

## Borehole seismic services

## FORMATION EVALUATION | GEOPHYSICS

# Check-shot survey

Time/depth positioning puts the bit in the seismic section

## APPLICATIONS

- Accurate time/depth correlation
- Acoustic log calibration and accurate synthetic seismograms
- Improved velocity analysis for surface-seismic processing

## BENEFITS

- Source matching for a better tie to surface seismic: "True" seismic velocities
- Accurate time/depth correlation: 1-way, 2-way, vertical times
- Wellbore position verification placing the drill bit on the seismic section
- Improved velocity analysis for surface-seismic processing: Average, Interval, RMS Velocity data
- Calibrated acoustic log to improve correlation of log-derived synthetic seismogram

Halliburton Borehole Seismic Services (BHS) provides a proven, cost-efficient way to improve surface-seismic interpretation and confirm reservoir location with the Check-Shot velocity survey.

## The complete package

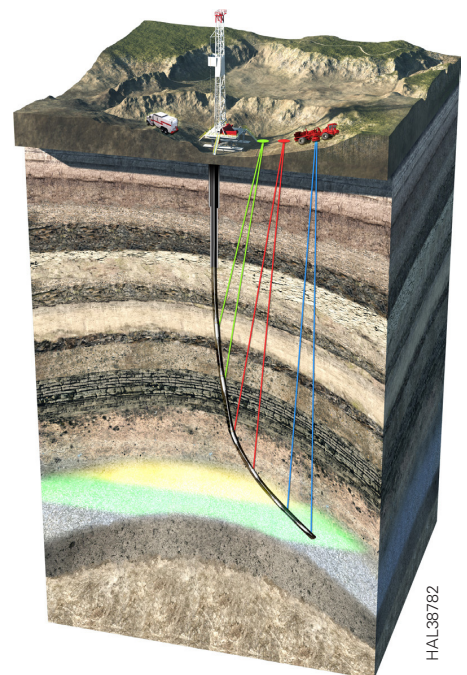
Halliburton uses the latest technology in data acquisition coupled with advanced VSP software to provide quality images of the borehole and its vicinity. From presurvey plan design, to data acquisition, processing and interpretation, our fully trained professionals work with you from start to finish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

## Check-shot velocity surveys

Providing accurate time/depth correlation from Zero-Offset or Normal Incident Check-Shot surveys gives an immediate confirmation of where you are in both time and depth, regardless of wellbore geometry, so you can quickly make informed drilling decisions and position the bit directly in the seismic section.

Additional data, including Average, Interval and RMS Velocity data, provides the essential information for acoustic log calibration and improves correlation of log-derived synthetic seismogram to surface seismic.

Depending on wellbore deviation, the Check-Shot source is positioned differently to minimize cosine corrections. For a straight or slightly deviated well, the source is positioned near the wellhead, and data is collected at a course geophone increment of ~500 ft or 100 m. If the wellbore is deviated by more than ~10 degrees, it is recommended to move the source over the geophone to remain normal incident. Again, data is collected at a course geophone increment of ~500 ft or 100 m.



Check-Shot Survey

## 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.

## 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.

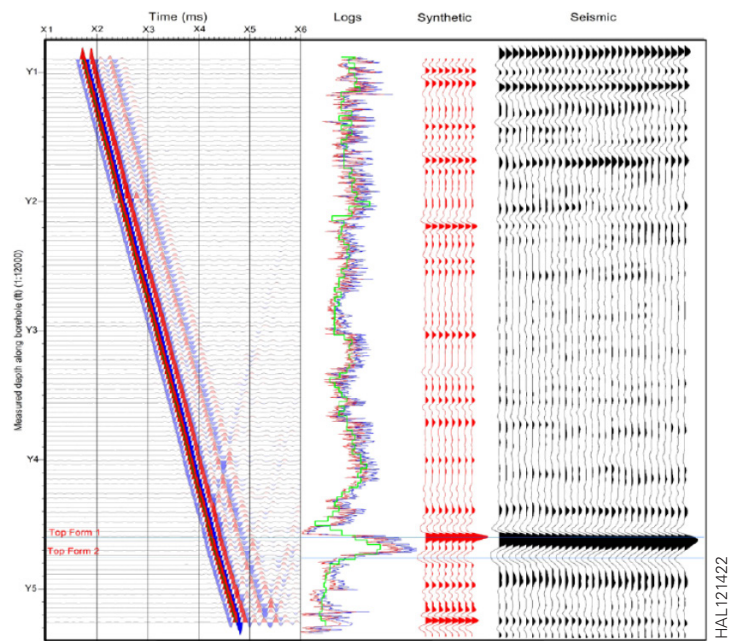
## Seismic recording systems

Avalon and Sercel PC-based systems provide digital and analog recording with full QC capabilities, and 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, first-arrival picks and 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.



Time/Depth Correlation

(Courtesy of Anadarko)

## 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.

## Tool specifications

TOOL ARRAY	MAXIMUM NUMBER OF SONDES	LENGTH	DIAMETER	MAXIMUM PRESSURE	MAXIMUM TEMPERATURE	WEIGHT
		IN. (MM)	IN. (MM)	PSI (MPA)	°F (°C)	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)	1⅞ (43)	20,000 (138)	356 (180)	10 (4.5)
ASR-EHP	2	35 (889)	3¼ (83)	30,000 (297)	400 (204)	51 (23.1)
Geochain™ EHP 60	60	35 (889)	3¼ (83)	30,000 (297)	356 (180)	51 (23.1)
GeochainX™ EHP 60	60	35 (889)	3¼ (83)	30,000 (297)	385 (195)	51 (23.1)
ASR-EHT-EHP	2	35 (889)	3¼ (83)	30,000 (297)	435 (224)	51 (23.1)
MaxiWave®	100	17 (432)	3½ (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.

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