OWSG GENERAL MEETING

May 23, 2023

8:00 am CDT Start Time

Jonathan Lightfoot

Sub-Committee Chair

AGENDA

- OWSG Mission & Anti-Trust
- SPE Technical Sections (SPE Connect Update)
- SPE 2024-25 Distinguished Lecturer (Potential)
- API RP78 - Maximum Recommended Survey Interval (SF & MRSI Table Final Update)
- Upcoming Events
  - API RP78 Ballot Mtg.
  - IADD Directional Drilling Digital Transformation
  - IADD Annual Technical Forum (Abstract Call)
- Open Discussion Session

Name	Operator Affiliation	Email
Jonathan Lightfoot	Oxy	Jonathan_lightfoot@oxy.com
Marianne Houbiers	Equinor	mhou@eqinor.com
Kevin Sutherland	Chevron	Kevin.Sutherland@chevron.com
Pete Clark	Chevron	peterjclark@chevron.com
David Baker	ConocoPhillips	David.Baker@conocophillips.com
William (Bill) Allen	BP	William.Allen@bp.com

8 Attendees – May 23, 2023

Name	Affiliation	Email
Marc Willerth	HP Tech	Marc.Willerth@hpinc.com
Jerry Codling	Halliburton	Jerry.Codling@hallibrton.com

Our Mission

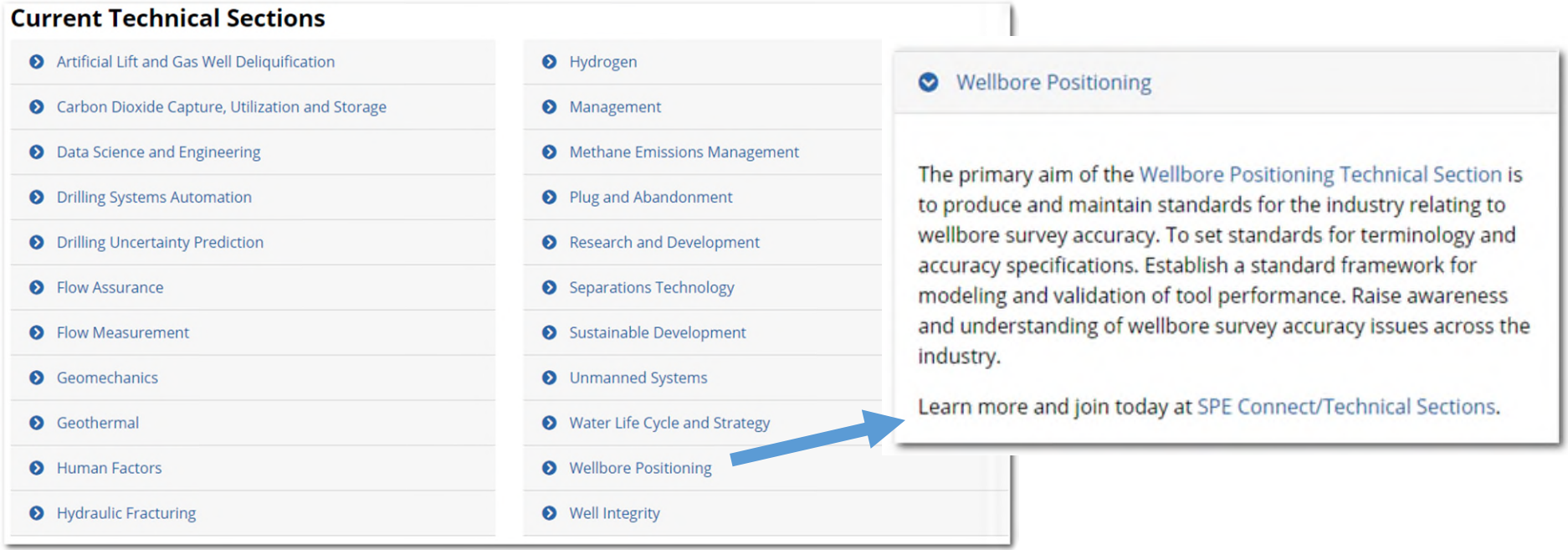
To promote practices that provide confidence that reported wellbore positions are within their stated uncertainty.

Anti-Trust

We are meeting to help develop and promote good practices in wellbore surveying necessary to support wellbore construction which enhance safety and competition.

