How Wellbore Positional Uncertainty affects automated steering decisions
Or should it be:
How automated steering decisions affect Wellbore Positional Uncertainty
Introduction

- 39 years Operations, Engineering, Manufacturing, Product Line Management
  - M/LWD, Surface and Downhole Instrumentation, Automation
- Degrees in Physics, International Marketing
- Founder of several successful small businesses
- Currently President of xnDrilling, Inc.
- Based in Houston, TX
- Specialized in
  - Wellbore Positioning
  - Instrumentation
  - Automation
- Treasurer, SPE Wellbore Positioning Technical Section/ ISCWSA
Agenda

- Value of Wellbore Positioning
  - Risk reduction
  - Asset / reservoir value
- Wellbore Positional Uncertainties
  - ISCWSA Error Models used widely
- Real Time steering decisions
  - Why don’t we just follow the line?
- Automated Steering
  - needs and benefits
Introduction

- Todays faster drilling of complex well paths increase the demands on Directional Drillers

- Longer laterals / more complex well paths / multiwell pads need risk reduction to achieve production goals

- Good Wellbore Positioning knowledge is important for all Directional Drilling, whether manual or automated
Poor Surveying reduces overall Asset Value

Incorrectly placed wells can leave reserves untapped, or thieve production from other wells, reducing Asset value
What the Reservoir Engineer asked for
Initial Well Plan showing Uncertainty

Anti-collision risk above company tolerance, using standard MWD
1. Pay for good survey management in the Drilling AFE.
2. Get improved reservoir drainage and more payback.
And then you start drilling

And run into a problem requiring a sidetrack
So do you put in a double dog leg

- Adding additional Torque and Drag problems
  - Reduced Lateral length?
  - Sump blocking gas flow?
Or stay in the new lane for longer?
Changing lanes can cause problems
Especially if you don’t have the full picture?
And then the geologist moves the target anyway
Magnetic Corrections in Action

PLAN – Blue
REAL TIME MWD
SURVEY - Red
CORRECTED SURVEY – Green

Post Processed
Real Time Magnetic Corrections in Action

PLAN – Blue
REAL TIME MWD SURVEY - Red
CORRECTED SURVEY – Green

Post Processed

Applied in “real time”
So you need good information input

**Initial Plan**
- Wellplan
- Targets
- Adjacent wells for AC
- BHA information
- Goals for well
  - Acceptable drilling envelope
- Survey Management Plan
  - Error models?
  - Survey corrections?

**Live Data Streams**
- Rig data
- Surveys – QA/QC/corrected?

**Updates throughout well**
- Current BHA
- Revised geological target
- Revised trajectory based on T&D, etc
  - aiming for target or tight line?
  - What about replanning for sidetracks?
So what do you get out of Automated Steering?

- Faster Well Data Analysis
  - Allows faster response for smaller course corrections
  - Hence better Wellbore Quality
  - Hence lower torque and drag
  - Hence fewer wellbore problems in drilling, completions and production

- More consistent decision making
  - Bring more experience to more wells
  - Consistent results allow for Continuous Improvement
  - Process control for directional wells

- More accurate and detailed knowledge of wellbore position
Thank You