Adrian Ledroz opens 2nd day of meeting

Some Technical and Economic Consequences of Directional Drilling and Surveying Progress and Success
Steve Sawaryn

Introduction:
- Analyze how the industry has reached the present situation
- Assess trends
- Identify the stakeholders and the future roles
- Role of the WPTS and its Subcommittees
- Identify key actions
- Conclusions

Summary of the Well Positioning Technical Session (WPTS)
Chronological sequence of key directional drilling and survey tools
ERD Step-Out (1970 to 2020)
Evolution & Needs
- Technologies and Methods
- Conceptual/Theoretical Underpinnings
- Operational Requirements

WPTS Challenges
- Defining well construction quality requirements
- No generally accepted holistic approach to the definition of well objectives
- Require life cycle criteria against which the quality can be assessed
- Error model verification
- Geomagnetic modelling
- Survey calculation methods
- Collision Avoidance
- API RP78 delays
- Automation and Digitalization

Introduction of a Four-Step Model
- Theoretical Foundations
- Distillation
- Controls and Regulations
- The Real-World application

Should the WPTS set standards?
Resourcing
- Best formalized and collectively funded by industry stakeholders

Conclusions:
- The present situation
- Elements of a sustainable future
- Challenges to be addressed

Discussion Prompt SPE 204027
Steve Sawaryn

Next steps:

- ISCWSA's future path is determined by its members
- Feels like a critical point
- Needs and expectations
- Goals and focus
- Capacity
- Resources

Questions:

Bill Allen
BP

I know we had a chance to talk as a group at the subcommittee but one of the things seeing this again comes to mind is there a recommended path? The thought that came to me watching this again was one of the things, there's good and bad to the current configuration of these entities. The ISCWSA group that brings a lot of fruit to the Industry. I think it's a good meeting place of ideas and yet there is this pull for standardization and or standards and I think that would be a completely different organization. I don't think that's what's being recommended but I just wondered if you or the other authors have thoughts on not losing the value of what the group is now, but also being able to address those future needs to be more systematic in the industry and safe.

Steve Sawaryn –

Outstanding question Bill. The simple answer is no. I've got no clear thoughts on that. The whole purpose of writing the paper in the first place stemmed from the tasks that I undertook about a year and a bit ago, which is to sort of lead the charge on what elements of funding. The more that I thought about thought about it the more I was thinking well actually it's not just funding. Nobody's going to hand out a whole bunch of cash to us simply because we need money. There has to be a basis for it, and then when I started looking at well what is that basis, I started asking myself saying or similar questions that you just posed about what is the role? What are the actual industry needs? What are the priorities? How quick do we want to get there? And clearly the standard side of things are important. The training is important, and we've seen over the last 24 hours ISCWSA has invested something like sixty thousand dollars into its training effort to take over what UHI was doing. We've seen the contribution that various members have made to the p7, and the list goes on.
I fully support your notion we don't want to throw the baby out with the bath water. There is something good about being able to offer a lot of the stuff that we do free of

charge. It's there on the website. People can take and make use of it. The fear that I have is that unless we can keep pace with the changes, which I think are going to be quite rapid, people will go off and they'll do their own thing and we'll be left with the task of trying to pull together all these different ideas and notions to create if you like a standard as opposed to help guide it on the way. I use the word guide carefully because you know I mentioned in the presentation that you know the whole purpose is not to stifle innovation. So, I think there's a huge amount of thinking and strategic planning required to set whatever passive path it is that we need to go on. I do believe that a path deserves to be looked at and tackled and that is the reason for saying we need to have conversations around it.

Hans Dreisig -
Total

What struck me was the figure of sixty thousand dollars, which for a private individual of course is a lot of money, but if we look at the consequences getting any of this wrong it seems ridiculous that you wouldn't expect the companies to be able to cough up significantly more without even thinking about it. I'm thinking of the operators. The question is just how we do it, because typically if you want money you get to be told what I am getting for it, but could we perceive company subscription a little bit like we remember is that companies could be members of as a support because it's small in the big scheme of things. The second was also if we could use it as a board for when companies do have an initiative, to try and sound it on here because there's this dual thing everyone wants to do something where they perceive it as being a benefit in the competition, and at the same time I see a lot of the operators where they don't want to be the first to do something. So, there's this kind of you can get someone else to go along and you can kind of benefit and get a kind of blue stamp because it's always if something goes wrong it's nice to show that I did everything as per recommended. I'm thinking we must be able to sell this to the
Operators. It shouldn't be a hard sell. But the question is what are we selling? Because that's we need to give something where you say I'm buying that. It was not a very clear idea, but it was just it shouldn't be hard to get more money if we just have said and maybe just keep it a few things, this is what we think we can sell.

Steve Sawaryn -

Yeah, Hans great comment. Thank you. Certainly, going out with if you like the begging bowl, but offering something for the financial contribution is certainly on the list of things that we're considering. There are also some industry funds that we're looking that we might tap into. The combination of all of these will probably do the job.
It does seem quite a lot compared to the amount of money that we currently have in the kitty and to the income that ISCWSA gets each year, but in the big scheme of things when you see what it is that we do that actually and what it underpins within the

industry. I fully agree with you it isn't a huge amount of money. I think one of the tasks that we have going forward is to put together a package describing what we do and I think industry sourcing is one route that we could certainly look at going down. The only question again that I would raise is if such funding is given uh freely with no constraints on it that's easy. We need to be wary about where if there are constraints because you know what I think one of the big strengths as Bill pointed out is that we provide a lot of things for the industry, and they dip into it as they feel fit and that's I think a good thing to maintain.

