44th ISCWSA Meeting – Glasgow, Scotland, UK – September 22, 2016

Introduction

(Son Pham)

- Michael from the hotel staff provided a safety briefing.
- Thanks to Robert Wylie for his hard work arranging the meeting venue.
- 71+ attendees, with 4 being on the webcast. This may be a new attendance high for a European meeting.
- Thanks to MagVar for sponsoring the networking event, Scientific Drilling for sponsoring lunch, and Halliburton for sponsoring the webcast.
- We will start recognizing members who have made significant contributions over the years. The honoree this meeting is Dave McRobbie.
- We will be having elections today for some of the officer positions (detailed farther down in the minutes).

Schedule and Program Review

(Jonathan Lightfoot)

- Overview of the agenda.
- Please note that we have a poster session today.
- There will be a guest presentation on gravitational physics.
- The slides and audio are being recorded. This is the first time we have tried on online webcast option. The recording will be uploaded to Halliburton's iEnergy portal, to be accessible by those who have registered/paid for the event.

Wellbore Positioning - Past, Present and Future; What's Next?

(Len Duncan)

- From the 20's thru the 70's there were survey tools that were very operator intensive. The associated errors were quite large.
- From the 50's thru the 80's, anti-collision was done via crossing the fingers and looking for concrete over the shakers.
- The first surface recording gyro was used on a 60 slot pad in the North Sea in 1977. The slots were typically 6-8 feet center-to-center.
- 1978 saw the 1st commercial MWD job.
- 1978 also saw the introduction of the FINDS Tool, and fully inertial platform.
- The first North Seeking Gyros came along in 1981. This was a step upgrade, but still had to be stopped at survey stations for data acquisition.

- Drop gyros came along in the mid-1990's, and Gyro MWD came along in the 2000's.
- There is a timeline of technology development in the presentation, including anti-collision and well planning software.
- The first ISCWSA meeting took place in 1995. Since then there have been great advances in our understanding of surveying errors and best practices.
- In the future we're likely to see higher transmission rates, more sensors, and a large number of other advances (see presentation for a list).

(Questions)

- None.

Swarm Satellite Data to improve Global Geomagnetic Reference Modelling

(Ciaran D. Beggan)

- BGS produces the BGGM, which includes the night time external field and long wavelength crustal variations (> 300 km).
- The core field variation is dominant at +/-60,000 nT, but varies slowly; the ionospheric and magnetospheric field varies by about +/-60 nT (see presentation for other levels of variations).
- A global model includes the main field, crustal fields, and some external fields.
- The ESA Swarm mission involves the Novel 3-satellite constellation. It was launched in November of 2013.
- The use of a constellation of satellites provides information on along-track and cross-track magnetic field gradients.
- Note that data from fixed ground observatories is critical to the creation of global magnetic field models. It is combined with the Swarm data to generate the models.
- There is ongoing research concerning how to best utilize the gradient data to improve the magnetic models. They should be able to help model smaller components of the magnetic field, such as the tidal field component.
- Regarding the rate of change of the core field, it is not constant. There are "jerks" in the rate of change of the direction of the main field. The satellite data provides more detail on these jerks, but the main components are captured by the ground observatory data.
- Due to the 2014 jerk, which happened while the IGRF was being created, the IGRF-12 prediction is different by 15.7 nT RMS from the recent core model in 2016.
- The "total power" in the change in the core field is about twice the total power in the crustal field, indicating that it can be more important to capture the secular change in the core field over time than it is to capture the crustal field components.
- There is also an update on global magnetic field model uncertainties in the presentation. The uncertainty values represent an improvement over the previous

analysis. There is a suggestion to look up a 1-value look-up table for the model uncertainties.

