

Simplifying Complex Seismic Acquisition in the Marcellus Shale

CGGVeritas discusses the imaging and operational challenges of working in Pennsylvania

The Marcellus promises to be one of the most lucrative shale gas plays in North America as it has all the ingredients to be profitable, yet it is critical, especially in the current economic environment and with the continued volatility of natural gas prices, for E&P operators to seek ways to continuously lower the cost to produce.

CGGVeritas is leading an extensive multi-phased, multi-client survey over the Marcellus that covers much of Lycoming, Clearfield, and Clinton Counties in Pennsylvania, an area ripe with opportunity. The complex survey was carefully evaluated and designed with a team of client and CGGVeritas geoscientists to determine the imaging objectives for the program. This collaborative spirit has enabled detailed discussion about the reservoir on a regional basis, similar in nature to the Haynesville program CGGVeritas recently completed. The CGGVeritas approach to onshore shale multi-client programs leverages the strengths and capabilities of our land acquisition teams, who are accredited with delivering innovative technology and support for complex surveys, as well as the advanced analysis expertise of the industry-leading CGGVeritas Hampson-Russell Software & Services group. Also of primary benefit to our clients is the ability to work side-by-side with an acquisition team that has more than 80 years of experience, an established reputation for HSE excellence, and the necessary proficiency to cost-effectively manage operations such as those in the Marcellus. This paper first addresses the operational solutions and then highlights the technology that CGGVeritas brings to simplify the creation of value while lowering the cost to produce in this complex geological and operational setting.

Challenging Operations in Pennsylvania

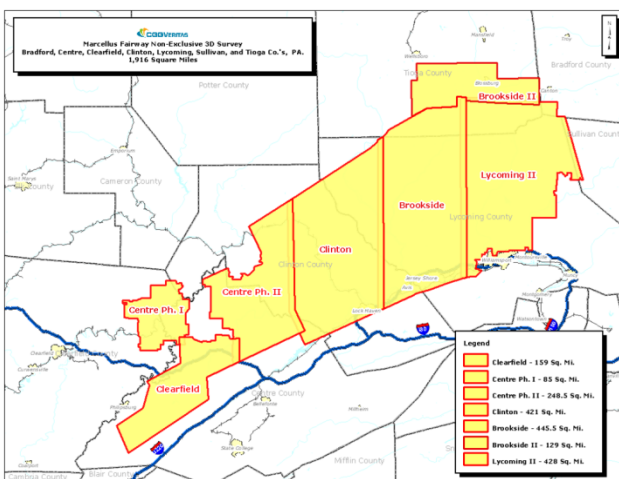
In Pennsylvania, this is particularly important as the area of operation is characterized by undulating topography with several natural and man-made obstacles, such as highways, farms and towns, operating oil field infrastructure, canyons and state-protected forests. It requires vigilant emphasis on high standards of HSE and strict attention to detail to ensure efficient operations without compromising data quality. With so much variation, a service provider must have the ability to support blended energy sources (vibroseis and explosives), cabled and cableless operations, and helicopter transportation to enable ecologically sensitive practices on private and state-owned land. The CGGVeritas Marcellus multi-client programs employ all three techniques to sustainably overcome the challenges. In addition, inclement weather can pose a significant threat to productivity as well as data integrity. For example, this summer the crews working in the Marcellus encountered severe thunderstorms and the havoc of hurricane Irene. Furthermore, they had to manage the unexpected tremors from the 5.8 magnitude earthquake. To overcome these challenges and ensure the safety of the crews, proactive communication and journey management plans, as well as the implementation of strategies to recover productivity momentum, are critical for success. Finally, much of the acquisition takes place in the protected wildlife reserve of a government-owned forest where on top of our strict environmental procedures we also maintain programs to manage local hunting seasons, government support and permitting.

As part of the CGGVeritas operational strategy working in Pennsylvania, the company proactively engages with the local community and authorities to effectively manage their expectations. Community

outreach programs to address concerns and provide information to private landowners and local businesses about what seismic data acquisition is, its sustainability and how it impacts daily routines is extremely important. Active participation and education on a regular basis also keeps the crews safe and creates an atmosphere of support between service providers and the community.

Technology Delivering Added Value

The CGGVeritas Marcellus multi-client survey will be the first of its kind to deliver high-quality post-stack and PSTM data of more than 1,800 sq mi in the prominent Lycoming, Clearfield, and Clinton Counties. The first phase, an 85 sq mi portion of Clearfield County called Centre I, was acquired in 2010 and is already providing impressive data that clients are using to optimize drilling programs. The success of Centre I encouraged the subsequent addition of four more phases totaling 1,800 sq mi. Acquisition of the extensive surveys will continue well into 2013, with 600 sq mi of post-stack data targeted for delivery in 2011. Similar to the Haynesville program, clients will have an opportunity to further evaluate the data with the Hampson-Russell reservoir team if desired. On completion of the overall program, the CGGVeritas Marcellus survey will be one of the most comprehensive datasets of the region.



The CGGVeritas Marcellus multi-client program is scheduled to cover approximately 1,800 sq miles, delivering high-quality 3D PSTM and post-stack data to clients for further evaluation.