41st ISCWSA Meeting – London, UK – March 20, 2015

Introduction

(Son Pham on behalf of Pete Clark)

- Safety orientation covered evacuation plan.
- Pete Clark, Phil Harbidge, Mike Long, and Neil Bergstrom could not make it (Son Pham and Ross Lowdon are standing in on their behalf)
- Steve Sawaryn is retiring from BP, but has been unanimously requested by the committee to continue with his work on the Collision Avoidance sub-committee. He has agreed to stay on at least through the Houston session in Fall 2015.
- Sponsorship is changing to be more affordable. More/smaller sponsorship opportunities are sought. Implementation is ongoing. Thanks to MagVAR for sponsoring the networking event this evening.
- New timer was donated by an operator.

Introduction to Relief Well Planning and Drilling

(John Wright)

- Relief wells are drilled only when there is absolutely no other option to contain a blowout: congested offshore wellbays, blowouts that are broached to the surface, subsea BOP stack is bent.
- Plug and abandon relief wells when there is no surface access has become a more prominent use of relief wells.
- Relief wells should be treated as a project: the intersection and kill teams must work together.
- Some important parts of the relief well planning process are determining intercept depth, relief well surface location, ranging strategy, target positional uncertainties, and hydraulic communication method. Should have someone looking at subsurface drilling and well control hazards; the intercept team may not be focused on this, but it is important.
- Hydraulic communication can occur via open hole (best way), milling, or perforating. Milling requires perfect alignment. Perforating guns can be put together with slight misalignments to improve the spread.
- There's no magic number for surface spacing. During Macondo, they were ~800 meters away. Surface blowouts require consideration of effluent constraints. Gas plume formation depends on the depth of the blowout compared to the depth of hydrate formation. Deeper blowouts may not have a surface gas plume.
- Rule of thumb for ranging interference: require twice the ranging distance between the ellipses of uncertainty of the target well and any other nearby well that might cause interference.
- It's important to verify that grid, magnetic declination, and convergence are correct. Surveying surface locations directly is a good idea.

(Questions)

- None.

A Guide to Relief Well Trajectory Design using Multidisciplinary Collaborative Well Planning Technology (SPE 173097)

(Roger Goobie)

- Purpose of the paper is to provide a standard methodology of contingency planning in the event that a relief well is needed.
- First relief well was drilled in 1933 with a single shot surveying tool. It was a proximity kill. It was not until 1980 that technology allowed the interception of the metal casing of the blowout well.
- BP classifies relief wells into 3 types: simple intercept, parallel track, and oriented intercept.
- Five phases of relief well planning: data gathering, drill, locate, track, and intercept.
- BP uses software that accepts constraints and automatically generates surface location suggestions for relief wells. BP tries to stay between 750 meters and 1,000 meters away from the surface location of the blowout.
- In salt, passive magnetic ranging has historically been used. There is new interest in acoustic methods for this application with an eye toward increasing the radius of investigation.
- Try to intercept at less than 5 degrees at 100 feet above the last casing shoe (there is a good chart in the presentation containing quite a number of trajectory design constraints).
- Locate phase is designed such that the ROI of the ranging technology is at least as large as the center-to-center distance (if possible).
- A ladder plot is suggested to help summarize the drilling plan.
- Automated technologies are suggested to reduce the chance of gross errors in the design.

(Questions)

- Son Pham – Thanked Roger and BP for sharing with the industry. Do you plan to offer the paper up for peer review? Answer – Yes, we are going to do that so that the industry can look at the paper and add to it or correct it if necessary. We saw this as a gap in the industry, so we tried to write a paper from a high-level view of what needs to be considered to put together a base plan.
- Roger Goobie – We recently started looking at our salt challenges. We wanted to figure out how to locate a well in salt. One of the better things we did recently was try to use acoustic ranging in salt. We were able to see both the offset casing and the open hole at a much greater range than passive magnetic ranging allows.
- John Wright – I noticed that the intersection point chosen was 100 feet above the casing shoe. I've done that before, but it was complicated. I'm curious as to why it was chosen. Answer – We wanted to keep a fixed point for the analysis and allow the engineers to be able to range to pipe. John – What I've found is you're taking a very big risk because of the accuracy of the ranging tools that you may miss the target and not be able to turn. So I've taken the position of moving the relief well casing 200 ft up and risking the hole collapse. Roger – This is the kind of feedback that will be valuable during the peer review process.