Marc Willerth -
H&P

I guess is a question as much for the authors as it is for the group. When we talk about the things we need to do and starting down the path to get there do we need to first actually even align on what are some concrete goals we'd want to achieve or what the destination is? Or else we might start carving different paths in different ways.

Steve Sarawyn –

Simple answer is yes. Absolutely. The papers deliberate intention was a very broad brush. We looked at all the different things, the challenges that are being faced. We didn't offer a large amount or a great number of solutions, it was just to paint the picture of what it is that we need to prioritize. The other aspect of the paper that you know we felt obliged to do that increased the length was just to show the history. What it is that we've done with and for the industry and how far it goes back and what it underpins and that underpinning I think is going to get bigger not smaller because of the push to automation. The taking a cold look about what the priority should be as I put in the last slide is I think a key point. you spot on

Marc Willerth –

Indeed, even a clear goal because in my mind the separation rule is one where we set a clear goal and over a few years really achieved it and so we might need to have another one of those specific things where we want success.

Steve Sarawyn –

I think everybody would welcome lists and suggestions. You know I wouldn't want to speak for all of the committee, but it is a lot easier if somebody gives you a list of priorities and their feelings to deal with that than it is to say we need to do something and then not say what something is.

Ross Lowdon –

Yeah, Steve just to just to add to your comments, I think that there's two parts here. One is obviously we need to come up with a list of a list of priorities. I think we have some already and Steve's done a good job of characterizing those, and asking other groups for, and funding in order for us to achieve those goals but I think more broadly than that we probably if we were to and I think this is a difficult thing and if angus is on the call he will I'm sure say this as well but it's a difficult thing to bring groups like operators and service companies together say putting in five or ten thousand dollars a year each to fund something. The way that the companies give out money makes it incredibly difficult for one person or even several people to try and get all that money together from all these separate companies even with real push from within the companies and I think that's a difficult thing to do, which is why we went down the road of looking at other funding options, but I agree I would love us all as an industry to get together and ascend. I think it sends a very strong message as for us as an industry if service companies and oil companies get together and provide a fund for experts to expand. But as Steve said there's a balance to be had between turning this into a professional organization and what is now a volunteer organization. So, there is a balance to be had about how we go about doing that and you know going about funding professional writers or professional authors on a full-time basis and all this sort of stuff has a large overhead and can be difficult to control so I agree perhaps what we think the priorities might be going forward and then in the next meeting I think that's a very good idea perhaps we should present those priorities and have a discussion about it. In terms of funding, I would love us to come together as an industry and fund all our activities. I think realistically trying to make that happen is going to be difficult. there may be some people out there who want to fund this but then it becomes a political game and such and such a company funded this much and then somebody else funded this much and it could become a bit of a bit of a political bond fight as well. We must be careful of them going down that road. I think it's great we need more funds and there are things that must be done and must be paid for, and I think we should look at all avenues.

Mike Attrell –

I just had a question was there any discussion about approaching a standards organization like ISO who already has an established presence within trades and engineering industries to maybe develop some standards through them versus trying to champion the standards from our own position?

Steve Sarawyn –

I think the answer to that is certainly not yet, but the standards organizations tend to take the technical content from industries and then issue it at standards rather than if you like do all the donkey work themselves which is the reason why we considered the four-step model and the role that ISCWSA were actually of the SPE plays

in that which is the distillation process. You know we're very happy for somebody to take the distilled information that we produce and convert that to standard, and clearly because these are highly technical areas for ISCWSA were to spend time to draft them or to put them together in an initial form is appropriate too. It just gets rather onerous if all that administrative effort must be expended and we can see if you like just in the work that's been done through the API78 and that obligation will continue. So yeah, this is another avenue that we probably need to put some thought into.

Andy McGregor –

I was just wondering what sort of response you've had when you presented this from outside of this group. What do others think we should do?

Steve Sarawyn –

Andy that's a remarkably good question. I'm going to really stick my neck out here and say well no there wasn't an awful lot of comment and I think largely the rest of the industry is very happy for ISCWSA to carry on doing what it's doing simply because we have proven that we're actually pretty good at what we do. You know they trust us it's a very closely defined set of activities that are associated with the SPE as one of its more active subsections. So really, I think we we've already been given the remit to go ahead and do it. I think if we ask for help which is part of the purpose of writing the paper in recognition of all the fantastic work we do that help will be given but I think we just must articulate what it is that we really need, and the priorities and help will be forthcoming or at least that's what I'm rather hoping.

