ISCWSA / SPE Wellbore Positioning Technical Section

Error Model Maintenance Work Group

Minutes of the Meeting at ISCWSA#50, Calgary, 2nd October 2019

Present

Andy McGregor	H&P Technologies	Benny Poedjono	SLB
Jon Bang	Gyrodata	Sergey Shabanov	Total
Harry Wilson	Baker Hughes	Neil Bergstrom	H&P Technologies
Sue-Anne Marquis	Total	Shuba Love	H&P Technologies
Phil Scott	DGI	Denis Reynard	Pathcontrol
Darren Aklestad	SLB	Mahmoud ElGizaway	Schlumberger
Manoj Nair	NOAA	Levi Smith	Icefield Tools
Pete Clark	Chevron	Mike Calkins	Three Sigma
Craig Sim	DGI	David Erdos	Erdos Miller
Adrian Ledroz	Gyrodata	Patrick Knight	Halliburton
Stefan Maus	H&P Technologies	Steve Sawaryn	Independent
Erik Nyrnes	Equinor	Susan Macmillan	BGS
Gunnar Tackmann	Baker Hughes	Dalis Deliu	Conoco Phillips
Steve Grindrod	Copsegrove	Paul Strohmeier	Conoco Phillips
Jerry Codling	Halliburton	Mike Attrell	Mostar
Jonathan Lightfoot	Occidental	Bill Allen	BP
Chad Hanak	Superior QC		
Anne Holmes	Halliburton		

Revision 5

At the previous meeting the committee approved the adoption of revision 5, with changes to misalignments and Sag, addition of long course length terms and re-organisation of geomagnetic errors to deal with correlations.

Some outstanding details remained to be finalised:

1) Prompted by Pathcontrol a sub-group met online and discussed alternative sag formulations. There was some discussion about previous Pathcontrol suggestions for sag and whether errors after sag correction had been applied should have the same weighting function as uncorrected sag. After consideration Jerry Codling's sin(I)^0.25 term was accepted for general use. It was also recommended that a guidance document on handling sag corrections should be prepared.

2) To avoid the contribution from the now random XYM3 and XYM4 misalignments disappearing for high rate surveys, Jerry Codling proposed modifying the existing W34 misalignment term to: $\qquad MAX[1, sqrt(10 / dMd)] * w34$

This equation effectively means that the random terms will not drop below the equivalent level of a 10m survey interval. Andy McGregor presented some graphs showing how this worked in practise.

The committee approved this change, agreed the minimum misalignment term should be a parameter in the tool-code so that any minimum interval could be used, but that as default ISCWSA models would use a value of 10m.
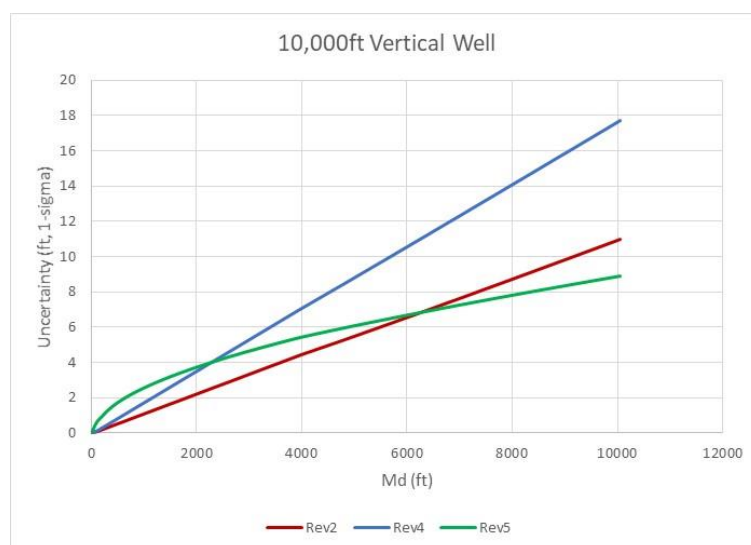
3) There was concern about how revision 5 would handle very long/very short/ irregular course lengths. Andy McGregor presented some results showing that these were well behaved. His results did not match Jerry Codling's Compass results as closely as other MWD terms, but the match was <2% and deemed fit for purpose.

We agreed the new terms names would: SAGE, XYM3E, XYM4E, XCLH and XCLA.
Note that given the change in weighting function we need a new name for SAG, so that historic models can still be supported.

There was a discussion relating to the reduction in ellipse sizes, particularly for vertical wells where the misalignment terms are the major contribution to overall size. The move to revision 5 could lead to more wells closer together in top hole potentially increasing collisions. Also, this could cause problems if the well planning assumed a perfectly vertical well with small uncertainties. But since it is not possible to realise a perfectly vertical well, this could lead to either collisions or unexpected stop drilling conditions.

The committee agreed that the model should be our best estimate of true survey uncertainty. If users need to change their anti-collision then that is a separate issue. We would however add a warning on this matter to the revision 5 release material. Also, thee would be a comparison of rev4 and rev5 for a vertical well in the update to the main committee. A version of this plot is given below:

Based on these discussions the committee agreed to release the details of revision 5 as a BETA release. This would allow it to be implemented and allow further user evaluation before giving the revision formal endorsement.