Sub-Committee Activity Report: Error Model

(Andy McGregor)

- There are now 54 members of the sub-committee, which is quite a lot. We've decided we will be more rigorous in getting minutes out, but we are also looking to confirm the desire to contribute from the sub-committee members.
- We would like to consolidate the error model documentation. Steve Grindrod has taken the existing ISCWSA models and formulated them in the same spreadsheet format as the OWSG models.
- Reminder that the AMIL term has replaced the AMIC and AMID terms for axial magnetic interference. We tried to come up with a term value to assign to AMIL. The OWSG model used 300 nT. The two groups have now agreed that 220 nT shall be used.
- Misalignment value will be changed to 0.1 degrees from 0.06 degrees. This again is consistent with the OWSG model.
- There was an addition of random terms to properly model the magnetic disturbance field.
- BGS published an SPE paper several years ago describing BGGM uncertainty via lookup tables. Some apprehension about how to use the lookup tables. Decided to approach the issue from a cost/benefit perspective. Investigation still ongoing.
- Question of how to handle correlation of magnetic models (BGGM, IFR1, IFR2) for relative position calculations. We can't currently handle partial correlations.
- BGS is doing some early work to analyze the errors in IFR2 depending on the distance from the observatories, particularly at high latitudes.

(Questions)

- None.

Acoustic Ranging

(Benny Poedjono)

- Postponed until the Houston meeting.

Sub-Committee Activity Report: Well Intercept

(Ross Lowdon on behalf of Mike Long)

- Lexicon was finished (should be on the website shortly).
- Ranging document to be added to the e-book (Halliburton to contribute)
- Link to John Wright's website for guidance on the entire relief well planning process.
- Desire to build a training course or workshop based on the information from John Wright's website, pending his permission. Will collaborate with the Education sub-committee on this effort.
- What to do next? Perhaps focus on education and best practices.

(Questions)

- Roger Goobie – Is an e-book contribution part of the objective? Answer – Yes, the e-book has received a lot of traffic and we want to contribute to it.
- Robert Estes – Well intersection should be more common in the future in non-relief well applications. We should be able to look at well interception for the purpose of production.

Satellite Measurement of Wellhead Locations

(Jim Turner)

- PhotoSat produces topographic mapping from satellite data. Satellite-based mapping has advanced to the point where it represents a viable alternative to ground-based and airborne LIDAR based mapping.
- The data is collected by high resolution stereo satellite photos, and is then run through specialized algorithms hosted on GPUs.
- Long-running operation with Suncor has allowed for characterization of the cameras, which improves resolution to about 15 cm.
- Comparisons are made in the presentation to ground-based DGPS and to airborne LIDAR data. RMSE for the satellite data (compared to the DGPS data?) was 15 cm, based on using 14 ground control points. RMSE for the satellite data compared to the LIDAR data was 15 cm).
- The USGS has accuracy reporting standards that PhotoSat adheres to.
- A recent pilot program involved mapping the location of 70 well heads in a 100 square km area using a 1 m elevation grid. $12,000 USD was the cost of the project and 7 days were required.
- A job in support of a planned 3D seismic operation revealed a discrepancy of 1.3 meters between two sets of ground control survey points. The cause was found to be that the two sets of points had different references.
- A similar experience was encountered in Northern Iraq.
- Accurate surveying minimizes costs and delays throughout an oil and gas project when compared to the use of multiple ground surveys taken as needed.
- You can still get better LIDAR data than satellite data, but the satellite errors are less than 30 cm, and often 15 cm.