Phil Harbidge –

I was asking you know where's the money in the first session so I'm getting leaned on ironically by operators to where's the API/RP 78? We need the survey and the anticollision and data survey records, drilling survey records. There is some urgency, and it looks like it may be further delayed until something is resolved. I think another aspect of the committee really is you know the fact that everybody's volunteer but at a certain point no offence to Steve, but we need a success and succession plan as well. You know we have some unique firepower retiring, Andy brooks not that long ago and more will follow. So, we also need to look after the group in terms of somehow keeping them involved even when they're not employed as such. I think that should be something that we consider.

Collision Avoidance Subcommittee Update:
Steve Sarawyn

Actions:
Develop draft of the standard CA Report
Investigate tie-in mode for the ISCWSA sidetrack example
Intend in-depth discussions of collision example with associated root cause analysis
Invite human factors expert to assist with analysis of the above example
Discuss collaboration required with DQA/QC
Develop an updated list of CA related papers
Finalize the draft of the CA management presentation slide pack

March Meeting actions:
Arrange a virtual meeting to discuss the standardization of nomenclature across ISCWSA sub-committees
Organize a special collision avoidance meeting dedicated to discussing technical developments in the separation rule

Questions:

Benny Poedjono –

Steve this is again the discussion for everybody. Here's the thing that yesterday I have a talk to this safety moment. We don't have any collision in relation with the surface rule failure. That's why I called, and we've been putting a lot of effort into mathematically defining it, and just making sure it can fit all conditions. Currently we have eight separation rules plus one WPTS rule and yet we don't have any failures. Whatever rule that you are using in my view rather than diving on the mathematics there is another part of it that we have not pushed as a group. The risk management part of it. That's the thing that's really missing in terms of the overall workflow, so in the second paper we discussed about classification of how to identify and how to manage. My question is to the teams here rather than focusing on one can we just expand on what we have and then complete the whole picture rather than mathematically?

Steve Sarawyn –

I'll keep the response relatively short because of time but the purpose, going back to the previous meeting, the two-hour session is just going to be dedicated to discussing the separation model. Whilst I agree that the you know the mathematics alone, monkey safe, a common cause of failure in engineering industry is uh you keep shaving away margins until all of a sudden something happens and then you say whoops we've gone too far, we don't want to do that, and hence if like the focus on the math I think is actually quite important doing the tests but I hear what you're saying about the need to broaden out the conversation because you know the human factor side people are far

more responsible for the failures that we see than the actual masses, but we mustn't fall into a hole on the way.

Mark Willerth –

This is kind of now almost I guess echoing some of what other folks said but, in my mind, since we published the paper and are pushing the standards wouldn't the discussion be is the surface margin causing adverse effects in special circumstances? shouldn't the default be staying with the things we've already published and if there's not an adverse event for it avoiding the logistic complexity of changing our minds with the whole industry we're trying to communicate with as opposed to could we have gotten by without this?

Steve Sarawyn –

Again, the risk of dipping into the conversation that the meeting that we agreed to set up would be in between the times we've introduced the rev 5 model and the work on the rev 5 model and the changes that are in there have helped indicate that we might be double dipping and therefore we need to go back, and challenge. Part of the problem is that the cycle time for us to respond across the various parts particularly the error modeling and the collision avoidance is lengthy, and this goes back to the presentation that was made earlier on or starting out this session so ideally, we'd like to sort of stay but I think there are certain things that we can't because if we undermine what it is that we're saying we lose the credibility and we can't afford to do that so I'm just going to ask for patience. I'll organize the meeting and we can thrash through a few things.

Ross Lowdon

Yeah, just to come back to one or two points, I'm going to be very brief but basically, I don't think we have much choice but to get involved in some of the more risk analysis side of anti-collision and the reason I say that is that we publish the paper, we as an Industry, and there is nobody else out there grappling with this problem. We're going to have to push ourselves a little bit to go and grapple with that risk and side of the business and a little bit of drilling engineering and stuff. Most of us have a reasonable amount of experience in them and looking at these problems so I don't think it's beyond our capabilities by any means, and in fact I think by not being engineers ourselves or perhaps some of us are but generally we get to the nub of the problem rather than getting bogged down by the detail of the drill and engineering side of things so I think we can come up with some good guidance than I think we have before. Again, this all comes back to I think we need to grab that with both hands, and we need to drive it and we need to own that entire process.

Bill Allen –

I'll try to be quick as I can here, I would love to hear the discussion on this and everybody that's part of the A/C subcommittee. We get a lot of discussion in, and I think it's all good stuff and I find I'm listening to this commentary now and a lot of us are talking about whether we got this part of the equation correctly or that IPM correctly, and those are good things to fret about. One of the things I think this group could do and we should really think more about is an example between a drilling engineer and a nuclear engineer on a particular activity. I think it's where we find ourselves on the drilling engineering side an example is drilling engineer will put a barrier in place and when things don't go wrong it must be working. when a nuclear engineer puts a barrier in place they assume it's not working until they prove that it is. We're trying to put together a safety related rule instead of just trying to measure whether bad things happen therefore it must be okay. Maybe we should be rethinking how do we prove that it's working and assume it's not until it is, and I know that's a lot harder to do and it usually requires money and time and so it's painful and takes work, but to me if we look at it in that regards, we're not guessing anymore we're solving something. I'm not saying we're not doing that but that's the contrast there between two different teams. They're both very intelligent groups but the assumptions around the quality of the barrier is looked at differently so I'll leave with that.

