Our mission is to support our customers in their pursuit of reservoir optimization through global leadership in perforating systems and technical services.
Perforating Vertically – SPE Paper Quotes

• SPE 77363
  – The 180 degree phasing will be the best completion technique for horizontal perforated wells because all the perforations will be oriented in the direction of minimum permeability

• SPE 166086
  – Perforations at top and/or bottom of the well may be a better choice than the popular pattern of helical 60 degree perforations
Perf Orientation to Max Stress

Phasing

- 60 Degree
  - Unknown direction of fracture
  - Scatter gun

- Oriented
  - Known direction of fracture
  - Orient for more penetrations on plane
  - Limit tortuosity

- Wireline orientation requires eccentric weight bars
  SPE 166369 demonstrated $\pm 62^\circ$ ERROR in a horizontal

- TCP or Coil uses weights with required Swivels and Kick-overs
  $\pm 31^\circ$ ERROR dependent on sized hardware for casing size
Oriented Perforating Gun Example

- Positive orientation in deviated well bore
- Accurate shot placement
- Charge tube rotates independent of gun
- Weights orient the charge tube
- Charge orientation not affected by wellbore debris, downhole conditions
- Void of additional down-hole equipment

± 8 Accuracy

Maximum Stress

Minimum Stress

Eccentric Weights

Bearings

Owen Oil Tools
Oriented Gun Cutaway in Lab
Oriented Gun System Case Study Results

Rocky Mountains-
- Hydraulic fracturing pressure was reduced 2400 psi with same flow rate as similar wells.
- Open perforation flow area calculated 100% of the zero and 180° oriented perforations to be open.

South Texas-
- 18 stages shot successfully with zero & 180° oriented guns.
- Vertically oriented gun effectiveness showed pressure reduction of 600 to 1200 psi during hydraulic fracturing.
Positive Orientation to Optimum Phasing

- Accurate Shot Placement in the deviated well bore of ± 8°
- Known orientation allows for tighter charge performance
- Increased number of effective holes with more shots on plane and open to flow
- 1500 psi reduced breakdown when compared to 6spf, 60°
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