ISCWSA / SPE Wellbore Positioning Technical Section

Error Model Maintenance Work Group

Minutes of the Meeting at ISCWSA #55, Online, 13st April 2022

Present

Andy McGregor	H&P	Stephen Winchester	Baker Hughes
Jon Bang	Gyrodata	Manoj Nair	NOAA
Harry Wilson	Baker Hughes	Pete Clark	Chevron
Darren Aklestad	SLB	Shuba Love	Independent
Ty Mitschke		Jonathan Lightfoot	Occidental
Mike Attrell	Mostar	Anne Holmes	Halliburton
Eric Maynard	EQT	Gary Skinner	Baker Hughes
Kexian Yang	Occidental	Mike Calkins	Three Sigma
Phil Scott	DGI	Harald Bolt	Depth Solutions
Denis Reynard	Pathcontrol	Neil Bergstrom	Independent
David Gutierrez	SuperiorQC	Scott Farmer	H&P
Craig Sim	DGI	Hans Dreisig	Total
Dalis Deliu	Conoco Phillips	Aprameya Murali-Dhara	Weatherford
Steve Grindrod	Copsegrove	Adrian Ledroz	Gyrodata
George Soden	Stockholm Precision	Brett Van Steenwyk	Algo & Analytical
Levi Smith	Icefield Tools	Joel ??	

Side-track Errors – Recommended Practices

The side-track working groups has produced a final draft detailing recommended practices for dealing with handling survey errors in side-tracks and running clearance scans.

The main outcomes of this work were that a new DST-S term should be added for use in wireline models.

Errors between a side-track and parent well should be evaluated using the relative uncertainty formulation as used in Rev5 for geo-magnetic errors. Zero error model should not be used to the side-track point and measured depth should not be reset. Changes will be required in some software applications.

The document was circulated for review prior to the meeting. Gary Skinner voiced a concern about the recommendation to zero surface margin in parent to side-track scans. Surface margin is used for different purposes by some companies. This issue was deferred to be resolved offline. No other concerns were raised. Therefore, once the surface margin language is reviewed a final draft will be circulated for approval.

ACTION: Gary Skinner and Harry Wilson to review the working about surface margin.
ACTION: Andy McGregor to send out the final draft document around the committee.
ACTION: Andy McGregor to put side-track recommend practices on the website.
ACTION: Andy McGregor to add the new DST-S wireline term to the definition document.
ACTION Jon Bang & Erik Nyrnes to write up the matrix summation method for the definition document.

Side-track Errors – Diagnostics

As part of this work a spreadsheet was produced working some simple relative correlation examples in detail. The working group felt that a full set of diagnostics should be produced to allow implementers to validate that they were correctly handling clearance scans to side-tracks. The intention is that some further side-track cases will be added to the existing set of standard wells for collision avoidance validation and that new diagnostics be produced for the whole test set using the rev5 models.
Proposed new cases include:

i) A side-track of a side-track
ii) A side-track which is entirely at TVD above the other side-tracks
iii) A side-track which loops back round on the parent well
iv) A pair of multi-lateral wells, parallel to the reference well
v) Running the side-track against an independent offset well.

The working group also suggested that to maximise the effect of geo-magnetic correlation and to fully test its application that many of the wells should use an MWD+HDGM+Axial model.

Survey program should be varied across the test set and include at least one gyro.

ACTION: Andy McGregor to add worked example spreadsheet of relative correlations to website.
ACTION: Andy McGregor, Craig Sim and Phil Scott to work on diagnostics.

Breaking Models into Component Blocks

The working group considering breaking the models into distinct component blocks has met offline. The intent was to try to reduce the overheads for model management by defining and creating error models from grouped blocks of error terms. The MWD models in particular break down in a fairly obvious way into depth, sensor, geomagnetic, misalignment and correction terms.

There was a lot of common ground between various implementors who had done something like this in their software. Part of the discussion related to how models are created and exchanged, but a big factor was how they are presented to users to select different models.

After much discussion there was little enthusiasm in the working group for defining an ISCWSA standard for handling models in this way. However, Darren Aklestad offered to produce a document outlining how models might be broken out and identifying some of the complications to be aware of.