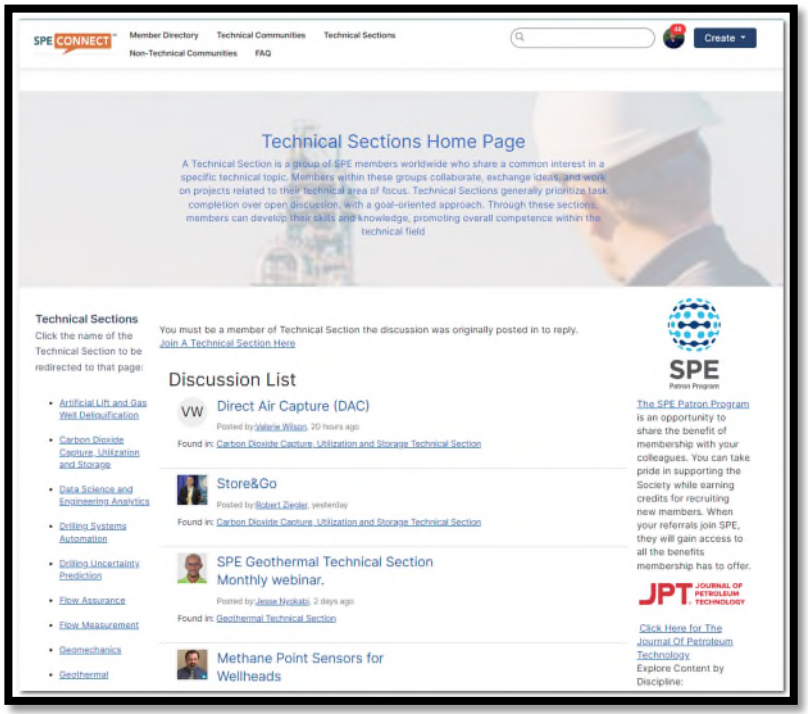
The meeting will be conducted in compliance with all laws including the antitrust laws, both state and federal. We will not discuss prices paid to suppliers or charged to customers nor will we endorse or disparage vendors or goods or services, divide markets, or discuss with whom we will or will not do business, nor other specific commercial terms, because these are matters for each company or individual to independently evaluate and determine.

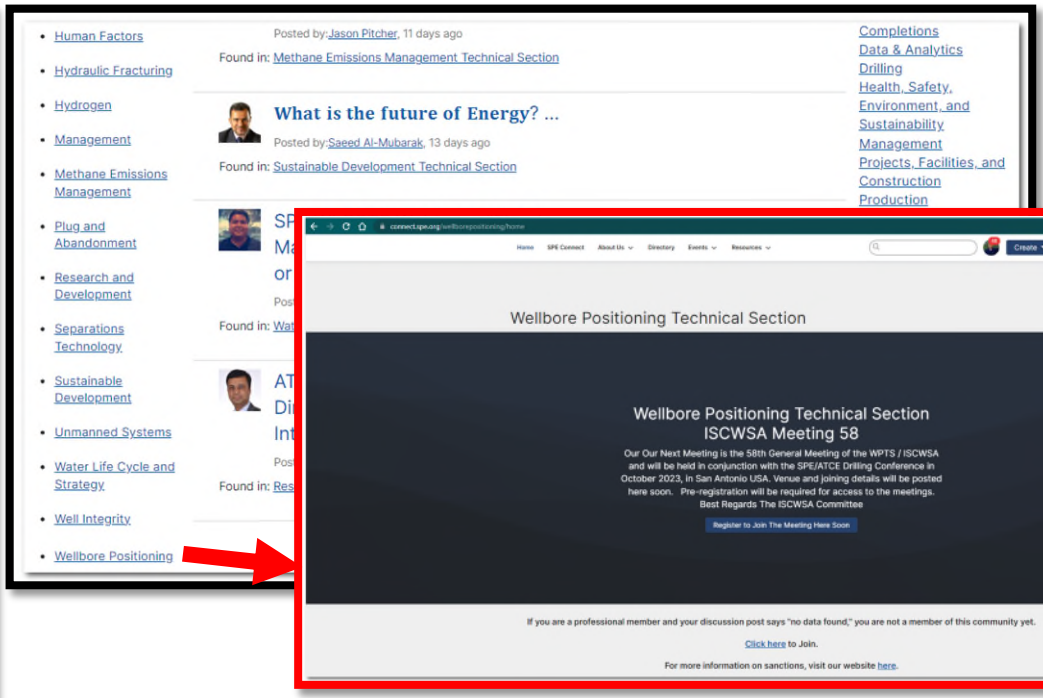
SPE Technical Sections



https://www.spe.org/en/industry/technical-sections/

SPE Technical Sections on SPE Connect





https://connect.spe.org/technical-sections/tshome

SPE Distinguished Lecturer 2024-25

Dear Jonathan,

The SPE Distinguished Lecturer Committee (DLC) convened last week to review the nominees for the 2024-25 lecture season. It is with great pleasure to advise you that your topic was selected to continue the process as a Potential Lecturer (PL).

