

ISCWSA / SPE Wellbore Positioning Technical Section

Error Model Maintenance Work Group

Minutes of the Meeting at ISCWSA #53, Online, 12th April 2021

Present

Andy McGregor	H&P	Mike Calkins	Three Sigma
Jon Bang	Gyrodata	Jerry Codling	Halliburton
Harry Wilson	Baker Hughes	Jonathan Lightfoot	Occidental
Darren Aklestad	SLB	Anne Holmes	Halliburton
Phil Harbidge	Pathcontrol	Dalis Deliu	Conoco Phillips
Mike Attrell	Mostar	Levi Smith	Icefield Tools
Eric Maynard	EQT	Orlando Ramirez	Stockholm Precision
Gunnar Tackman	Baker Hughes	Brett Van Steenwyck	SDI
Phil Scott	DGI	Adrian Ledroz	Gyrodata
Denis Reynard	Pathcontrol	Harold Bolt	Depth Solutions
Anas Sikal	Pathcontrol	Steve Grinrod	Copsegrove
Neil Bergstrom	Independent	Hans Dreisig	Total
Francuska Emilija		Scott Farmer	Total
Craig Sim	DGI		

Depth

Andy McGregor presented a summary of the depth model as it currently stands.

The primary role of this committee is to provide a framework for calculating position uncertainty. These uncertainty calculations are generally used in collision avoidance and target sizing and as such are required at the planning stage and during operations.

Generally, it is up to service providers to populate models with term values appropriate to their application. However, it is a secondary role of the committee is to populate models for generic use. As such we provide term values for uncorrected driller's depth (implicitly assuming strapped pipe, weight off bottom and pumps off scenarios.) and for corrected wireline. We do not currently provide any generic models for depth correction.

The current term values were derived from work done by Roger Ekseth. Roger modelled 14 sources of error in drill-pipe measurements and 11 in wireline. These were cast as finite element equations. However, detailed evaluation requires a variety of parameters and details of the drilling conditions that may not be known at the planning stage and may not even be well known during operations. For this reason, Ekseth derived four simplified error terms which gave an 80% accurate solution over three well geometries that he evaluated. This greatly simplified the model.

Subsequent published work agreed that Ekseth's simplified model was generally appropriate and verified the magnitudes he derived (SPE 95611, SPE 89899, work by Angus Jamieson at 20th ISCWSA)

Harald Bolt then presented his thoughts on depth correction and uncertainty.

(the content of this presentation was an update to an earlier one that Harald gave at the 51th ISCWSA meeting (<https://www.iscwsa.net/files/614/>))

He argued that an operator should be able to specify the depth accuracy required for their needs and could then be presented with a range of options in terms of technologies and corrections to meet that need.

A variety of issues influence depth uncertainty, including well conditions, measurement technologies used, correction accuracy and the fidelity of the correction model to the depth error physics. However, the ISCWSA generic model only provides four fixed terms to cover these scenarios.

The way in which the physical error sources are lumped in the ISCWSA model means that errors which can be calibrated are merged together with values related to the specific measurement technology used. Reference errors, measurement calibration uncertainties and uncorrected physical error sources are all combined.

Harald suggested that the existing terms are replaced with components specifying the reference stability, the measurement methodology and calibration, the correction calculation and the fit of the correction model.

He commented that service companies have the option of delivering measurement accuracies that affect the final uncertainty obtained. Choices should be made based on operator defined along-hole depth data uncertainty requirements. The uncertainty quantification method was applicable across all the depth measurement methodologies, including drill pipe, wireline, slickline and coiled tubing, and is independent of well geometry, hence providing a stable system for application across data bases.

Each of these should be modelled with a polynomial with coefficients which are unique, and which evolve from actual measurement and well parameter uncertainties. A suggested summation methodology for uncertainty calculations was also presented. This would give a better match to the reality of the depth errors.

His summation was that, "The ISCWSA error model should be based on actual measurement and well parameter uncertainty values. These variables would include fixed reference variation, measurement / calibration accuracy, correction calculation and the correction model used."

This was followed by questions and an open discussion. Relevant points made by those in the meeting included:

It is an issue for operators maintain and managing databases where some depths have been corrected and other have not. Better to be consistent and compare like with like.

The old bias terms were confusing and only one operator generally still uses them.

Although we might think it desirable for G&G staff to consider the uncertainties associated with their MD and TVD measurements this is rarely the case.

It was recognised that there is a great reluctance in the industry to correct depth measurements and that it's not this place of this committee (or ISCWSA) to set required accuracy standards.

It is common practise to create error models with term values to match service provision. If a 'menu of depth correction options' needs to be provided to an operator this can be achieved under the current model framework by determining appropriate term values.

Harry Wilson pointed out that Baker Hughes have a range of service levels for depth correction and error models to match.

If there is a weakness in the current model, then most likely it is in modelling wireline.

If logs for formation evaluation are corrected with more detailed and specific parameters, this is normally done offline and in any appropriate way. It is not done within the well planning and survey database, which relies on the ISCWSA model.

In summary there are three considerations for the committee:

- 1) Is the current framework adequate to model depth uncertainty for the purposes for which the model is used?
>> The conclusion of the meeting was that the current framework is fit for purpose and an overhaul is not required.
- 2) Are our generic term values correct and suitably conservative?
>> There was no detailed discussion on this point.
- 3) Have we sufficiently well documented the model and its limitations, such that users understand what is covered and are able to create bespoke depth models as necessary?
>> It was agreed that further details in the definition document would be useful and it would be desirable to provide a means to replicate Ekseth's calculations.

ACTION: Andy McGregor, Harald Bolt, Darren Aklestad and Harry Wilson to update documentation with details of the assumptions implicit in the current driller's depth error model and with further details of the derivation done by Roger Ekseth

ACTION: Andy McGregor & Darren Aklestad to attempt to replicate Roger's work to derive the current term magnitudes.