Operator Wellbore Survey Group Update
Pete Clark

Vision
No Meeting This Year
Looking for new Chairperson nominees

OWSG API RP78

- Ongoing with no substantive progress
- Will Tank – Vice chair
- Draft with API for formatting
- Continue with Technical Review

Fully Automated Collision Avoidance Analysis and Wellbore Quality Monitoring in Real-Time
Ali Karimi / Jonathan Lightfoot

Outline

- Scope and Objective
- Workflow
- Directional Metrics
- Automated Offset Survey Loading

- The Discreet Boundary Model
- Ladder Plot
- Summary, Future Work, and Q&A

Phase 1
- Current Capabilities

Definition of Workflow Process
Real Time Survey Example
Plan vs. Actual Plots
Directional Metrics Explanation
Offset Wells Search Box
Offset Survey Uploads
Traditional Scan Methods
Utilization of The Discrete Boundary Model (DBM)
Calculating Distance between two UTM points
Conservating Safety Factor
Tool in Action: GUI Design

Summary and Future Work
- Directional drilling metrics are calculated real-time
- Offset surveys are loaded automatically
- DBM is deployed to compute the center-to-center distance
- User-friendly GUI
- More realistic separation factor calculations
- Real-time alerts
- Offline version of the tool for well design
- Further validations

Questions

Mike Attrell –

Thanks for the presentation. It's always good to see what other operators are doing and getting some ideas and insights from them. I just had a quick question on your plan versus actual metrics and the directional metrics. I guess the cumulative dog leg cumulatively and the unwanted curvature and torque velocity index metrics. Can you provide any insights and learnings that you guys have had after running these metrics on the number of wells and just kind of how you use those metrics in practice?

Jonathan Lightfoot –

We've implemented this into this dashboard, but we've been using these various tortuosity metrics and cumulative curvature type equations for quite some time to help evaluate maybe when we finish drilling what type of casing difficulty we may get as we run casing and we have a variety of other post well surveillance tools that we use where we've been plotting these values and just looking at comparing to try to better understand commands being sent down to the rotary steerable. We're primarily using verticals in the lateral so really trying to get a gauge on when we're steering and having you know a lot of azimuth control issues due to limberness of the BHA and using it to try to better stabilize our assemblies so that putting these in here we're looking at all the different metrics the utility rapid indexes also are helpful. We also have some algorithms that have been written for the energy and torsion some of the work that Robelo Samuel did and we're just still trying to evaluate which of these equations they all may have a little bit different story to tell, but that's something we've used quite often.

Benny Poedjono –

I like the system that you built. I noticed there is a couple of metrics in there so I just turned the idea for you maybe you should monitor also the ADP especially if you want to control the dog leg and for the anti-collisions part of your system. Put ADP in there because that's very critical.

Jonathan Lightfoot –

Allowable deviation from plan and traveling cylinder would be great to have and we also have some production monitoring systems where we can gain access to our nexus database to really know what exactly is going on with that well currently you know so that if you have a procedure to shut in a well you can verify that it is in fact shut in while you're drilling past it, that would be another piece

Benny Poedjono –

That’s very good especially for the DD. I presume this system was available in real time on the rig floor.

Jonathan Lightfoot –

Not yet a work in progress. You know this is a concept but one of the big things is that you know when you have wells that have operators trespassing in the subsurface into your lease acreage and that well might have been permitted may have been already be drilled and you don't know where that well is in and it's not in your database this allows

you to go search those industry databases and pull that data in and at least try to see is there a survey available for that well. If not maybe there's maybe there's a plan that we can generate that simulates where that well would have been from its first take points and last take points in its surface location and at least have that as a warning to notify me. Quite often we'll contact that operator and say hey if y'all drilled that well yeah oh you did you know can we run a gyro in it so that we can you know get a better uncertainty those are things that we do operationally, but you know this dashboard can give us the vision to do that and ability to pull that data in as a secondary check. I mean our primary analysis is with our industry standard software. This is going to be a dashboard to provide additional information to help validate what we're doing in the planning and execution phase.

Robert Wylie –

How do you deal with uncertainty in the valves when developing the mesh so in terms of selecting which one is closest for the trim ladder plot with a couple of wells may be relatively near?

Ali Karimi –

Especially when we get the data from IHS we don't have the uncertainty associated with them for not Oxy data that you put from IHS the plan is to incorporate well origin uncertainty that is estimated from the direct distribution studies and an experience between oxy geomagnetic verified location coordinates and the listed IHS coordinates. Those ranges of uncertainty will be applied to offset wells.

Knut Ness –

Just a practicality question when you get your real-time surveys in you obviously so to speak tie on your plan again and again how do you treat issues where you're failing to follow the plan? How does the system flag you or how does the system react if you are let's say requiring a seven-degree dog leg in order to get back on plan? How do you treat such things?

Ali Karimi –

We are in the phase two. We're planning to add some alerts that our engineers must specify what exactly what kind of alerts they would like to see. For example, this one as you mentioned could be a good example of the alert for example, you're not following the dog leg or you're getting too close to another wellbore that you didn't intend to and in terms of acting.

