

Unconventional Reservoir Imaging & Characterization

SHALE PLAY CHALLENGES

Oil and natural gas production from unconventional reservoirs, and shale resource plays in particular, remains an active focus for trends in onshore exploration and production today. Key challenges associated with shale play exploration and production revolve around understanding the spatial variability in reservoir rock properties to effectively manage a cost-effective development program, and ultimately maximize shareholder value creation. ION's ResSCAN™ offering addresses these key challenges.



● ION's 3D ResSCANs

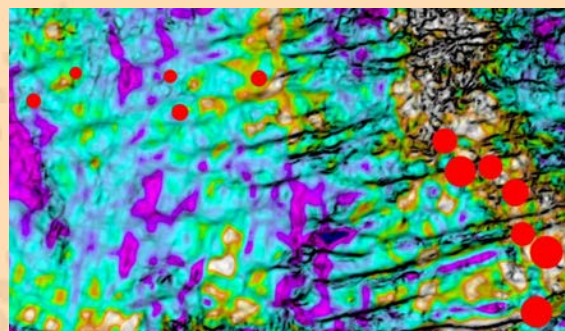
ION'S ResSCAN OFFERING

ResSCAN programs are developed and managed by ION's GeoVentures group and imaged and interpreted by ION's GX Technology (GXT) group using the most advanced technology available. ION offers a start-to-finish, multi-disciplinary approach that identifies the drivers behind productive wells. Our ResSCAN programs are custom-designed in collaboration with our clients, ION's geo-consulting team, and outside specialists. Relying on upfront geological, petrophysical, and rock physics analysis, ION's ResSCAN programs establish which seismic attributes provide a predictive expression of key reservoir properties in a given shale play, and most importantly impact an operator's drilling and completion engineering decisions and parameters.

With this approach, oil & gas companies are able to:

- Understand the extent, varying thickness, and primary fairway of the play for acreage assessment
- Know where to steer horizontal wells in order to stay in zone and avoid geo-hazards such as faults and karst zones, minimizing the time to drill and complete each well
- Estimate in-situ stress conditions and characterize the density and orientation of the naturally occurring fractures for "sweet spot" mapping and the definition of a development drilling program that maximizes the number of high performing wells
- Understand key rock properties such as reservoir and frac barrier brittleness for drilling prioritization and cost-effective hydraulic fracturing designs

ION's GeoVentures group serves as the project manager from survey design, planning and permitting, through data acquisition, data processing, and geophysical attribute analysis to provide seismic analogs for the critical engineering parameters needed to maximize the number of high-productivity wells and minimize developmental costs.



Advanced multicomponent, multi-attribute seismic analysis from a ResSCAN project highlights most productive areas. Cumulative well production is indicated by red circles.

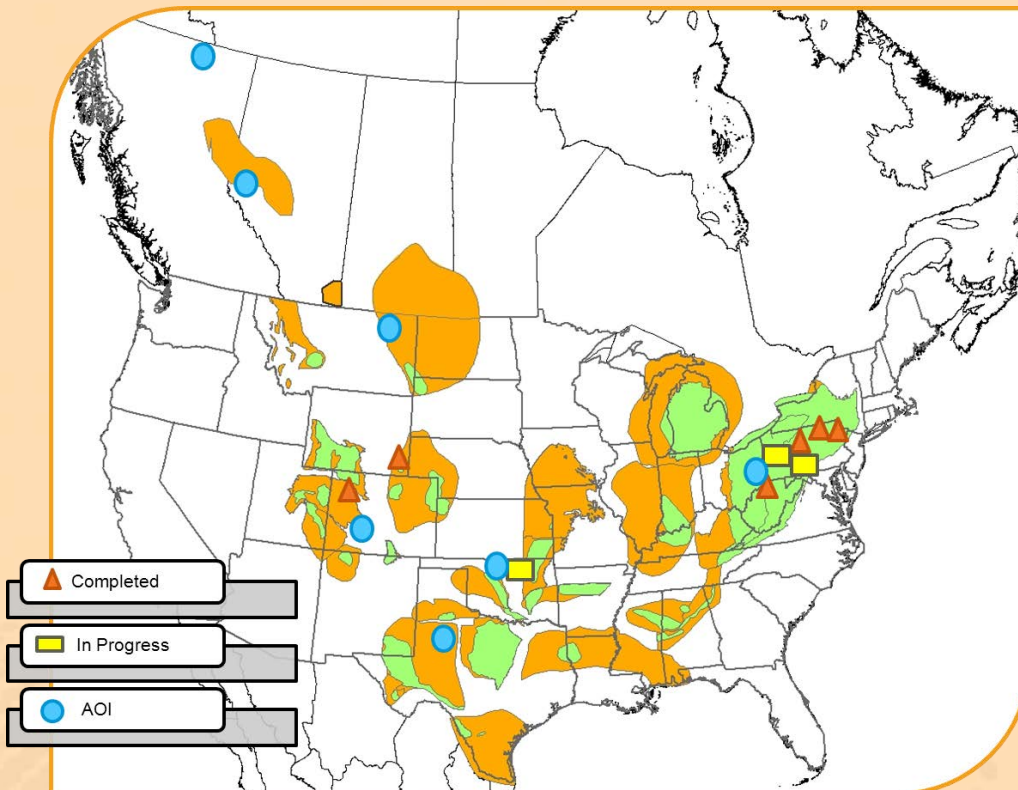
ION'S SHALE PLAY EXPERIENCE

In addition to our ResSCAN workflow, what differentiates ION from other seismic service providers is the depth and breadth of our shale play experience. Since 2003, ION has been providing enhanced imaging, fracture characterization, and rock property studies to oil & gas companies across virtually all of the North American shale plays.

- 250+ shale play projects
- 22,000+ square miles of data delivered
- Projects include the Barnett, Fayetteville, Woodford-Caney, Bakken, Marcellus, Haynesville, Horn River, Montney, Eagle Ford, and Niobrara plays

MAXIMIZE THE ECONOMIC VALUE OF YOUR RESOURCE PLAY

Drill and complete wells in the shortest and most cost effective manner. Locate and space your wells optimally. Design hydraulic fracturing treatments with the optimum stage spacing, proppant volumes and pumping pressure. Minimize the number of poor performing wells and maximize the number of high performers. ION will provide you with the customized seismic imaging and reservoir characterization needed to meet these unconventional reservoir challenges. Rely on ION's proven shale experience, ResSCAN toolkit, and experienced geoscientists and seismic operations staff to maximize the economic value of your resource play.



North America 3D ResSCANS Programs

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