

3D Salt Proximity

HIGH-RESOLUTION 3D SALT FLANK PROXIMITY AND IMAGING

Halliburton Borehole Seismic Services (BHS) includes high-quality 3D Salt Proximity surveys to help minimize the risks of drilling near salt, and to accurately define the salt flank in 3D space.

THE COMPLETE PACKAGE

Halliburton uses the latest technology in data acquisition coupled with advanced VSP software to provide quality images of the borehole and its vicinity. From presurvey plan design to data acquisition, processing and interpretation, our fully trained professionals work with you from start to finish to optimize the value on every project.

SALT PROXIMITY SURVEYS

Using 3-component downhole geophones, Halliburton offers refraction- and migration-based Salt Proximity methods to help operators drill around salt formations and guide directional drilling to potential accumulations of hydrocarbons found updip from producing zones and trapped against the salt.

When combining the robustness of the 3D Salt Proximity analysis with Offset VSP Salt Flank imaging, we are able to provide the most complete and accurate method to map the salt face.

With 3D Salt Proximity surveys, the source is offset over the apex of the salt body, with multiple source points in multiple directions, depending on the salt top.

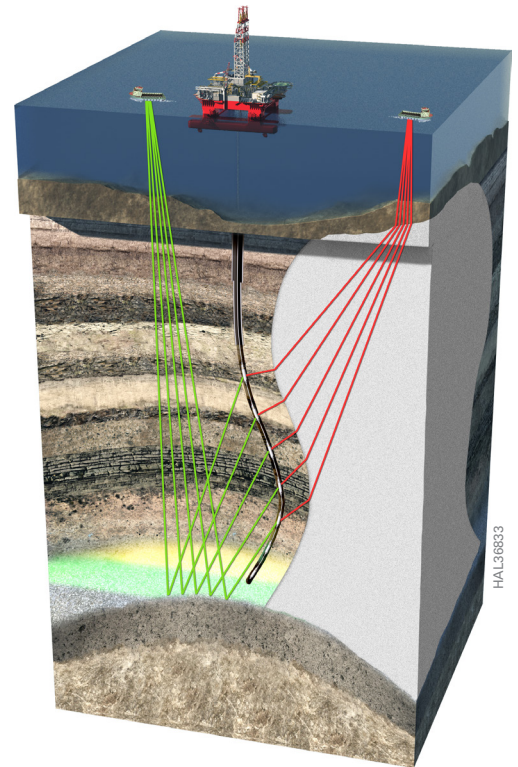
These surveys require orientation of the 3-component geophones, spaced at ~50 ft (15 m) to capture the wavefield angle arrivals and provide an accurate 3D depiction of the salt.

APPLICATIONS

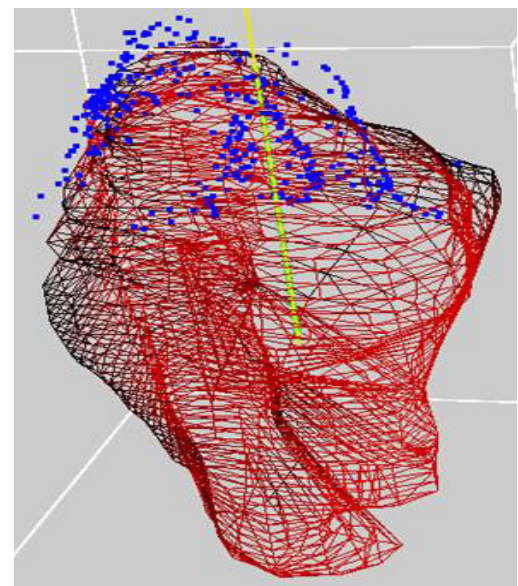
- » Maps salt flank in 3D space using salt exit points
- » Confirms the surface-seismic salt interpretation
- » Provides an indication of sediment truncation position
- » Aids in geosteering to avoid salt penetration
- » Helps define massive salt bodies for liquid-storage purposes

BENEFITS

- » Simple and robust methodology
- » Provides an accurate 3D depiction of the salt flank using X, Y, Z salt exit points in 3D space
- » Potential cost savings/risk reduction when drilling near salt bodies
- » Combined 3D Salt Proximity and Offset VSP salt image provides assurances and redundancy of the salt flank interpretation



Salt Proximity Survey and Offset VSP



3D Salt Proximity Exit Points

- » Reflected energy off updip sands terminates at the salt-sediment boundary
- » Reflected energy off the salt flank confirms Salt Proximity exit points, and links the truncations of the sediment reflections

DATA PROCESSING SOFTWARE

Halliburton iBHS™ next-generation data processing software incorporates advanced proprietary processing techniques to address the basic to the most complex reservoir imaging challenges.

