Virtual ISCWSA Collision Avoidance Subcommittee Meeting- Minutes

15 February 2022

Agenda

Gary Skinner: Action Items from Previous Meeting

Pete Clark: Inferred wellbore position from sustained inclination

Gary Skinner: Project Ahead Uncertainty

Contents

Action Items from Previous Meetings

Several of the Previous Action Items discussed in the last meeting are still outstanding:

- Ty – close out the CA docs update on the web
- Pete – actions from reporting nomenclature
- Bill – will send out an invite for the Project Ahead questions
- Gary: Lexicon between CA/EM/QAQC -> Education Subcommittee Mahmood

After this meeting Bill proposed removing the action item with the discussion that took place on Project Ahead Uncertainty.

Pete Clark: Proposal to initiate a workgroup on Inferred Wellbore Position

Many wells lack directional survey information

Leads to a blind error model, 46° cone; TD error radius > depth

Need to get details:

Potentially form a workgroup on the Inferred Wellbore Position

Would like to share what Chevron has worked up with the industry and would feel better if industry experts were engaged and would give their input into the design.

Information passed to the regulator are the formation tops (as MD).

Based on Seismic & other wells, would have regional formation grid surfaces. TVD comes from formation grid. MD from Log

- Sustained inc (SustInc) = acos(TVD/MD)
- Less than 5°, inc only planned
- 5° - 10°, inc only planned 10
- Greater than 10°: No longer considered nominally vertical: Assign Blind

Process and Rules:

- Calculated from at least 2 credible formation top comparisons
- SustInc = Maximum of ALL available comparisons

Individual Calculation outcomes:

- No match, no calculation
- MD<TVD, invalid calculation

Credible Calculations

May have tops and grids nominally for the same item, but are not; top naming can change, and what can be called the top of a given formation may change.

Geologists have an evolution of their knowledge of the geology.

Looking for the grid and top being sufficiently close to each other to be credible.

Tolerance value set: based on horizon, and 10° offset. @10,000ft 154ft tolerance

Not credible to have a **single** reference point.

When a top doesn't make sense, the credible counter decreases...

Looking for this to be algorithmic / machine lead

Well that has a curve that requires high angle at surface and 'slacks off' would be invalid.

Q&A

Jerry: Have you done data analysis?

Pete: No

Jerry – we have some data for Permian basin and inc only. For old wells, if you do have data it may be from wireline and you may have wireline slippage.

Pete: Want to assign a model based on data. Want data and can honour it

Darren: What's the end game of the committee?

Pete: Process to select an error model

Darren: one problem is the number at xSigma

Pete: A 1-sigma blind model doesn't make sense, we have a cone around where it may be.

Dalis: Do you think we should look at this as a 1-model fits all? Difference between land and offshore?

Pete: The places where this is an issue are only land. It is possible to observe this offshore.

Andy: From an error model management perspective: I've seen a small set of cone models and run a process to choose which one to fit. Can do it per field, comes back to Dalis point, you may pick a different option on land and off-shore.

Pete: The important thing is it is a process

Harry: TO Darren's point: We are stuck with a mechanism where clearance scan is done at this type of distribution. But in this case it is OK, as we are using it for AC and it will be scaled to 3.5sigma and we can live with the limitations. It is a box-car distribution but we are only interested in the thing that is on the wrong side.

For the blind model, we have a different model: we have the BP version which is the bell shaped one, and the problem with that is it quickly exceeds MD, in low angle wells it recognises that you won't have taken off at 45°. We tweaked it so its growth rate eventually becomes linear and is primed with a larger uncertainty

Pete: This may be better applied to unsurveyed well data. I want to echo one of your points in the challenge. We assign blind and that's the solution, we assign blind then run AC calc and commonly find 100=odd offset wells some with SF<1 with wells >2 miles away.

The DE is continuously provided with SF calcs less than 1 and 'assume' its unsurveyed, blind and miles away and not a risk. This is the most problematic thing to my mind. Removing the chaff that is nominally vertical and deal with the wells that are collision risks

Harry: Yes, this desensitises the DE and it needs to be overcome

Harry: we have a process for wells that are uncontrolled drilled nominally vertical.