(Questions)

- Ross Lowdon – How well will you be able to define the main field and the crustal model with the Swarm data. Answer – Degree 150 is achievable, with degree 250 potentially possible. We are up to degree 15 in terms of secular variation, and we might be able to get to degree 20, at which point the secular variation from the core becomes negligible.
- Stefan Maus – The total power in the crustal field seems small because the power is in higher degrees, which is why it's important to create high degree models. There are many areas where high degree models are very necessary. Answer – When you go out to degree 720, the power does go up, but it still only gets to about 6,000. The peak is at about 80-100, but yes locally you can get larger deviations. You do still need to add in local aero-mag. surveys to get shorter wavelength variations.
- Angus Jamieson – Two misconceptions from the field are that the IGRF model is cheap and just as good, and that if the IGRF has just been released, that it's just as good as the BGGM. Do you have a one sentence response to that? Answer – To be fair, when the IGRF is released it is more or less just an accurate representation of the main field. But it doesn't capture the crustal field.
- Gary Skinner – As part of the sub-committee discussion on creating uncertainties, it we had an equivalent set of uncertainties that are tied in the with IGRF, I think that would help Angus with his problem.
- Darren Aklestad – The IGRF model didn't get the jerk information right, so does that mean it will be further off at the end of 5 years than the previous release? Answer – No, the previous model also had a jerk, so it was the same situation. There have been jerks in 2003, 2007, and 2014.
- Mark (SDI) – To what extend is navigation accounted for when creating the IGRF. Answer – The IGRF is intended primarily for scientific use, rather than navigation. The model depends on the combination of several models, which are not meant for navigation per se.

Sub-Committee Activity Report: Collision Avoidance

(Steve Sawaryn)

- The meeting was 1.5 days this time, and will be a 1-day event at the next meeting in The Hague. The first SPE paper was accepted by the SPE and will be presented at this conference. The goal is to get the second paper out for September 2017.
- The objective is to bring clarity and conciseness to the collision avoidance rule.
- SPE paper 1 will have management principles; SPE paper 2 will have the collision avoidance rule and assurance and verification information.
- The group settled on the Pedal Curve method, including a description of its link to probability.

- The focus on management principles in the first paper is to point people to information that exists, and then to highlight subjects for which the emphasis has changed. One example is a re-structuring of company documentation. We don't want to add to a recognized problem of a large amount of existing paperwork that is perhaps not efficiently organized.
- Principles should be reinforced with real examples. We should have about a dozen examples, which should add greatly to the weight of the paper.
- One note: Our group was unaware of a single case where the failure was due to the error model itself. The management and principles must be on an equal footing with the model itself.
- The meeting focused on gaps, the model, presentation, flowcharts, survey intervals, and the story. The model and presentation have the most work left to do.
- A list of gaps is included in the presentation slides.
- The survey interval recommendation is in the form of a table of dog leg severity and separation factor.
- Testing of the collision avoidance rule (the "model") is ongoing and should be considered a draft at this point. There is still more tuning to do.
- The Collision Avoidance group is contributing to the API RP 78 effort.
- A flowchart detailing the planning phase is included in the presentation.

(Questions)

- Gary Skinner – Referring to the survey interval table, is 10 meters an acceptable survey interval to the operators when DLS > 5 and SF < 1.5. Answer – I think most of the major operators would not have a problem with what we have presented.
- Pete Clark – Following up on Gary's question, the context is collision avoidance. So if there is no collision avoidance situation, those intervals are not so important.

New Instrument Performance Models for Combined Wellbore Surveys Facilitate Optimal Use of Survey Information

(Jon Bang)

- This presentation was originally presented at the IADC/SPE conference in Ft. Worth this past March.
- Having multiple survey provide benefits such as mutual quality checks and validation. A weighted average gives the optimal best position estimate with reduced position uncertainty.
- In order to create a weighted average, the surveys must be interpolated to a common measured depth.
- The averaging process was described in a paper from 2003 by Chia, et. al. An alternative is to average the directional data and the account for this fact in the IPM

file. The questions is how to create the combined Instrument Performance Model (IPM).

