45th ISCWSA Meeting – The Hague, The Netherlands – March 17, 2017

Introduction

(Jonathan Lightfoot)

- Kelly from the World Forum security staff provided a safety briefing. Holland emergency services number is 112.
- Son Pham could not make it, so Jonathan Lightfoot is standing in as Chairperson today.
- Election of Program Chair will occur at the next meeting in San Antonio. At that time Jonathan will become Chairperson of the ISCWSA.

Schedule and Program Review

(Jonathan Lightfoot)

- Overview of the agenda.
- There is a poster to view, so be sure to take a look at that.
- Overview of the pre-meeting survey results was presenting. Covered level of satisfaction with previous meeting, as well as a ranking of topics for future programs.
- We will present a new ISCWSA distinguished service award today. Dave McRobbie was the recipient at the last meeting.

Keynote Presentation - Collision Avoidance Management Principles, SPE 184730 Review

(Steve Sawaryn)

- SPE 184730-MS: Well Collision Avoidance Management and Principles. This paper was presented on behalf of the ISCWSA as a collaborative effort.
- Goal has been to standardize the disparate rules, process, nomenclature, and to reduce implementation errors.
- Adoption of a minimum allowable separation rule does not insure an acceptably low probability of collision without proper management and practices.
- First key is to identify if the offset well is an HSE risk well or a non-HSE risk well. Non-HSE risk wells can be addressed solely in financial terms. But there can be damage that only becomes apparent after some time, as well as other temporal effects that can cause problems. It is important to think deeply about whether a well is an HSE risk well or not.
- Well collision frequency: 1970-1980 had 3 collisions with uncontrolled flow to surface (1/2150). From 1980-1998 there was 1 (1/16330). But these were primarily North Sea, GoM, and Canada. Increased land-based drilling and closer spacing, as well as other concerns can increase the risk of collision. Also, there are also unreported incidents, no uncontrolled flow to surface, and changes in industry practices.

- A request was made for anonymous contribution to the group of well collision events. There were 19 of them over the last 15 years. These events were not recorded systematically due to the simple nature of the anonymous data collection.
- Risk habituation was a significant recurring factor in the collisions.
- Collisions are still relatively rare, but less so than indicated by previously published statistics.
- Well density is the major indicator of risk of collision.
- One example of a potential problem highlighted in the paper is drilling long horizontals close to lease boundaries. The EOU can transgress the lease boundaries, so it becomes important to know what wells your neighbors have in their database. This is not considered to be well addressed.
- The separation factor developed by the Collision Avoidance Sub-Committee will be presented in detail in the second SPE paper to be presented in San Antonio this fall (assuming the paper is accepted).
- Various ineffective mitigations for MASD dispensations were presented with the conclusion that they are not predictably effective.
- For graphical representation, for the current time, the sub-committee has decided to go with the traveling cylinder approach.
- A second graphical representation chosen is the ladder plot. It allows you to plot an approximate magnetic interference zone.
- Planning and Execution phase workflows are included in the document (two separate workflows).
- One important conclusion is that remediation cost for non-HSE risk collisions generally costs more than planned.

(Questions)

- Tyler Milford – There are only so much that surveys can do. Is there anything in the paper about ranging for mitigating collision? Answer – In the paper we say that if you are willing to go through the expense and time to directly measure well-to-well distance, then yes it changes your effective separation factor. But the more important point is of having a separation factor of 1 as a trigger to escalate the situation.
- Mahmoud Elgizawy – Dispensation is composed of two parts, prevention and mitigation. Mitigation is after the fact as I understand it. Prevention is what you can do to prevent a collision in the first place. It seems the terminology could be confusing. Answer – That's good feedback. The term mitigation was previously established in a document on the subject, but yes, it is really intended to mean prevention.
- Harald Bolt – You had a slide showing 3 collisions from 1970-1980 and a smaller number for 1980-1998, mentioning these were probably only the small number of reported events. How do you get people to spend money on prevention when you appear to be getting better? Answer – We recognize that circumstances change. For instance, vertical to horizontal wells, in-fill drilling near poorly surveyed wells. These changes

in operational practices means we have reintroduced dangers. Most of the suggestions do not involve a significant extra cost.