We reviewed the current status of Revision 5 documentation and support material.

ACTION: Andy McGregor and Steve Grindrod to finalise and upload the documentation to the website.

Sag Guidance Paper

Related to the revision 5 sag tele-con, AnaS Sikal had suggested that the committee produce a guidance document on the application of sag corrections. However, he was not present, and the group could not remember his suggested content.

ACTION: Andy McGregor to contact AnaS to confirm details and carry this forward.

OWSG Toolset

Activity by the Operators' Group has diminished in recent years. The OWSG set of tool-codes has been successful and is widely accepted across the industry. However, details of the OWSG models have not been available online for a while. The OWSG chair, Pete Clark suggest that the error model committee might take on responsibility for these models.

There was unanimous support for this move.

The details of the OWSG models and diagnostics will be placed on the ISCWSA website. We considered having a separate page which would link to contractor's models. These models would be kept on the contractor's website and suitable disclaimers would have to be included to ensure the ISCWSA held no responsibility for the content of contractor error models.

However, there were concerns how about support for the OWSG models can be practically achieved. Maintenance of these models is a significant task. In the past, Steve Grindrod was paid by a group of operators to do this work. The sub-committee agreed to approach the main ISCWSA committee to see if funding could be found to have someone continue to maintain the OWSG tool-codes and incorporate the revision 5 changes.

ACTION: Andy McGregor to discuss funding with the ISCWSA committee.

BGGM Error Term Webservice

There was a brief update from the BGS on there now webservice for obtaining term magnitudes for use with the BGGM model at geomag.bgs.ac.uk/bggm.html.
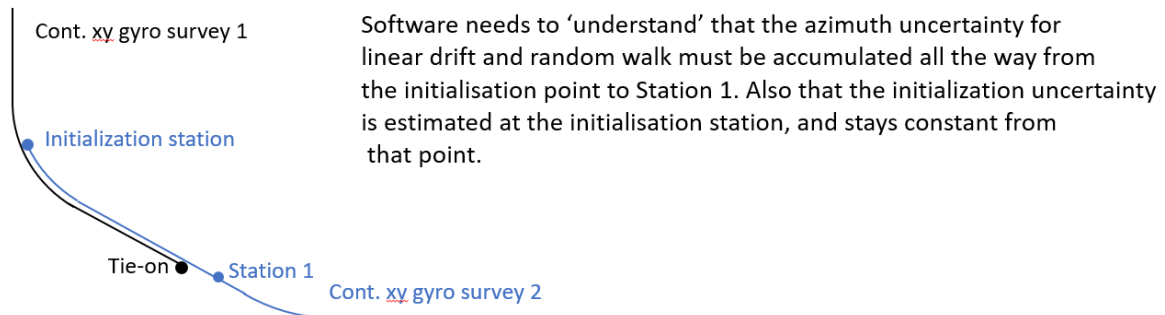
Tie-On Stations

Total asked a question about whether if there was no actual survey at a side-track point, should an interpolated point be added. This led to a protracted discussion about whether side-tracks could be from an interpolated point or must be from the last real survey in the parent well. There was no consensus in the group, although it was agreed that at the very least an interpolated point should be used.

Gyro Initialisation in Prior Survey Leg

Erik Nyrnes raised a gyro initialisation scenario that Equinor were encountering and questioned whether commercial software could handle it.

The scenario is where a continuous gyro is initialised in the previous survey leg, but its surveys are not used until a tie-on point lower down the well. Software needs to store initialisation data and accumulate uncertainty from the initialisation point for use later.

Cont. xy gyro survey 1

Initialization station

Software needs to 'understand' that the azimuth uncertainty for linear drift and random walk must be accumulated all the way from the initialisation point to Station 1. Also that the initialization uncertainty is estimated at the initialisation station, and stays constant from that point.

Tie-on
Station 1
Cont. xy gyro survey 2

The group agreed this was a valid concern and should be accommodated.
ACTION: Andy McGregor to add this case to the error model definition document.

Gyro Model Consistency

Andy McGregor presented some comparisons of results from gyro modelling and results against the test results in the SPE paper. Gyro diagnostics were clearly less tight. Details of initialisation and re-initialisation can be complex, and the specific details are not clearly documented. This also led to a wider discussion about how the error model definition document is scant on details of the complexities and pitfalls of the gyro model. This also ties into the on-going carried item about reviewing and re-documenting the gyro paper test cases.
ACTION: Andy McGregor to add some material on this to the gyro model definition document.

Items Carried Forward

Two items from previous meetings were not discussed but should have been included on the agenda. The actions therefore carry over for now.

Demonstrating MWD Tool Meets Error Model

The was discussed at the previous meeting. The action carries on to the next meeting.

Gyro Model Verification

It is still the case that more verification data is needed to ensure that the gyro models can be correctly replicated. The action is carried over.