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ISCWSA MWD Error Model Revisions

The current version of the ISCWSA MWD Error Model is Revision 3
The use of models with bias terms is not recommended

This note summaries the corrections, modifications and development of the ISCWSA MWD error model.

MWD Model Revision 0

The MWD error model was originally published as SPE 56702 in October 1999. This paper was updated and was published in SPE Drilling and Completion as SPE 67616 in December 2000. This Model has been assigned Revision Number 0

There are some additional corrections to paper SPE 67616:

No.	Page*	Corrections to SPE 67616
1	222	The magnitude of the Accelerometer Scale Factors in the table (page 222, column 2) should be 0.0005 (not 0.005)
2	224	The Dip Angle Weighting Function (page 224 top of column 2) should be MDI (not MFD)
3	233	Equation A-30 (page 233, column 2) should be ρ_{HL} (not ρ_{HA})
4	230	Table 4 (page 230) there are two MSZ weighting functions - the top MSZ weighting function should be MSX
5	224 & 230	Some of the Error Magnitudes in the Depth Model Table (page 224 centre) are incorrect: • The Scale value for a land rig should be 5.6×10^{-4} (Not 2.4×10^{-4}) • The Scale value for a floating rig should be 5.6×10^{-4} (Not 2.1×10^{-4}) • The Stretch value for a land rig should be 2.5×10^{-7} (Not 2.2×10^{-7}) • The Stretch value for a floating rig should be 2.5×10^{-7} (Not 1.5×10^{-7}) These values also need to be corrected in Table 4 (page 230) for the weighting functions DSF and DST.
6	223	Reference 6 in the paragraph on BHA Sag (page 223, column 1) is incorrect.
7	226	In Table 1,(at the bottom) the last bracket for MFI should be $1-\sin^2 I$ (not $I-\sin^2 I$)

* These page numbers refer to the original article published in SPE Drilling and Completion.

MWD Model Revision 1

Use of the Revision 0 model indicated there were problems with the misalignment terms MX and MY.

The new way of handling misalignment replaces the MX and MY terms in the original ISCWSA MWD model with new terms from the ISCWSA Gyro model (SPE 90408). The Gyro VSAG is the same as the existing MWD SAG term.

There are 5 terms and a calculation option (See SPE 90408):

Code	Term
XYM1	X-Y Misalignment 1
XYM2	X-Y Misalignment 2
XYM3	X-Y Misalignment 3
XYM4	X-Y Misalignment 4
VSAG	Vertical Sag – Same as existing SAG
ALT	1, 2 or 3 to Define Calculation Alternatives

Terms XYM3 and XYM4 also need to be added to the list of badly defined weighting functions in vertical hole (Table A-1 in SPE 67616).

The recommended numeric values for XYM1, XYM2, XYM3 and XYM4 are all 0.06° with Alternative 3 the preferred calculation option.

MWD Model Revision 2 (23-February 2007)

The numeric values for the Scale and Stretch terms in SPE 67616 are incorrect (See Correction 5 in the Table above) and should be corrected as per the table below.

Corrected Values (1 sigma) for Drill Pipe Depth:

Term	Code	DP Fixed	DP Floating
Random Ref	DREF(R)	0.35m	2.20m
Systematic Ref	DREF(S)	0.00m	1.00m
Scale	DSF(S)	$5.6*10^{-4}$	$5.6*10^{-4}$
Stretch	DST(G)	$2.5*10^{-7}\,m^{-1}$	$2.5*10^{-7}\,m^{-1}$

<u>MWD Model Revision 3 (8-October 2009)</u>

This revision was discussed and approved at the ISCWSA / SPE-WPTS meeting on the 8th October 2009 in New Orleans. This revision of the MWD model removes the toolface dependant terms and replaces them with toolface independent terms. This has removed the problems associated with planned wellpaths where unrealistic toolface values could give rise to unexpected results. The MWD model is now inline with the gyro model, which is also toolface independent.

Details of the changes are documented on the iscwsa.org website.