**Real-Time Geosteering Delivers Optimal Wellbore Placement in Thin Coal Reservoir**

**Location:** Coalbed Methane Reservoir, Alberta, Canada

**OPERATOR’S CHALLENGE** – An operator drilling a coalbed methane well in the Swan Hills area of Alberta, Canada needed to stay at the bottom of a thin reservoir to enable maximum production of methane gas. The reservoir was only 1.8 meters (6 feet) thick, and it was very important to place the well as low in the reservoir as possible without exiting. Knowledge about the geological structure and fault regime of the area was scarce and data from only one old offset well was available at the planning stage.

**HALLIBURTON'S SOLUTION** – Halliburton’s Sperry Drilling services deployed the InSite ADR™ azimuthal deep resistivity sensor, GABI™ Gamma/at-bit inclination sensor and StrataSteer® 3D geosteering service to place the horizontal section as close as possible to the lower coal seam boundary. Geosteering the well in real time was considered the best solution for precise wellbore placement.

The key to successful geosteering is accurate real-time reservoir knowledge. The well plan had been created using the limited available reservoir information. If the well had been drilled according to the proposed path, it could have ended up exiting the reservoir section. Geosteering helped to prevent this by modifying the well path during drilling, applying all of the formation evaluation data obtained in real time.

**ECONOMIC VALUE CREATED** – Sperry geosteered the well into the sweet spot close to the top and bottom of the thin coal beds and delivered a 1,358 meter (4,455 feet) lateral with only one (14 meter/46 feet) reservoir exit. Sensor measurements such as top quadrant resistivity and bottom quadrant resistivity were used to accurately place the wellbore and to indicate which boundary was being approached.

The InSite ADR sensor calculated the distance to bed boundary, and also indicated whether upper or lower boundary was being approached. The GABI sensor determined internal bed structures and StrataSteer® 3D software compiled the data. The geosteering team analyzed the data and made decisions in real time to modify the well path for precise wellbore placement in the most productive part of the reservoir.

**IN Site ADR Azimuthal Deep Resistivity Sensor** – The InSite ADR sensor measures multiple truly compensated resistivities at different depths of investigation, multiple truly compensated images at different depths of investigation and multiple possible geosteering signals that are used to calculate the distance to bed boundary. The sensor fires three frequencies at each of the six transmitters which are then measured at three tilted antenna receivers. These data can be transmitted in real time allowing the geosteering specialist to evaluate the reservoir while drilling. Transmitting an image from one frequency and spacing resistivities allows the
A geosteering specialist to compare the high-side resistivity with the low-side resistivity. These two resistivities will differentiate when coming in contact with a boundary. The resistivities also react differently when crossing an upper boundary and a lower boundary of a formation, helping with placement of well bore with respect to the reservoir. Transmitting two resistivities with different depths of investigation also allows a better evaluation of the reservoir.

**GABI GAMMA/AT-BIT INCLINATION SENSOR**

The GABI sensor, located just behind the bit, provides two important measurements for steering a well. The first measurement is at-bit inclination, which helps with the direction of the well. Not only does it contribute to longer and flatter well bores, it provides immediate feedback about trajectory changes. The second measurement is an azimuthal gamma ray. This gamma ray sensor positioned close to the bit detects adjacent beds and bed boundaries when they are approached. The image also indicates the direction of the well path – whether it is going up-dip or down-dip. With the GABI sensor, the gamma image is acquired while both rotating and sliding, which provides a continuous image while on bottom drilling.

**STRATASTEER 3D SERVICE**

With the combination of the InSite ADR and GABI sensors and the StrataSteer 3D software, an accurate picture of the geology and well placement can be mapped. The StrataSteer software combines the resistivity, gamma ray, images, geology and well bore placement representation onto one screen making a powerful tool for the geosteering specialist. With all of the information readily available, the geosteering specialist can take real-time decisions to help prevent a reservoir exit and deliver precise wellbore placement.