Knut Ness –

The problem I see is that it all of that requires again the human intervention and I mean this is where we want to go with the automation so that we don't need that human intervention.

Jonathan Lightfoot –

Well, if they have a plan well to get back to if they got off course far, they upload that plan into our planning database as a new principal plan then that takes priority over the AFE non-survey plan so quite often you can load that and then that will take precedence. Whatever plan is in in our software, in our case landmark compass, as the principal design that's the plan that's being used as the plan and that could be a plan that incorporates surveys up to a certain point and then those are the approved plans that are loaded otherwise you're implementing an algorithm calculation based on a schema and that's stuff that we're going to have to implement, and we have the code to do that and the knowledge to do that we just haven't fully adopted a set automated practice but there will be some options in there, user selected options, as well for the engineer, to adjust that as needed.

COFFEE BREAK

Error Model Maintenance Committee Update
Andy McGregor

Rev 5 Update
Documentation Updates
Working Group Report
Break Tool-code set into discrete blocks

Rev 5 Status:

- Last meeting status changed from beta to full release
- Changes in rev5 are
- Addition course length dependent terms
- Changes to misalignments and sag
- Breakout of geo-mag terms for relative uncertainty between wells
- Defined handling of tie-on to surface

Check on Random Misalignments

Rev5 Website documentation update

- Documented on ISCWSA website
- Added spreadsheets defining ISCWSA set of generic tool-codes
- Document defining the categories of geomagnetic model

- No diagnostic files yet

Standard Models – Set E
- MWD+HRGM+MS
- Dual Inclination Models
- Un-surveyed assumed vertical models

Documentation – Archive technical documents
- OWSG Rev2 Model definitions and diagnostics
- Technical notes by Steve Grindrod
- Presentations from Stefan Maus deriving the lrgm and hrgm magnitudes
- Derivation of the singular x-axis accel terms

Open-Source Error Model Implementation
- Well end Python library
- Calculate wellbore uncertainty data
- Calculate wellbore clearance and separation factors

Handling of Errors in Sidetracks
- Collision avoidance test set includes a sidetrack well
- Inconsistency in handling errors in that well
- Setup a working group to recommend best practice
- Has met three times since last ISCWSA

Calculation of Relative Uncertainty
- Existing method of calculating relative uncertainty will apply

Propagation: Term by Term Evaluation
- Reference DREF(S) and DREF®
- Scale Factor

Breaking models down into component parts
- >100 models in generic set
- Many are permutations of magnetic tool options
- Would be easier if published as building blocks
- Greater flexibility would allow more options
- Working group formed

Questions:

Bill Allen –

Andy, I like hearing about some of the building block concepts and I know I've heard that from others in the past. The one thought I'd have and I'm not sure there's probably two audiences if not more there's this group and people in this call especially people like yourself that can work the building blocks based on the more technical labels and such and deciding how to bolt it together or pick from a pick list but I think if for the software people in the room thinking about the users who are just trying to solve a problem I want to have better TVD control, I want to have a lot better long hole depth control or I want to have less lateral error, or I've got magnetic interference, I think the user needs to decide what are the challenges or constraints or what do they want to maximize or minimize and the software would then recommend a pick list or really that alone doesn't do it probably is a survey program because it may not be a single system. I'm just throwing that out there that if you're trying to solve it for the users, let them choose what their challenge is and not what survey system bolt together. I think that would be a step in the right direction but for you know this group and solving the problem of how to join up the models if you're doing a building block versus a pick list that's great discussion but again, I guess my comment I'm not sure if it's for this group or for the software programmers in the room I think is focus on the user not being somebody who'd even recognize the different pieces and parts to pick let them pick. My challenge is xyz and then give me an option of what tools or sequence of tools I would want to run to max or minimize that point.

Andy McGregor -

I think that's an interesting point. I mean one of the comments in the room when we had that conversation not quite the same as your one but its nowadays users get faced with a list of gobbledygook names for tool codes and some of the well planners will understand those, but a drilling engineer might not. I think what you're talking about is more into an expert system as well like you say it's designing a survey program or guiding a user into a survey program, and you know how many variables are going to be to play in that it's not just a pure technical I need an IFR or a multi-station or whatever but it's maybe the way we're going with the kind of machine learning and automation things that we provide those kinds of tools to the industry.

Benny Poedjono –

I just comment to Bill you know what the discussion before is very good I mean the approach that Andre took at the beginning based on what you the service provider, I think is excellent, but the questions and the comments are for the advanced user. The

next thing they're going to ask once you build the system, how much is going to cost you? And they want to do the sensitivity analysis that will be out of control of this group.

Carol Mann –

I just wanted to do a quick follow-up to Bill's comment. I think that's a great comment and the only thing we have to also keep in mind is for educated users that's great, there are a lot of uneducated users out there who say oh gee I can use or I like this error model because it gives me smaller ellipsoids so I'm going to use that but it has absolutely nothing to do with the actual survey that's going to happen so we just have to keep that in mind.