- The Averaged IPM is created by adding a second tool model to an existing IPM with weighting factors added to tune the output.
- Step 1 involves identifying identical error terms between the two surveys and 1) if they are fully correlated, we keep the one with the smallest error term, or 2) if they are uncorrelated, we keep one with an improved magnitude.
- Step 2 involves terms that are different between the two surveys. For these you need to add weighting factors. The error sources in the IPM file divide into 3 groups (MD, I, A). Variances are calculated for these error source groups by examining uncertainties in the along-hole, high-side, and lateral frame. These variances are used to create weighting factors. These weights are approximate because the reference system is local and the variances will change with measured depth. So the largest values for each curve are used in the weighting factors.
- Step 3 is an adjustment. The motivation is that the true average EOU's may be underestimated. Adjustment factors are created by comparing the true averaged EOU's and the approximate averaged EOU's.
- Some examples of EOU's before and after averaging are presented in the slides.
- Potential challenges include validating the method for different well profiles. Sections with high curvature may be problematic.

(Questions)

- Jonathan Lightfoot – What do you do if you have two surveys that don't match? Is there any opportunity for the averaging to account for this by showing an enlargement of the EOU in such cases? Answer – One of the assumptions is that the EOU's accurately model the uncertainty on each wellbore. If you have a gross error, this invalidates this assumption and this procedure should not be run.
- Ross Lowdon – We struggle sometimes to apply the correct error model to the surveys we already have. How should we handle these modified error models? Answer – These IPM files are artificial in that they don't represent any real tool. That should be clearly stated in the file. Ross – So you could end up in a situation where your definitive survey could have its own error model, apart from the tool specific IPM. Answer – Yes.
- Andy Brooks – What do you see as the advantage of this technique as opposed to the true averaging technique described in Chris Chia's paper? Answer – You don't have to go through the wellbore position/EOU propagation for each survey individually. You only have to do it once.
- Mahmoud Elghizawy - How do you handle the depth scale difference between both surveys, which won't necessary agree? Answer – Any corrections to depth should be done beforehand.

Directional Drilling Measurement Errors Caused by Drilling Fluid Constituents. Mud contamination from iron contaminants primarily from casing and string wear modifies the Earth's magnetic field leading to MWD directional sensor error and increased uncertainty

(Giorgio Pattarini)

- The magnetic error induced by the presence of magnetic mud is on the order of a 2.7% attenuation of the magnetic field in bad cases. An Azimuth error of 0.24 degrees has also been observed to be due to magnetic mud.
- The error gets worse at high latitudes.
- There is an existing model that works quite well from a theoretical standpoint. However, there are gaps. The first gap is that the amount of steel in the mud is unknown, so the magnetic susceptibility of the mud is unknown. The second gap is that the particles likely settle on the bottom in horizontal wellbores. In this case, they will not shield the field; instead they will change its direction. The third gap is that the relation between steel concentration in the mud and magnetic susceptibility is not simple.
- Current practices include banning the magnetic ingredients in the mud, using ditch magnets, keeping the pumps on while measuring, centering the magnetometer in the MWD tool, using a gyro, and analyzing the mud after drilling.
- Giorgio's work includes modeling the mud to better calculate the magnetic susceptibility. A main target is to understand the magnitude of this error. Also to understand whether each of the current practices are useful or not.

(Questions)

- Anas Sikal – How do you explain the lack of effectiveness of ditch magnets? Also, regarding the post-drilling tests on the mud, can you put the test protocol in real conditions to gain additional insight. Answer – The ditch magnets remove about 10% of the iron in the magnetic mud, which is the problem. It's a quantitative problem. Regarding the testing, it was in artificial mud. In the well there is the problem of high temperature and pressure. The effects of the downhole conditions can be calculated.
- Steve Sawaryn – Early on we did some work where we had a sample of mud sent in from the rig, setup an experiment to account for both the mud annuli, and we measured absolutely no effect. I think the reason is the time sensitivity you mentioned; the particles probably fell out. Answer – Another possibility is that survey errors are incorrectly attributed to magnetic mud.
- Phil Gurden – A very simple test is taking the mud from the rig and putting a tool inside it. It matched up every time we tried it.
- Angus Jamieson – When we are doing high inclination work then a quarter of a degree can be significant. A correction that's simple to use could be useful. It would be interesting to see if correcting X/Y magnetometer scale factors actually corrects for this magnetic mud problem.
- Patrick Knight – Have you tried sequential pumps-on/pumps-off surveys to see if you notice a difference? Answer – No, but I am aware that this is tried. I only have pumps-on data.