Bill: One more wrench to throw in: BP also make use of the global filter, blind offset wells 'interfering' if the global filter with pu is scanned we would see them, but looking at the nominal wellpath only it won't fail in the global filter. We need a filter that understands if they are reputational or HSE related, then some methods for allocating PU is OK, but where HSE is a risk then something else is needed.

If it is a non-HSE well, the worst you have is killing the offset wells production.

Bill: Pete - per your request for industry support, it may be worth talking to Kevin McClard. He gave a presentation within the ISCWSA a number of years ago you may recall. In it, he had a lot of data that I (maybe incorrectly recall) included surveys of a large number of previously "blind" wellbores. If I remember correctly, he may have some interesting data to "test" some of these proposed solutions

Darren: To Harry: We ought to have a cap if PU>MD.

Darren: The workgroup could expand to other aspects: so probably should look at situations where we use these models in wells e.g. when your tool fails

Gary: Include in the wellbore name that the PU was estimated from a process.

Pete seeking 4 volunteers to participate

Jonathon, Darren, Dalis, Andy…

Outcomes

Team

- Jonathan Lightfoot
- Dalis Deliu
- Jerry Codling
- Darren Aklestad

Suggestions

- Use of “Global Filter” to limit extent
- Truncate blind cone model by MD
- Alternate blind model with expanding cone
- Equinor modification to expanding cone to accommodate unexplained inclination at surface
- Should cone model be correlated with confidence level
- Offshore as well as onshore
- No substitute for good survey practices
- May expand to inclusion of Blind within survey
- Wireline measurement errors

Project Ahead Uncertainty

Sigma PA looks at the uncertainty ahead of the last survey station. Between this point and where the bit is at the end of the next survey interval the well is drilled blind.

A working paper has been produced to discuss the impact of changing Sigma PA from the 0.5m value proposed in the ACR SPE Paper. This is for discussion as there is a proposal to incorporate a reduced factor in API RP78 as a dispensation.

The critical zone where sigma PA contributes significantly to collision avoidance uncertainty is at shallow depths when wellpath PU is small.

The analysis in the paper largely supports work previously done on observed vertical drift in a large group of wells and ability to stay

Guidance for choosing a value of sigma-PA

- a holistic approach is required incorporating:
  - Corporate risk profile
  - Previous experience in similar campaigns
  - Directional sensor to bit distance
  - Project ahead distance (survey interval)
  - Angular control from BHA
- Prior to adjusting the WPTS published rule a **thorough risk analysis** should be performed
- A rule of thumb is to adopt a value of **0.01 meter per meter (1%) total projection to bit and Lookahead distance**.

Rule	Proj to bit (m)	Lookahead (m)	σ_{pa} (m)	Angular Control equivalent
WPTS	-	≤30	0.5	≤2.5°
10m survey	≤20	≤10	0.3	≤0.5°
Continuous survey	≤10	≤5	0.15	≤0.15°

Angular Control Equivalent is the directional control required throughout the collision risk zone

Q&A

Mike Attrell: Does the scope of the error model to include operational considerations and human factors or do you asses and judge the risk on a case-by-case basis.

> Gary: The error model assumes that you are gross error free at all times, which is why the SPE rule added a factor for the 'unknown' parts of things
>
> We have to incorporate in the ACR that the plan won't be exactly followed. The error model really looks at the TOOL side of things. There is a partial correlation, but it doesn't accomplish everything: it looks backwards instead of forward
>
> Andy Macgregor: I started in Aircraft navigation and we used to break down into navigation sensor error (how good the tool is) and flight technical error (how near you can pilot to that sensor position).
>
> This is the same kind of analogy. I think we have drawn the line between CA and Tool model appropriately, with the error model focusing on the tool, and this is the flight technical error.

Jerry: Comment: as I said in previous meetings, I did a station drift study in near vertical holes, it's not quite the same as looking at what the DD is doing, but my numbers came out with 0.5 as we put into the model. We are basing these projection that this 0.5 is good to go with. It isn't an exclusion zone, it is statistical. As this project ahead error is something we can encourage people to use practices that make it tighter

Mike: It would be nice if there is possibility of doing sensitivity analysis on a directional plan. If AC point is right after 8/30m your ability to meet it will be lower than if you had a tangent before it. We also see cases where you get pushed off plan or kicked off early and then have AC issues. This is what I'm struggling with, but I think there is something that needs to be done.