PRESURVEY MODELING

As a key to a successful survey, Halliburton BHS provides accurate 2D and 3D presurvey modeling to optimize parameters for data acquisition.

DATA ACQUISITION

To obtain an accurate and comprehensive geological picture of the well, field or reservoir, Halliburton BHS combines

industry-leading borehole seismic energy sources and downhole array technologies with experienced, dedicated experts worldwide to provide operators with improved data quality while reducing rig time.

SEISMIC RECORDING SYSTEM

Avalon and Sercel PC-based systems provide digital and analog recording with full QC capabilities, and a source interface with vibrator electronics and digital airgun source controllers.

This technology helps ensure optimization of sources and frequency bandwidth, and enables users to monitor S/N ratio and first-arrival picks with critical velocity data.

ENERGY SOURCES FOR MARINE AND LAND APPLICATIONS

Halliburton BHS provides the full range of auxiliary equipment, including compressors, airgun array source controllers with constant real-time tuning, near- and far-field signatures, gun pressure

and depth. In addition, we offer a range of tuned gun arrays designed to optimize peak/peak-to-peak barm output, peak-to-bubble ratio, with broad, flat frequency spectrum and source directionality.

Our land vibroseis units use advanced vibrator electronics to deliver repeatable and reliable broadband results to match surface-seismic acquisition parameters.

DOWNHOLE TOOLS

Halliburton BHS downhole tools are designed for use in open and cased holes using 7-conductor wireline. All tools are 3-component with various options of gimbal, and fixed packages in single-, dual- and quad-receiver package configurations with a high locking-force-to-weight ratio. BHS tools can be deployed via wireline, pumpdown, tool-pusher logging (TPL) and tractors.

Optional aligned rigid interconnects can be used between multiple tools to allow a single gyro azimuth reading to be applied to all receivers in the tool string.

Tool Specifications

Tool Array	Maximum Number of Sondes	Length in. (mm)	Diameter in. (mm)	Maximum Pressure psi (MPa)	Maximum Temperature °F (°C)	Weight lb (kg)
ASR-HP	2	35 (889)	3 (76)	25,000 (172)	400 (204)	38 (17.2)
Geochain™ 60	60	35 (889)	3 (76)	25,000 (172)	356 (180)	38 (17.2)
GeochainX™ 60	60	35 (889)	3 (76)	25,000 (172)	385 (195)	38 (17.2)
ASR-EHT	2	35 (889)	3 (76)	25,000 (172)	435 (224)	38 (17.2)
GeochainSlim™ 100	100	45 (1,143)	1 1/16 (43)	20,000 (138)	356 (180)	10 (4.5)
ASR-EHP	2	35 (889)	3/4 (83)	30,000 (297)	400 (204)	51 (23.1)
Geochain™ EHP 60	60	35 (889)	3/4 (83)	30,000 (297)	356 (180)	51 (23.1)
GeochainX™ EHP 60	60	35 (889)	3/4 (83)	30,000 (297)	385 (195)	51 (23.1)
ASR-EHT-EHP	2	35 (889)	3/4 (83)	30,000 (297)	435 (224)	51 (23.1)
MaxiWave®	100	17 (432)	3 1/2 (89)	17,400 (120)	275 (135)	17.6 (8.0)

Geochain™, GeochainSlim™ and GeochainX™ are trademarks of Avalon Sciences Ltd. MaxiWave® is a registered trademark of Sercel.

For more information, contact your local Halliburton representative or visit us on the web at www.halliburton.com/bhs

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