- Harry Wilson – An observation on Angus's comment. I noticed MSA is missing from your current common practices slide. That's one of the biggest uses at the current time: attempting to correct for magnetic mud. As Phil mentioned, when we do a dunk test we do see a good correlation. Another option is to arbitrarily increase the magnetometer X/Y scale factor uncertainty values in the error models to account for this effect.

New Advances in Geomagnetic Field Modeling. Advanced Modeling of the ionospheric fields, as well as improved modeling of the magnetospheric current sources. Introduction to a new Global Compilation of lithospheric anomaly fields

(Patrick Alken)

- The three primary magnetic field components are the main field (from the core), the crustal field, and the disturbance field. The main field is modeled very well from satellite data.
- The disturbance field from the magnetosphere is generated by the charged particles emitted from the Sun. They generates currents (and this a magnetic field) when they are deflected by the main field.
- We model the average behavior of the various currents in the magnetosphere, and then modulate it with real-time space weather indices. Current satellites are capable of giving 15-60 minutes of warning about solar events.
- Real-time prediction is done via an cloud calculation, and the result is available on geomag.colorado.edu.
- The disturbance field from the ionosphere is generated by currents that are much closer to Earth. The currents are generated by neutral particles that are ionized during the daytime. They can be responsible for about 80 nT of variation daily at low latitudes (Sq currents). At high latitudes, the perturbations can be between 100 and 200 nT.
- The DIFI model attempts to predict the effect of the Sq current. It is currently being transitioned from a research model to an operational model.
- The HDGM model contains effects from the main and crustal fields. HDGM-RT predicts the effect of the magnetosphere. Adding DIFI to that result helps to capture the Sq currents as well.
- The EMAG2 (Earth Magnetic Anomaly Grid) has undergone a major update. The primary data for the model comes from marine and airborne track lines.
- Send NOAA your surveys to help contribute to a more detailed grid. The data can be flagged as private/proprietary.
- The EMAG2 grids are produced at sea level and at a 4 km altitude.

(Questions)

- Angus Jamieson – One of the issues we currently have with our IFR surveys is that there are two categories: Airborne/seaborne surveys of total field, and primarily land-based

vector surveys. For the later type of survey, we can't get an estimate of the downward continuation. We can do this from airborne total field surveys. It would be useful to know whether the vertical gradient is high or not in some areas so that we know if airborne surveys are required. Answer – If we have good coverage in that region, we should be able to generate good downward continuation. But we do have regions with data gaps where I wouldn't recommend it. Angus – Could we have a world map that shows vertical gradients? Answer – The validity of any inversion would depend on the depth at which you want data.

- Patrick Knight – Will this be available through NASA's (specialized software: GTECH?) as in the past? Answer – No, they will be distributed through our NOAA website.

Gravitational Physics: a tour of Precision Measurement, Astronomy and Industrial Applications

(Giles Hammond)

- One early attempt to weight the Earth by Nevil Maskelyne involved measuring the gravitational attraction of a mountain. He measured the deflection of a pendulum from vertical on each side of the mountain. The vertical direction was determined from the stars. The result was only off by 25%.
- Advanced LIGO attempts to measure gravitational waves by measuring the separation between free test masses in space-time.
- Gravitational waves can give us a new (non-electromagnetic) view of the universe. There is a spectrum of gravitational wavelengths.
- Detecting the source of gravitational waves requires a network of detectors. The worldwide network contains 4 detectors, with 2 others under construction.
- The detectors are very long baseline interferometric devices (4 km). The precision required is analogous to measuring the distance to the nearest car accurate to the width of a human hair.
- The aLIGO quadruple suspension (the lower part of it) were developed in Glasgow. The 4 stages of isolation protect against the seismic noise fairly well.
- There have been two astronomical events detected so far. They were both binary black hole systems, which was somewhat unexpected.
- There are various options for taking gravitational measurements. Glasgow is currently developing a MEMS gravimeter. It can be used to measure (solid) Earth tides.
- A 6-axis gravimeter (measures the tensor components) is projected for 2018.
- There is a desire to engage with industry to find additional applications for the device.