Presentation Review Meeting
As part of the final selection process, you are invited to present your nominated topic at the Presentation Review (PR) Meeting. Final acceptance to the Distinguished Lecturer Program (DLP) occurs after successful completion of this process, which includes giving your oral lecture presentation to the DLC. Please note that only 60-70% of the Potential Lecturers (PL) who are invited to present will be able to continue as SPE Distinguished Lecturers.

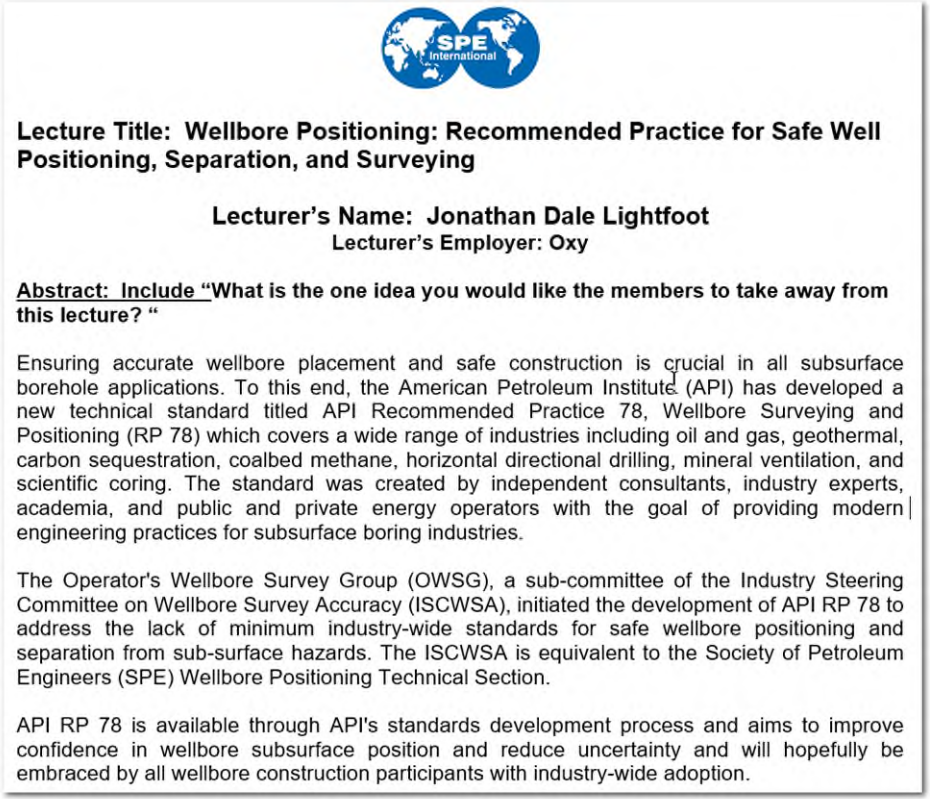
- **It is mandatory that you attend this verbal presentation meeting in person, as this is where the lecturers are selected, and this is the basis of the DL Program.**
- Potential Lecturers located in Canada, South America, and USA should plan to attend the **18-20 October 2023 meeting in San Antonio, Texas USA following ATCE.** The meeting will begin with a reception on the evening of 18 October. Details about this meeting will follow.