(Questions)

- Robert Estes – Many of your examples were on bare ground or deserts. What about the new green laser LIDARS that can penetrate vegetation and water? Answer – The LIDAR gets penetration through the foliage. You need to be able to see an area of bare ground between the trees, and then you can interpolate. We ballpark the error as 10% of the canopy height in that case. We also cannot see through the clouds.
- Son Pham – Can you talk about archive data vs. live data? Answer – There are areas of the world with archive data. The first thing we do is search for data in the archives. If none is available, we go task a satellite to take data.
- Ross Lowdon – We have problems with people having cut and abandoned wellheads in large areas of open grounds. Could you process images to search for abandon wellheads? Answer – The pixel sizes from the cameras are better than 20 cm we think (it's classified). But the providers distort the images (like GPS used to), limiting the usable pixel size to about 40 cm. We can do vegetation mapping. Ross – Do you ever use a different light spectrum? Answer – The new satellites have multiple bands, so we can do some spectral processing.
- Son Pham – This unspecified operator is likely excited about the SAGD work and is interested in auditing other properties.

Magnetic Mud

(Steve Grindrod)

- There are a number of good studies published in SPE papers (listed in the presentation).
- There is conflicting information about whether magnetic mud interference is repeatable and consistent. Generally, it tends to be time dependent.
- Looks like a scale factor reduction on x/y magnetometers. The effect increases with mud weight.
- Can detect by failed pumps off surveys and passing pumps on surveys.
- Eccentricity in the hole can cause the effect on x to be different from the effect on y.
- Typical SF reduction in practice tends to be around 2.5-3% (have seen 1-5%).
- Charts detailing the effect of SF reduction on B_total and Dip QC limits are located in the presentation. These allow for the driller to predict what he should see in terms of QC while drilling in various directions in the case of pure magnetic mud effects.
- There are certain areas of the world where magnetic mud effects tend to be dominant (Eagle Ford, North Sea). They tend to be shorter wells with mud that is reused over and over again.

(Questions)

- Regis Studer – Is there a way on the market to measure recycled mud? Answer – There was a probed developed for that purpose, but I'm hearing conflicting results about the consistency of it. One of the problems is that the effect depends on whether the mud is stationary or flowing.
- Mahmoud Elgizawy – Is it fair to say MSA can correct for this sufficiently? Answer – The thing there is to get consistency on the survey conditions. Also, having multiple dominant errors can make it difficult. Mahmoud – If not MSA, how can we correct for this? Answer – What we're doing is using these charts. If we're in the green areas, we may accept the surveys regardless. In the other areas we may take pumps on surveys.
- Robert Estes – It's very difficult to detect the amount of magnetic particles in the mud. We have seen inconsistencies between chemical analysis results and those from magnetic probes. What you want to do is remove the effect. Ditch magnets have been very ineffective. There's an open hole net out there that may be useful. What do you think of that approach? Answer – The main aim is to try and stop the particles from getting into the mud to start with.
- Phil Gurden – What about a filter system like one used for water? Also, regarding the use of ditch magnets, we have found wells where the use of ditch magnets decreases the effect. Answer – Ditch magnets do take out a lot of the material.

Sub-committee Activity Report: Education

(Steve Mullin and Angus Jamieson)

- ATW to occur Nov 9-11 in Galveston, TX (with new name: Well Placement and Intersection best Practices).
- Special one day event (Nov 12) – Surface and Wellbore Positioning Errors Impact Subsurface Models and Reserve Estimates (unsure if this will go ahead; do not yet have a committee with downhole people)
- April JPT article, focusing on the above subjects.

