Ford field - are hotbeds of oil and gas drilling.

## ***'We can't prove it'***

Fracking, despite its controversial reputation, isn't the chief culprit for most scientists. Wastewater worries them the most.

Oil and gas drilling produces an enormous amount of salt water. That water, trapped underground after the ancient oceans receded millions of years ago, is released during fracking operations, leaving companies with about 4 billion barrels of wastewater a year, according to one estimate.

Some companies recycle the water, but that's expensive. Most in Texas inject it into disposal wells designated and permitted as permanent underground holding tanks.

As water is injected underground, pressure increases. With enough time and water disposal, that pressure can reach nearby faults, pushing them to failure.

None of that is new.

"There has been widespread recognition among seismologists since the 1960s that wastewater injection and other activities commonly associated with petroleum production can sometimes induce earthquakes," wrote Cliff Frohlich, a seismologist and University of Texas researcher, in a journal last year.

What's new is the volume of water pumped underground. As U.S. oil production nearly doubled between 2007 and 2015 to 9.5 million barrels a day, the amount of waste water injected into Texas disposal wells rose 50 percent to 12 million barrels a day, according to data collected by the Railroad Commission and compiled by the research firm IHS Markit.

Some reject any widespread connection: "You've heard a lot about what's happening in Irving and Dallas," said Sitton, the Railroad Commissioner. "I think the odds of those earthquakes being caused by disposal wells are exceptionally small."

Frohlich's response: "We can't prove it. But the evidence is pretty strong."

For oil companies, it's a bottom-line issue. Wastewater injection can cost as little as 25 cents a barrel, if they operate their own disposal wells, not including transportation

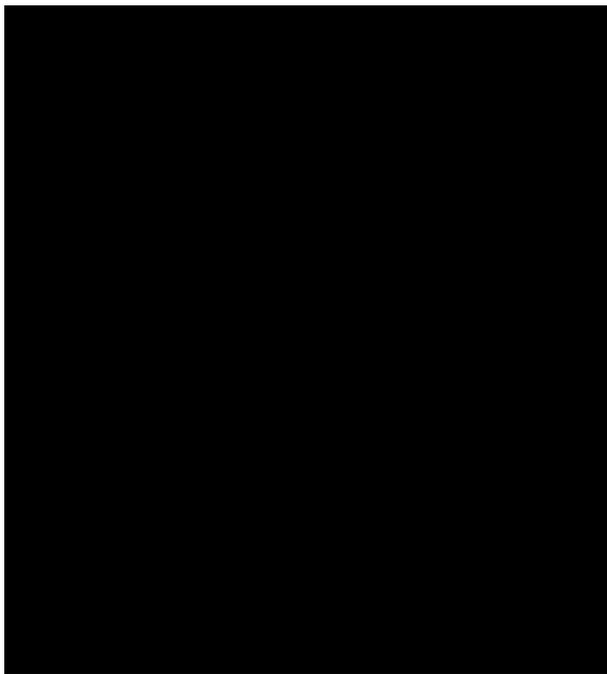
costs. Paying to recycle water can cost as much as \$8 a barrel.

Gov. Greg Abbott signed House Bill 2 into law on June 22, 2015, establishing TexNet and authorizing UT's Bureau of Economic Geology - the state's official geological survey - to build the network, maintain it and figure out under what circumstances, exactly, disposal wells might cause quakes.

The old network, just 18 seismometers, couldn't pinpoint earthquake epicenters with much accuracy and couldn't say how close one quake was to one well.

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TexNet should be up and running by middle of this year, with 73 stations, making it one of the biggest and best financed seismic monitoring systems in the country, behind such states as earthquake-prone California, which has 1,000 stations, and Nevada, with 150.

UT has asked the Legislature for \$3.4 million for the next two years to continue

research, a sum not included in the Senate's budget. Even if funded, TexNet scientists will have to prove more than correlation between disposal wells and earthquakes.

"If you don't have the right kind of information available, we call that speculation," said Dana Jurick, a geophysicist at the Houston oil company ConocoPhillips and a TexNet board member. "Scientific research requires data."

Six months ago, UT put a seismometer on Lee Eustace's land in Alvarado, about 30 miles southeast of Fort Worth. It's three feet underground, attached to a solar panel for power. It doesn't bother the cows, said Eustace - certainly not as much as the first earthquake he felt.

"I thought something had exploded somewhere," said Eustace, 74.

### ***'Don't bounce back'***

Parker County Commissioner Larry Walden, 59, said people blamed the earthquakes for darn near everything when they hit his county, west of Fort Worth. Cracks in houses. Cracks in foundations. Difficulty sleeping.

"There was a lady who said her hens had actually quit laying eggs because of the earthquakes," Walden said.

Walden found a spot for a seismometer on an old county-owned farm. Now it's mostly used by the local 4H club.

Christopher Ritzi was happy to help UT find a spot for a sensor in Alpine, near West Texas's Big Bend National Park. Ritzi, a biologist at Sul Ross State University, worries about drilling and pipelines, both expanding ever closer to the little town, which in the 1990s was hit by some of the biggest earthquakes in the state.

"Desert landscapes don't bounce back very well," he said. "We're playing with systems we don't fully understand."