- Selected as a Potential Lecturer (PL)
- 2024-2025 Season
- SPE WPTS Nomination (Education Sub-Committee)
- Lecture Title: Wellbore Positioning: Recommended Practice for Safe Well Positioning, Separation, and Surveying

https://www.spe.org/en/industry/technical-sections/

SPE Distinguished Lecturer 2024-25

- Selected as a Potential Lecturer (PL) – 1st Round
- In the past, there have been tour schedules involving as few as three presentations to as many as forty during a lecture season. The average number of presentations per lecturer is 15-20.
- September 2024 through June 2025
- Final Presentations in San Antonio, TX after the ATCE – October 18-20, 2023.
- Only 60-70% of the Potential Lecturers (PL) who are invited to present will be able to continue as SPE Distinguished Lecturers.
- Final SPE DL Selections by EOY



Lecture Title: Wellbore Positioning: Recommended Practice for Safe Well Positioning, Separation, and Surveying

Lecturer's Name: Jonathan Dale Lightfoot
Lecturer's Employer: Oxy

Abstract: Include "What is the one idea you would like the members to take away from this lecture? "

Ensuring accurate wellbore placement and safe construction is crucial in all subsurface borehole applications. To this end, the American Petroleum Institute (API) has developed a new technical standard titled API Recommended Practice 78, Wellbore Surveying and Positioning (RP 78) which covers a wide range of industries including oil and gas, geothermal, carbon sequestration, coalbed methane, horizontal directional drilling, mineral ventilation, and scientific coring. The standard was created by independent consultants, industry experts, academia, and public and private energy operators with the goal of providing modern engineering practices for subsurface boring industries.

The Operator's Wellbore Survey Group (OWSG), a sub-committee of the Industry Steering Committee on Wellbore Survey Accuracy (ISCWSA), initiated the development of API RP 78 to address the lack of minimum industry-wide standards for safe wellbore positioning and separation from sub-surface hazards. The ISCWSA is equivalent to the Society of Petroleum Engineers (SPE) Wellbore Positioning Technical Section.

API RP 78 is available through API's standards development process and aims to improve confidence in wellbore subsurface position and reduce uncertainty and will hopefully be embraced by all wellbore construction participants with industry-wide adoption.

https://www.spe.org/en/industry/technical-sections/

MRSI
Maximum Recommended Survey Interval

Maximum Recommended Survey Interval - Guidance

The following recommendations for the maximum survey interval are intended only for safe-separation and collision avoidance, Table 7. They do not address the requirements for routine drilling and meeting other well objectives such as targets. To be valid, all surveys are required to pass the defined QC criteria for the survey tools and positional uncertainty model being used. In general, the survey frequency increases with increasing dogleg severity (DLS) and decreasing separation factor (SF). The intervals may be adjusted for nonstandard tool joints or stands (Double, Triple, Quad, and Range I, II, III) as detailed in API 7G-1 (17th Edition, 2023). These intervals may also be extended when there is firmly established and continued divergence of the reference well from all HSE risk classified offset wells.

Maximum Recommended Survey Interval - Update

Well-Collision-Avoidance Management and Principles

S. J. Sawaryn, Consultant; H. Wilson, Baker Hughes, a GE Company; W. T. Allen, BP; P. J. Clark, Chevron Energy Technology Company; I. Mitchell and J. Codling, Halliburton; A. Sentance, Dynamic Graphics Incorporated; B. Poedjono and R. Lowdon, Schlumberger; J. Bang, Gyrodata Incorporated; and E. Nyrnes, Equinor ASA

Maximum-Survey Interval (ft)		DLS (degrees/100-ft MD)		
		<1	1–5	>5
SF (-)	>2	200	100	33
	1.5–2	100	100	33
	<1.5	33	33	33

Table 3—Recommended maximum survey interval for safe separation and collision avoidance.

Table 7—Recommended Maximum Survey Interval for Safe Separation and Collision Avoidance

Separation Factor (SF)	Planned DLS [°/100 ft MD]		
	DLS ≤ 2°/100 ft DLS ≤ 2°/30m very long radius / tangent	2° < DLS ≤ 6°/100 ft 2° < DLS ≤ 6°/30m long radius	DLS > 6°/100 ft DLS > 6°/30m medium radius
MRSI w/ given directional drilling action without collision avoidance	140 feet (42m)	100 feet (30m)	100 feet (30m)
SF > 4.0	Follow Regulatory Requirements (FRR)		
1.5 < SF ≤ 4.0	200 feet (60m) or FFR	100 feet (30m)	100 feet (30m)
SF ≤ 1.5	140 feet (42m)	100 feet (30m)	45 feet (14m) or DP joint length

Revised May 23, 2023 (OWSG Mtg)

Maximum Recommended Survey Interval - Guidance

From the surface (ZDP) to the anticipated crossing, intercept, or closest approach point, the maximum surveying interval (course length) is suggested. Once the divergence between the reference well and all offset wells is firmly established and the separation factor exceeds 1.25, the survey interval may be extended. The separation factors provided in the table reflect the minimum separation factor for the proposed well and should be applied to all parts of the wellbore, prior to and during the close approach section.

