Minutes of the Seventeenth Meeting of the

Industry Steering Committee on
Wellbore Survey Accuracy

Amsterdam, Holland
18th February 2003

Present:

Name	Company	E-Mail
David Kerridge	BGS	djk@bgs.ac.uk
Greg Cellos	BHI	greg.cellos@inteq.com
Harry Wilson	BHI	Harry.Wilson@inteq.com
Andy Brooks	BHI	Andy.brooks@inteq.com
Inge Edvardsen	BHI	Inge.edvardsen@inteq.com
Matthew Rhodes(*)	BP	rhodesm1@bp.com
John Thorogood	BP	thoroj@bp.com
Ed Stockhausen	ChevronTexaco	edjs@chevron.com
Olli Coker	Conoco	Olli.coker@conocophillips.com
Steve Grindrod	CopseGrove	copsegrove@compuserve.com
Steve Mullin	Gyrodata	stevem@gyrodata.com
Roger Ekseth	Gyrodata	rogere@gyrodata.com
Glenn R. McColpin	Landmark	gmccolpin@lgc.com
Hans Dreisig	Maersk Oil	hcd@moq.com.qa
Robert Wylie	MicroTesla	rwylie@microtesla.com
Odd Inderhaug	Norsk Hydro	Odd.helge.inderhaug@hydro.com
Connor Hyland	Paradigm	connorh@paradigmgeo.com
Graham McElhinney	Pathfinder	graham.mcelhinney@pathfinder-ltd.co.uk
Kevin McClard	Performance Drilling Technology	Winsurv3d@sbc-global.net
Chris Chia	Schlumberger	cchia1@slb.com
Darren Aklestad	Schlumberger	aklestad@slb.com
Katy Heidenreich	Schlumberger	kheidenreich@slb.com
Ross Lowdon	Schlumberger	rlowdon@aberdeen.oilfield.slb.com
Wayne Philips	Schlumberger	phillips3@slb.com
Bill Lesso	Schlumberger	lesso1@slb.com
Dave McRobbie	Sperry Sun	dave.mcrobbie@halliburton.com
William Allen	Sperry Sun	william.allen@halliburton.com
John Weston	Sperry Sun	john.weston@halliburton.com
Anne Holmes	Sperry Sun	anne.holmes@halliburton.com
Patrick Knight	Sperry Sun	patrick.knight2@halliburton.com
Angus Jamieson	TECH21	T21es@aol.com
Sergio Giorgi	Total Fina Elf	Sergio.giorgi@tfeeuk.co.uk
Torgeir Torkildsen	Statoil	totor@statoil.com
Stein Havardstein	Statoil	steint@statoil.com
Erik Nyrnes	Statoil/NTNU	enyr@statoil.com
Mike Nero	Weatherford	Mike.nero@weatherford.com

1 Introductions

Matthew Rhodes and Ed Stockhausen welcomed the group to the Hilton Hotel, Amsterdam, Holland and after a brief HSE moment introduced the agenda for the day.

2 Re-evaluation of the ISCWSA role (Rhodes & All)

In response to questions raised at the last meeting, (Oct 2002, Houston), over an apparent lack of operator support and an inability of the committee to put words into action and make decisions the chairman presented a brief re-focusing session.
It became apparent that the committee has to a large extent lived up to its initial mission statement of "*producing and maintaining standards for the industry relating to wellbore survey accuracy.*"
The free and open forum for discussion amongst operators, service companies and independents was voiced as being particularly useful. Especially amongst the Service Co's and independents! The result of this though was the current less than formal arrangement that results in difficulty assigning workload and in making decisions.
Those present agreed that a minor adjustment in the manner by which the committee assigns responsibility and votes on decisions would address the majority of current problems.

Angus Jamieson suggested a split tier group in which we would maintain the current wider open forum but establish smaller more formalised groups for making decisions and working on specific action items.

Bill Allen would welcome the committee's increased ability to make decisions, as he believed one of the key goals of the ISCWSA was to influence more operators.

Olli Coker thought that the current arrangement of the committee worked fine. He questioned what was broken.

