ISCWSA / SPE Wellbore Positioning Technical Section

Error Model Maintenance Work Group

Minutes of the Meeting at ISCWSA #52, Online, 8th October 2020

Present

Andy McGregor	H&P	Mahmoud ElGizaway	Schlumberger
Jon Bang	Gyrodata	Knut Ness	ADNOC
Harry Wilson	Baker Hughes	Juan José Expósito	CEPSA
Craig Sim	DGI	Susan Macmillan	BGS
Darren Aklestad	SLB	Ellen Clarke	BGS
Pete Clark	Chevron	Jerry Codling	Halliburton
Mike Attrell	Mostar	Jonathan Lightfoot	Occidental
Gunnar Tackmann	Baker Hughes	Anne Holmes	Halliburton
Steve Grindrod	Copsegrove	Erik Nyrnes	Equinor
Phil Scott	DGI	Roger Carlson	
Denis Reynard	Pathcontrol		

SurveyMonkey

Since the previous meeting, an online survey was conducted to gather views on current work and help decide what tasks the group should tackle next. 17 responses were received. Responses to individual questions are listed in the appropriate sections below. All comments received can be found at the end of this document.

Revision 5

Since the previous meeting, some clarifications have been in the rev5 release note and diagnostics for anti-collision calculations with relative geo-magnetic sources have been added to the website.

Diagnostics for irregular course lengths are still required.

Satisfaction was the revision 5 changes was 3.9/5 with 4.3/5 stating that their organisation was likely to adopt revision 5. This is in-line with previous discussions. However, work to implement and adopt is still ongoing in most companies.

A comment was that we needed to get the message about rev5 out to companies. Some slides will be produced to assist with this.

The group discussed whether rev5 should remain or beta or be formally approved.

The XCL changes had been available to Compass users for about 2 years. If rev5 is our current best estimate of survey errors after careful consideration should we not just endorse it? If we do reconsider would that not entail a revision 6. Individual companies still need to assess rev5 for themselves to

decide to what extent they would adopt it. Should we evaluate the effectiveness of the breakout of geomagnetic terms in anti-collision.

After discussion, a vote was taken and the group agreed to drop the beta designation and approved rev5.

Release of details of the standard set of models at rev5 is still at an impasse due to the difficulty of obtaining funding. Andy McGregor to check the status of this and discuss before next week's meeting.

ACTION: Andy McGregor to produce irregular course length diagnostics.
ACTION: Darren Aklestad to produce a slide explaining the advantages of rev5.
ACTION: Andy McGregor to check on funding for standard set of models.

WITSML

One survey comment was that standardised error source names should be used. The group commented that error model definition document, spreadsheets defining the standard models and proposed WITSML format are all aligned and use standard naming. This group can only recommend that implementers follow this guidance.

There was a question as to the current status of the WITSML format. Darren Aklestad commented that he believed that the technical work was complete and that Energistics only need to publish the format.

ACTION: Andy McGregor to enquire regarding status of the WITSML Error Model Format.
ACTION: Energistics still to be informed of the rev5 changes re. the WITSML format.

Test Scenarios

Harry Wilson, Steve Sawaryn and Andy McGregor met to discuss whether changes were needed to the error model test wells or to the standard set of collision avoidance wells. It was agreed that the tests are to meet different purposes. The error model tests included various locations and wells which build and drop, including through vertical to exercise the error model framework. The collision avoidance wells test the separation factor rule in varying relative geometries. These are distinct separate purposes and the tests are fit for purpose. No changes are required at this time.

However, we suggested that the misalignments should not be changed in the DIPMETER and CB-FILM models. This is summarised in the table below:

Future Tasks

Via the online survey a vote was taken on future tasks. Descriptions of the tasks are listed at the end of this document Results were:
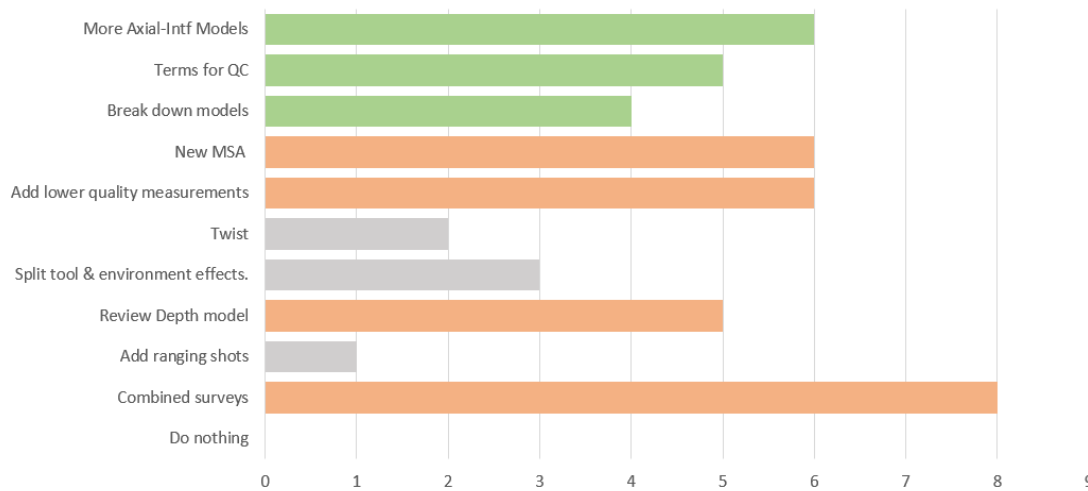
Tasks in grey got low votes and will not be considered at this time.

Tasks in green should be quite straightforward to complete. We will discuss these in the next few weeks with a view to agreeing and progressing them quickly.

Tasks in orange are important but more substantial pieces of work. The intent is to organise a series of meetings on these topics individually to act as project kick-off. Views can be aired, work scope and the way forward agreed and actions or working groups created as necessary.

Working Practices

Overall satisfaction with how the group operates was 4.3/5. Most comments stressed the need to maintain progress between meetings and ensure that actions are complete.

After each meeting, the chair will also prepare an email to those with actions and reminders will be sent out at two and four months after the main meeting and one month before the next main meeting.

As described above, over the next six months there will be a series of short meetings organised on specific tasks.

Close

Having used up the allotted time the meeting closed. A follow up online meeting will be held on 15th October.

Description of Possible Future Topics for Error Model Committee

Add more axial interference options to set of standard tool-codes.

Currently our MWD model and the standard set of tool-codes assumes 220nT axial interference. Many companies run differing spacing options and evidence from the field suggest that in US land many BHAs have very much higher axial interference. Therefore, create additional models with differing axial interference terms.

Add terms to model required only for QC.

RP-78 guidance and output from the QC committee recommends using the error model to derive QC limits. However to do this you need knowledge of the background field uncertainty and this is not necessarily included in the specific tool-code being used. For example, the MWD tool-code does not include Magnetic Total Field (although a value can be inferred from the MWD+Ax tool-code.) Therefore, add the necessary terms to the standard tool-codes.

Consider improved multi-station analysis model.

MSA uncertainty is dependent on the uncertainty in the reference field and the (variation in) wellbore attitude. These effects are not included in the model in the standard set. Consider ways to improve this model including a suggestion from Konstantin Bulychenkov.

Break standard tool-codes into discrete blocks.

In the standard models, we currently specify individually all the combinations of sensor errors, geo-magnetic reference, misalignment/sag correction, MSA/axial correction etc. We could re-define the tool-codes as a combination of separate discrete sets of terms.

Define method of modelling lower quality measurements in the survey leg (mag-interference, continuous, synthetic stations).

There have been some requests that we consider a better method of including occasional poorer quality measurements in the error modelling. e.g. occasional surveys subject to mag-interference. A general solution to this problem might also allow continuous measurements to be mixed with regular static surveys or to include synthetic survey points.

Add effect of twist

Twist (or BG-misalignment) the angular misalignment between the magnetometer and accelerometer clusters is not included in the model. This error can be quite common in some tools and effects both standalone and corrected MWD surveys.

Separate tool and environmental errors to that manufacturers can demonstrate their tool meets the error model.

By design the error model consider the uncertainties of surveys in-hole and lumps together error due to the environment along with pure sensor post-calibration errors. This is fine for a service provider who both builds and runs tools. However, it is difficult for companies who only manufacture tools to prove that their tools meet the model.