A survey interval of no more than 100 feet is advised for any steered interval of hole. To ensure trajectory trends and BHA directional tendency are recognized, further surveys should be taken at the conclusion of a steered interval. This is because these trends may alter as the well profile, drilling parameters, formation, or BHA wears. Instead of drilling forward and surveying, it is advised to pull back and conduct repeated surveys if a survey reveals unanticipated magnetic interference. In this case, it is advised to use the ladder plot that illustrates the equivalent magnetic field contributed by the nearby wells, which is discussed later in this section.

Maximum Recommended Survey Interval – Guidance (Continued)

Long- and medium-radius intervals, such as buildup curve sections, that are consistently steered with a footage ratio (slide-steering or rotary-steering) ≥ 80% steering per stand do not require surveys every joint. For example, a planned build rate of 10° /100 ft, motor or rotary steerable yield is maintained between 8° /100 ft and 12° /100 ft, resulting in continuous steering for greater than 80% of the stand, 75 ft in a 93-ft stand. In this case directional surveys can be taken every stand. Otherwise, surveys are required at the joint near the end of the steered interval to ensure accurate well placement.

To shorten the survey interval, continuous high-definition MWD or MWT (measured while tripping) magnetic or earth-rate gyro surveying is suitable. If the wellbore section employing memory surveys is ahead of the close approach interval, stored surveys from downhole tool memory may also be employed to satisfy the RMSI criteria. When utilized in conjunction with static surveys or when used in place of actual stationary surveys, memory data should be included prior to the close-approach interval.

The use of synthetic or simulated directional surveys, a technique for adding projected surveys to the survey program while drilling, is an alternate way to adhere to the advised survey interval practice. By looking at steered and non-steered intervals for rotary steerable or steerable motors and utilizing advanced data analytics modeling to construct computer-generated surveys, simulated surveys are included in this scenario.

AADE Paper about API - RP78

Posted on the AADE Website

Introduction to API RP 78, Wellbore Surveying and Positioning

Abstract

The American Petroleum Institute (API) recently undertook development of a document called Recommended Practice 78, *Wellbore Surveying and Positioning*, (RP 78), a modern technical industry standard for wellbore placement that can be applied to all wellbore construction applications. The standard is intended to serve as the primary technical reference for proven engineering practices in the application of oil and gas, geothermal, carbon sequestration, coalbed methane (CBM), horizontal directional drilling (HDD) trenchless boring, mineral ventilation and extraction, scientific coring, and all other subsurface borehole construction applications.

API RP 78's development was led by a group of independent consultants, industry experts, academia, and representatives from public and private energy operators. The Operator's Wellbore Survey Group (OWSG), that later became an official sub-committee of the Industry Steering Committee on Wellbore Survey Accuracy (ISCWSA), initiated the project after a poll of operator members showed the need for a set of minimum industry requirements for wellbore construction, safe-separation, and positioning. The ISCWSA is equivalent to the Society of Petroleum Engineers (SPE) Wellbore Positioning Technical Section (WPTS). The establishment of this standard, made available through API's standards development process, will provide modern practices for all subsurface boring industries, beyond just oil and gas applications.

AADE-23-NTCE-073

Introduction to API RP 78, *Wellbore Surveying and Positioning*

Jonathan D. Lightfoot and Will Tank, Oxy; Ben Coco, API

Abstract

The American Petroleum Institute (API) recently undertook development of a document called Recommended Practice 78, *Wellbore Surveying and Positioning*, (RP 78), a modern technical industry standard for wellbore placement that can be applied to all wellbore construction applications. The standard is intended to serve as the primary technical reference for proven engineering practices in the application of oil and gas, geothermal, carbon sequestration, coalbed methane (CBM), horizontal directional drilling (HDD) trenchless boring, mineral ventilation and extraction, scientific coring, and all other subsurface borehole construction applications.

API RP 78's development was led by a group of independent consultants, industry experts, academia, and representatives from public and private energy operators. The Operator's Wellbore Survey Group (OWSG), that later became an official sub-committee of the Industry Steering Committee on Wellbore Survey Accuracy (ISCWSA), initiated the project after a poll of operator members showed the need for a set of minimum industry requirements for wellbore construction, safe-separation, and positioning. The ISCWSA is equivalent to the Society of Petroleum Engineers (SPE) Wellbore Positioning Technical Section (WPTS). The establishment of this standard, made available through API's standards development process, will provide modern practices for all subsurface boring industries, beyond just oil and gas applications.

