



Minutes of the 31st
Meeting of the



**Industry Steering
Committee on
Wellbore Survey
Accuracy**

and

**SPE Wellbore
Positioning Technical
Section**

AT&T Executive
Education and
Conference Center

March 3rd 2010

Attendees:

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Attendees continued...

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* Chair

** Minutes

Austin Texas SPE ISCWSA meeting 3rd March 2010

Simon McCulloch opened the meeting and thanked Aubrey Holt and Kim, Bench Tree for sponsoring and arranging the meeting venue.

Stefan Maus, Manoj Nair, (University Colorado and Boulder, USA)

Presented on The National Geophysical Data Center's Enhanced Magnetic Model (EMM)

Wayne Phillips, Schlumberger, asked how Stefan Maus, University Colorado knows that the degree variance goes down as the graph shows an extrapolation and no real data.

Stefan Maus, University Colorado replied, we know and understand the slope and we think this extrapolation is correct.

Harry Wilson, Baker Hughes asked if this product is commercial and asked if it will be released?

Stefan Maus, University Colorado responded that it is publicly available on the website and everything presented here is public domain information.

Andy Brooks, Pathfinder said that for the root mean square (RMS) data used for the comparison, ISCWSA error models assume the errors are normally distributed, and it is known that the error source is not normally distributed. But rather it is actually heavy tailed. Andy also asked if there is any recommendation on how to deal with that, (heavy tailed distribution of the presented geomagnetic data)?

Stefan Maus, University Colorado, replied No and said that was a good question.

Simon McCulloch, Maersk asked if there is difference between the EMM and BGGM?

Stefan Maus, University Colorado replied that for the BGGM there is not a large difference from the IGRF model. And the main difference (between the IGRF and BGGM) is that BGGM has annual update on main field component.

Truls Hansen, University of Tromso, Norway

Presented on Magnetic Effects of Earth's Ring Current

Benny Poedjono, Schlumberger asked if the data for the DST (The strength of the ring current is described by the geomagnetic index DST) at -350nT was from the BGGM or IGRF model?

Truls Hansen, University of Tromso stated that the data is from the IGRF model, and stated that it doesn't matter which model you use, it will have the same outcome.

Kevin McClard, PDT asked Truls Hansen, for the web address where the DST data is available.

Truls Hansen, University of Tromso stated that it is real-time updated, from Truls presentation [<http://wdc.kugi.kyoto-u.ac.jp/>]

Kevin McClard, PDT asked what Truls Hansen assumed to be a low latitude range, compared to a high latitude?

Truls Hansen, University of Tromso stated that it would depend on where you are and further explained if you were at high latitude you will see these effects and that both effects were seen globally.

Harry Wilson, Baker Hughes asked if there are any data on what happens at mid latitude locations?

Truls Hansen, University of Tromso replied yes and that both are affected (Mid and high latitude locations).

Harry Wilson, Baker Hughes asked how the effects can be seen two weeks in advance of the storm occurring and how is that happening?

Truls Hansen, University of Tromso explained that the storm occurs up to two weeks in advance in outer space. This is the true start of the magnetic storm and is not normally considered a start of storm until it affects the Earth.

Simon McCulloch, Maersk asked Truls Hansen, University of Tromso to confirm if the effects mentioned occurred globally.

Truls Hansen, University of Tromso confirmed yes, this is global.

Daren Aklestad, Schlumberger

Presented an update for the WITSML project

Daren Aklestad, Schlumberger stated that the release of the WITSML version 1.4 update is being worked on and that the group are ticking off the remaining work to be done.

Andy Sentence, Dynamic Graphics stated that the next WITSML meeting will be in Bergen.

Bob Waters, Bench Tree

Presented on Accuracy Requirements of Magnetic Survey Sensor for Different Locations and a Means of Checking Their Performance

Bill Allen, BP asked at what range Bob recommended tools should be calibrated.

Bob Waters, Bench Tree replied between 165deg Celsius and 200 degrees Celsius. The higher temp tools more susceptible to vibration effects and in generally units are supplied.