> Gary: Kicking off early has to be included in your while-drilling CA practices, if you are using a TC plot to manage collision avoidance and kick-off early it will no longer be valid. Kicking off 500ft early to be above the plan at all times proves that there needs to be part of the plan: the DD, Well Planner and the Drilling Engineer all need to know the implications of making decisions in real time.
>
> Slide 3 shows the deeper you go, the less impact sigmaPA has on the overall MASD. You are adding a small fixed uncertainty to something that is getting bigger and bigger. After 500m/1500ft reduces to 0.42m with the paper's value, which is about a bit-diameter off plan.
>
> Andy: I do like the idea on the sensitivity analysis. It is not just purely 1.01 I'm fine: Separation factor is a useful metric, but it is far from perfect

Bill Allen: My gut tells me we are blending a lot of stuff into the project ahead. While I think it is valid and needed, I am concerned at how we are using it. It feels like the old error model term compass error. How do you know that you are doing something that is impacting it? This feels to me like we are double dipping, we aren't but... I would rather break it out into a separate layer. I like Andy's Navigation sensor error and Flight Technical Error. We can focus on the elements that can affect it. Lumping it into this causes artificial fails too often. It will create 2 things: people won't believe it and make things more costly. I'm aligned with what's going on, but it feels heavy handed and I'm not buying into it as I don't see numbers that we are struggling. I can't say we don't have these issues, that we have the space to do it.

> Gary: You have your 10% drilled depth cone in your ACR, this was intended to be its broken out, modern counterpart. You can easily output the individual components from the software so that you can do a one-off investigation to see what terms are 'doing the damage'. The purpose of this is that we have a value of 0.5m in the SPE rule; Jerry showed that this isn't unreasonable. We do have situations where this does punish us. This was to look at is there a potential from an engineering discussion to reduce it
>
> Bill: 2 Points: I say its masked as you can't come to the table and say that I've got a BHA / System that can give you better control, and Jerry has data that shows it, but I've just monitored a well that maintained verticality to within 0.1° over 3000ft. If you break this out as a component you can design it as a factor. Maybe 0.5 is the right number. I'm personally not comfortable with how we do it, but maybe in my case we are double dipping.
>
> Gary: For the 10m survey version, we could call it an RSS one, and the top one a motor rule. If you are drilling vertical with something that automatically steers to vertical you will get sufficiently better directional control than 0.5.

Benny Poedjono: I'm a little bit confused here on how we are going to do this. I get Bills and Andy's point on the plane, but today we do things differently using GPS. If you lump it together, I would have difficulty to explain to the DD what is happening. I tell the DDs Allowable Deviation from plan: At this depth you have this separation. It is difficult to explain this to someone who is doing it.

> Gary: This number is fixed in the ACR. This isn't something that is varied. On the output side you still have your available space / ADP number to give to the DD. This just ensures that it includes a Lookahead factor.
>
> Jerry: I don't feel that it is double dipping. This is something that we didn't include in previous calculations. It is something that should be included in the ACR. Other rules have terms put in for the same reasons. Now there is science behind it.

Harry Wilson: Benny & Bill for this parameter being merged, we need this in the clearance statistic. It is a component in the ACR. It isn't fully fixed, as you can have different rules with different values. When we wrote the paper it is the FORM of the rule that needs to be pushed, the values that are plugged in are a secondary input. We need to provide these. Primarily a K=3.5; but if you are less risk averse you can plug in a different numbers. The co-authors agreed that there was a need for Sigma-PA and we considered 0.5 for a 90ft stand appropriate as a slightly conservative, global value – similar to error models. If your experience shows a better/worse performance is achievable you can modify it.

The ACR is explicit as to what is survey uncertainty vs. project ahead uncertainty. To Benny's point: this affects ADP, I don't think you can stick with an SF1 limit, but telling the DD that they have to stop 0.5m before they hit it. You have to build it into the rule.

> Jerry: As per Harrys comments: see SPE - 204049 - NOC Qatar using a variation of the WPTS rule to suit local drilling conditions (like jetting)