We are meeting to help develop and promote good practices in wellbore surveying necessary to support wellbore construction which enhance safety and competition. The meeting will be conducted in compliance with all laws including the antitrust laws, both state and federal. We will not discuss prices paid to suppliers or charged to customers nor will we endorse or disparage vendors or goods or services, divide markets, or discuss with whom we will or will not do business, nor other specific commercial terms, because these are matters for each company or individual to independently evaluate and determine.

Introduction

In 2012, the OWSG was formed to bring oil and gas operators together for more frequent collaboration. The group aimed to prioritize operator needs and initially met monthly in Houston, Texas, with operators taking turns as hosts. The OWSG established a mission statement and an anti-trust statement which remain unchanged today.

The mission of the OWSG is to enhance confidence in wellbore positional accuracy by promoting best practices in directional surveying. This involves calculating wellbore positional uncertainty, also known as error models, using directional survey software programs.

To comply with anti-trust laws, the following anti-trust statement is read at the start of every OWSG meeting to ensure attendees understand the rules and regulations governing the meeting:

Virtual meetings are now held online every other month and are open to anyone as opposed to previously being exclusive to oil and gas exploration and production operators. Presentations and past meeting minutes are posted on the ISCWSA website, and those interested in participating can request to be added to the distribution list through the website.

OWSG Focus Areas and Initiatives

The need for a standard set of position uncertainty models, also known as error models, became a priority at early meetings. Error models, also called instrument performance models (IPM) play a crucial role in the management of directional survey operations (Thorogood et al, 1990). Another common name for an error model is a positional uncertainty model (PUM). Examples of instruments that require error models include conventional legacy film-based instruments, modern electronic magnetic tools, and gyroscopic survey systems.

Some of these models serve only a utility purpose and are not based on survey instruments. These include:

- Inclination-Only Planning – A method for near-vertical wellbore paths based on departure trend analysis from field studies.
- Blind Model – A conservative model applied to long intervals without directional survey data.
- Unknown Model – A conservative instrument performance model used when data is available but key

2 J. Lightfoot, W. Tank and B. Coco AADE-23-NTCE-073

attributes are missing.

- Zero-error Model – A utility commonly used for wellbore paths which need to avoid subsurface hazards or follow specific boundaries such as hardlines.

Separation Factor (SF) is a ratio of separation distance to combined uncertainty of subsurface proximity analysis for drilling and planning. Error models generate ellipsoids and are included as the denominator of the SF calculation The closest distance between wellbores is used as the SF numerator and termed the center to center least-distance or closest approach. The WPTS Error Model Maintenance Sub-Committee previously maintained a set of error models based on the industry standard Accuracy Prediction for Directional MWD (Williamson et al, 1999).

In addition, another challenge presented itself because of unintentional reliance on invalid and inconsistent models from various sources. Before the MWD model, uncertainty calculations were based on the now retired Wolff and de Wardt (WdW) systematic model (Wolff et al, 1981). Developed in the 1990's, the WdW systematic method was still used in the application of modern gyro instruments. However, these advanced gyros were different from the conventional film-based gyros covered in the systematic method. WdW continued to be used for modern gyro instruments like advanced inertial and true north-seeking earth-rate gyros until a new key industry paper was authored establishing a framework for all gyros (Torkildsen et al, 2004).

The elementary half-percent calculation method is another separation rule used in the industry. This method calculates the separation distance based on one-half percent of the measured depth (MD) resulting in a linear slope of five feet of separation per thousand feet of depth along the borehole but does not consider wellbore position uncertainty and is based on practical experience rather than engineering theory or measurement. For example, at 10,000 ft MD, the separation distance would need to be at least 50 ft, while at 15,000 ft MD, it would need to be at least 75 ft. While still in use today, depth-based rules are secondary to SF rules and are mainly used to complement them.

Another important issue raised by operators focused on the improper application of the standard MWD model. It became apparent that because the industry had been using this model with low-resolution references, unrealistic position confidence was occurring, and a need existed to take advantage of the improved magnetic models. The MWD error model was modified to accommodate both the low resolution (LRGM) and high resolution (HRGM) geomagnetic models. The original MWD model assumes the use of a standard resolution geomagnetic model (SRGM). The common SRGM is the BGGM crustal field model developed by BGS, and it determines local magnetic reference values. Geomagnetic models are used to calculate the magnetic declination correction crucial for directional and horizontal well surveys and is the primary source of lateral uncertainty. The date-sensitive reference values, including magnetic dip angle and total magnetic field strength, are crucial for quality control and meeting field acceptance criteria.

