



Minutes of the 25th
Meeting of the

**Industry Steering
Committee on
Wellbore Survey
Accuracy**

and

**SPE Wellbore
Positioning Technical
Session**

Shell's Rijswijk offices,
Netherlands
February 23rd 2007



Attendees:

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** Minutes

1. Welcome and introduction

Mike Cauley welcomed everyone to Shell's Rijswijk facility before handing over to the Section chairman, Angus Jamieson.

Angus reviewed the Section's progress against its objectives, since its original formation as the ISCWSA in 1995. Significant progress has been made in terms of developing standards and increasing subject awareness, more operating companies now participate and the participants represent a wider geographic spread. However, progress has been slow and therefore Angus scored our success at only 6/10.



Introduction_Jamieson.ppt

2. Proposal for inclusion additional parameters in survey reports

Noel Zinn argued for the inclusion of an additional column in the survey report for azimuth referenced to true north. He said that his own company, ExxonMobil, store data in geographical co-ordinates, not projected co-ordinates, so in future they will insist on the inclusion of these data in survey reports.

Noel went on to stress the importance of taking account of geodetic effects when defining the well path, claiming that failure to do so can result in errors that are up to 40% as large as the 1 sigma uncertainty associated with the survey measurements. He thought that the Section had an obvious role to play in encouraging best practice in this area.

Angus Jamieson suggested the formation of a Work group to determine best practices. Noel agreed to lead the group and the following volunteered or were nominated:

- Pete Clark, INTEQ (Absent. Harry Wilson to confirm)
- Steve Mullin, Gyrodata
- Wayne Phillips, Schlumberger
- TBD, Shell



ExxonMobil Well-Survey Procedure

ACTION

Noel Zinn to co-ordinate first meeting of the Work Group in Houston later in the year.

3. Collision Avoidance Work Group – status report

The Group leader Harry Wilson first restated the Group's original goals:

- Education
 - Bibliography
 - Lexicon
 - Description of current methods
 - Followed by details of strengths and weaknesses
- Review of current methods
 - Recommend best practices with explanations and exceptions
- Investigate novel techniques
 - Describe, comment and recommend

The Group had met the previous day. Detailed minutes are attached here.



Collision
Avoidance_Minutes R

Regarding the third objective from the above list, John Thorogood commented that the papers published by BP some years ago on the subject of quantitative risk assessment provided a very useful starting point for anyone looking at the subject afresh, in particular the key issues raised in Hugh Williamson's paper "Towards Risk-Based Well Separation Rules".

John offered to provide brief case studies of collision incidents, and requested contributions from other operators to compile a set of such "war stories" to help illustrate the range and scale of the collision avoidance problem.

4. Section administration

The Chairman brought forward this item from its later slot on the agenda to allow participation by those that might have to leave early.

Harry Wilson raised two points for consideration:

a. The SPE requires Technical Sections to have a constitution. The Section officers produced a draft version more than one year ago, but it has not been discussed with the membership of the Section and has not progressed beyond its draft status. Harry felt that it was time to complete the writing of the constitution, allowing members to review it and comment before it was finalized.

ACTION. Officers agree on a draft version and post to the Section web site for review by members prior to the next meeting of the Section.

b. Section members often attend meetings of Work Groups that they are not members of. The Section officers feel this practice undermines the original intention of forming such groups, has the potential to reduce their effectiveness, and should therefore be discouraged. Work Groups have no obligation to advertise where or when they will meet, or facilitate the attendance of observers in any other way. Several members expressed the opinion that the presence of observers need not affect the productivity of the Groups. Harry agreed that this was generally true, but could not be assured.

Section administration

He reminded members that:

- Membership of Work Groups is open to all (although active participation is expected)
- Groups are required to report progress at each Section meeting, and those reports are minuted
- Material intended for publication normally receives peer review from the rest of the Section during those briefings

5. Model Maintenance Sub-Committee – Status Report

Group leader, Steve Grindrod reported that the group had met the previous day.

His presentation is attached:



error model
maintenance_S.Grind

Steve announced the first revisions to the MWD model. It has been decided to consider the published model as revision 0. In rev 1, the sub-committee had earlier agreed to replace the misalignment terms with those used in the gyro model, but before this revision was made widely known, they also managed to resolve some ambiguities regarding the depth reference terms. These changes constitute rev 2.

The subject of increasing the set of MWD models to include additional corrections was discussed. In-field referencing is an example of a technique which is now commonly applied, but for which there is not a published generic model. Steve was interested in the Section's thoughts on how to arrive at suitable term values. Phil Gurden, Angus Jamieson and Dave McRobbie all thought that there was too much variability in IFR methods to allow a generic set of term values. Dave felt that the generic values would necessarily have to reflect the lower end of the IFR specification range and would therefore the model would have very limited value. Harry Wilson commented that he thought that the sub-committee should concentrate on specifying any additional terms required to model advanced corrections and leave the associated term values to the service providers.

This last point addressed Steve's concern that the accommodation of multiple corrections and operating environments resulted in a very large set of MWD models, which the sub-committee would have to manage and provide standard test data for. Harry reiterated that he felt that such activities would be wasteful of the sub-committee's time, and that their efforts would be better spent on managing the general model, particularly the merging of the MWD and gyro models.