- Hans Dreisig – I find a major problem with preventative cost is that they don't come at the same time. For instance, shutting in wells years after the planning process to make them non-HSE can be astronomical.
- Shawn Deverse – Is it fair to say that the paper is not so much new practices, but a consolidation of existing practices already adopted by the industry. Answer – It is a consolidation of work, but there are some additional points in the paper.

Sub-Committee Activity Report: Collision Avoidance

(Steve Sawaryn)

- We have presented 1 of the 2 SPE papers, with the other tentatively scheduled for San Antonio this fall.
- Now the management practices and material will be passed on to the API RP 78 committee.
- The second paper will include the separation rule, the model, the parameters, various calculations, error distributions, well classifications, tolerance lines, and validation and assurance. It will also have worked examples.
- The bulk of the material has already been collected, but the process of putting it in paper form is forward work.
- There are a number of gaps that were identified during this most recent meeting.
- Some guidance on drawing and using traveling cylinder tolerance lines came out of the meeting. They will be addressed in the second SPE paper.
- A small set of "reserved decisions" was created. More detail to come in the second SPE paper.

(Questions)

- Gary Skinner – Will there be a statement that there is no HSE difference between an offshore and onshore well? Answer – No, my guidance would be to treat them all the same.

Technical Poster Briefing

(Manoj Nair)

- The poster details a new approach to determining the error in magnetic models.
- Please come by with questions.

What Depth? Review of wireline and drill pipe derived along-hole depth determination and how this relates to API RP-78 Depth QA-QC report. Introduction of a proposed method for driller's depth measurement improvement.

(Harald Bolt)

- We know that measured depth differences between driller's depth and wireline depth increases with MD, as does the spread of the data.
- Different depth measurement methods give different results. There is a disconnect between wellsite demands and the demands of later users in terms of accuracy requirements.
- Uncorrected MD on the rig might be accurate do 2 in 1,000. But can we do better?
- Driller's depth is measured with drill pipe. The value can be corrupted by various influences, such as compression/stretch, buckling, thermal expansion, etc. There are corrections that can be used, but they are often not used.
- Drill pipe length calibration: Manual strapping might yield 1 in 1,000 accuracy. Laster length tally can get 1.5 in 10,000. But without calibration for the other corrupting effects, this accuracy is degraded.
- Wireline length calibration can be based on dual wheels ("wheels only") or magnetic markers.
- The wheels only approach claims 5 in 10,000 accuracy after correction, but this number is not well supported.
- The magnetic marks approach can provide 1 in 10,000 accuracy.
- The big difference between driller's depth and wireline depth is in the corrections.
- A pull out of hole correction for driller's depth would make it more directly applicable to wireline depth. One such correction would be a POOH tension correction, which is repeatable.
- One of the results/graphs demonstrates that the elastic stretch correction is non-linear over the length of an S-shaped well.
- The key concept is that depth is determined while pulling out of hole. This one could get a True Driller's Depth.

(Questions)

- Angus Jamieson – What one or two things in correcting depth would give a significant step forward without costing too much money? Answer – The most important thing is for the data users to recognize what the uncertainty should be for their project. The moment that recognition comes into play, then the rest follows. And that will be an API RP 78 recommendation.
- Jonathan Lightfoot – I am a proponent of measurement while tripping. We could go correct our depths from the static surveys with this data. Tension is definitely something you would have to account for, but I think these things can be accounted for. I think turning the hole on memory and recording inclination and azimuth while tripping out of hole.

- Steve Sawaryn – Do you have any comment on the fact that the wireline is very flexible relative to the hole compared to the drill pipe. Would you expect to see differences due to that? Also, can you measure intermediate tension with wired drill pipe? Answer – The difference between the media is important, but the place to capture that is in the stretch coefficients. Also, the only stretch that is effective is the stretch that you measure when the pipe comes up thru the zero-depth point.
- Robert Wylie – In real time, I am looking at depths not just for measurement purposes, but also for optimization purposes. Making corrections in real time could be very important going forward. Another thing is that most people assume that the traveling block measurement is linear, when often it's not. I've seen 4 to 6 feet of variation over a stand due to non-linearity. Answer – That's one of the reasons why using the waypoint system you don't look at what the travelling block is telling you in terms of the calibrated length. I would avoid using the traveling block for anything other than the interpolation between stations.
- Shawn Deverse – You mentioned the difference between accuracy and precision. Do you have an opinion precision of the measurements when drilling a multi-well pad? Answer – In the same well the precision is very high. If you have a different well, the tension profile will change. It will be consistent on the new hole, but different from the previous hole. It doesn't go from well-to-well.