BGS are now providing a webservice to supply geo-magnetic term values that vary by location. Darren suggested that we should define a specific error model short name to identify models using these values. So, for example MWD+DYNAMIC or MWD+DYGM for a dynamic geo-magnetic model. This should be included in the document.

Additionally, Steve Grindrod already builds the ISCWSA model definition spreadsheets in this way, using a method he has developed. Therefore, there would be no saving to existing ISCWSA admin by going down this path.

That has implications for us if we wish to provide more axial correction models.

There was consensus that although we will add a wireline DST-S term to definition, we should not provide generic term values and this term is intended for service provider bespoke models.

ACTION: Darren to draft a document and circulate to Andy, Steve, Harald, Chad and Adrian.

Website Updates

Various updates are required on the website – minutes, rev5 documents and the addition of Roger Ekseth's thesis.

ACTION: Andy to get this done.

Rev5 Management Presentation

Scott Farmer showed a presentation that he had put together, which can be used to explain to senior management who ISCWSA is, what revision 5 is about and why a company might want to adopt rev5.

Harry Wilson suggested adding a comment that the geo-mag relative correlations will generally increase the available space. Andy McGregor commented that it should be clarified that we are not proposing that survey intervals should be increased.

ACTION: Scott to update the presentation.

Un-surveyed Vertical Wells

We discussed handling un-surveyed nominally vertical wells at the previous meeting but passed on starting a group to work on this. However, this work is going ahead under the collision avoidance sub-committee.

Continuous MWD Models

Current MWD models assume that surveys measurements are taken when the tool is stationary. Increasingly, MWD data may also be taken dynamically during slide or rotate sections. This may be rotating 6-axis survey data or it may be inclination only information from a single axis.

The group discussed whether continuous data was used in the definitive survey database and whether there was a need for additional weighting functions in the error model framework.

Some time ago Chad Hanak presented some initial work on rotating weighting functions, and these have been adopted by Schlumberger who provide a tool taking data when rotating. There may be issues transferring these models between software.

Jonathan Lightfoot comment on the usefulness of inclination measurements between the static surveys to characterize changes in the curvature of the well, especially when using aggressive BHA and high slide-rotate patterns. He suggested that ISCWSA guidance on a workflow for merging single-axis continuous inclination data with static data would be useful. QC of continuous data is also a concern.

Generally, there was support from the operators present to look into this issue further. An initial step might be to identify what tools/process are used and where there are gaps in the current modelling. Thereafter, we might create a workgroup to consider this in detail.

ACTION: Andy to arrange further meeting.

Mixed Accuracy Models

As a discussion point, Andy McGregor then suggested a means of having differing levels of accuracy in a single tool-code, by switching weighting functions on and off at different survey stations. He suggested that this could be useful for example in cases where magnetic interference effects a limited number of survey stations within a leg. This would make it possible to switch on additional uncertainty in this region, without using a tie-on between an standard MWD model and MWD+Interference model, which in this scenario would lead to an unjustified reduction in error growth due to the way that survey errors tie together. Another possible use would be to add uncertainty for continuous data used between normal static points.

Although the group recognized the issue the general feeling was that the complexity and management issues that this would bring outweighed any potential benefits. Of more potential interest was a previous suggestion of Marc Willerth's to have paired survey models e.g. "MWD+Int" and "MWD+Clean" which could be entered as normal in the survey program but which would trigger suitable handling of tie-ons.

Actions Carried Forward

ACTION: Add QA\QC Terms to Error Model
ACTION: Chad Hanak to write up some work he has done gravity reference.
ACTION: Andy to produce a write up on Ekseth's depth model.
ACTION: Andy and Darren to collaborate on repeating Roger's calculations.
ACTION: Andy to liaise with Jerry to get details of the solution in Compass and circulate by email.
ACTION: Jerry Codling to look into some data on RIP tests he has on this and discuss with Jon Bang.
ACTION: Harry Wilson to produce a document on site and slot uncertainty, with Gary Skinner and Andy McGregor to review.
ACTION: Andy McGregor + Scott Farmer to write up gyro moding flowchart and have Adrian and SDI review.