ISCWSA / SPE Wellbore Positioning Technical Section

Error Model Maintenance Work Group

Minutes of the Meeting at ISCWSA#45, The Hague, 16th March 2017

Present

Steve Grindrod	Copsegrove	Nicolas Rigard	Total
Pete Clark	Chevron	Harry Wilson	Baker Hughes
Darren Aklestad	Schlumberger	Gunnar Tackmann	Baker Hughes
Stefan Maus	MagVar	Chad Hanak	SuperiorQC
Jerry Codling	Landmark	Marc Willerth,	MagVar
Andy Sentence	DGI	Phil Harbidge,	Independent
Barry Smart	Gyrodata	Leida Monterrosa	Schlumberger
Adrian Ledroz	Gyrodata	Jonathan Lightfoot	Occidental
Shawn Deverse	MagVar	Olivier Cousso	Total
Andy Brooks	Independent	Anas Sikal	Pathcontrol
Erik Nyrnes	Statoil	Manoj Nair	NOAA
Patrick Knight	Sperry-Sun	Ellen Clarke	BGS
Hans Dreisig	Maersk	Ciaran Beggan	BGS

Steve Grindrod stood in as Chair as Andy McGregor was unable to attend the meeting.

1) Minutes of the Last Meeting 21-Sep-2016

Documentation

Current documentation is insufficient to enable consistent implementations and results, especially for the gyro models.

The write up has been reviewed by Steve/Jon/Ciaran. Edits made (or will be shortly.)
Also inspired by Andy Brooks, Andy McGregor has created a spreadsheet format to demonstrate how the model works.

Jon Bang would like a short piece added on his/Torgeir's matrix method for implementing the model.

Jerry Codling has updating the inclination document (now Rev. D) to include tie-ons. This was presented to the meeting – **See Agenda item 8**.

Action: Documentation to be updated after clarification on Agenda Items

Website Documentation:
Phil Harbidge has updated the overall ISCWSA website but the Error Model part has not been finalised.
Suggestions are:

1) An introductory page stating our objectives and what we do, with contact details for me.
2) A separate page detailing the latest version of the model –
   Spreadsheet tool models, Definition document, spreadsheet examples and link to validation data on Copsegrove.com

3) Another page with meeting minutes
4) Perhaps a documentation or miscellaneous page.

Verification Test Cases - See Agenda Item 3 and 4

Following discussions and the change to surface tie-ons (Agenda Item 3) the diagnostic files will need to be updated.

Gyro Model Verification – See Agenda Item 4

Inclination-Only Surveys: Tie-Ons – See Agenda Item 6

Effect of Error Correlation on Uncertainty Value

This has not been progressed this.

Action: Andy McGregor and Jon Bang to look into this further

Geomagnetic Models & Lookup Tables – See Agenda Item 7

Long Survey Tool Codes – See Agenda Item 8

Validation Requirements

Hole Misalignment – See Agenda Item 9

2) Unique Identifiers and Standardisation for Error Model Transfer

From RP78 work, Andy started to think about creating a standardised tool model checksum that would allow a quick comparison between models in different software to see if they match.

The idea being that use the tool name identifier and a checksum you could quickly know if two models were the same or different, without having to do a term by term comparison.

We need to code error source identifier (unique numbering??), magnitude, propagation mode and any inclination bounds.

Need standardisation for terms and weighting functions before we can develop a checksum system for error model verification.

We need to standardise the Error Model Transfer
WITSML - need to review with respect to OWSG error models

Action: Jonathon Lightfoot to coordinate web meeting in the next few months with Steve Grindrod, Darren Aklestad, Jerry Codling, Andy Sentance and Nicolas Rigard to review WITSML and report back by September.

3) Surface Tie Issues (MWD Model)

In the MWD model, ties between surveys are split over the tie interval. For a tie to surface the first half of the interval is zero error resulting in errors starting half way between the first two survey stations.

Baker Hughes use the first survey station to calculate uncertainty over the entire first course length from the tie-on, not just the second half of the course length. The first downhole survey log should be tied to the Well Reference Point

Agreed that this should be the recommended practice.

Action: Harry Wilson to write this up.

4) Gyro Error Model Verification

There is insufficient information in the current documents to allow consistent implementation and results for the gyro models, especially for initialisation and mode changes.

Action: Steve Grindrod with SDI and Gyrodata (Adrian Ledroz) to write a note on the options.

5) Error Model Verification Values

Current acceptance values are 1% on the covariance matrix for values over 200 and +/- 2 for values less than 200 (from the Gyro SPE paper)

A preferred method is to compare HLA values.

Action: Use HLA comparison for validating results. Agreement should be better than 0.1%. Each term for the whole well path of each of the three ISCWSA profiles need to agree.

6) Inclination-Only Error Model Ties

Jerry Codling has updated the Inclination-Only Error Model documentation (Rev D) to include a recommended method of 1) The tie between Inclination-Only and MWD and 2) Gyro and Inclination-Only.

Action: Document to be circulated for comment and feedback - before September.

7) Geomagnetic Look Up Tables

Jerry Codling has been working with BGS to have the geomagnetic error values displayed when spot calculations and accessed through a web based server. These values can then be stored with the geomagnetic parameters in directional software and removes the need for look up tables.

Note: these values are 95.4% values divided by 2 to give a 1-sigma equivalent.

Action: Jerry Codling to write this up for comment and feedback - before September

8) Long Course Length (XCL)

Jerry Codling presented some further work on his empirical data to validate the XCL model.

Jon Bang and Adrian Ledroz had done some similar work which also confirmed the model.

Action: Need to demonstrate the model in well planning (default interpolation is 30 ft) and does not show the XCL effect. Current note to be circulated for comment and feedback by end of May. Final decision on including XCL in all models to be taken in Fall Meeting. [Software providers]

Note: Chevron are currently using 5 specific XCL error models in Set E. When implemented in current error models they will be 'hidden' - no need to include 'XCL' in the model name.

9) Random Misalignment Terms

This is a follower on to the XCL study.

Currently the 0.1 deg Systematic misalignment terms in the OWSG models gives too small an uncertainty near surface and too large deep.

Based on an empirical study Jerry proposes to reduce the XYM3 and XYM4 to 0.06 deg (Systematic) and add two more XYM3 and XYM4 Random terms with a value of 0.25 deg.

This will have the effect of increasing uncertainty in the top hole (to ca 800 ft MD) and reducing the deeper uncertainty.

Action: Jerry Codling to write up and circulate for comment and feedback, specifically is the analysis of the empirical data valid?

10) Geomagnetic Model Accuracy Validation

Manoj Nair (NOAA) presented his poster on evaluating geomagnetic model accuracy. This is to be presented tomorrow during the main meeting. The main aim is to present the validation approach rather than the actual values.

11) Rotary Drilling Mode Surveys

Chad Hanak presented a proposed error model for a rotating/averaging while-drilling error model for a new tool that is being developed. This adds some new terms and removes others from a standard MWD error model.

12) Degraded Azimuth MWD Model

Chad Hanak raised the issue of a growing industry need for a degraded azimuth error model for top hole in pad drilling scenarios where short lengths of NM material (ca 20 ft) are used in the BHA and there is cross-axis interference from adjacent wells. Large azimuth errors in wells close to vertical have a small effect on position.

Note, this is similar to a proposal from Neil Bergstrom a while back.