Correcting stationary MWD surveys using high-resolution inclination measurements

(Marc Willerth)

- Errors of process cover things that are outside of the sensor. Examples include drill string interference, sag, crustal anomalies, solar weather, and survey frequency.
- Survey frequency can cause aliasing in the wellbore position. More frequent surveys (< 30 ft) can remedy this issue. This problem is often called the Stockhausen Effect.
- Several options have been previously suggested, included continuous inclination, pseudo-surveys, multiple instruments, etc.
- However, changing drilling practices is often a non-starter. There is also a reluctance to add "extra" surveys.
- We seem to be ok with adjustments to existing surveys (for instance MSA and Sag corrections).
- Orientation is usually good, but the first thing we deliver is position. We could degrade the orientation accuracy for increased position accuracy. We could use various input sources (slide sheets, continuous survey data, etc.), but this is more about hijacking minimum curvature to get the wellbore position in the proper place.
- Real-time corrections can create dependencies for future solutions. Other constraints are required to make the process useful. But the problem is tractable.
- Some caveats are that directional drillers may have a requirement for accurate orientations to compute motor yield for instance.

(Questions)

- Leida Monterossa – I think this is a good approach to start getting industry acceptance that we have to do something better. However, I believe it adds artifacts to the trajectory that could be detrimental to other uses of the trajectory. For instance, in drag and tortuosity calculations. Answer – I think this is likely to be as good as a poorly sampled directory, though not as good as a high-resolution trajectory.
- Gary Skinner – Is the bigger problem that we are not sufficiently quantifying the TVD error with standard survey uncertainty. Is there something we could add to the error model to sufficiently describe that type of error and not sacrifice truth for beauty. Answer – There has been work on adding a course length to the error model format. One issue is that a lot of this error can come out of human interaction. However, directional drillers can sometimes cause issues thru the way they intentionally drill the well. You wouldn't want to put that in an error model.
- Ross Lowdon – Discussing the error model, what about if we took thousands of data sets together to quantify the effect? Answer – To an extent that's what Jerry has done. But part of it comes down to human error. Ross – If the DD knows he's being watched on TVD, it completely changes the way he drills. Jerry Codling – We are discussing the XCL component in the error model. It agrees very well with the 2.5 in 1,000 feet number you showed.
- Angus Jamieson – I would like to suggest a slight change to the idea. You mentioned adding synthetic surveys. If you've got continuous data, you could create a synthetic survey halfway back through the interval which forces position agreement with the more correct position. Answer – That is a good method, but it's just not done. This is a tool that geology will like that drilling will have a hard time objecting to.
- Patrick Knight – The DD drills to a point, and then we go correct the well and put it in a different place. The process does not fulfill the primary objective of placing the well in real time. Answer – That's why I was speaking of this in terms of real time corrections.
- Steve Sawaryn – The underlying problem is data density. Should we be thinking about alternative forms of supplementing that data. For example, if we actually measured the stress and toolface angle to get a slope and curvature at the point. That would probably do more good than any mangling up of the data we already have. Answer – We already have a lot of this data, but we just aren't using when we calculate a position. Stress data would absolutely be useful.

Sub-committee Activity Report: Well Intercept

(Chad Hanak on behalf of Roger Goobie)

- The ranging e-book content is done (one last scrub due by March 25th). It is awaiting a technical writer. Tyler Milford is checking on an option at HAL that may let us host the e-book directly. Otherwise, we will pursue other professional options.
- The desire is to have the Education Sub-Committee take over the maintenance of the book long-term.
- Purpose of the committee is largely concluded. It was decided to have one more meeting to verify the proper roll-out of the ranging e-book.

- Roger Goobie has completed his 2 year term. A new chair can be appointed if necessary.

(Questions)

- None.

