

## Expanding Conventional Seismic Stratigraphy into the Multicomponent Seismic Domain

DE-FG26-04NT42131

### Goal

The objectives of this research are to create examples that illustrate that different stratal surfaces are imaged by different elastic wave modes and to demonstrate how this new seismic imaging technology should be applied to improve geologic understanding of oil and gas systems. The technology developed in this research will provide the oil and gas industry a subsurface interpretation technology that may revolutionize the way geophysicists interpret and map subsurface strata. The intent of the research is to replace conventional P-wave seismic stratigraphy with the broader discipline of elastic-wavefield seismic stratigraphy.

### Performers

Prairie View A&M University  
Prairie View, TX

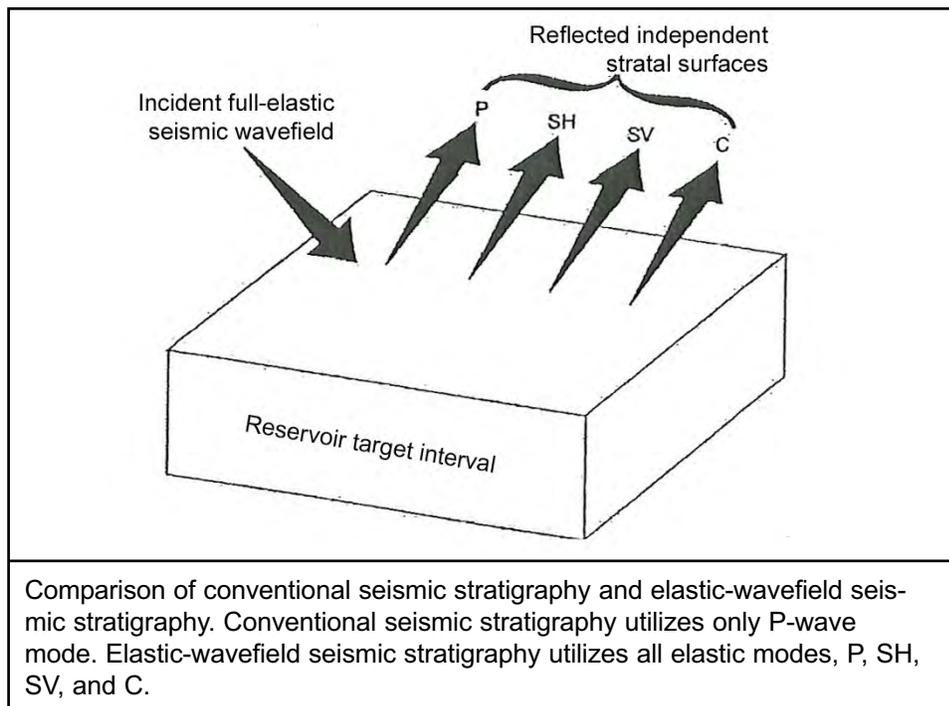
Bureau of Economic Geology  
University of Texas  
Austin, TX

### Results

This project is intended to expand the science of seismic stratigraphy into a new seismic interpretation technology that could influence worldwide seismic operations for a long time. With such technology, stratigraphers will realize that it is necessary to include all seismic modes into sequence and facies analyses to fully define depositional architecture across critical intervals.

### Benefits

The study will lead to a development of a new seismic interpretation technology that will provide the oil and gas industry a better comprehension of reservoir architecture and seals and the distributions of baffles and barriers to hydrocarbon migration. Industry will be able to understand that each of the basic elastic-wave modes (P and all S modes: horizontal shear [SH], vertical shear [SV], and converted) image different stratal surfaces (in some stratigraphic intervals) and provide different types of information regarding the nature of depositional sequences and facies across hydrocarbon prospects.



Comparison of conventional seismic stratigraphy and elastic-wavefield seismic stratigraphy. Conventional seismic stratigraphy utilizes only P-wave mode. Elastic-wavefield seismic stratigraphy utilizes all elastic modes, P, SH, SV, and C.