(Questions)

- Gary Skinner – What laser frequency is used by aLIGO? Answer – It's an infrared laser. The power and low noise performance from the solid state lasers was the deciding factor.

- Adrian Ledroz – (missed the question). Answer we use silicon, but silica would be a better material because as it heats up and tries to expand, the Young's Modulus actually increase, causing it to try to contract.

Sub-Committee Activity Report: Error Model

(Andy McGregor)

- The first draft of the document is complete and is now ready for review by a few of the individuals within the group who volunteered.
- There are some additional validations sets that need to be brought up to date or created.
- There is a need to account for correlation of error sources to support the anti-collision group. Combining covariances to calculate relative uncertainty does not currently account for the correlations in magnetic reference terms. These values were found to be important.
- Stefan Maus created a table that puts forward correlations between magnetic reference values from multiple reference models.
- Jon Bang contributed a method for including non-binary correlations in position uncertainty calculations.
- The correlations nearly cancel out declination in parallel wells, but can increase declination-induced uncertainty in opposing wells by ~25%.
- BGS provided an updated estimate of the uncertainty in the BGGM. They mentioned the option of a single look-up table. There was debate about finding a solution for all global models, but no consensus was reached.
- Also discussed analysis of a term to penalize long survey intervals for failing to capture the shape of the wellbore. Steve Grindrod examined the impact on position uncertainty for the various ISCWSA test wells. People seemed generally happy about the results. We'd like others to look at the terms in the context of their databases with a goal of deciding on adoption at the next meeting.
- The handling of hole misalignment was also re-considered. Many operators are now concerned that the higher misalignment uncertainty and systematic treatment are causing violations of anti-collision policies where there were none before. No conclusion was reached on this topic.

(Questions)

- Bill Allen – We've been looking at the misalignment in top-hole with multiple surveys and we found that our misalignment was underestimated. The current model addresses it better, but the increase might be a little high. We had the most problems with large hole size and centralized tools. If the centralization was off at all, we were failing. The new model seemed to bring everything back in. Answer – Getting some of that data would really help firm up the numbers in the error model.

Recognition of Dave McRobbie

(Angus Jamieson)

- Son Pham - The directors chose Dave this time, but we would like nominations from the Directors at Large for future meetings.
- Dave was a founding member of the ISCWSA in 1994 and was a widely respected contributor.
- He was a survey focal point for Sperry Sun.
- Worked with BGS to pioneer IIFR.
- Was a survey consultant with Tech 21.
- Helped develop marine based IFR and inertial trip surveys.

Elections for Officers

Director's at Large, Treasurer, Secretary, Webmaster

- Robert Wylie (Treasurer), Phil Harbidge (Webmaster), and Chad Hanak (Secretary) ran unopposed and were re-elected.
- Vote on whether to change the constitution to move from 3 to 4 directors at large, and to shift the Director at Large elections so that two are elected every year: Unanimous approval.
- The 2 continuing Directors at Large (up for election in Fall 2017) are:
    - Anas Sikal
    - Ludovic Macresy
- Nominees for Directors at Large (2 out of 4 positions) are:
    - Neil Bergstrom
    - Adrian Ledroz
    - Carol Mann
    - Stefan Maus
    - Andy McGregor
    - Benny Poedjono
- The top two vote getters and new directors at large are:
    - Carol Mann
    - Andy McGregor
- Suggestion from Gary Skinner to codify voting procedures in the constitution.