Phil Harbidge, Baker Hughes asked what effect could thunderstorms have on the calibration process and survey tools while drilling?

Bob Waters, Bench Tree replied that thunderstorms have low frequency effects at approximately 0.05 hertz and the Earth's field is affected locally by sporadic lightning effects and cloud to cloud electrical transfer effects.

Michael Terpening, Schlumberger asked Bob Waters, Bench Tree if he has seen any occurrences where sensors and in particular magnetometers could not be recalibrated due to drift from exposure to vibration and other effects?

Bob Waters, Bench Tree replied no and he had never seen a magnetometer sensor that needed to be discarded due to a hard failure from such effects. Bob explained that he recommended that where possible, operations should always try to do roll tests and re-recalibrate to rectify the problem if found. Bob also explained that it is very important to do roll tests before running tools due to large shocks and vibration conditions encountered prior to running in the field.

Rene Ray, Bench Tree, added that when the calibration process is going on, there is monitoring of the Earth's magnetic field and thunderstorm effects do not affect the calibration process or outcome.

Dr. Xiong Li, Fugro Gravity and Magnetic Services Inc.

Presented on Surface Magnetic Surveys for Accurate Wellbore Positioning

Andy Brooks, Pathfinder asked how many equivalent sources would you use in a typical calculation, (magnetic model)? Andy then asked is each equivalent source at a different depth?

Xiong Li, Fugro answered one source was used with one depth.

Adrian Ledroz, Gyrodata asked if you get a unique solution with this method?

Xiong Li, Fugro answered saying that there is no unique solution and stated that all geophysical inversions do not have a unique solution.

Adrian Ledroz, Gyrodata asked how do you choose which solution and how do you quality control which solution to take?

Xiong Li, Fugro answered that they (Fugro), do not have so many controlling parameters. Xiong Li also said that parameters are used to choose which solution to use.

Robert Wylie, NOV

Presented the Treasury update report

Robert Wylie, NOV told the audience that there were 66 attendees paid for the Austin Texas SPE ISCWSA meeting which is an improvement. Robert updated on the recent New Orleans and Amsterdam meeting debts and stated that the debt has been cancelled out by the takings from the subscription fee payments to date and that this leaves a balance in the accounts close to the amount needed to fund the next SPE ISCWSA meeting if no alternative funding is obtained.

Simon McCulloch, Maersk suggested that the group could use SPE provided lecture halls if available possibly on a weekend day, i.e. Sunday to be held for the main meeting.

Bill Allen, BP asked if the group had looked at a petroleum University who we could approach and possibly invite students into the meeting and use their facility?

Robert Wylie, NOV asked the audience for proposals for funding next meeting in Florence Italy, on or around the 26th September 2010.

No further suggestions on funding or sponsorship offers were given by the audience.

Simon McCulloch, Maersk stated that the treasurer and secretary and the other elected members would need to stand for election soon and asked for volunteers for these positions.

John Weston, Gyrodata

Presented on IFR-MSA May Be Less Accurate Than Predicted

Xiong, Fugro asked from slide number three, showing inconsistency among general or conventional MWD and MWD+IFR+MSA that for shallow depths from Gyro to Conventional MWD and what is the reason that you did not compare the Gyro to MWD_IFR+MSA?

John Weston, Gyrodata explained that based on the error model, the IFR and MSA correction we would expect to be at a similar performance to the gyro and what we do not expect is this jump between the two.

Xiong, Fugro clarified, asking John Weston Gyrodata if the IFR+MSA is quite close to the Gyro throughout the entire depth range?

John Weston, Gyrodata answered yes and that is what the error model prediction suggests.

Andy Brooks, Pathfinder asked that after the studies were performed, were you able to resolve the discrepancies that were seen here, (referring to the MWD+IFR and Gyro azimuth jump between the two data sets)?

John Weston, Gyrodata answered no. John Weston, Gyrodata explained that these were the results that raised concerns and initiated the study which led to the analysis.

