ISCWSA / SPE Wellbore Positioning Technical Section

Error Model Maintenance Work Group

Minutes of the Meeting at ISCWSA#47, Inverness, Scotland, 10th April 2018

Present

Andy McGregor	AJC	John Patterson	Craigcross Ltd
Koen Noy	Shell	David Erdos	Erdos Miller
Huan Liu	Uni. Of Calgary	Alexandre Gonsette	RMI
Jon Bang	Gyrodata	Francois Humbles	RHE
Andy Brooks	Independent	Anne Holmes	Sperry
Susan Mcmillan	BGS	Jerry Codling	Halliburton
Erik Blake	Icefield Tools	Lee Roitberg	Benchtree
Scott Farmer	Total	Shawn DeVerse	MagVar
Sergey Shabanov	Total	Barry Smart	Gyrodata
Hans Dreisig	Maersk	Patrick Knight	Sperry
Marc Willerth	MagVar	Jonathan Lightfoot	Oxy
Denis Reynaud	Pathcontrol	Chad Hanak	Superior QC
Darren Arklestad	SLB	JC Ang	Benchtree
Alan Thomson	BGS	Brett Van Steenwynk	SDI
Manoj Nair	NOAA	Ross Lowdon	SLB
Pete Clark	Chevron	Giorgio Pattarini	Uni. Of Stavanger
Andy Sentence	DGI	Harry Wilson	BHGE
Adrian Ledroz	Gyrodata	Matthew Rhodes	BP
Stefan Maus	MagVar	Gary Skinner	BHGE
Erik Nyrnes	Statoil	Benny Poedjono	SLB
Gunnar Tackmann	BHGE	Phil Harbidge	Pathcontrol
Steve Grindrod	Copsegrove		
Daniel Flores	Benchtree		

Long Course Length Models

Steve Grindrod prepared some diagnostic files for OWSG Rev5 which included the XCL models. Others trying to implement the models had some problems and it became clear that the details had not been fully defined. Issues to be resolved are:

i) Value for tortuosity in the weighting function – agreed at 1 deg/100ft.

ii) Two weighting functions XCLI and XCLA are needed for the source to behave correctly.

iii) Handling of singular in vertical case needs to be defined in accordance with other functions.

iv) Some situations (e.g. side-tracking) require specific handling – Jerry has produced a write up on this.

v) Inc Only models should also have a version of XCL, even though this may not greatly impact EOU sizes.

Release of Rev5 of the model will be postponed until a group of implementers have agreed these details and replicated results. Draft documentation for the website has already been prepared but will require modification in light of this task.

ACTION: Jerry, Steve, Darren, Andy M and Andy S to define the outstanding issues and share results
ACTION: Steve Grindrod then update the OWSG diagnostic datasets.
ACTION: Andy M to produce documentation for ISCWSA website.

Hole Misalignments

Revision of the hole misalignment terms were discussed at the last meeting 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.

There was a concern that there might be a residual systematic effect that we would be missing if we went purely to random propagation. Since the last meeting Jerry has looked at some MWD which suggested that toolface was mostly random.

Some in the group were still concerned that if very short survey intervals are applied then the random misalignments will have little to no effect on the EOU and that we may end up overly optimistic.

The outcome of the discussion was that we need more data if we are to remove all the systematic effect in top hole. Otherwise, we should retain a smaller systematic XYM3/XYM4 value to be determined.

ACTION: Jerry to write to the operators present to formally request further data to help us conclude this matter.

WITSML

Total have started up a work group to modify the WITSML format to allow transfer of error models. This work will look to dovetail with the existing error model definition and the P7 format. Some specific details were discussed in the meeting. The aim is to have a draft in place by the end of the year and to have the implementation in place by the end of 2019.

Previously the WITSML format was not taken up because it took significant effort to implement and there had not been much demand from customers. Operators in the room stated that they saw great value in means to transfer error models.

Anyone interested in contributing to this effort shout 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. Practical application of that method was discussed in great detail in the anti-collision meeting. This appears to be an important factor in the EOU size, however determining which correlation applies between two wells is not straightforward.

After that meeting closed a suggestion was made that instead of using partial correlations, the error model could be modified so 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.

We would also like to have further input from the geo-mag community to consider the correlations calculated by Stefan Maus.

Action: Stefan Maus to consider how this might be represented in tool code.
Action: Andy McGregor contact the various geo-mag institutes in attendance to assess the correlation values that have been presented.

DREF Term

Harry Wilson and Erik Nyrnes presented some issues with the DREF source in random and systematic form.

DREF-R would appear to model stick-up and seems to work correctly. The origin of the 0.35m value generally applied in the model does not seem to be documented.

Values where shown for tie-ons of the DREF-S term, which seemed to be unusual. It was not completely clear what the DREF-S term was modelling, although it is suspected to be changes in depth reference due to platform ballast. It was not clear if the behaviour of DREF-S was correct or if it was modelling what was required.

After the meeting closed, Andy Brooks came up with an explanation of the behaviour. See the enclosed pdf. Note: "… in the general case there is also a covariance term which was ignored in the quick sketch. The covariance happens to be zero at 60º, but not at 90º."

Explanation of DREFS propagation

Harry now believes that the DREFS term correctly describes the effect of adjusting rig ballast between successive survey logs if we assume there is a correlation between re-ballasting and survey log tie-on (normally a change of hole size).

Inclination Only Tie-Ons

Pete Clark raised a question about how the well position should be handled when an inclination only survey is tied on to a directional survey. This is defined in some of the images of survey reports included in the inclination only guidance document, but the handling isn't explicitly detailed in the text in the document.

It was also noted that the latest revision of the document isn't on the website.

ACTION: Jerry Codling and Andy McGregor to revise document and issue on website.

Tie-Ons

Pete then described another tie-on scenario when a 4,000ft interval of blind drilling was tied on to a directional survey. This was handled differently in two different software implementations, with one program giving ellipse dimensions of ~5,000ft and the other giving ~2,500ft the implication being that later case was assuming that the directional survey continued halfway down the interval.

ACTION: Andy McGregor and Andy Sentence to liaise on this.

Matters Arising

Two matters arising from the previous meeting were not discussed but should have been included on the agenda. The actions therefore carry over.

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.