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Lydia DePillis

Business reporter, Houston Chronicle



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I had occasion to interview a geoscientist who had some experience on this topic. She said unequivocally that hydraulic fracturing doesn't cause earthquakes, but that the injection of waste water from fracking operations into underground disposal wells - which is a part of the fracking process - does, particularly when the sites of the disposal wells are located near faults, whether previously active or not. Her information is consistent with what most scientists say.

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**" if scientists find that oil and gas operations are indeed causing [earthquakes], regulators could be forced to curtail key activities in the industry."**

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**Or they could just sweep everything under the rug and continue to act like there's no correlation. The Press needs to watch this very closely and be ready to blow the whistle if need be.**

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**@ZAW We could be looking at another "the facts don't matter issue".**

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The TX Railroad Commission is useless. It ought to be called the Oil and Gas Lapdogs. They've failed at regulating the industry and the only people's interest they have is the industry. Maybe they should live next to the fracking operations and see how well that works out for them. Actually, I think that ought to be one of the requirements to be on the Commission.

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**@Special\_Snowflake** Rex didn't like living by a fracking operation...but then as CEO of Exxon he got it shut down.

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**It's nearly impossible to prove cause and effect with something like earthquakes, but the circumstantial evidence is very strong as earthquakes in Texas/Oklahoma were very rare until fracking came along.**

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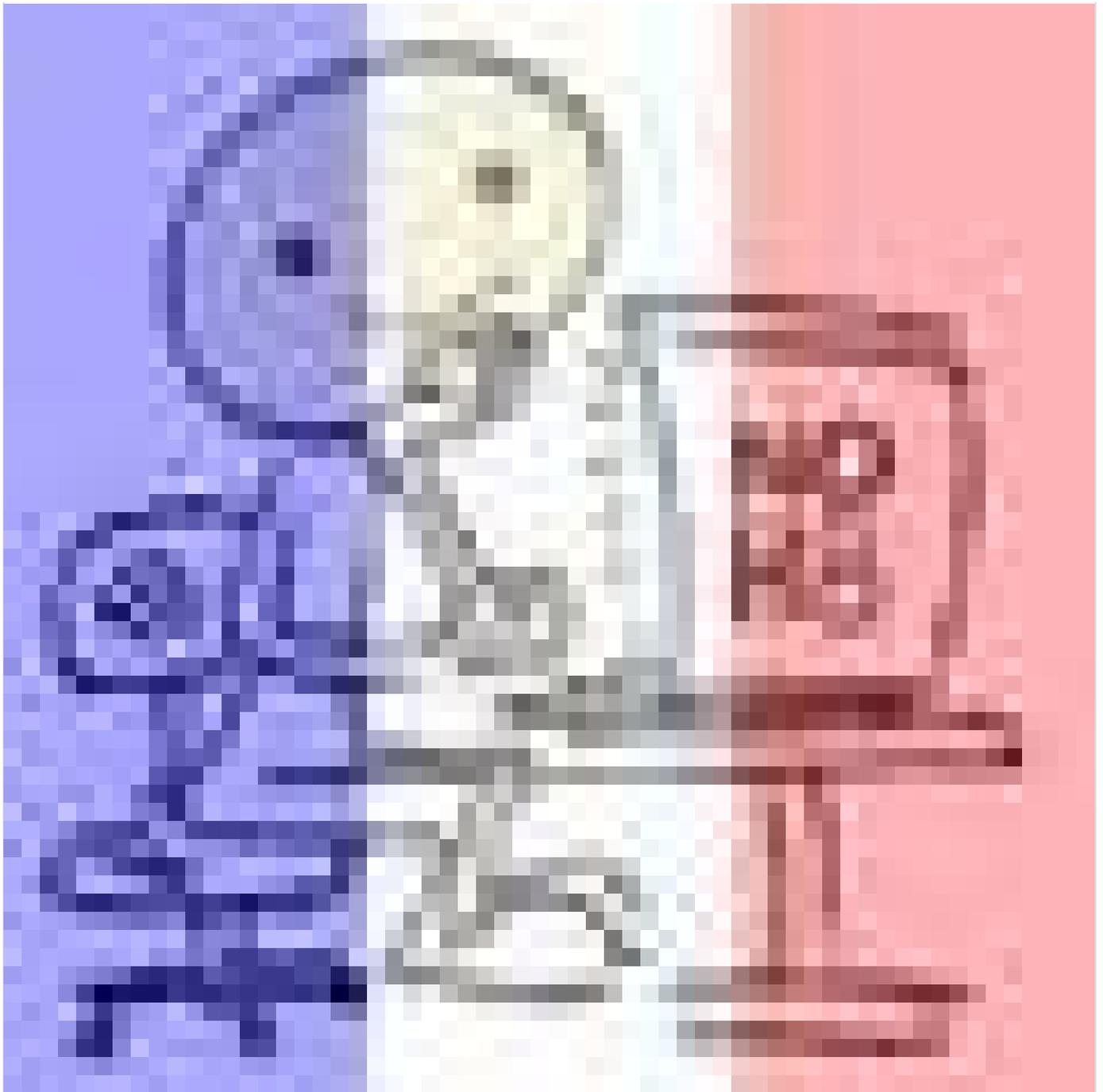
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I'd say it's proof beyond a reasonable doubt.

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