Barry Foreman asked why the Section should not be engaged in validating service providers' term values. Harry responded that the Section had insufficient resources for such a task, and that he felt it was a step beyond the Section's remit. The Section had published two papers on how to QC data for conformance with the ISCWSA models and how to use data to validate the models; these were more appropriate activities for the Section.

Tim Price suggested that suppliers should put their tool models in the public domain. Harry agreed and said that INTEQ's models were available on the Company's web site. Angus Jamieson suggested that such model descriptions be supported by results for the three standard ISCWSA wells. It was generally agreed that these were good ideas and examples of good practice on the part of the suppliers.

Steve said that he still sees frequent examples of incorrect implementations of the model, and there followed wide discussion on how to achieve a standard implementation. Many members favour the idea, proposed by Kevin McCaird at our previous meeting, of providing a standard software implementation.

Angus closed this discussion by thanking Steve for the significant time and effort he has spent on this project.

7. BHA Sag Behaviour

The validity of the current sag and misalignment terms has been a recurring topic of debate at previous meetings. Andy Brooks suggested alternate definitions for the sag and misalignment terms, based on whether or not the error rotated with BHA toolface. This would permit a BHA Sag term to have an azimuthal component.

Andy showed the results of the sag analysis of 79 rotary steerable BHAs over a variety of inclinations and build up rates giving a total of 4426 scenarios.

The presentation is attached here, but Andy's conclusions were:

- SPE 67616 sag model can be improved
- Uncorrected sag tends to be biased and therefore should be corrected
- Magnitude of sag error depends on hole size
- ISCWSA weighting of $\sin I$ underestimates the effect at low inclinations
- A fixed error cannot be used as it produces unrealistic results near vertical



Sag

analysis_A.brooks.pp

Regis Studer pointed out that steerable motors will tend to drill a slightly over gauge hole, resulting in larger than predicted sag effects.

Andy hopes to have added more data to this analysis by the time of the next meeting.

8. Managing Inclination-Only measurements

Jerry Codling pointed out that directional databases contain data acquired by inclination only tools such as drift indicators, and that although not true directional data they still require an estimate of position uncertainty to allow collision monitoring.

How to model such data has always been a problem and is not dealt with by the ISCWSA models. In his presentation, Jerry proposed a novel way of modelling inclination-only data. The model results in a toroidal distribution instead of an ellipsoid.



Managing IncOnly_J
Codling.ppt

The method requires inclinations to be entered into the database, but not used in the calculation of co-ordinates. Instead, the wellpath is assumed vertical, with the inclination only used in the calculation of position uncertainty. Although common to other methods of modelling inclination-only measurements, and possibly the only consistent way of handling inclination-only data, it is not standard practice in the Industry.

9. Management of Survey Legs

Per SPE 67616, “a survey leg is a set of contiguous survey stations acquired with a single tool or, if appropriate, a single tool type”.

Regis Studer described the inconsistencies in results for concatenated MWD surveys, due to variable interpretations of what set of circumstances should trigger a new survey leg. Regis pointed out that too free an interpretation of the criteria results in excessive randomisation and an over optimistic reduction in uncertainty.



Management of
MWD survey legs_Stu

Regis' conclusion was:

- The basic MWD model leads to over optimistic uncertainty estimate for concatenated surveys
- Cause is insufficient differentiation of relevant terms
- The ideas proposed in SPE 36863 on categorisation of terms should be followed up
- Meantime, recommends that MWD data be entered as a single leg to avoid under estimation of uncertainty

Harry Wilson said that it might be impossible to have the model automatically accommodate every situation correctly, and that there might always be a need for an accompanying policy for the management of MWD survey legs. Harry said that INTEQ currently applied a simple policy of one leg per hole section for both planned and actual wellpaths, although this might be refined to acknowledge significant BHA changes in actual wellpaths. Regis agreed that such a policy would be adequate in controlling the excessively optimistic outcomes that TOTAL have observed.

10. Summary of SPE 105669 – Survey Accuracy Extends Well Displacement at Minimum Cost

Benny Poedjono described a survey management project which identified that inefficient water flood on a 600 well development was due to inaccurate MWD surveys. Reprocessing of the existing surveys improved their quality and allowed a better understanding of the observed results of the water flood program. A new surveying and drilling program was implemented that achieved the required accuracy and even resulted in fewer days to TD.



SPE
105669_B.Poedjono.1

This case study illustrates the difference between assuming that the wellbore positioning process is being delivered to specification and applying specialist supervision to ensure that it is.

11. New BHA Sag Correction Methodology

Ludovic Macresy presented the latest DrillScan/TOTAL study of BHA sag effects,



BHA Sag Results_
StuderMacresy.pdf

A new correction method was applied to field data and several weaknesses of the current method were identified. Ludovic noted that uncorrected sag effects at low inclination are much larger than predicted by the ISCWSA model (supporting Andy Brooks' study) and that overall they appear to exhibit a bias not predicted by the model. The study indicates that there is no obvious general rule that can be used to model these effects.

12. Any Other Business

Angus Jamieson suggested that the next meeting be planned to coincide with the SPE ATCE, which will be held in Anaheim California in November. There was general agreement and Angus requested Companies consider volunteering to host it.

He requested feedback before then on the important recommendation that the Section produce a software implementation of the ISCWSA uncertainty models (e.g. a DLL).

ACTIONS

Volunteer hosts contact Angus.

Anyone with thoughts regarding coding up of the model please summarise for Angus in time for the next meeting.

Angus thanked Shell once more for their generosity and closed the meeting.