Sub-committee Activity Report: Operator Wellbore Survey Group (OWSG)

(Pete Clark)

- Have held two meetings this year.
- The minutes of the last meeting will be put on the ISCWSA website, along with a write-up from the more recent meeting.
- API RP78 has consumed much of the group's attention this year, which is the reason for only having two meetings to this point.
- Reminder that the purpose of the OWSG is to find a minimum standard, as opposed to a best practice.
- In RP78, there needs to be a distinction between "requirements" and educational material. In addition, there are prescriptive and performance categories of requirements.
- Lisa Noble is the chair of the RP78 committee. A full list of core members is included in the presentation.
- There is currently an outline/strawman. Substantial progress has been made in fleshing out the various sections of the document. A team lead and a technical lead are assigned to each section (a list of section leads is included in the presentation).
- RP78 is not intended to replace existing material. Rather it will reference the body of work created by the ISCWSA so that it maintains alignment with the group.

(Questions)

- Gary Skinner – How does one review the standard? Answer - Your company representative is the method of input/review. Those who are contributing have a login to the API SharePoint where they can download the documents.
- Jonathan Lightfoot – We do have about 80 people on the roster and we encourage each company participant to review the document with other individuals within their companies. Also, there has been quite a bit of development and meetings in support of this effort to keep the ball rolling. We welcome any feedback.
- Is there an estimated completion date? Answer – As quickly as possible.

A New Approach to MWD Calibration to Improve Accuracy and Reduce Calibration Time

(Angus Jamieson)

- Purpose of this approach is to avoid orthogonality issues, accommodate more sensors, make calibrations more accurate and faster, and to improve MWD accuracy.
- Each sensor vector has two angles describing its orientation relative to the along-hole and high-side vector.
- Microtesla's 4AM tool does not have 3 orthogonal axes. It actually has 4 sensors.

- The new approach is to try and find the two alignment angles for each sensor using a hot tumble and a cold tumble. Linear interpolation is used at other temperatures.
- Two cooling curves are measured. The point is to measure the second curve with each sensor oriented opposite its alignment during the first curve.
- In the firmware, synthetic 3-axis data is constructed using the angle estimates.
- Overall there are 4 processes:
    - A cold tumble (12 orientations)
    - A hot tumble (12 orientations)
    - The first cooling curve (1 orientation)
    - The second cooling curve (opposite orientation)
- The math of the polynomial fit is included in the presentation.
- Can provide standard output, so no need to change the surface system or field procedures.

(Questions)

- Adrian Ledroz – How will you QC the data or do MSA with the 4 sensors? Answer – Unfortunately that's a proprietary bit of math, but we have a MSA solution that will address that as well. The procedure is still much the same as with any other MWD however.
- John Weston – Your just taking readings when it's cooling, correct? Answer – Yes, but we also do multi-attitude tumble at high and low temperatures. John – Do you observer a hysteresis effect? Answer – Yes, that is something that has to be addressed, but it is more of a QC concern.
- Steve Sawaryn – With the non-orthogonal 4 sensors, if one goes out you still have a viable system. Does accuracy degrade in this case? Answer – That's why these angles were chosen, but the A axis is most important. It would degrade accuracy some, but not enough that you'd have to trip out of hole. Also, with no axis pointing straight downhole, it tends to be more robust because it's experiencing less direct shock.
- Mark (SDI) – Does this calibration require precision fixturing? Answer – It does because you have to know you are level to start. But as long as your error in where you think magnetic North is less than 0.5 degrees, it can adjust.
- Robert Wylie – Accels are actually weakest to cross-axis shock along the hinge. That's why z-axis breaks frequently. Also, on the last slide you claimed higher accuracy. Why? Answer – If you've calibrated correctly, you can actually do much better than the 0.6 degrees in the error model. That and the statistical redundancy.

