A Short Set of HNAV Examples

Why Geo-Navigation is Important in Your Every-Day Horizontal Wells
Let Us Begin with Some Basics

- A Vertical Pilot Hole and Lateral with a “Hook” at the End
How Most People Construct a TVD Log

Points in the Curve are Projected into the Vertical
Limitation of TVD Logs in a Repeated Section

- Notice the Blue Arrows WOULD Overlay the Red
- These Points of Data are NOT Normally Included
Our Log Needs a Correction for Dip

Data SHOULD be Projected Back Along Dip

How do We Decide What is the Correct Dip?
  – The Answer lies in Finding Correlable Horizons

Horizontal Well Data Calculations Simplified

The Data Should be Projected Along Dip,
But How is This Done?
Our Application Will Tell Us the Real Story and Define Dips and Faults

Horizontal Well Data Calculations Simplified

The Real World is a Complex of Faults

- Let the Data “Speak” to Us with a Data Visualization Tool
How Our Software Looks

- We Can Zoom in Any Window
- The Repeating Section at the Start of this Well is Very Important Because it Gives an Accurate Dip
- The Colored Segment on the Log is the Same Piece as on the Section
How Our Software Looks

- Section View and Log View with Control Mouse Driven Pop-Up Menu
- Notice the Repeating Section on the Log Where the Well “Loops” Through the Strata
A “Live” Example

Following Post-Drill Appraisal, Operator Initiated “Live” Navigation on All Wells
This Well was a Success for Four Sevens - Did not Drill Too Far, Did Not Cone Water, Good Rate of Production
“Life is Harsh”

- Your Geo-Navigation Shouldn’t Be
Another Operator’s Lessons in Parker, Palo Pinto, and Erath Counties, Texas

- Small Investor Funded Public Company
- Drilled $15 MM Worth of Hz Wells (4)
- Have 1 Producer

History:
- Started with Gilbert 1 H Interpretation
- Did Post-Completion Evaluations on All Other Wells
- Remediation and Redrills Justifying Round II of Financing
Produced Gas with Slugs of Water Until Well Loaded Up - Note Well is in Marble Falls and has Perfs on the Faults
Gilbert 1H Logs
Let’s Review:

- We Build a TSP Log that Correlates to an Offset Log or Pilot Hole
- Take Small Segments & View Them at a Low Angle
- OR, Shift Them Up & Down for Faults
- Match Them to the Pattern on the Offset Log
Still Another Barnett Example

- Perforations on Fault Zones - More Water!
Another Shale Play Example

The Fayetteville Shale Play in Arkansas

- Note: Gas Increases in Certain Fault Blocks
Fancy Example of a Mississippian Biohermal Reef, with Lithologies

The HNAV Process and Results

- Hardeman Basin Miss Bioherm with Collapse Breccias and Shows
An Example of a Subtle Fault
Petrohawk Lehman 1H in James Lime of Nacogdoches County, East Texas

- Most Faults Can be Easily Discriminated, Just Looking at a Log
- But the Trick is Finding the Displacements of the Fault and Direction
- Here is a Clean Gamma to Clean Gamma Fault! Cooool…
- Note: Even With Faults, Navigator Kept it On Target
Conclusions

- Geo-Steering is Evolving into Geo-Navigation. Tracking Zones is Still Important, but -
  - Knowing Locations of Faults is Critical
  - Knowing Fault Magnitudes, and
  - Perforation Planning is Critical

HNAV is the ONLY Tool that Can Define Fault Throw
What? More Questions? Then Try the NHAV Link to More Info

- All Information on Methods and Examples