Harry Wilson in response to both Bill and Olli re-emphasized the requirement of the committee to increase standardisation.

Dave McRobbie added that if the committee could publish more of the findings/ideas it would encourage more operator participation.

Chris Chia & Harry Wilson agreed that at the very least the committee could set forward best practice and at the very least identify worst practice.

Ed Stockhausen added that the time currently taken to get actions is problematic.

ACTION: A more formalised technical decision making committee of around 10-12 members will be established. (Rhodes)

3 ISCWSA and SPE – Possibilities for Closer Cooperation (John Thorogood)

John (SPE – Director for Drilling & Completions) joined us to propose a closer working relationship between both the SPE and the ISCWSA.

Following on from e-mail and telecon discussions previously held John presented the concept to the wider committee. The idea of technical sections within the SPE was seen as a natural development of which the ISCWSA would be a welcome addition.
Building on this idea of SPE technical sections there is an opportunity for the ISCWSA to develop it's own structure and governance under the SPE whilst at the same time benefiting from the increased exposure and plethora of established collaboration and publication tools available.

Those present were asked by the chairman to vote, by a show of hands, on whether they could see benefit arising from a closer affiliation with the SPE. The vote was almost a unanimous yes.

ACTION: A working group of Rhodes, Wilson, McRobbie, Chia, Turvill, Rodney, Jamieson, Mullin & Stockhausen to work with John Thorogood in preparing draft constitution and operations documents for final approval / disapproval by the committee.

4 Definer Surveys (Angus Jamieson)

Angus presented a new method for utilising all available survey data whilst at the same time minimising the number of survey stations required to accurately define the wellpath.

Drilling surveying is apparently the only form of surveying that still uses only the non-redundant data.

As accurate a definition of the wellpath as possible is obtained by using all the available data and combining this by means of a weighted least squares method.

Integration of the true X, Y & Z positions by the varying curvature method followed by selection of variable survey intervals, (to ensure positional error of <1/1000), ensures accurate definition of the wellpath with a small number of stations. The resultant definer survey may then be quoted as normal.

For further details see the attached presentation or speak with Angus.

Dave McRobbie asked who and where the original dataset would be held?

Angus stated that the original data would need to be stored separately.

Patrick Knight pointed out that this would greatly increase the amount of stored data not decrease it.

Harry Wilson thought this would only be a problem if we stored all the continuous data.

Olli Coker reiterated that the onus was on the operator to store the original data. All too often the responsibility was misplaced on the Service Co. The Service Co's agreed.

Patrick Knight wondered how this would affect the survey frequency element of the error model.

Ed Stockhausen queried how this method differed from Schlumberger's MAP proposal.

Chris Chia replied that this was a new calculation method as opposed to Schlumberger's proposal of combining surveys.

Ed Stockhausen voiced fears over the well position changing dramatically at a later date.

John Thorogood questioned the effectiveness of the proposal in long vertical sections.

Angus Jamieson pointed out that the concept was in its infancy and further investigation would be required.

Steve Grindrod quoted work he had performed for Norsk-Hydro where continuous data was used to good effect to pick specific static survey points.

Angus finished off by pointing out that the method would not reduce positional uncertainty.

5 Effect of Survey Frequency upon Well Positioning (Wayne Phillips)

Following up on findings cited at previous meetings (*) Wayne demonstrated the impact of different slide build rate (SBR) and rotate build rate (RBR) sequences during a stand on wellbore position assuming 90ft survey intervals. It was not uncommon for drillers to have a routine for combining slide and rotate sequences through a stand. Wayne illustrated these as driller A & B respectively. It was demonstrated that calculated TVD largely depended on whether the slide section of the stand was performed at the beginning or the end of a stand.
Wayne proposed a balanced method of slide/rotate whereby an accurate calculation of wellbore position may be achieved from 90ft survey intervals. It was argued that this would be equally applicable for X & Y coordinates as well as Z coordinates.

Wayne concluded that the problem warranted further investigation and indicated that:

- Survey interval effect on 3D wells should be further investigated.
- More real data needed to be used to investigate/quantify correlations between error vectors.
- The model parameters, such as SBR, RBR etc, needed to be tied down.