### Background

Seismic stratigraphy was formalized as a science by researchers at Exxon Corp. in the early 1970s and made publicly available through AAPG Memoir 26 in 1977. Industry education on the concepts of seismic stratigraphy occurred in the late 1970s and early 1980s, with the result that the interpretational principles of seismic stratigraphy are now the accepted methodology for interpreting seismic images of subsurface geology.

Seismic stratigraphy is well-structured and widely practiced throughout industry, government, and academia. However, use of the technology suffers from the fact that seismic stratigraphy concepts are applied only to conventional compressional (P-wave) seismic data. The research proposed here will expand seismic stratigraphy to the full-elastic seismic wavefield. A full-elastic wavefield contains all possible wave modes, with the reflected wavefield consisting of a P mode and three S modes: SH, SV, and converted modes (P-SV and SV-P). A partial-elastic wavefield (either 3-C or 4-C data) will provide only the converted P-SV portion of the S wavefield. This study will demonstrate that each of these reflected wave modes has equal value for seismic stratigraphic analyses and that the seismic sequences and seismic facies associated with each mode provide rock and pore-fluid information not found in the other modes.

### Summary

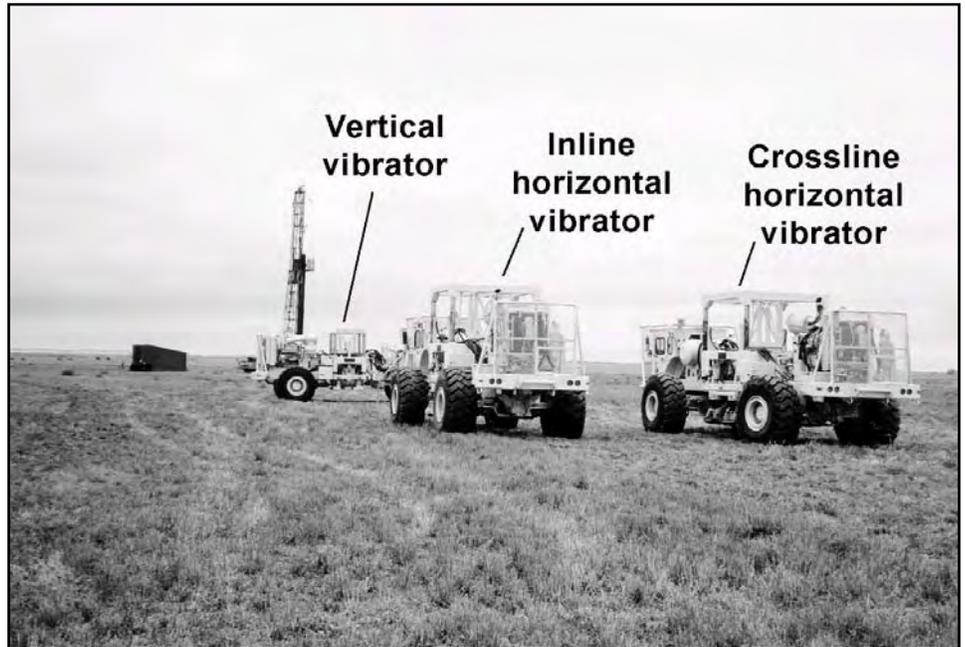
Work to date included interpreting seismic stratal surfaces and constructing sequence models. Efforts are underway to initiate construction of facies models, which involves applications of similar geologic and engineering data utilized in the construction of sequence models. The technical findings are currently being summarized. Also, the integration of seismic and geologic models is being conducted.

### Current Status (February 2007)

The project has reached a slowdown. The last stages of the project are time-consuming, and the computer system currently being utilized for the project is outdated. A new system has been ordered. Work will continue when the system is received and installed. A no-cost extension of 1 year has been granted to complete the work.

### Funding

This project was selected in response to DOE's solicitation DE-PS26-04NT42031, November 12, 2003 (focus area: support of advanced fossil resources conversion and utilization research by historically black colleges and universities and other minority institutions).



Orthogonal vibrators used to generate 9-component vertical seismic profile.

**Project Start:** September 1, 2004

**Project End:** August 31, 2007

**Anticipated DOE Contribution:** \$200,000

**Performer Contribution:** \$0

**Contact Information**

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