SPE Technical Section Chair to provide a Drilling Uncertainty Prediction Technical Section Overview and Update

(Jon Curtis)

- The DUPTS is a new technical section of the SPE.
- Drilling Ahead of the Bit was a Saudi Aramco internal initiative to use math/science to predict and avoid drilling problems that cause invisible lost time and NPT.
- Saudi Aramco wished to make this a SPE initiative, but the name had to be changed.
- The DUPTS is composed primarily of NOC members at this time.
- The professional members are around 1,100 in number at the current time.
- The DUPTS addresses major challenges affecting the cost and efficiency of drilling operations.
- The well plan is developed based on geology, but then the driller gets the responsibility of managing of the geological challenges as they affect real time drilling operations, often without real-time support from the SME's.
- Based on experience, trying to set drilling rates based on expected formations can cause problems, and likely won't be more efficient than just allowing the driller to do the job.
- The idea is to integrate sensors with a "road map," similar to GPS navigation systems.
- Without such a GPS navigation system, the driller must accept a conservative approach by changing drilling parameters, mud type, etc. early. This translates into Invisible Lost Time (ILT).
- An exacerbating challenge is that the logging sensors are typically far behind the bit. That makes geo-steering of the LWD images inefficient, leading to snaking among other undesirable problems.
- One of the things the DUPTS is trying to promote is to make just the information from the Earth model that is needed in the drilling process available via RESQML.
- The DUPTS also looks for patterns of behavior in the drilling data that can be correlated with the logging data. This can be used to place your position in the geology to a certain degree and also project what you should expect to see ahead of the bit. May eventually be able to feed this information into a controller and automate the drilling process.
- A lot of people that are geo-steering have never heard of an ellipse of uncertainty at all.

- The problem we have is that all of the various bits of information are sitting in different silos. The only practical way around this is by creating a central data repository.
- We are at the beginning of the end of spreadsheets due to the need for big data analytics.
- There was a recent competition to determine lithology ahead of the bit based on machine learning. There is a website listed in the presentation with the results. The top 5 contestants all used the same mathematical technique. The accuracy of the result for the winner, when used on a blind well, was 90%.

(Questions)

- Jonathan Lightfoot – It's very easy to join the DUPTS section if you are already an SPE member. You can just click a button when you update your membership.
- Anas Sikal – Are we moving toward hybrid human skills between drilling and G&G? Answer – The computer does not have intuition. They are there to help build and vary algorithms. We still need people. The computer can pick up and auto-correlation, but it doesn't know what it's looking at. Jonathan Lightfoot – I think you are seeing more working together between drilling and geology.
- Marc Willerth – When you talk about the drilling signatures for each style of well, is that dependent on the BHA? Answer – Any change in the mechanical parameters will affect the ROP. If you have enough information from enough wells with different BHA's, you should still be able to determine the formation curve.

Sub-Committee Activity Report: Error Model

(Steve Grindrod on behalf of Andy McGregor)

- Agenda is listed in the presentation slides.
- We are currently in the process of coming up with a single document that includes both the gyro and magnetic error models. There is currently insufficient documentation to come up with consistent results. This is a work in progress.
- The demand for unique error model identifiers is cropping up from the API RP 78 effort. The OWSG error models have a check sum, but we need a standardized model for error model transfer. We will coordinate a small group to look at what WITSML is doing. We may use this for error model transfer as a standard, which would make checksums more useable.
- Verifying similar results between different software packages shows we don't always have the same interpretation of the existing literature. The issue of surface tie-on highlights this issue.
- There are similar issues with gyro error model verification.
- Suggest a 0.1% agreement for high-side, left, and along-hole values to validate error model calculation. This would need to hold at all survey stations.
- There are some issues with how you handle inclination only tie-ons.

- Jerry Codling mentioned putting in auto-lookup for magnetic reference field model accuracy based on a web-service methodology.
- Jerry also presented more extensive analysis of the XCL error model, and saw good agreement between empirical data and the XCL model. The purpose is to create a penalty in the error model for long course lengths.
- Jerry also looked at a modification to the misalignment terms to better match the empirical data. Jerry has the action to write-up the proposed modification.
- Chad Hanak presented an error model framework for rotating/averaging while drilling tools. There would be terms added to the existing models, while other terms would drop out. This is a work in progress.
- There was also a brief discussion on a degraded Azimuth MWD error model for top hole drilling. This may be similar to a proposal from Neil Bergstrom from a while back.