Wayne Phillips, Schlumberger asked if you were in a situation where the possible field was small and there was no significant drill string interference, would you expect this exact result where the MWD and the MWD+IFR lie on top of each other, (i.e. the azimuths for both the MWD and the MWD+IFR would plot very close to each other as shown in slide 3).

John Weston, Gyrodata answered Yes that is true.

Adrian Ledroz, Gyrodata added that he thinks the problem, there, is that size of the uncertainty of the MWD+IFR+MSC is similar to the Gyro uncertainty but the actual azimuth is different so the ellipses would not overlap.

Wayne Phillips, Schlumberger added it is different and it looks like something happened in the well that is reflected in the Gyro at around 1500m MD. There is a jump in the azimuth at this depth and it looks like the same has happened again where it shows up on the MWD data (shows and azimuth jump in the MWD+IFR+MSC data) and it is not shown in the Gyro azimuth because the Gyro is not overlapping. Wayne suggested that it is incomplete data and he did not think that there is any conclusion to be drawn from this.

Simon McCulloch, Maersk added that he agreed with Wayne Phillips, Schlumberger and suggested that he could think of many field around the world where there was not much of a crustal anomaly and therefore for wells drilled with well spaced magnetic survey tools the magnetic survey will not vary much when you apply an IFR and multistation correction (referred to earlier as IFR+MSC). Simon quoted a difference of about 0.7 degrees azimuth difference between MWD and the multistation corrected azimuth is often seen (MWD uncorrected and MWD Multistation corrected azimuth). Simon stated that he had seen many cases where validated Gyro surveys had been subsequently re-run with another Gyro survey taken on top of the first survey from the same company and that it had been seen to be out by more than that (more than 0.7 degrees azimuth difference or azimuth bust).

John Weston, Gyrodata replied that perhaps this is a bad data set example to use for this presentation.

Dave McRobbie, Tech21 Suggested that there was a need to look into this example further. Dave McRobbie, Tech21 described that looking at the data at approximately 2300m MD and the fact that the Gyro survey stops at that depth, potentially we are looking at the casing break. Dave McRobbie, Tech21 suggested this (referring to the jump in azimuth between the MWD+IFR+MSA and Gyro surveys) could

be where the casing gyro survey stops, the casing was set and then there would naturally be a drill out at this point. Dave McRobbie, Tech21 suggested that drilling out of the shoe would normally be drilled with a right turn. And potentially the dataset shown by John Weston, Gyrodata is representing a normal drill out situation with a rotary assembly. Dave McRobbie, Tech21 suggested it would be good to clarify this situation in relation to other similar datasets which may have been used in the study.

Benny Poedjono, Schlumberger, suggested that gyros do have problems at horizontal East and West attitudes.

John Weston, Gyrodata agreed that gyros do have problems when trying to survey horizontal East and West.

Ross Lowdon, Schlumberger suggested that some papers do state that it is not recommended to run MSA (multi station analysis) when horizontal East West and that this is an industry known issue. Ross further explained that it is still possible and recommended to apply (the IFR or IIFR) declination correction even when it is not possible to apply the MSA process or correction. Ross further explained that service companies have a responsibility to only apply IFR and MSA where appropriate.

Bill Allen, BP suggested that further work could use a dataset where both data were included (and overlapped).

Harry Wilson, Baker Hughes

Presented on the Collision Avoidance Work Group

Harry explained that there are three collision avoidance documents which have been written and are maintained by the group (Collision Avoidance Work Group). The three documents are the Lexicon (dictionary of collision avoidance specific terms), Bibliography (list of papers relevant to collision avoidance), and the Current Common Practice document.

Harry Wilson, Baker Hughes explained that one of the added items to the Current Common Practice document is a recommendation about the use of the separation factor or R-Type collision avoidance rule in the document. Harry Wilson, Baker Hughes explained that Bill Allen, BP requested that collision avoidance process management be addressed by the group and further explained that one could produce a sophisticated error model and rule and the user could apply them inappropriately. Harry Wilson, Baker Hughes explained that Bill Allen, BP has already done some preliminary work with some operators offline.

