

Accurately pinpointing areas of prospective interest using seismic technology reduces cost and risk. P-wave seismic technology has been well established in hydrocarbon exploration for over half a century. Conventional P-wave seismic is particularly useful and most often used for defining structural plays. Over the last two decades, methods developed to analyze pre-stack P-wave data have proven useful for defining stratigraphy and lithology. However, full-wave seismic data (combining P-wave & C-wave) delivers a more complete measurement of the seismic wavefield.

Using full-wave data, a broader range of imaging rock and fluid properties can be estimated. Combining the P- and S-wave seismic data skillfully is proving to be a very powerful tool. If drilling success depends on the accurate detection of rock properties (e.g., fracture intensity, porosity, fluid content, lithology, density, or permeability), these measurements are much more reliable if obtained from combined P- and S-wave data.

Full-wave data can be used to:

- Image through gas clouds: GXT has had many global successes using converted-wave (C-wave) technology to reveal what was previously impossible to see through the gas cloud.
- Confirm hydrocarbon bright spots: Bright amplitudes on P-wave data have the potential to be hydrocarbon indicative, and full-wave data can be used as a confirmation tool.
- Confirm over-pressure zones: Identifying over-pressure zones due to gas saturation is important not only because these areas are highly prospective, but they may also pose a safety hazard during drilling
- Characterize fractures: Multicomponent acquisition and processing have been used successfully to characterize prospective areas subject to azimuthally anisotropic velocity variations
- Obtain rock properties: C-wave data vastly improves the reliability of the measurement. Joint inversion using combined PP & PS is now providing more accurate measurements of density and porosity.

Full-wave Processing & Algorithms

Extracting useful properties from full-wave data requires thorough pre-conditioning and processing. We have developed a comprehensive suite of advanced proprietary algorithms to

solve the demanding technological challenges that shear and converted waves present. Our algorithms for noise attenuation, shear statics, signal processing, shear splitting, registration, velocity model building, and imaging tools.

C-wave processing requires a complete set of moveout, velocity analysis, and migration tools that comprehend the asymmetric raypaths unique to converted waves. GXT recently modified these tools to include depth and include constrained PP-PS tomography and reverse time imaging.

Our Experience

After pioneering full-wave technology beginning in 2005, GXT formed a division devoted entirely to full-wave processing and imaging in 2009. This foundation allowed us to address the anticipated demand for full-wave services while keeping us at the forefront of this advanced and emerging technology. Today, we have more than twenty highly experienced geophysicists dedicated to full-wave processing and imaging.

Based in Houston, Texas, we also offer full-wave services through our centers in Denver and Beijing. GXT has processed more than 50 full-wave projects worldwide spanning North America (including the Gulf of Mexico and Canada), Central and South America, Europe, the North Sea, North Africa, West Africa, Arabia (including the Arabian Gulf), Russia/CIS, India, and China. GXT's experience also includes the largest ocean bottom 4C project ever recorded and processed.

Full-wave Acquisition Design

Our expertise with converted-wave (C-wave) and shear-wave data enables us help design acquisitions optimized for the best possible recording of C-wave data. Our suite of technologies includes full elastic modeling, ray tracing, illumination, and fracture simulation.