(Questions)

- None.

MEMS GMWD System Feld Test Comparisons

(Ross Lowdon)

- GDIS is the name of the tool. This is a gyro measurement while drilling tool.
- The GDIS tool consists of 3 axes of MEMS solid state gyros. It is a barrel-based tool that works in conjunction with a separate MWD tool.
- The gyros have a significantly reduced noise level. An accurate flipping mechanism is used to remove bias errors.
- Survey time is about 2 minutes, with the best survey pumped up.
- There is continuous toolface while sliding from the 3 axis gyro.
- There are multiple ways of triggering surveys, and multiple survey per correction.
- For QC we use Earth rate and latitude. We have a standard deviation indicator through the rotation cycle. We also use a shock and vibe indicator.
- The tool is calibrated via a true North referenced stand.
- Worked to develop an empirical and lab based error model; working on merging the two.
- We have run 21 separate runs with 26 separate runs. 1,300 operational hours, up to 110 degrees Celsius. 95,000 feet drilled. There has been 1 misrun.
- We have multiple surveys at each connection, so we averaged the ones that passed QC at the connection. Then the GDIS surveys were compared to definitive gyro and MWD surveys.
- The GDIS EOU’s use the empirical error model.

- EOU inclusion between the MWD and GDIS surveys (using the smallest of the two EOU's) was the metric used for analysis.
- There is a table of field test results in the presentation.
- There were a couple of tools that had misalignment problems from indexing. This problem has been fixed.
- The two runs with high azimuth standard deviations were vertical wells; this is a numerical artifact of how azimuth is defined.
- All the runs showed EOU overlap. 17 or 19 runs showed EOU inclusion.
- In conclusion, we have produced an accurate MEMS gyro tool. GDIS is comparable with other MWD and gyro systems.
- There is a reduced calibration requirement due to lack of significant mass imbalance. It has shown to be reliable and robust.
- There is scope for accuracy improvement.
- Further work is to come up with GDIS running procedures, as well as some added functionality.

(Questions)

- Andy Brooks – You used overlapping or enclosing ellipses. What was the confidence level? Answer – 95%.
- Angus Jamieson – The industry had to get to this point where MEMS is taken seriously as an alternative. What are the key critical success factors in getting the accuracy down? Answer – Having a robust mechanical system to spin the gyro and be able to drill with it was quite difficult. Also, the noise levels are fairly appalling. Some of the better ones in terms of noise are inaccessible due to military restrictions. Eventually, we would like to get to where we have a strap-down gyro.
- Pete Clark – Accels in the collar? Answer – They are mounted very close to the gyro. Pete – I assume it's gyro-compassing? Answer – Yes. Pete – How does the error model compare to the MWD error model? Answer – significantly smaller.
- Ezra North – What is the dimension of the collar? Answer – 2 1/8". Also, we know if we get to 150 degrees Celsius that there will be a degradation in the azimuth. We are working on that.
- ?? – What type of applications do you envision in the future, and what does the operational envelop look like? Answer – With the MEMS price-point, you could envision including putting them in completion tools or completions themselves. You could include them in a RSS tool. As far as the envelop, the MEMS gyro will take 250 degrees C without physical degradation, but the accuracy of the surveys degrades. We are currently at 150, but trying to get to 175. The accuracy halves going from 120 to 150 degrees C. It's a really fast drop off and you can't easily calibrate it out at temperature.
- Jonathan Lightfoot – Would you need to warm it up in cooler deep water applications? Answer – No, it's extremely stable up to 110 degrees C.

- Marc Willerth – One of the challenges is the flipping mechanism. Is the flipping mechanism not aligned with the tool axis? Answer – No.