Harry Wilson, Baker Hughes stated that the group has reviewed the Lexicon document and no changes have been made to it and that the Bibliography has some new papers identified for addition.

Harry Wilson, Baker Hughes explained and that all the documents can be found on the ISCWSA.org website, [<http://iscwsa.org>] click on the [Collision Avoidance Sub-Committee](#) link.

Ross Lowdon, Schlumberger

Presented on Well avoidance with vibration analysis

Pete Clark, Baker Hughes asked if the vibration sensor is run in hole, cemented in place or somewhere else?

Ross Lowden, Schlumberger answered no, the sensor is strapped onto the riser or the conductor above mud line with a wireless link to the surface system computer.

Shola Okewunmi, Chevron said this is a very novel approach. Shola asked if the effects of deep water vibration are considered, for example how does the service account for deep water effects such as VIV (vortex induced vibration)?

Ross Lowden, Schlumberger answered by explaining that the current application has been focusing on a simple situation first, including running for non deep water applications where the background vibration is as low as possible. We need to prove this for a simple scenario application before we move onto more complex scenarios with more complex background effects. Service considered vibration from a VSS type sensor, (a VSS can be a vibration stick slip type sensor)?

Ian Mitchell, Halliburton Sperry Drilling asked if the isolation (vibration isolation) from conductors is important? For example if you are looking at multiple flow lines connecting conductors you could have an issue.

Ross Lowden, Schlumberger answered yes and explained that you need to take data for some time without doing anything (i.e. without drilling ahead), in order to establish the base line vibration levels for all of you offset wells. After that is established, then you can start to drill. Ross agreed that this will be an issue.

Ross Lowdon added that for the operators requiring this service, if they are willing to fund a project, he would be more than happy to listen to them.

Phil Harbidge, Baker Hughes asked if the offset well or wells were shut in when this vibration monitoring service was used for this example?

Ross Lowden, Schlumberger answered Yes and added that the big prize would be where you could run this service and not have to shut in wells.

Robert Wylie, NOV asked if depth was an issue for this service for collision avoidance with respect to how deep you can run this service? Robert Wylie, NOV also asked if formation was a major factor affecting the service results?

Ross Lowden, Schlumberger answered that we could still hear the drill bit at 1000ft (approximately 300m) depth and the drilling well was thought to be more than 15 meters from the well being monitored.

Robert Wylie, NOV then asked if the seismic while drilling team have been involved (Schlumberger)?

Ross Lowden, Schlumberger answered no, but he agreed that he needs to talk to them about this work.

Shola Okewunmi, Chevron asked how soon this service will be available?

Ross Lowden, Schlumberger answered that there is approximately six weeks lead time from service order to delivery of the sensors. And that more funding would be required to work up software, standard operating procedures and a better sound filtering and warning system.

Ross Lowden, Schlumberger added that at first, all the service will be able to do is log data and it will not be able to position well the exact positioning of the well would not be possible.

Ian Mitchell, Halliburton Sperry Drilling, asked how do we know if the vibration or noise that is detected is actually coming from the drilling well?

Ross Lowdon, Schlumberger agreed that it is not easy to determine and that a system needs to be developed and more data is needed. Ross Lowdon, Schlumberger also stated that it was a benefit still having the GMWD in hole for this job and the sensor could be calibrated using the GMWD data and that the service may also benefit from some of the ranging service techniques available to make the service a failsafe service.

Phil Harbidge, Baker Hughes

Presented on The need for JORPS for Collision Avoidance

Simon McCulloch, Maersk asked if this (presented JORPS for Collision Avoidance) is what you do or would like to do?

Phil Harbidge, Baker Hughes answered yes this is the Baker Hughes system for managing collision avoidance policy.

Simon McCulloch, Maersk asked if Phil Harbidge, Baker Hughes had been sent or opened up a proposed client collision avoidance policy that was not acceptable and did you successfully manage to change their (clients) minds as it is not necessarily only a case of getting them to sign off to take responsibility?