Sub-Committee Activity Report: Education

(Carol Mann on behalf of Steve Mullin)

- We are an advisory/awareness committee, not a school. We try to raise awareness thru workshops and other things.
- In the past we have run SPE Advanced Technical Workshops (ATW)
    - 4 Hits and Misses since 2012; have been asked to run another one either in the US or Canada at the end of 2017
    - Have also had a request to do it in the Middle East; we are evaluating the level of buy-in
- There will be a topical luncheon at the SPE conference next week in Dubai.
- Subsurface Errors and Reserves is a potential topic
- Steve Mullin suggested promoting an SPE Distinguish Lecturer
    - The committee decided on Steve Sawaryn as a means of promoting the anti-collision work of the ISCWSA
- Videos are another avenue that is being pursued (YouTube and website availability). They will initially based on e-book topics.
- Potential to reach out to other organizations: Send suggestions to Steve, Carol, or Angus.
- Additional ideas include putting ISCWSA links in your email signature.
- Also trying to work on more content for the educational portion of the website.

(Angus Jamieson)

- There is a new chapter on Depth (written by Harold Bolt)
- New math appendix
- New chapters on survey interval effects and combined surveys
- Additionally, the latest version has a revamped index and searches are easier.
- Upcoming on new chapters on data QC and error model verification, and an improved chapter on magnetics.
- The book has been downloaded by over 8,000 people to date.
- The UHI Certificate in Wellbore Positioning has had about 50 registrations so far this year.
- There will be a Summer school this coming June.

(Questions)

- None.

Sub-committee Activity Report: Well Intercept

(Chad Hanak on behalf of Roger Goobie)

- The ranging e-book has been filled in with content from a large number of contributors and Heather Vannoy spent some time organizing the document and making it look nice.
- It has yet to go thru a formal review process, so that was our major focus in the meeting yesterday.
- After deliberation, the suggestion was made to re-organize some of the material in the sections that describe the different types of ranging technology. That process is ongoing. We will have to revisit the review process between now and the next meeting.
- Angus has also graciously offered to give the document an editorial look.
- We have an offer from NEXT for a technical writer in exchange for getting to host the document, but we are waiting on input from the Education Sub-Committee.

(Questions)

- None.

Increasing the ability to drill horizontal East/West wells using Single and Multi-Station Corrections. Using probability theory and smart algorithms to completely eliminate the common practice of restrictive exclusion zones while still ensuring safe practices

(Chad Hanak)

- Secretary was presenting.

Webmaster's Report

(Phil Harbidge)

- We have engaged a professional company to improve the website.
- We would like volunteers with strong ideas about what to do to contact Phil to participate in a conference call on Monday.
- The SPE.org site will be a copy and paste of the ISCWSA.net revision for the most part. The ISCWSA.net site will be incorporated into the .net site.
- The new site should be a responsive mobile-ready website.
- The company that is updating the website will also offer some training for Phil on how to manage the site.
- In terms of the SPE WPTS membership, we have grown considerably to over 1,400 members, but we are not actually using this list yet.
- There is a wealth of demographic data in the presentation that we now have access to thru the SPE.
- The SPE will often waive a 1 year membership fee for those out of work in the industry.

(Questions)

- Carol Mann – I was at a talk at ERTEC (sp?) and there was a drilling engineer giving a talk about what he wished the G&G folks new. It was a well-attended talk, so there probably is desire for that out there.
- Harry Wilson – If you are over 60, you get a really good deal on SPE lifetime membership.

Treasurer's Report

(Robert Wylie - online)

- Financials from the meeting in Ft. Worth are in the presentation. Thanks to our sponsors we actually had a net income for the meeting.
- We are at 73 attendees for this meeting. Again, thanks to our sponsors we are projected to have a net income.
- The available balance in the WPTS bank account is ~$71,000.

(Questions)

- None.

Closing Statement

(Son Pham)

- Thanks to all the presenters for presenting and all the people who help put on these events.
- The sub-committee chairs and members do a lot of the heavy lifting, and we'd especially like to thank Steve Sawaryn for all the hard work he puts in there.
- To keep everything balanced, we will probably be in Europe next time (perhaps The Hague). I will keep everyone informed. Let me know if you have suggestions or feedback.