Harry Wilson pointed out that the surveys were not taken at the bit.

Chris Chia raised concerns over placing more onuses on the drillers to adjust their drilling sequences. He went on to add that the nature of the problem should be investigated further and options for defining the BHA should be investigated.

Patrick Knight asked what impact this could have on the size of a driller's target.

Chris Chia reckoned that at the very least it would force planners into a re-design of the well trajectory.

Harry Wilson suggested the need for a new error term that is a sensible weighting function. This was much more preferable than having an additional error model.

Andy Brooks agreed and pointed out that this was an extension of his proposal set forward at the previous meeting.

Chris Chia said he would like to see more use of the continuous D & I data.

Ed Stockhausen agreed vehemently with the previous statement.

Harry Wilson proposed putting in place a mechanism for updating the error model.

ACTION: A technical sub-committee, comprising Wayne Phillips, Andy Brooks and Anne Holmes to work towards an amendment to the existing error model.

6 Vertical Hole Azimuth Selection – It's effect on EOU computations (Darren Akelstad)

Darren presented to the committee the current feature of the standard-MWD error model whereby the selection of vertical azimuth during the planning stage can greatly influence the growth rate of the ellipse of uncertainty after kick off. (See presentation).

It was demonstrated how this was dependent upon the length of the vertical section and the degree of build achieved at the kick off point. The result of this was often large differences in EOU size between the planning stage and the surveyed wellbore.

Darren briefly demonstrated the error terms responsible and then went on to propose a number of possible solutions:

- Leave it alone and live with it!
- A preferred short-term solution of setting the azimuth to equal the next no-zero inclination station azimuth.
- A modification of the error model weighting functions to better handle the problem.

Andy Brooks highlighted that this was a tool face problem rather than an azimuth problem.

Patrick Knight reinforced the fact that the planned EOU does not bear any resemblance to the actual surveyed EOU because of the randomised tool face.

Wayne Phillips suggested randomising the tool face in the vertical section of the wellbore.

Andy Brooks highlighted that Torgeir Torkildsen had previously written a paper on this subject.

Torgeir Torkildsen briefly described this method.

Darren Akelstad pointed out that it was inevitable that the standard MWD error model would require "ongoing maintenance" and that it was the job of the committee to provide that.

Steve Grindrod said that based on work he had done why did the committee simply not remove the terms, as their overall contribution to the EOU size was minimal?

Patrick Knight re-emphasized that the reality of drilling the well was not maintained from the planning stage, as currently they were not working with a real drilling target.

Harry Wilson suggested that Torgeir Torkildsen's methodology should be introduced as standard and indicated that it was SPE paper # 63275.

ACTION: Darren Akelstad and Torgeir Torkildsen to work together towards an amendment of the current error model.

7 Update by the Gyro Error Model sub-committee (Torgeir Torkildsen, Roger Ekseth, Stein Havardstein)

Torgeir, Roger and Stein briefly presented an update on the progress made by the gyro error model sub-committee. Full minutes of the previous days meeting are attached below: (Double Click on the embedded attachment).

Microsoft Word Document

8 Implementation of the ISCWSA Error Model – An Operator's View (Steve Grindrod)

Steve Grindrod highlighted the difficulties he had as an independent specialist in encouraging certain operators to adopt the ISCWSA error model format. He quoted a number of negative remarks he had received:

- No published gyro models
- Difficulty mixing models with existing Wolff & de Wardt
- Strange results
- Inexperience within Service Co's
- Difficulty validating models
- Too many different models

Steve went on to highlight specific problems he had encountered whilst attempting to validate the error models him self. Through his work he had actually discovered 82 different ISCWSA tool error models of which only 5 had duplicate error terms!

He re-emphasized the statement in the MWD error model paper that highlighted the need to push forward with agreed error models for other survey services.

In conclusion Steve suggested the committee agree as soon as possible on a variety of magnetic and gyro survey models. He felt there was also a need for more and better test profiles.

Harry Wilson questioned what Steve had seen as the problem with the tie-on points?