The industry faced a new challenge with the need to adopt improved magnetic models such as NOAA's HDGM (Maus et al, 2012). This new model contains detailed information on the Earth's main magnetic and crustal fields derived from satellite and sea vessel measurements and is updated annually to correct for changes over time. However, at the time the MWD model was not designed to accommodate a LRGM and HRGM such as WMM or IGRF and HDGM, respectively.

A vital need arose to adopt the improved magnetic models. Most operators relied on magnetic models supplied by vendors or software providers leading to inconsistency between planning and drilling operations.

OWSG Error Models

The OWSG set of error models (Rev2) was developed to establish consistency among operators and service providers (Grindrod et al, 2016). The paper defines five primary sets:

Set A: Standard
Set B: Extended
Set C: Vendor-supplied
Set D: Gyro software validation
Set E: Prototypes in development

The OWSG models were updated in June 2015 with a model selection guide and standardized naming structure. Meanwhile, the ISCWSA MWD models were updated to Rev4 from the original Rev0 in 1999 and were included in OWSG Rev2.

The OWSG models were handed over at the 50th ISCWSA meeting and are now stewarded by Error Model Maintenance Sub-Committee (EMM SC). The latest revision (updated September 2022) is referred to as ISCWSA Revision 5-1, and the OWSG is no longer used in the model naming. The latest ISCWSA generic tool codes are available on the ISCWSA website in Excel workbooks for easy download. The update includes generic reference names for low, standard, and high-resolution reference models, and details for five primary geomagnetic reference categories can be found on the ISCWSA EMM SC website including power-spectrum degree and update rate requirements.

The OWSG meetings continued discussions related to the need for establishing standard engineering practices in survey data management, directional planning, collision avoidance, and drilling near offset wells. Conversations centered around the need for joint survey operating and reporting procedures (JSORP) to confirm calculated wellbore position and estimated uncertainty. The requirement for raw sensor measurements (RSM)1o independently process surveys was discussed because service providers were not consistently reporting RSM. This led to improved survey reporting requirements with more reference information. Desired post-job reports included BHA details, steering reports, tool calibration, estimated uncertainty, and quality control plots. A final survey program with a specified error model was required for loading into a survey management database.

[Link - 2023: American Association of Drilling Engineers (aade.org)]

AADE RP78 Intro Paper

Upcoming Events

Thank you for attending this meeting

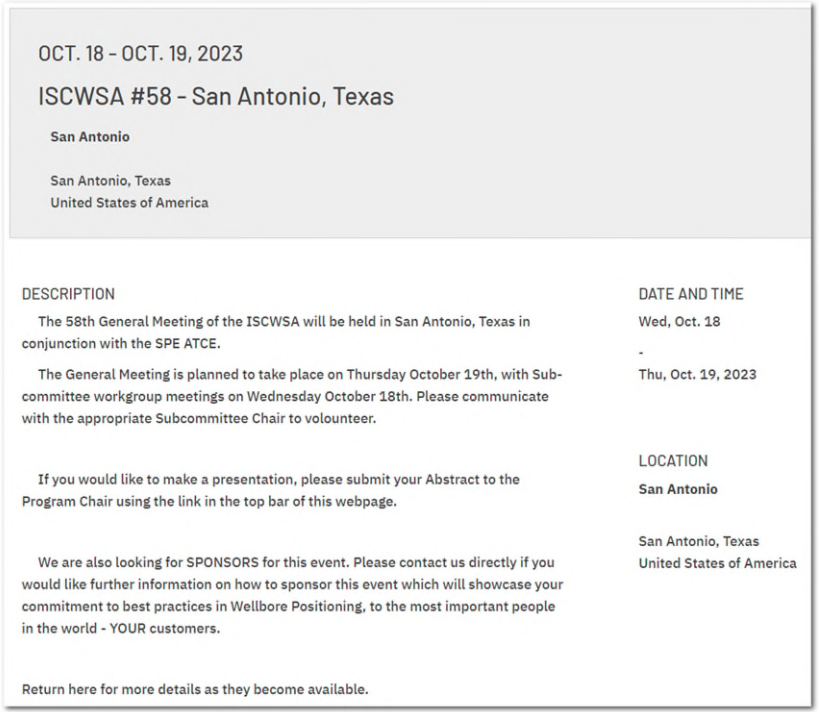
API RP 78 Meeting

- Next Technical Draft Due June 9th
- Balloting Meeting
  Location: API Hosted Facility (TBC)
  Tentative Date: Thursday June 29, 2023