Phil Harbidge, Baker Hughes explained that in one case a client had been asked if there were any offset wells, and the client did not answer and further explained that for one offset well there was about 2500m measured depth before the first good survey and insufficient information on the well status. Phil Harbidge, Baker Hughes explained that he had seen other cases where operators had their own policies with some key parts not adequately described or were missing but if the equivalent parts were added then the client policy was fine and safe to use.

Phil Harbidge, Baker Hughes explained that negotiations were made to add the missing sections or parts such as casing size and hole size.

Simon McCulloch, Maersk asked again that it (it being the collision avoidance policy) must first be acceptable to Baker Hughes before it can be used?

Phil Harbidge, Baker Hughes answered yes and added that ultimately it is the operators risk and responsibility, however Baker Hughes were only a visitor to the rig.

Harry Wilson, Baker Hughes added that it was only the HSE risk and that Baker Hughes would only intervene where the HSE risk was deemed unacceptable.

Shola Okewunmi, Chevron, asked how the other service companies and operators would react if a client's policy contravened their collision avoidance policy and does Schlumberger and the others do the same?

Benny Poedjono, Schlumberger stated that Schlumberger implement their rule regardless of the client rule (Collision Avoidance Rule) and both rules are implemented side by side.

Shola Okewunmi, Chevron asked if Schlumberger had ever had a situation where there was a contradiction in the rule (Collision Avoidance Rule)?

Benny Poedjono, Schlumberger replied yes, and explained that if this occurred Schlumberger would follow the Schlumberger potential HSE risk matrix process. Benny Poedjono, Schlumberger further explained that if there is an unacceptable anti-collision outcome then Schlumberger will not drill the well. Benny Poedjono, Schlumberger also stated that it is important that the negotiation process is done where this is a conflict of HSE risk identification between the client and Schlumberger.

Gregory Forde, Baker Hughes stated that you can recognise that for the discussion so far that there is a base standard that all the contractors agree to, so that when operators approach the contracts and if the operator is told that they cannot drill a well because there is an HSE risk, then the operator cannot just go to the next contractor to drill this well. Gregory Forde, Baker Hughes restated the point was made earlier that operators can evaluate the financial risk but the HSE is the top priority concern and that is true of all the contractors in the industry.

Bill Allen, BP stated that it is good for the operator community and they like to see where the contractors have their own policies. BP has its own policy. But it is good that the contractors will look at the HSE risk and they will not just send out their engineers to a job unless it is safe. BP does not discourage contractors from adding value to the HSE risk management process.

Jason Pitcher, Halliburton-Sperry Drilling stated that Halliburton are on board with the discussion and they have their own policy and procedures which they follow and they work to the highest standard, and if the operator has a higher standard then they will work to that, but they will not compromise and go down. Jason Pitcher, Halliburton-Sperry Drilling described a situation where they have had operators

saying that they did not care about a major risk situation and told them to just drill the well. Jason Pitcher, Halliburton-Sperry Drilling stated that in this case they would try to negotiate to manage the HSE risk but said that they would not compromise their anti-collision policies.

Jason Pitcher, Halliburton-Sperry Drilling added that it was easier for the major service companies to do this, (manage collision avoidance HSE risk and not drill unacceptably high risk wells), but that it is more difficult for the smaller service companies and is more commonly seen in North America.

Phil Harbidge, Baker Hughes added that he agreed that an operators procedures and policy was more safe than an alternative service contractor's policy, then it should be used to make it as safe as possible. Phil added that he thought it important to note that this is not stopping you from drilling, it is raising a red flag (HSE risk) and making you deal with or manage the HSE risk first then the financial risk can managed in a separate process and this is the start or trigger for the communication between the service company and the operator to manage the HSE risk and drill the well safely.

Shola Okewunmi, Chevron stated that it is critical to enforce the rules at the rig site and Chevron want to encourage this process to improve management of risk at the rig site.