Steve Grindrod elaborated on the manner in which Sputnik assumed an averaged tie on point between two stations?

Harry Wilson suggested that once the two new error terms, survey frequency & vertical hole azimuth, had been implemented into the error model then perhaps the major software providers should post top to bottom listings of the ISCWSA test profiles.

9 AOB 1

Graham McElhinney gave the committee an update on the concept of ”gravity MWD”, or put another way the use of uncorrelated accelerometer sets to determine direction in areas of magnetic interference. Graham briefly presented results from the 4 most recent wells drilled with this method. Comparison between the gravity derived direction and the magnetic direction when free of interference looked good and provided an extra level of assurance.

Matthew Rhodes asked what the current limitations with the method were?

Graham replied that the technique was currently limited to 1000ft MD as an initial reference azimuth was required.

Olli Coker wondered what the effects of torsional and sag effects would be?

Andy Brooks thought that the process would assume no torsional effects.

Dave McRobbie asked if the surveys were dependent upon the unit length between the surveys?

Graham said yes because the accelerometers were essentially measuring the difference between the two.

Graham concluded that the technique was still in its infancy, although already commercial, more detailed evaluation of the technique was required and this would be fed back to the committee in due course.

10 AOB 2

Robert Wylie presented the ISCWSA contribution to the industry to date. He felt that the committee functioned largely as it was intended and provided an invaluable yet often unnoticed service within the industry. He suggested the committee think hard and fast before jumping into an affiliation with a larger body. A minor adjustment to the decision making process may well all be that is necessary to re-align the committee with it’s overall objectives.

Robert presented a prototype mud meter to the committee. This was in response to a poll of the committee gathered at the 15th ISWSA meeting in Gatwick. It was hoped that the meter could be used at the rig site to highlight the phenomena known as “magnetic mud” prior to tripping out of hole with a functional MWD tool.

Dave McRobbie asked what the meters accuracy and sensitivity was?

Robert replied that it was much better than initially expected.

Dave asked what the likely cost would be?

Robert hoped that the units would come in at less than $1000.

Robert Wylie went on to ask the committee what there thoughts were on a tool for accurately measuring pole strengths? Would it be beneficial?

Harry Wilson warned about getting spurious readings. For example –ve pole values at both ends of a motor! He went on to add that the values would be totally different when the rotor was rotated.

Torgeir Torkildsen thought it was a good idea even if it only gave a good quality measure. Patrick Knight quoted a problem Sperry had encountered with electro-magnetic pipe lifting equipment on the StatFjord C platform and thought Statoil might want to investigate their use.

The subject then moved onto the use of gradiometers for measuring pole strengths down hole.

Dave McRobbie questioned where the sensors should go? He thought that it was a waste of time measuring pole strengths at surface.

ACTION: Dave McRobbie to look into patent and intellectual property rights with respect to down hole gradiometers.

Robert Wylie concluded with a brief demonstration of the proposed ISCWSA website. He is still looking for ideas and feedback from the committee members prior to launch.

It is proposed that the current chairman of the ISCWSA will be responsible for editing and updating the website.

Olli Coker proposed a maintenance free service provider at a charge of $150/month.

Robert Wylie explained that he got small business discounts that enabled him to publish the website at minimal costs.

11 Thank you & Arrangements for the 18th Meeting

I should like to thank Ed Stockhausen of Chevron Texaco for his efforts in arranging the venue and refreshments for this meeting. I am sure you will all agree they were excellent.

