Active Acoustic Ranging

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Surface Seismic Acquisition
Active Acoustic Ranging

- Target Well
- Relief Well

Compression (P)

Shear (S)

Stoneley
SonicScanner

• Designed to detect acoustic reflection

Upper Monopole Spacing 1 – 7 ft
Far Monopole Spacing 11 – 17 ft
SonicScanner

- Designed to detect boundaries, sonic reflection
  - Azimuthal measurement; 22.5 deg resolution

13 receiver stations * 8 receivers / station = 104 receivers
Active Acoustic Ranging

Target well

Relief well

Reflection

Time

Relief well

Target well
Active Acoustic Ranging – Parallel

Reflected Arrival
Relief well approaching Target well
Acoustic Modelling - Reflection

$P = \text{Compressional}$

$S = \text{Shear & Stoneley}$

Relief well approaching Target well
Acoustic Anisotropy

Shear (S)

Compressional (P)
Active Acoustic Ranging - Accuracy

- Record Time
- Slowness
- Transmitter
  - Monopole (Compressional/Pressure)
  - Dipole (Shear)
- Reflection Type (PrP or SrS)
- Attenuation (Q-Factor)

**Theoretical ranging distances at the maximum record time**

- 165 ft. @ 60 us/ft
- 82 ft. @ 120 us/ft
Active Acoustic Ranging - Accuracy

Distance $\sim 0.5 - 1$ ft.

- Formation Slowness
- Anisotropy (velocity model)
- Wave Path
  - Straight rays used in calculation

Vertical Resolution $\sim 1.5$ ft.

- Reflection pattern allows determination of the MD of the event down to approximately 1-3 samples (0.5 ft. – 1.5 ft.)

Azimuthal Direction

- 8 azimuthal receivers can resolve the side of the target well within $\pm 22.5$ deg
- Perpendicular orientation to the target (3DLD)
Active Acoustic Ranging – Example 2

Two wellbore present before drilling
• Unable to intercept either well
• Acoustic Ranging was run for
  • distance and direction to both the open hole and cased hole wells
Active Acoustic Ranging – Example 2

Top of Casing

Compression
Shear
Stoneley
Active Acoustic Ranging – Example 1

Figure 12 – Distance to reflections overlayed with a curve connecting the cased hole refraction and reflector 3.
Appendix P – Workflow Process – Roles & Responsibilities