ISCWSA / SPE Wellbore Positioning Technical Section

Error Model Maintenance Work Group

Minutes of the Meeting at ISCWSA#48, Dallas, TX, 26th September 2018

Present

Andy McGregor	AJC	Jonathan Lightfoot	Occidental
Jon Bang	Gyrodata	Chad Hanak	Superior QC
Andy Brooks	Independent	Brett Van Steenwynk	SDI
Scott Farmer	Total	Benny Poedjono	SLB
Sergey Shabanov	Total	Mike Attrell	Mostar
Darren Aklestad	SLB	Dalis Deliu	Conoco Phillips
Manoj Nair	NOAA	Neil Bergstrom	MagVar
Pete Clark	Chevron	Paul Strohmeier	Conoco Phillips
Andy Sentence	DGI	Lu Jiang	SLB
Adrian Ledroz	Gyrodata	William Allen	BP
Stefan Maus	MagVar	Mohamed Elmoghazy	Weatherford
Erik Nyrnes	Equinor	Eric Maynard	EQT
Gunnar Tackmann	BHGE	Orlando Ramirez	Stockholm Precision
Steve Grindrod	Copsegrove	Steve Sawaryn	Independent
Jerry Codling	Halliburton	Jose Garza	Stingray Directional

Long Course Length Models

Whilst resolving outstanding issues with the XCL models, Jerry Codling had come to the realisation that they did not currently achieve what was intended. They are good for regular survey spacings but may not be so good for occasional missing surveys. In particular, due to the usual balanced tangential assumption in the error model framework, the XCL contribution did not necessarily add to the overall uncertainty at the correct survey station but may be added after the survey of interest. Jerry thought he could see a way to resolve this issue.

Since XCL has not been widely implemented and these problems seem to go directly to the intent of the XCL functions, it was agreed to try to resolve these issues before committing to a Rev5 release with XCL models.

The intent is to have some of the software houses implement and share results before the next meeting.

ACTION: Jerry to define and document a solution to handling the XCL functions.
ACTION: Andy M to circulate this.
ACTION: Steve, Darren, Andy M and Andy S to implement and share results.

Hole Misalignments

Revision of the hole misalignment terms has been discussed at the last few meetings since they may currently be overly conservative. Jerry Codling has proposed increasing the XYM3/XYM4 terms to 0.3° and changing these terms to random propagation. These terms dominate in top hole.

After the previous meeting, Jerry had asked operators to provide more data to validate his proposed change to the hole misalignment terms. He received a small amount of new data and presented his latest results.

However, one new point that came out was sign of a low inclination sag effect. Therefore Jerry is suggesting that the current SAG term is wrong and should be replaced with a sin(Inc) to power 0.25 function.

ACTION: Jerry to write up this proposal.
ACTION: Software teams to implement and assess the effect.

WITSML

Total have been leading a work group to define a WITSML protocol to allow transfer of error models.

This group has made good progress in the last six months with assistance from members of this committee. Lots of detail has been generated and they are targeting a draft release this year. The WITSML work is focused on real time data transfer and parallels work done by the P7 group, which is more focussed on archive of definitive surveys.

Anyone interested in contributing to this effort should contact Scott Farmer, scott.farmer@total.com

Effect of Error Correlation on Uncertainty Value

Over previous meetings we had defined a means of handling partial correlation between error sources. At the last meeting a suggestion was made that instead of using partial correlations, the error model could be modified to have to different terms for the various components of the Earth's field. This might mean that only integer correlations would be used and more importantly might avoid the need for either the directional software or user to determine which correlation value to apply.

Any McGregor investigated this further and presented a proposed implementation which would break each of the existing DECG, DBHG, MFIG and MDIG terms into multiple new terms. These would RSS to give the values we currently have, but the new terms would have either well by well (uncorrelated between wells) or global (fully correlated between wells). If software handled the full correlation between these global terms, the combination of well by well and global would allow the tool-codes to naturally handle the fractional correlation between all the usual combinations of WMM, BGGM, HDGM and IFR1/2.

However, a consequence of this was that care would need to be taken with current tool-codes using the existing global terms (e.g. DECG, DBHG etc.) otherwise all of the effect of that error could be removed from the error evaluation.

NOAA and BGS also reviewed Stefan's correlation values. They raised some concerns, however it became apparent immediately before the meeting that they had been sent an earlier and incorrect version of Stefan's analysis.

Action: Software teams to consider best way to safely handle existing tool-codes.
Action: Andy McGregor to update his breakdown of values based on Stefan's later analysis.
Action: Andy M to send latest analysis to geo-mag institutes.

Gyro Model Mode Changes and Re-Initialisation Logic

Steve Grindrod has been developing a gyro error model for a new survey tool. This tool has three survey modes (static, gz-cont and gxy-cont) with differing running speeds and complex mode changes and initialisation criteria between these modes. Steve wondered if we needed to consider enhancements to the gyro model to accommodate the behaviour.

Some in the group were against making the mode changes and re-initialisation logic more complex if that could be avoided. This is an area where even with current definition it is difficult to replicate the gyro paper test results and ensure that differing software implementations are consistent.

It was suggested that Steve should conduct an analysis to assess whether these details made a significant difference to the uncertainty results for this tool in realistic scenarios. If results showed that these changes were required to adequately model the performance of this tool, then they would be considered for inclusion

ACTION: Steve Grindrod to come back to the meeting with further data if enhancements are required.

Items Carried Forward

Two matters arising from the previous meeting 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.
ACTION: A workgroup was formed consisting of Andy McGregor, Randy Riggs, Gunner Tackman, Chad Hanak, and Marc Willerth. This group to review Randy's calculations and progress from there.

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.

ACTION: Steve Grindrod, Adrian Ledroz and SDI to look into what is needed.