

Applications In Action

LAND IMAGING SYSTEMS

ADDRESSING LAND ACQUISITION CHALLENGES IN RUGGED TERRAIN AND COMPLEX GEOLOGY

FireFly® Delivers in Challenging Conditions

SEGMENT: LAND ACQUISITION

REGION: NORTHWESTERN COLORADO, UNITED STATES

SOLUTIONS: FIREFLY® CABLELESS LAND ACQUISITION SYSTEM, VECTORSEIS® DIGITAL SENSORS, SURVEY PLANNING, DATA PROCESSING AND INTERPRETATION

THE CHALLENGE

In the 1950's when reservoirs were first discovered in Northwestern Colorado, the techniques used to image the subsurface and drill and stimulate wells in a highly variable, fractured formation were somewhat primitive. Drilling efforts were categorized by multiple dry holes. Today, East Resources Inc., a privately held, independent E&P company has leased the mineral rights. In 2008, East Resources planned a multi-client survey, known as Durham Ranch to revisit the area. Their objective was to acquire densely sampled, full-wave seismic data to better characterize the fractured shale (the Cretaceous Niobrara Formation) that the company planned to re-develop. While East Resources invited many seismic contractors to bid on the survey, many turned away with the belief that the project could not be completed using traditional cable-based acquisition methods due to time pressures and budget. Jointly recognizing the need for a flexible solution to counter the area's challenging conditions, Geokinetics and East Resources determined that ION's FireFly cableless system could help them achieve their survey objectives.

The Durham Ranch topography is delineated by precipitous terrain populated with wildlife such as deer, bear and raptors. Thick underbrush and surrounding irrigation systems for nearby crops present additional challenges for conventional seismic operations with cabled systems. Much of the land is a mix of ownership (private and government). Surrounding ranchers insisted on minimal footprint while the Bureau of Land Management (BLM) had numerous restrictions in place to protect native species. Equally challenging, the survey shooting window was narrowed by the start of the rapidly approaching hunting season.



"Many of the seismic contractors we spoke to told us that they wouldn't be able to acquire data in the area (using conventional seismic technology and methods) while abiding to the timeline, cost, metrics, and environmental abatement measures we had specified for the project. In the end, one company stepped forward to help us — ION Geophysical."

Marty Williams
Geoscience Manager
East Resources Inc.

→ Geophysicists designing a survey for cable-based systems are often forced to make tradeoffs in data quality due to environmental, safety or logistical restrictions. FireFly enables surveys to be designed and deployed to get the best possible image due to its flexible architecture.



→ CHALLENGING CONDITIONS, VERY LITTLE FOOTPRINT—A FLEXIBLE SOLUTION

The cableless, stakeless approach enabled by FireFly ensured seismic operations accommodated the needs of both ranchers and the BLM for speed and environmental sensitivity.



Vertical Systems International photo courtesy

ion
[CHARGED WITH INNOVATION]

LAND IMAGING SYSTEMS

THE SOLUTION

In many fractured reservoirs, well productivity can be maximized by identifying horizontal well locations that bridge highly fractured intervals. East Resources believed acquiring densely sampled, full-wave data using FireFly®, ION's cableless acquisition system with VectorSeis® Digital Sensors, would help them achieve their goal. More than 6,000 VectorSeis-enabled FireFly stations were deployed on the 93 km² survey; 10,500 receiver points of full-wave seismic data were acquired. Nearly 7,000 dynamite shot points were used as the source, with the time from 'first shot' to last spanning 20 days. Geokinetics, a leading geophysical services company headquartered in Houston, served as the field acquisition contractor, while Green River Energy Resources executed various permitting and shot-hole drilling tasks.

Activities once reserved for 'stake and flag' operations were eliminated due to Connex™, the brain of the FireFly system. It serves as the command and control center for field operations, allowing visibility and directing daily activities. Connex also allows source and receiver locations to be accurately determined during deployment and acquisition for higher imaging and operational efficiency. FireFly's cableless architecture minimized footprint and disruptions to the natural habitat, and significantly increased the crew's productivity by reducing system weight and minimizing the number of field personnel. With its cableless design and Connex software, ION's advancements in technology have clearly been a valuable asset in extracting information from the survey. "From some of the early traces, the seismic data looks to be of the highest quality. We couldn't have completed this project without FireFly and the Connex system," said Marty Williams, Geoscience Manager for East Resources Inc.

ION is executing the Durham Ranch project under its Integrated Seismic Solutions (ISS) business model. In an ISS project, ION acts as the overall project manager, coordinating a full-scope of tasks ranging from survey planning to overseeing field acquisition, as well as data processing and reservoir analysis. By using the ISS approach, ION is able to customize the technologies, imaging and operational methods to the unique challenges and objectives of a particular project, whether proprietary or multi-client. For more information about this survey or FireFly, please contact the Land Full-wave Solutions team, LFWS@iongeo.com.



Vertical Systems International photo courtesy

→ NEW APPROACH TO LAND SEISMIC ACQUISITION

The first commercial deployment of ION's FireFly was challenged by a tight timeline and rough topography that at times required professional climbers to position equipment.

"FireFly represents a new approach to land seismic acquisition. This was among the more challenging seismic surveys we've undertaken. After some initial training, our crews became very comfortable with the system and production increased accordingly. Our ability to complete the project within the specified timeline was enhanced using this system."

Jim White
Executive Vice President of
North American Operations
Geokinetics

**→ CONNEX, COMMAND & CONTROL SOFTWARE SYSTEM**

FireFly's command and control software Connex delivers faster troubleshooting and supports complex Vibroseis operations. Connex can employ pre-set decision rules which enable the seismic acquisition crews to avoid sensitive locations and better incorporate all aspects of the pre-survey environmental impact assessments. FireFly offers a comprehensive solution that enhances field operations visibility and increases productivity.