Phil Harbidge, Baker Hughes added that this presentation addressed one of the items included in an extensive list of proposed items to be included in a new Collision Avoidance Work group, Collision Avoidance Management document , presented by Bill Allen, BP at the Collision Avoidance Work Group meeting yesterday on 2nd March 2010.

Robert Wylie, NOV asked the collective audience how do we (ISCWSA) communicate with the smaller operators and contractors drilling in North American land operations?

Ian Mitchell Halliburton-Sperry Drilling

Presented on Improved Accuracy of Borehole Positioning in Horizontal Wells

Simon McCulloch, Maersk stated that he noticed the 0.06 figure was used for misalignment and that was left or remained, but with the rotary steerable that was used, did you not consider that this could have been randomised and could this figure (0.06 degrees Sag misalignment) be reduced in size?

Ian Mitchell, Halliburton-Sperry Drilling answered no and explained that that (randomization from drilling with a rotary steerable) had not been taken into account.

Simon McCulloch, Maersk asked if they were running a multistation analysis on the accelerometers to reduce the uncertainty?

Ian Mitchell, Halliburton-Sperry Drilling answered Yes, and explained that multistation analysis was run in real time for the primary sensor Gz and that for the secondary probe only inclination (calculated inclination values) data was pulsed at the time.

Andy Brooks, Pathfinder asked that given it was a soft formation, do you have any idea of the sensitivity of the sag correction to whether the hole was in gauge and would this affect the results?

Ian Mitchell, Halliburton-Sperry Drilling, agreed that it would affect the result and that no affect was noted from the results in this job and that it was not something that was looked at closely for this case.

Martin Cobern, APS asked if an over gauge hole would significantly affect the SAG corrections and asked if they saw any evidence of this (over gauge hole effects on the SAG correction) in this well?

Ian Mitchell, Halliburton-Sperry Drilling, replied Yes and explained that potentially it would (the over gauge hole would affect the SAG correction), and they did not see evidence of this in this well and that there was good agreement between the two sets of data and that there are other sources of error in addition to sag correction.

Kevin McClard, PDT asked how much was the survey frequency over what you would normally run for a survey and is it a function of the BHA (configuration)?

Ian Mitchell, Halliburton-Sperry Drilling replied that the survey frequency was not increased to make any additional corrections and that the corrections applied were standard multistation corrections. The increased survey frequency came from the fact that the spacing between the probes was 19m, which meant that they had two surveys for every stand drilled and no additional rig time was taken for the extra surveys.

Pete Clark, Baker Hughes asked if they changed the azimuth from the recorded azimuth from the second tool? Pete then asked if the final survey would have been made up of inclinations and azimuths from both tools taken while drilling the well? Pete asked if maybe multiple inclinations were used in combination with the azimuth from the primary tool?

Ian Mitchell, Halliburton-Sperry Drilling answered Yes and explained that when they did the multistation correction they would have looked at that.

Simon McCulloch, Maersk asked if Ian Mitchell, Halliburton-Sperry Drilling rated the quality of the ABI inclinometers and the two other directional inclination measurements?

Ian Mitchell Halliburton, Sperry Drilling answered No and explained that the ABI inclination is subject to more movement compared to the survey probes taking measurements while stationary and explained that calibration and verification for ABI sensors is more challenging to do which was why they opted to use two full separate survey systems. Ian Mitchell Halliburton, Sperry Drilling explained that the ABI is useful to use for making sure you are within the corridor, but it was not used as the definitive survey.

Simon McCulloch, Maersk asked if they got ABI measurements about every foot?

Ian Mitchell Halliburton, Sperry Drilling answered yes; it was about every two or three feet.

Simon McCulloch, Maersk asked if they made a survey log of all the ABI data points with interpolated azimuths to see where this data placed the well?

Ian Mitchell Halliburton, Sperry Drilling, answered No, they did not do this.

Shola Okewunmi, Chevron asked if the assumption of 0.02 was too optimistic and asked if further work would be done to confirm the 0.02 specification for this dual sensor service?

Ian Mitchell Halliburton, Sperry Drilling, replied that the 0.02 comes from a combination of both the advanced sag correction and the fact that they used two independent directional sensors and agreed, that more data supporting this (0.02) would be better and they want to continue to work on getting this evidence.