Separation Factor – Where are we?
Harry Wilson

Contents:
- Current status – SF type anti-collision rules
- Most correct SF formula
- Direct Hit vs Unintentional Crossing
- Conclusions

Separation Factor: What is it?
- Most widely used criterion for managing well separation
- Basic formula
- Limit Value
- SF relates to the probability of unintentional crossing, not direct hit

Direct Hit Probability by 1D Formula

Relation to Unintentional Crossing

Current Status:
- Many variants in use, lack of standardization
- SPE WPTS recommendation still not widely accepted

Explanation of current formula
- Example of non-intuitive results

Conclusions:
- We must fully understand SF rules and not rely on undocumented practice
- SF formula all relate to unintentional crossing, not direct hit
- SPE WPTS rule applies the best formula, but still flawed
- Its weaknesses are common to all SF Formulas

- ISCWSA must achieve a common understanding of the current status, then work to resolve the remaining challenges

Questions:

Benny Poedjono –

Harry thank you for highlighting all these things, crossing or intersection, for what we're doing today we make sure we identify HSE and non-HSE. That's the main objective just make sure we all be safe, and we can proceed drilling. I'm pushing the same question before, are we going to just keep spending the time pounding on this thing or the piece that is not being pushed is the risk management part of it. That is the big chunk of keeping us safe. For example, you mentioned none of this product is true, but you know many of the service companies implementing whatever their rule they've had since 2002 and we keep safe today. Have statistics been published as well to keep that going with the current situation? I mean are we still going to wait or just keep a different standard okay just like metric and imperial?

Harry Wilson –

I agree. I think that's well accepted. It's really the ACR that causes a collision; however, you know we are all using ACR's, and they should be optimized. There's so many out there that that causes discontinuity or confusion and makes everybody's life difficult. The lack of standardization across the board is disruptive it wastes time; It introduces a higher probability of failure to comply with whatever was intended, so I think standardization is a huge benefit for our bit of the industry and is kind of one of the objectives of I would say a key objective of the ISCWSA. You're right that this may not you know it may not be as big a problem in practice as we're perhaps suggesting here, but it is something that we can improve on.

Steve Sarawyn –

Harry many thanks for putting that together really very clear and deals if you like with some critical interpretation issues with the rule. One comment that I would make in your list of reasons why the wider adoption has not taken place that I think would be worth adding is there is no teeth applied to the adoption of the model. In other words, we've put out the papers as it were we've suggested to people that that is a de facto standard but at the end of the day there's no baseball bat to force people to implement it. The mechanism to implement it is the formal adoption within a standard and so long as it is an acceptable model to go back to something that benny was talking about it would represent a good starting point yeah so I think for me it's appropriate that we keep on pushing on this but to recognize that actually it's not going to be uniformly adopted within the industry until such a time as it is enshrined in some sort of legislative code

like the API or national standards and that we should put for or push for. I think there are a couple of other statements in there that you know less important but when we talk about what will be a no crossing condition, one could see whereby that may not be the case in the future that you could end up with a curved boundary on there but that is getting into technical detail that we don't need to at the time. I think what you've done is beautifully clear and for me at least if there was the addition of the statement regarding the adoption being endorsed by the standards like API/RP78 which everybody's working on now that would certainly do it for me.

Hans Dreisig –

Just before Total bought Maersk, we had tried to implement the rule and one of the things I was struggling with is that when dealing with a lot of the people working, their common sense is a very strong powerful tool and the problem was that the new rule with the square root of summation of this graphically, it's non-intuitive. You have okay situations with overlapping ellipses, and it just comes when you're trying to deal with people common sense keeps on stepping in and then re-interfering and I think that joins up with benny where I was faced with well in the past, I've never had problems with our rules. Our problem was usually more do dealing with dispensations to the rules and risk assessments. I've started putting more emphasis on bow ties looking between dispensation with rules and protected mechanisms and barriers to make avoid the HSE situation.

Harry Wilson –

Absolutely that's important but I think kind of separate and your example shows how dysfunctional this is. So, we have people, could we have operators to be like yourself that say no we're not going to use that rule, we use simple arithmetic summation of the penal curve radii at three sigmas. because we want three sigma confidences. Well, that isn't three sigma confidences. I don't mind them saying it's a completely arbitrary rule. it's worked for us in the past. But it's it doesn't like that they think they think they've engineered it and they haven't the simple summation of three sigma ellipses doesn't give you three standard deviations of relative uncertainty. So, you know if nothing else we could do this mathematically correctly that's a sound basis for moving forward. Now we're stuck with all sorts of historic misconceptions and we're wasting time wrestling with them.

Hans Dreisig –

What I was struggling with was because I don't understand the math enough myself to explain it in a convincing manner so usually what I 've been very happy with is being

able to show your documentation showing, this curve is right, that is wrong, so actually using the SPE paper to show this.

Harry Wilson –

That's exactly the example we have but that's historic you know that's how we did it we did it graphically and without any mathematics just arithmetic and the root sum square isn't correct either. That's just a temporary convenience as Andy's presentation from the error model committee discussed there is mathematics that will calculate the correct relative uncertainty. It's a single ellipsoid and if we're doing wrong sign, we'll take the pedal curve of that pedal curve radius of that single ellipsoid. It isn't the root sum squared that's just an interim convenience until we all implement the correct mathematics whether it be the summation of errors or the covariance matrix solution. it's the same mass we'll have a single ellipsoid of uncertainty which represents the relative uncertainty. Now we've got people looking at quite fancy 3d visualizations of two separate ellipsoids and thinking there must be space between them that's incorrect. So that's one reason we need standardization on the correct method.