Sub-committee Activity Report: Operator Wellbore Survey Group (OWSG)

(Pete Clark)

- Operators are reasonably well represented at this meeting, which is good.
- Looking for some ways to increase the uptake in the online surveying competency course from UHI. Some options are re-branding the course, and offering more presentation materials that can be distributed to the OWSG mailing list.
- A lot of the OWSG membership are involved in API RP 78, meaning the number of OWSG meetings per year is in a temporary lull.
- Email Ben Coco if you want to see the API RP 78 materials.
- Pace on RP 78 has slowed some but should pick back up soon.
- Pete Clark is now the chair of the API RP 78 committee, taking over for Lisa Grant (who is now with BSEE, thus necessitating her stepping down).
- Much of the RP 78 material is written. Now the challenge is to combine the 15+ sections and find the gaps. The goal is to have a recommended practice document for consumption by the average user. The e-book is used as reference educational material. We also need a home for reference instructional material.
- OWSG Positional Uncertainty models: There are A & B sets that are available. Contractor models are available. There is also an E set (MWD+HRGM+MS, XCL, Dual Inc). The E set will be eventually moved into the B set (hopefully).
- Continuous attitude measurement: there will be an attempt to characterize the types of available continuous attitude measurements. The intent is to give the user some independent reference material.

(Questions)

- Phil Harbidge – Do you have minutes for your meetings? Answer – I will be writing them up and send them to you along with the minutes for the previous meeting.
- Shawn Deverse – For the MWD+HRGM+MS, is that the same as the +SAG version with the 0.2 degrees for sag? Answer – Yes, not having it originally was an oversight.
- ?? – What is the desired RP 78 timeline? Answer – Hopefully by the end of the year, excluding a final editing pass.

ISCWSA Distinguished Service Award: Recognition of Steve Grindrod

(Pete Clark)

- Steve started at meeting #3 in spring of 1996. He has a great attendance record.

- Steve was the error model maintenance sub-committee chair for 10 years, and is still heavily involved. These error models have great adoption in terms of being an industry standard.
- Some of his SPE papers are SPE 178843 and 11382. Note the difference in the paper numbers.

Sub-Committee Activity Report: Education

(Carol Mann)

- Steve Mullin has decided to retire, so Carol has now been appointed Education Chair.
- We decided to nominate a distinguished lecturer for 2018: Steve Sawaryn. We should know by sometime in the fall if his nomination is selected.
- Collision Avoidance / Well Interception will possibly be in the US in 2018. We are evaluating the Middle East.
- We also looked into working with a multi-disciplinary team to look at how reserves change with positional uncertainty. It did not go off due to the timing of the event at the beginning of the downturn. It is still in holding.
- Money, Money, Money may be a workshop to target upper management (1/2 to 1 day).
- A topical luncheon was held in Dubai in 2016 in conjunction with SPE ATCE. There was one non-regular attendee from the Middle East. However, someone has pointed out that ADIPEC 2017 in Abu Dhabi would be a better place to test the Middle East waters.
- There will be a topical luncheon this fall in San Antonio.
- There is an effort to put out a flyer for the e-book in the SPE bookstore. There have been 20,000+ downloads so far.
- There will be no Kindle version at this point.
- The UHI Wellbore Surveying Course has been reviewed by the sub-committee, and there is agreement that it is based on ISCWSA recommendations. We are happy to do this for any other courses as well.
- We will be sending out some links and a nice logo that you can put in your signature.
- Also, we want a set of PowerPoint slides we can distribute that discuss what the ISCWSA does. There will be a short version and a full presentation.
- We will be asking people to give regional presentations. You can email Carol or Angus if you are interested.
- We will be reaching out to other societies, like the IADD. We will be asking about this too.
- Thinking about JPT advertising.
- Steve has agreed to do a Webinar for the SPE in June 2017. Carol will be the moderator.

- Last meeting we discussed creating youtube videos around the e-book topics. We have a list of topics. Angus will do some, but we need more volunteers for the 2-3 minute videos.
- Please like postings on our LinkedIn page. It helps raise awareness.
- We do have a Twitter account, but Carol does not tweet. Talk to Phil Harbidge about this.
- We are looking at a Web App.
- We would like better searching on the website, as well as to add categorizations to the talks for better browsing. We are going thru the categorization process.
- The Education page of the website has available resources. We are also looking for testimonials. We will also have a self-assessment available.

(Angus Jamieson)

- 50 students have taken the course so far.
- There is a Summer school planned (sign up and spread the word).
- Pioneer gave UHI the funding to run a pipe into Loch Ness (polyurethane), about 800 feet in TVD. Thanks to Pioneer.