Adrian Ledroz, Gyrodata asked how they had concluded that they were within the 1m target corridor when the graphic showed that the error model placed the well outside the plus or minus one meter boundary?

Ian Mitchell Halliburton, Sperry Drilling replied that the drillers target was plus or minus one meter and he suggested that there may have been a 90% criteria for being within the drillers target.

Simon McCulloch asked if the Drillscan representatives wanted to comment on the claim of the 0.02 sag correction term value?

Ludovic Macresy, Drill Scan asked how can you say 0.02 is correct as sometimes the plots showed a difference of up to 1.0 degrees difference or greater at around 3300m measured depth and how do you believe that this TVD reduction is not even greater? Ludovic Macresy, Drill Scan added that the sag correction term could be different depending on many influences.

Ian Mitchell Halliburton, Sperry Drilling replied that there are other errors that are contributing towards the difference in inclination and stated that it is not just the sag correction (affecting the inclination measurement) and that you have to make a decision on what number you believe is right.

Andy Brooks, Pathfinder said that he would like to see a paper published to show how they used multistation correction on the accelerometers to reduce Gz bias on a horizontal attitude well. Andy stated that it is not an easy thing to do and he said he would like to know how they had done that.

Anas Sikal, Drill Scan

Presented on Finalization of proposed changes to SAG error terms in MWD model

Steve Grindrod, Copsegrove Developments

Presented on Error Model Work Group progress

Kevin McClard, PDT asked what the significance of this effect (fat tailed distribution of the BGGM data) applied also to the IGRF?

Steve Grindrod, Copsegrove Developments replied that the IGRF 2000 and 2005 had a big jump in the harmonic order and the IGRF 2010 will be relatively close to the BGGM but the problem with that's it is not updated and can end up not modeling the Earth magnetic changes.

Harry Wilson, Baker Hughes asked if it was possible to adopt a simple option of dividing the three or four sigma value by three or four so that it would be very conservative when using it at three or two sigma confidence limit.

Steve Grindrod, Copsegrove Developments agreed that there is a very rapid degradation in accuracy when you go above 2 sigma 95% confidence limit and could result in grossly over estimating the error at 2 sigma.

Harry Wilson, Baker Hughes stated that this may be the cost of simplification and may be a cost worth bearing.

Steve Grindrod, Copsegrove Developments added that in some cases this effect would in effect double the uncertainty from this particular contribution.

Phil Harbidge, Baker Hughes asked what is the difference in uncertainty from this effect (heavy tailed distribution and therefore implementation of the BGGM look up tables) compared to the difference between using an IFR reference and not using an IFR reference model?

Steve Grindrod, Copsegrove Developments replied that the improvement with the axial correction model is significant, due to the current MWD model (ISCWSA) grossly over estimating the error value for the B Total residual and that there is not such significant degradation in accuracy at the high confidence levels with axial correction applied.

Stefan Maus, University of Colorado asked what was the motivation for introducing such a nice term as the MWD 50000nT degree/dh (ISCWSA MWD model), which takes care of the geometrical effect if you have a small horizontal field and you get a larger declination error also and you still keep the 0.36degrees as the constant background error?

Steve Grindrod, Copsegrove Developments replied that those terms will actually go, the declination constant and the location dependant term will be replaced by a single value from the lookup table that is valid for that particular location.

Stefan Maus, University of Colorado asked how did you come up with the look up table values for the different latitudes?

Steve Grindrod, Copsegrove Developments replied the BGS came up with the values as almost part of the BGGM model development which also includes looking at the accuracies of the BGGM model data.

Robert Estes, Baker Hughes stated that is clever to apply correction values from a table such as the BGGM lookup table, and therefore should you not also add correction values to magnetic sensor data and also other data values until it gets too complex. Robert Estes, Baker Hughes also stated that if this is the primary contribution to the error then we should also assess the overall improvement from applying the correction (BGGM lookup table values) and should we not also be looking at the improvement on the other error areas?