Improving the ISCWSA 3D positioning and Error Models using Changes to A Long-Hole Depth Calculation
Phil Harbidge / Harald Bolt

Overview:

- Why are we talking about 3D positioning uncertainty?
- True along-hole depth
- Generic correction and uncertainty model components
- Correction model uncertainty
- What is new

Along hole depth is tied to the seismic section

- Estimated structural uncertainty in the seismic image displayed as displacements

Asset Lifetime Uncertainty

TVD uncertainty value

- Incorrect TVD can affect project estimated pay value and production rates
- Extreme cases up to 1MM bbl. per TVD foot error in reservoir modeling and production rate estimates

What is True Along-Hole Depth

Definition of current ISCWSA terms relating to A Long-Hole Depth

Opportunity for industry to managed AHD uncertainty

- Realities of real world well conditions
- Measurement technology used
- Drilling string architecture
- Measurement and correction accuracies
- Correction model accuracies and options
- Uncertainty requirements/expectations set

What's New – Proposed Uncertainty components

- Reference integrity and stability
- Length measurement calibration accuracy
- Correction accuracy
- Correction model fit
- Uncertainty calculation

References need to be managed
Different drill pipe depth correction calculations
New: Average correction value at any point
New: Way of determining correction uncertainty
Choosing a Typical Survey Program Accuracy Range
New: The role of polynomials
Correction Parameters measured while POOH
Directional survey log with corrected AHD value and uncertainty

Questions:

Andy McGregor –

I support correcting the along-hole depths. I think probably a lot of us on here do, but also recognize that it's really done in the industry so with the method you're discussing now. If you compare current uncertainties from the error model with the values, you get for uncorrected drillers depths what kind of differences do you see?

Phil Harbidge –

Well, the case example it was a big difference. It's a 50-60 percent difference. So, what I showed in the case example was the best possible laser tracking everything that is available in the industry now and it showed a significant difference.

Andy McGregor –

But what I mean is if you're running normal drillers depth, strap pipe, effectively what we model with the error model now, and you run the method that you're trying to promote for changing the error model purely the uncertainties how do they change if there's no extra corrections being applied to the drill pipe?

Phil Harbidge –

Well, we don't know do we unless we audit it and uh and follow our process and standardize it so it's not just about applying a correction it's part of the whole process, eliminating gross errors, eliminating drift from people not following procedures and allowing equipment to be uncalibrated, so it's not just about the correction. The idea is to get a standard approach and gather the data that is available and have it as an option so, then when this data is available, and the understanding is in place then where something extra is required in the survey program for example after you do the risk analysis, then you can pick the appropriate level of uncertainty that you want to have and then you upgrade the rig, or you change out the equipment and you follow new processes, and you apply that correction. That's the intention.

Gary Skinner –

Just so I understand that with terms of what you're doing with the uncertainty, we calculate the function and then we calculate a per station uncertainty that we then must store along with the survey log you then add that when you do your calculations is that correct my understanding.

Phil Harbidge –

Yeah, for the case history that's the only way of doing it now. I think basically zeroed the depth terms and replaced them with a calculated uncertainty and that is a it's a curve so the polynomial you either get the values from the polynomial or ideally, we calculate a polynomial and that is imported into the error model, and it uses it directly.

Gary Skinner –

With the data you've looked now is it possible to define a new depth term or a couple of depth terms that follow the current methodology as opposed to having a completely different way of approaching things because there's lots of other functions that we now just take it as it's statistical we've run a hundred million tools out there these are approximately the uncertainties that come out of it. We don't now go and put in an MSA corrected uncertainty for each of the stations so I'm just trying to think how we reconcile having the ability to tag the wells that have had additional processing with how we currently manage the error models.

Phil Harbidge –

Now the error models contain some theoretical values so like I said a couple of times there needs to be input from the equipment providers, the calibration process and just agree on what is possible if it's possible to change uh change some new terms and understand some different grades of depth and have those uh implemented in in the error model.

Membership Chair Update
Marc Willerth

Official Membership continues to slide
- Multiple factors
- Heaviest losses still in younger demographics
- Struggling with Lapsing SPE Memberships
- SPE overall has similar declining numbers

Renew your SPE Membership
- Ensure connection to WPTS technical section

SPE Members in Transition Toolkit

Breakdown by job classification
Professional by company category
Members by technical discipline

Questions:

Benny Poedjono –

Thank you for that information. One thing that the source of your data is SPE membership, so as we know ISCWSA could be outside SPE. Is there any way to track the members that not the SPE members? What I can see as I just mentioned before you know the membership is getting old. We need to get new blood in the system and the whole industry is losing the new blood. How from your perspective to make it attractive for the younger generation to come in and I think there should be a way for the non-SPE member to join ISCWSA. That's what the charter at the beginning to have a two separate silos or organization.