  Will Tank (Chair)
  Jonathan Lightfoot (Vice-Chair)
  Ben Coco (API Task Group Leader)

- Society of Petroleum Engineers
  - Annual Technical Conference and Exhibition 2023
    - San Antonio, Texas, USA
    - 16-18 October 2023
    - ISCWSA Sub-Committee Meetings – October 18th, 2023
    - ISCWSA Meeting 58 - October 19th

Event - ISCWSA #58 - San Antonio, Texas



OCT. 18 - OCT. 19, 2023

ISCWSA #58 - San Antonio, Texas

San Antonio

San Antonio, Texas
United States of America

DESCRIPTION

The 58th General Meeting of the ISCWSA will be held in San Antonio, Texas in conjunction with the SPE ATCE.

The General Meeting is planned to take place on Thursday October 19th, with Sub-committee workgroup meetings on Wednesday October 18th. Please communicate with the appropriate Subcommittee Chair to volounteer.

If you would like to make a presentation, please submit your Abstract to the Program Chair using the link in the top bar of this webpage.

We are also looking for SPONSORS for this event. Please contact us directly if you would like further information on how to sponsor this event which will showcase your commitment to best practices in Wellbore Positioning, to the most important people in the world - YOUR customers.

Return here for more details as they become available.

DATE AND TIME

Wed, Oct. 18

-

Thu, Oct. 19, 2023

LOCATION

San Antonio

San Antonio, Texas
United States of America

- IADD Events
  - Directional Drilling Digital Transformation Forum – May 25, 2023
  - Some Like it Hot – June 7, 2023
  - Annual Technical Forum (ATF) – October 25 & 26
    - Seeking Presentation Abstracts

Directional Drilling Digital Transformation Technical Forum (iadd-intl.org)

8 to 8:30 a.m.: Digital roadmap for digital directional drilling; Matt Isbell; Hess Corporation
8:30 to 10 a.m.: BHA Standardization; Braxton Minor; ConocoPhillips

a) IADD BHA standards; Son Pham; SigmaStream
b) EDR digital pipe tally; Bob Best; Pason
c) IADC Dull Grading; Paul Pastusek, P.E.; ExxonMobil
d) Operator's Perspective; David Johnson; Oxy

10:30 to Noon: The Future of Wellbore Placement; Edgar M. Rodriguez; SigmaStream

a) Directional & Bit Guidance; Marc Willerth; Helmerich & Payne
b) DSC (Decision Support Center); Kelsey Prestidge; Chevron
c) Real-Time Center; Lee Bartholomew; Hess Corporation
d) Scaling Remote Operations Services (ROS) to 90%+ adoption in US Unconventional; Eric Scribner; Baker Hughes

1 to 2:30 p.m.: Emerging Technologies and Development - Analytics, Automation, Technologies; Sarah Hern; Helmerich & Payne

a) What can be done with EDR Data? Son Pham; SigmaStream
b) SPE DSATS D-WIS; Eric Cayeux / Fred Florence; Norce
c) IADC ARTS; Blaine Dow; SLB
d) Closing the Loop with the Subsurface; John McPherson; Baker Hughes
e) Drilling Rig Downhole/Surface Data; Tatiana Borges; NABORS DRILLING

3 to 4:30 p.m.: The importance of Data Collaboration in digital Transformation; Spencer White; Apache Corporation

a) Public domain data; David Gibson; Gibson Reports
b) Operator experience and point of view: ExxonMobil
c) Open Data – OSDU / Energistics; Patrick Kelly; Chevron
d) Automating data sharing; Spencer White; Apache Corporation
e) Educational perspective; Eric van Oort; The University of Texas at Austin

IADD Annual Technical Forum (2-Day Event)
Call for Presentation Abstracts
October 25th & 26th

Oxy Woodlands Tower Conference Center
300 Guests (Max)
Steering Committee Participation
Exhibition (Limited Space)
Sponsorships

Discussion
Future Topics
Questions

Thank you

Next OWSG Meeting: July 25, 2023