(Questions)

- Chad Hanak - What does the web app entail? Phil Harbidge – Not quite sure, but we know it works on all platforms. Probably will start by populating it with educational material.

Quantification of Wellbore Collision Probability by Novel Analytic Methods

(Jon Bang)

- This was just presented at the SPE IADC 2017 conference. The paper number is SPE-184644-MS.
- The cause of direct hits and unintentional crossings is the uncertainty in wellbore positions.
- What is the acceptable probability? Depends on consequences.
- Existing methods are either complex/time consuming or approximate and only suited for simple geometries.
- For this method, the relative uncertainty is combined and assigned to the reference well. Then the wellbore dimensions are combined and assigned to the reference well.
- The mathematics of the method are described in the paper and the presentation.
- No assumption is made on the nature of the probability distribution function.
- Results are shown to agree very well with monte carlo simulation.

- For unintentional crossing, it is more appropriate to use Mahalanobis distance rather than the closest approach.
- A fence approach for creating a cross-over boundary is more appropriate to use than a single plane. Integration is then done in polar coordinates. Then each individual fence calculation breaks down to the probability of being in a sector and simultaneously past a certain distance.
- Included in the presentation is a table comparing the new method to existing methods in terms of their satisfaction of the Current Common Practices for Collision Avoidance Calculations ffrom the ISCWSA.

(Questions)

- Chad Hanak – Would using the Mahalanobis distance fix the closest approach method and make it conservative. Answer – Yes, Andy Brooks came up with that a couple of meetings back and that would fix everything. I tried to come up with a simplified method here with easier implementation.
- Harry Wilson – What would it look like if you included a comparison of the current standard method vs. this method for the situations where the current method is weak. Answer – As far as I see, these methods should be able to solve that because all points on the offset well are properly included.
- Gary Skinner – Going back to the human factors, do you think providing people with a probability could induce overconfidence? Answer – Possibly, but as it is now, you rely upon separation factor which has a lot of definitions. It's possible there is more false confidence in those results. There is only one interpretation here, and they are accurate as long as the PDFs are accurate. I think it's time to think in probabilities.
- Steve Sawaryn – Going back to the table you put up, you added some addition features such as probability distributions. Do you have to use Normal distributions? Answer – I had to assume a normal distribution for one of the mathematical simplifications, but it's possible it could be extended to other PDFs.
- Angus Jamieson – Can I suggest further work? With probability, less accurate tools can sometimes yield a lower probability of a direct hit. That could determine bad surveying practice. Is there some other way of presenting the risk? Answer – I agree with that concern. We should consider how to present these results. There is a small discussion on that in the paper. We could try to redefine separation factor so that it is monotonically related to probability.

Webmaster's Report

(Phil Harbidge)

- We have a brand new www.ISCWSA.net website.
- A list of the officers is available on the webpage, hyperlinked to their email addresses.
- The minutes of the meetings are now presented in a much more user-friendly format, along with the presentations.

- Soon we will make the website searchable by keyword.
- Sub-committee meeting minutes are available on the website, along with the purpose of the sub-committees.
- Sub-committees have the ability to modify the content of their sections. Let Phil know.
- The SPE.org website can be used similarly to the LinkedIn account to distribute information very quickly. We can join technical sections with the DUPTS to get a larger distribution footprint.
- The presentation has visual instructions for joining our (or other) technical section.
- We are adding search engine optimization, and contact forms.
- We have now taken over www.iscwsa.org and redirected it to the *.net site.
- Send ideas for a potential web app to Phil.

(Questions)

- None.

Treasurer's Report

(Robert Wylie)

- Thanks to our sponsors Petrolink for lunch and MagVAR for the networking event.
- There were 74 attendees at the previous meeting. Revenue was $11,000 and sponsorship of $3,000. We added to our account on that occasion.
- This meeting we have 63 attendees (est.) with a net income.
- Current bank balance is around $84,000, which puts us in a healthy position for future meetings and for funding the education sub-committee.

(Questions)

- None.

Secretary's Report

(Chad Hanak)

- Send me your new email if it has changed.

(Questions)

- None.

Closing Statement

(Jonathan Lightfoot on behalf of Son Pham)

- Thanks to all the presenters for presenting and all the people who help put on these events.
- Next meeting will be October 13, in San Antonio, TX.