Marc Willerth –

Yep, so to address those I guess kind of one by one, one of the things that's a little complicated is the fact that we are a wellbore positioning technical section of the SPE and that SPE does provide a lot of resources for our events and things like that. There is an implied component of that where our members are supposed to be SPE members to attend.

Benny Poedjono –

There is no requirement Matt. I think that's a misconception. I can see that Robert Wiley can support my statement.

Marc Willerth

I know it's been different yes, the ISCWSA operates separately, but the best way we would have to track membership is either through registrations at this event or through the website where they sign up. Which would be a much lower number for sure than the numbers with the SPE, and then to come to the other question in terms of how to attract more folks I think that is something our industry is suffering from right now and perhaps some renewed ESG focuses and things like that might start making us look a little better. When the world gets back to normal I think a big part of it would be university outreach, getting students involved in things like this so when they join our profession they're already looking towards doing these types of activities to make it to make it seem normal to them that you would participate in a group like this as opposed to being something that you're several years into your career you got assigned to Ross's team or something and he made you come to this event.

Benny Poedjono –

I don't disagree with you Mark as you know the oil and gas is declining. I mean it's relying on the new university students I think is going to be very tough, even my sons not interested to join oil and gas. I got two boys they said no it's not for me.

Robert Wylie –

I mean basically I appreciate what betty was saying there about the fact that you don't have to be an SPE member to be at an ISCWSA meeting and that's really where I was going with part of my question here because it's part of the challenge that you really have big time as a membership chairman because you've got two different demographics really. You've got the SPE members who are supposedly on the SPE

technical section list and you also have the ones that are not and really what I was going to ask you about was maybe you can speak about the challenges we have in making the announcements about the meetings in terms of the SPE role in that and the communication to maybe non-SPE members who may not

Marc Willerth –

So, to try and guess at what Robert is trying to get me to say, there are challenges communicating with members and a lot of it is driven by new European privacy laws where for us to send out announcements and for us to collect a mailing list and for us to have these membership roles, we must follow a lot of procedures. The SPE provides tools that make that easy for SPE members who are you know voluntarily signing up checking the boxes and on our mailing list so we can reach out to them we can perform outreach, we can send mailers, and the other way for us to try and do that is through the efforts Phil's spoken to about getting folks to actually again actively sign up at our ISCWSA website but it ends up being this sort of self-fulfilling prophecy where most of our outreach only goes to people who have actively come to us and say would they want it it's hard to promote to groups who either don't know who you are or have not like actively given you their information to follow up with them.

Robert Wylie –

Thanks Marc, so basically what you're saying is our standard announcements can only go legally to those who have signed up to say that they can get the announcements either through the SPE website as being part of the wellbore positioning technical section or through signing up on our iscwsa.net as a member. That's the official announcement, emails will go out to them, so people who are not signed up to that, and people who I think was expressed in the last day or two who have their company restricts their email access to social media it then starts to get more difficult to spread the message in terms of how our meetings are presented or when they're going to be so I think that's maybe where we need to have to have some forbearance or some time given to us as the as the group in terms of how we get this out.

Phil Harbidge –

Just chipping in even more the non-SPE members are not allowed to vote in the proceedings. Officially we have a constitution and that includes it so everything you want to know about what you can and can't do is in our constitution and it tells you what you must be a member of the SPE, and you'll find it on our website.

Mark Willerth -

One thing that this group has, I won't say struggled with, because I don't think it's really been a negative thing is like at what point do you consider someone an ISCWSA member? Is it because they went to the website? Is it because they attended a conference? Is it because they go to three subcommittee meetings a year? We've never really had a hard line and I guess as phil brings up here the closest we could come to drawing a line is if they can vote.

Phil Harbidge –

We are open to the public, we have no boundaries, everybody can access all our material. They can't access the training without paying a fee but that's the first time that we've ever had anything that is a pay knowledge.

Ross Lowdon –

I'd just like to add perhaps we need to improve our social media footprint in other words spend a bit more time on LinkedIn adding in more information in there, maybe even posting some of the presentations that we've had and so on and so forth. That would help. The online course will help as well from a student perspective because what we can do is we can go around touching that to universities they're doing petroleum engineering or whatever perhaps is they can take it in part or its they can take the course in part or in whole but the point is I think that's that that's something else we can we can push but genuinely we do have a problem and the industry does as well but we need to encourage those youngsters who are still in the industry to come along to these meetings because even I'm getting old now, and I remember coming here when I was young and I would say I had hair but that was a lie.

Steve Sarawyn -

Is there a way of putting on the ISCWSA website a way of checking that we are a signed-up member in order to ensure that the communications will come through?
What we do if you like to make sure the communication or check on the communication to ensure that existing members are not actually slipping through the cracks?

Phil Harbidge –

When you log in you sign up for contact us or you log in as a member and it's not working yet I think you log in and sign up to the subcommittees, but you also allow basically email rights. You tick the box and then we can email you but not individually but just a group just like we do with the SPE.

Gary Skinner –

Woohoo! I get the last question. It was more a suggestion, but do we want to try and advertise for these meetings?

Adrian Ledroz –

Sounds like a good idea.

Meeting Close w/ Thanks to sponsors and participants as well as attendees.