

## Seismic While Drilling (SWD) Techniques: A Journey From 1986 to 2006

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### Abstract

Seismic While Drilling (SWD) specifically encompasses the seismic techniques operated while the drillstring is lowered in the borehole, during effective drilling, during maneuvers or while connecting drill pipes. Various SWD techniques have been used by the industry. This paper provides a State of the Art review on both old and newer SWD techniques used by the Industry. In the past 18 years (1986-2003), the Drill-bit-SWD technique practiced by the industry uses the acoustic energy radiated by a working drill bit to provide time-to-depth and look-ahead information while drilling.

Another emerging technique which is being used mainly by Schlumberger since 2000 is Vertical Seismic Profile While Drilling (VSP-WD), which consists in recording the seismic signal generated by a surface seismic source on seismic sensors integrated inside the downhole Borehole Assembly (BHA).

Recently introduced Swept impulse hydraulic tool is capable of generating a broadband seismic signal at the bit while drilling. This tool overcomes the limitations of drill-bit seismic particularly in soft formations and in inclined holes with PDC bits. The tool incorporates a sweep modulator; it provides real-time reverse seismic profile while drilling and high resolution look ahead imaging while drilling.

This paper aims to give a complete picture of the SWD techniques. Data acquisition and sensor deployment strategies are discussed in some detail. A brief overview of the signal processing techniques is given along with real field data. The benefits of SWD are demonstrated by means of several field examples, showing how the data can be used to reduce drilling costs, predict drilling hazards and improve efficiency of drilling operations on a real time basis. The current limitations of the technique are discussed and future development directions proposed.