

Borehole Geophysics: Recent Progress, Challenges, and the Road Ahead

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GeoConvention 2012: Vision

Wireline-deployed borehole seismic technology has evolved from single geophones to small arrays (say 5-10 levels) to current state-of-the-art of 100 levels or more. Accompanying this downhole hardware development has been increasing focus on high-end applications, such as 3D imaging, anisotropy determination, and reservoir characterization products such as AVA analysis and seismic calibration. In addition work had progressed on the next level of technology – instrumenting the oilfield with permanent sensors, either installed in production wells with the completion or embedded in dedicated wells. With permanent instrumentation the door opens to use the much greater coverage that can be provided by multiple wells instrumented with large geophone arrays for 1/ larger scale, high-resolution 3D imaging and 2/ reservoir monitoring using either active surface or downhole sources or using passive data, for example due to re-activation of faults caused by depletion or re-injection of the reservoir.

I will discuss progress and challenges around realization of these prizes and end with some thoughts on the road ahead – where will this technology be in 10 years?

Biography



Brian Hornby is a Senior Geophysical Advisor with BP's Subsurface Technology Group. Brian's current focus is on borehole geophysics, including 3D VSP imaging and reservoir monitoring using permanent sensors. He is recognized internationally as a leading authority in the areas of borehole geophysics, Rock Physics and fractured reservoir evaluation.

Prior to BP, Brian worked with Schlumberger in research scientist positions in Schlumberger's research centers in Ridgefield, Connecticut (1983) and in Cambridge, England (1990). In Ridgefield Brian developed new techniques for the inversion and interpretation of full waveform sonic data. This work included new techniques for high-resolution inversion and imaging away from the borehole using sonic frequency devices and estimation of formation permeability and fracture properties using borehole Stoneley waves. While in Cambridge Brian received his Ph.D. degree from the University of Cambridge with the thesis topic "The Elastic Properties of Shales" (1995). In 1996 he joined ARCO and worked on borehole geophysics and fractured reservoir projects at their Exploration and Production Technology center in Plano, Texas. In 2000 he joined BP with the ARCO merger.

Brian is a SPWLA Distinguished Lecturer and in 2000 received the "Best Paper" award in the *Petrophysics* journal. In 2008 Brian and co-authors were awarded the 2008 Cagniard Award (best

poster presentation 2007 EAGE), for the 2007 EAGE poster presentation entitled “Permanent Fiber-Optic Borehole Seismic Installation and Imaging at Valhall” and Brian was a co-author on the paper winning the Lorand Eotvos Award 2008 (best paper 2007 Geophysical Prospecting paper) “Migration methods for imaging different-order multiples”. Brian is part of the integrated BP team whose Helios entry “Innovation in Base-of-Salt Pressure Prediction” won the 2005 BP Helios award for Innovation. Brian has 6 patents, authored 30 papers in refereed professional journals, and has made more than 60 professional society presentations.