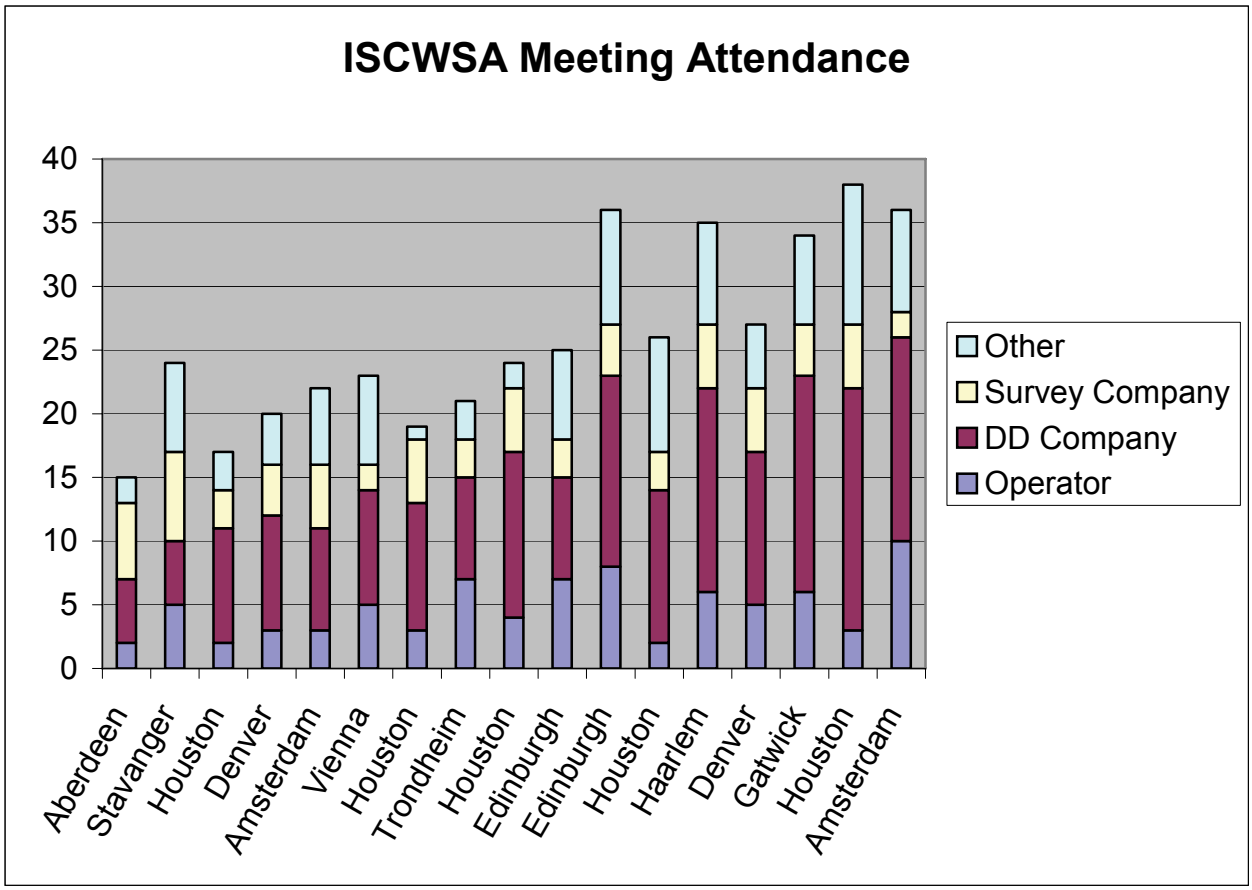
Thank you, as ever, to all those who gave presentations. The meetings would simply not function nor attract their large attendance if it were not for these.

Additional thanks go to all those involved in raising the awareness of our committee amongst the Operating community, especially Angus Jamieson. The attendance table at the end of this report is testimony to that effort. Keep up the good work.

Finally can I remind all of you lucky enough to have been included within the various action items. Time is our greatest thief. If we are to achieve anything we need to get cracking on these. All relevant updates will follow.

The next meeting is proposed to coincide with the SPE/IADC Drilling Conference Denver, Colorado in October. Glen McColpin volunteered Landmark to host the meeting. This has since been confirmed and the most likely date will be Thursday 9th October.

Matthew Rhodes
March 2003


ISCWSA Meeting Attendance
40
35
30
25
20
15
10
5
0
Other
Survey Company
DD Company
Operator
Aberdeen
Stavanger
Houston
Denver
Amsterdam
Vienna
Houston
Trondheim
Houston
Edinburgh
Edinburgh
Houston
Haarlem
Denver
Gatwick
Houston
Amsterdam