Speaker Mark Anderson

Mark Anderson has been the Manager of Drilling Mechanics Technologies at Shell International Exploration and Production for over 14 years. Previously, he worked as the Drilling Engineer for Shell Gabon, Shell Expro-Aberdeen and for Al Furat Petroleum Company - Damascus.

The objectives of this talk are to discuss 6 projects in Shell and then draw some conclusions about using real time drilling data for both decision making and automation. Hopefully this will spark some engaging conversations.

COMPILED PRESENTATION NOTES/DISCUSSION (FROM ATTENDEES):

- Comment: One goal of automation is to standardize the capturing of the data
- Challenge: Getting data that we can make sense of, and that is right (when looking at influx detection at pumps stopped - IDAPS)
    - Significant reduction in false alarms
- Dashboard: presents observation, and then recommended course of actions – how do we start to feed systems with these?
    - **Driller** is driving the decisions
- Tested in shadow environment with real data (but not taking any action)
    - Then once received enough confidence, presented to the driller
    - 2 year-project from start to finish
- Driller's roadmap for optimal parameters
- Pronovo mentioned, and then Shell builds further algorithms to produce micro-KPIs (breaking operations to a second by second basis)
- Video Analytics-UT Intern example (on list, but not priority at this time)
- SPE paper: Under-Reamer Health Monitoring
- Bit wear prediction – success rate is about 85-90%
- Comment: Bit wear versus bit damage brought up (to change perception of type of wear)
- Question: how do you train data regarding bit wear? Training data on imperfect information, runs several risks of course – Paper by Yu Lu mentioned on machine learning

- Onshore: Drilling automation – SCADAdrill – ROP performance beat “average” driller (10-40%) – but costs too high to sustain
- Improvements have come from more efficient drilling, so not necessarily attributed to automation (we just got better at drilling)
- Believes Shell has shifted from Innovators to Early Adopters with some of their projects
- Working in an agile way to be able to test and pivot as needed
- Fastdrill: Is a continuous improvement process
- Question on where data stored and for how long: Cloud-based, retained forever

Mark W Anderson

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The “staircase”

1) you have a process

2) you have digital data showing up real time on displays

3) you have calculations and decision support for process improvement

4) you can either start to use big data / artificial intelligence and machine learning or you can go off into control and automation (the jobs that are dull, dirty, or dangerous are the ones we want people NOT to do)

EX1, Pressure calibration:

to assess whether they should adjust the pressure, they need to look at historical data, historical decisions, and historical reports. make an algorithm. then tweak it over time with new data.

EX2, Influx detection:

once the algorithm sees that there’s a potential issue, it throws a warning at the drilling engineer. that person then must make the right decision as to if to override it or adhere and slow/shut down the process. kick detection has gone to 2.7 false alarms per every 1000 false alarms they had previously.

“We’re going to have less capable people on the drilling rigs soon, and the instructions for how to handle assessing the validity of the automatic flagging will become very important”.

specific example: on a rig that rolls, the pit detection level is wonky.

Alec’s thoughts: Are the drillers who are competent now documenting why they made the decisions they did when they evaluated the automatic alarms, and how is that data being stored for the use of future less experienced replacements?

Brian Tar, who was the project manager, wrote 2 excellent SPE papers on the topic of kick detection.

Shell uses (and Mark seems to like) Pronova — http://www.pronova-tde.com/

EX3, Underreamers:

When you have an underreamer in a hard formation and a drill bit in a soft formation, you have to watch out that you don't over-torque the underreamer.

"Bit tripping is half a day of cost. That's a big deal in the drilling world."

we correlate 49 bit runs and compare with the dulls coming out. use Keel's equation, bitware and all the other equations we know exist. use machine learning to help us with the factors that work with those models. there's a little bar that adjusts height and color. shorter green and higher red. it's a great tech tool, and it's been well-received.

in Mark's opinion, "If they don't look at this (tool), they should be fired. If they only look at this (tool), they should be fired. This is only one of the things they should be looking at." they still have to reference historical data and company expertise. but, of course, they must make the decision real-time.

"Getting software to work traditionally involved throwing 650k over the fence and then waiting 9 months. Then you get back something that doesn't solve your problem." now he and his team are getting software to work within a month internally. this is so exciting it's almost scary.

when they came back with a list of what kinds of stuff they could do using data science, it was a list of 35 ideas. now, the ideas are so much more than we have the capability to deliver. we're up to more than 100 ideas. this is more than my team can ever do. when people come in trying to sell us stuff, we must buy the stuff in as it checks off boxes on the list. they don't publish the list, and they go through the list just one after another. for example, they have a bitwear problem in the Permian. how it is solved is the IP we keep close to the chest, but the fact that it's a problem is shared with individual venders in the form of a rapid-fire list during meetings.

EX4,

"One of the real concerns we had was around how we were going to staff our operations with high quality staff." we were supposed to be at 40 rigs in Queensland and same in China. 15 in Marcellus. More in Permian. drilling was going to go wild. we were going to do drilling automation to help with this. drilled 391000' ROP for the three tests, and the automated version performed 10 and 40% over that of manned decision making in every instance. however, there were some problems with automation:

- the way we chose the architecture in 2008 was expensive. there was significant hardware as well as software infrastructure.

- “The Shell boots going out to fix the damn thing was too much! When the price went down, our drilling sequence got chopped. We didn’t have the number of rigs for economies of scale.” we had an economic pay back of 9 months. if you’re a rig superintendent who will pick up for a year, 9 months is not a good time period. if you’re delayed 2 months, no savings whatsoever.

- “As the rig count decreased in the industry, the great crews came back onshore, so they were really good even as compared with the automation.”

- overall, a section that used to take 18 days now takes 3 days. a 25% improvement applied to 2 days is not that big of a deal as compared to when the same improvement applied to 18 days.

- “If you’re down for even 15 minutes, people freak out. You can’t have computer systems failing, and they were.” the whole point was to make things more efficient. “Whenever something crashed, a 45-minute reboot was a big deal.”

if you fall over the first hurdle in technology, you’ll never make it. you must pivot the whole program. we learned from 391000’ drilled into C++ and plugged into the auto driller. we’re now running on two rigs in North America. note that Mark spent nearly 10 minutes talking about how new software languages and protocols are more flexibly and better than their predecessors. python is better than matlab, etc., and how quickly you can adjust the code to make differences.

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Questions

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What percent of time is spent on data prep?

so far, we’re disappointed in the text analytics. the NLP is disappointing. We’re not seeing that coming through. we’re working on it. production claims some success — I haven’t seen it in drilling. offshore is better than onshore. we have the data well centralized. smaller companies with lots of acquisitions have even more trouble gathering the data to the “center”.

does the data reside on your servers or Pason [sp?] or other servers?

we have gone to the cloud. private. hosted by one of the major providers of cloud services. copy it over and retain it forever. we get it and stick it in our own private cloud. data ownership is a commercial argument but quickly becomes a religious, political, and legal environment.