Steve Grindrod, Copsegrove Developments agreed and stated all the mathematical theory of propagation assumes normal Gaussian distribution and this is a simplification. Steve Grindrod, Copsegrove Developments explained that for the MWD model we replace the global declination term with a term from the lookup table and the *dbhg* term is set to zero.

Steve Grindrod, Copsegrove Developments asked the audience to vote on implementing BGS lookup tables in the ISCWSA MWD model rev 4.

Kevin McClard, PDT asked the audience to consider that the BGGM is not free and comes at a considerable cost before they vote on the implementation of the BGGM lookup table values.

Andy Brooks, Pathfinder asked Steve if the lookup tables are going to be free and publically available?

Steve Grindrod, Copegrove Developments replied that yes the lookup table values are free and they have been available from the BGS website and also from the ISCWSA.org website for download.

The proposal was passed with a majority vote for implementing the BGS lookup tables in the ISCWSA MWD model rev 4.

Steve Grindrod, Copegrove Developments said that he would post all ISCWSA group documents to SPE SharePoint site and ISCWSA.org website.

Harry Wilson, Baker Hughes asked if we could review the revision numbering system as it could become a problem for future models especially if we release a gyro model and also suggested that we may need a two track revision numbering system, which, may mean that we need to go back and rename some of the earlier model names.

Steve Grindrod, Copegrove Developments agreed that there is an error model number then a tool model revision number which will also spill over to the WITSML work and the group will have to re-think this.

Stefan Maus, University of Colorado asked if the user must use the BGGM model with the ISCWSA model?

Steve Grindrod, Copegrove Developments stated that the ISCWSA MWD paper assumes that the user is using the BGGM model and said that he would like to add a set of terms for non BGGM error models, but that information is not currently available.

Stefan Maus, University of Colorado agreed that perhaps he could provide such tables for the IGRF and EMM models to be used in revised (ISCWSA) MWD models.

Action for Steve Grindrod, Copegrove Developments to liaise and request this information from Stefan Maus, University of Colorado.

Harry Wilson, Baker Hughes stated that just in case it was not formalised in the discussion or minutes so far, that if a user is building a tool model and they are populating the general model with real data, they should identify 99.7% confidence values and divide by three to get the input values for the new model.

Bill Allen, BP

Presented on Driller's Targets, what's in it for me?

Bill Allen, BP asked the audience how many could use drillers targets?

Half of the audience identified that they could use Driller's targets.

Bill Allen, BP asked the audience how many do use drillers targets?

5-10 members of the 62 members in the audience identified that they actually used driller's targets.

Pete Clark, Baker Hughes explained how Baker Hughes uses driller's targets.

Harry Wilson, Baker Hughes described that using drillers targets allows us to manage hitting the target including the uncertainty without having to do anything else to include the drilling uncertainty and also creates something visual for the DD to use to drill the well and to hit the target.

Bill Allen, BP asked the audience to comment on a scenario where no gyros were utilised and the drilling program instruction was to drill out of the casing using BP models (without addressing the fact that the well was drilling through a zone of magnetic interference).

Harry Wilson, Baker Hughes added that recent quality control SPE papers described different levels of confidence in data validation from high level to zero quality control, where zero quality control would warrant uncertainty so large that it would not be useful to use that uncertainty.

Bill Allen, BP proposed to have score cards for judging BP fields regarding uncertainty values for drilling formations and proposed that BP to use this internally.

Benny Poedjono, Schlumberger offered that the number of sidetracks on a project could be used as a metric for missing geological targets.

Andy Sentance, DGI added that another metric that could be used is the number of formation tops coming in, on time.

Ross Lowdon, Schlumberger added that the G and G (geology and geophysics) teams have many pretty pictures and visualisation tools and that the drilling team members do not typically understand that part of the business. Ross Lowdon, Schlumberger explained that it is important that they (Drilling Teams) must understand the monetary value of this part of the business in order to evaluate the engineering impact on for example not landing the well in the correct formation.