Re-consider Depth Model

At the last main ISCWSA meeting online, Harald Bolt gave a presentation, which criticised the detail and accuracy of the current depth model. The depth model has been unchanged since the work in Roger Ekseth's thesis. This could be re-evaluated.

Extend model to include ranging shots

We could add functionality to include ranging errors - for example for SAGD wells.

Create an agreed framework for combined surveys.

Several companies have given presentations and written SPE papers on combining multiple runs in a hole section into a combined survey. Should we create an agreed format and way of handling the uncertainties for survey combinations.

Survey Monkey Comments

Q. Do you have any other topics that you would like to suggest for the future?

Wanted to select more than 3 topics in question 1 :)

The topics above are not independent - for example the discrete blocks also overlaps with tool and environmental errors. I would like to see a simpler model that is easier to understand - maybe a "pre-processor" that would take all the various effects and combine them into one simple user file that combines all the effects.

Depth remains my biggest concern

Good selection of topics - maybe we could look at a simulation framework for EM testing/validation .... this wouldn't be my first choice though

My 4th vote would be for item 10 above, which I see as somewhat related to item 3.

Error modeling and QCing for continuous surveys (recorded during drilling)

An explicit way of detailing the correlations when concatenating several surveys in the same well, effect on depth terms, field, etc for tools of the same kind or different kinds

Standardized error term names: Should be agreed and practiced (throughout the industry), not only recommended. This is fundamentally important for handling g-terms properly; and is probably more important for the general error model application than e.g. breaking tool-codes into discrete blocks (although this has some of the desired standardization effect).

The gyro model should be documented fully following the work carried out between Total and HP Tech.

Depth terms seem to be lagging behind current project publications. Harald's depth description is simplified into a depth term

Address depth model (model currently doesn't consider errors in survey depth due to a constant bit-to-survey distance instead of using actual/measured off-bottom distances at each survey station)

 We need to look at a way to help new survey tools to generate error models and guidance on accuracy verification.

Q. Do you have any comments on the recent Rev5 changes?

Complex - not simple changes e.g. XCL terms

It was a compromise on misalignment. The 0.1 systematic was too big. I think the 0.3 random is too big also. The actual misalignment should be some small (0.05?) systematic error plus some (0.2?) random error.

Will try to implement, but things take time....

Added conservatism at near vertical, shallow, makes the ACR Sm term less relevant and much less likely to be adopted.

I am concerned about the possible abuse of XCL terms and the possible underestimation of their contribution. These terms were estimated based on real data, but now will be apply to unknown circumstances

I have not had time to go into details, hence I have no answer on question 3. But we plan to adopt the Rev5.

They are great and cover everything we wanted at Total.

Need to send out a clear message to the OWSG users what it is and why the need to change again to rev 5.

Q. Do you have any suggestions as to how we could work better?

More work between meetings.

Continue multi-day online meetings - the more frequent, I think keeps us better on track to actually do the work needed in small bites and progress more consistently, and not have big time demands on volunteers in large chunks, which that time might not be available otherwise

Increased discipline/structure to working between meetings. (Easier said than done.)

I think it would help to define a standard set of rules for work groups such as having a limited amount of attendees (e.g. 5), having recurring meetings at a minimum interval (e.g. monthly) and having them report back to the sub-committee chair regularly (e.g. monthly).

No real improvements needed, but: The model of experts volunteering for specific tasks (within their fields of expertise / interest) is very good and efficient. Keep on applying and encouraging this strategy!

Split into sub groups for QAQC, DEPTH, Synthetic, Redundancy (combined surveys), lower quality surveys and RANGING projects

It seems like most work is done by software vendors/reps, however this is likely due to the nature of the error models and their implementations in software platforms

Q. Do you have any other comments you would like to make?

Not easy to maintain model traceability and version control

Updated the eBook with rev5 details and description

A structural problem is that there is no advantage gained by providing more accuracy - or penalty for low accuracy. Service providers either meet the standard (they all claim this) or don't, so the current binary structure (yes/no) does not encourage improvements. I would like to see some way to incentivize improvements like overlapping surveys or surveying on the trip out.

Still don't like the website structure. Think we need clear classification of documents, making it easy to access the current definitive error model definitions.

Great job Andy keep up the energy. Hats off to everyone driving this forward every year.