- We have arranged for UHI to manage some additions to the e-book (chapters listed in presentation). We have also identified the authors and reviewers for each new chapter in the e-book. Angus will be contacting the reviewers shortly.
- (Angus Jamieson takes over presentation for Steve Mullin)
- The new masters course in wellbore surveying is going forward. UHI has invested quite a bit into online learning materials and technology.
- A new development is the offering of a certificate in wellbore surveying, consisting of 100 hours of online content. Essentially, it's the e-book with some simulation work. (See presentation for further detail on course content.) The certificate is meant to be a way for companies to verify that employees understand the basics of wellbore surveying.
- UHI is also offering a post-graduate certificate in surveying with 900 hours of online instruction.
- There is also a post-graduate diploma in surveying, but it does require 2 months of in-person summer school in addition to the 900 hours of online instruction.
- The masters degree is obtained with the addition of a work-based dissertation.
- We are asking for a vote concerning the 100 hour certificate. The Education Sub-Committee would like to be authorized to approve the content of this course. The credits will be recognized by multiple universities toward degree programs.
- Son Pham – This is a vote to give the Education Sub-Committee the authority to act on behalf of the ISCWSA regarding a decision to endorse the course. This would make the course ISCWSA approved content. The e-book has been approved in such a manner.
- Proposed by Angus Jamieson, seconded by Steve Mullin
- Vote by hand.
- Motion approved by strong majority of members present. There were no dissenting votes.

(Questions)

- Roger Goobie – I think a periodic question of the day (including answer) would be a good idea for the surveying community.
- Ross Lowdon – Is this funded by the $30,000 approved by the ISCWSA last meeting? Angus – No, that funding is for the e-book. UHI and some of the oil companies are covering the certificate. Additionally, there will be a cost associated with the course.

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

(Son Pham on behalf of Neil Bergstrom)

- The major effort from the group has been to focus on the error model set. It has been implemented in most (if not all) of the software packages and implemented with some operators.
- OWSG version 2 has been aligned with ISCWSA MWD Model Rev. 4. Only required small changes.
- General agreement that we should come up with model specific acceptance criteria. Two operators have stepped up to fund a document describing field acceptance criteria to be developed by MagVAR. Should hopefully come out before the Houston meeting.
- North arrow convention: desire to make the software packages consistent.
- Drive toward a raw data format suggestion.

- Have decided to actually set timelines and assign tasks to get things done more efficiently.

(Questions)

- None.

MWD Survey Quality - a Manufacturer's Perspective

(Robert Wylie)

- Presentation contains an overview of mud pulse and EM telemetry MWD systems, including component parts.
- Most angle sensor packages contain a tri-axial accelerometer and a tri-axial magnetometer package. The z-axis is usually downhole, and 0 degrees toolface is usually referenced to the y-axis. This is not universal, however.
- Modern accelerometers are typically single axis quartz flex (Q-flex) designs. They are generally tactical grade with higher resolution than is required downhole. Magnetometers are usually fluxgate magnetometers with magnetic cores.
- Design considerations for electronics include: maximum operating and survival temperature, suitable heat sinking, suitable power management, etc… (see presentation).
- Spacing in the tool is important: magnetic interference can be a big issue. Spacing in the BHA (keeping magnetic components away from the magnetometers) is important too.
- A non-magnetic building is often used for calibration, but is not required. The important thing is that the field is known and can be help constant. Beware of tools that are calibrated such that the local acceleration value is 1. The global standard for 1 g should be used.
- Recalibration is needed because something has changed with the mathematical model of the tool. Otherwise, the tool likely has changed and may need to be repaired.
- Important things to assess during calibration are biases, scale factor errors, temperature effects, amount of non-linearity, non-orthogonality, and misalignment.
- Accuracy claims: accelerometer bias shifts with shock.
- Inclination accuracy affects azimuth accuracy. This is due to the fact that the magnetometer information is projected onto the horizontal plane via the accelerometer readings.
- Instrument Performance Models are only applicable if tested as a system. Testing 100(?) tools for this model verification has been done historically.
- See presentation for a list of things that can go wrong.

(Questions)

- Steve Sawaryn – The orthogonal corrections, are they calculated pre or post temperature calibration? Answer – Quite often the orthogonality is done at the sensor package level, then at the system level. The sensors are usually all on one chassis, which keeps them aligned fairly well. I don't think the thermal affects are too big of a problem for the orthogonality calculations.
- John Wright – A non-oilfield engineer was heavily involved in using magneto-resistive magnetometers. Are they used downhole? Answer – They are commonly used for low temp, low accuracy applications. Robert Estes – It's similar to the silicon accels situation. There is progress being made for low accuracy tasks, but for real navigation BHI relies on Q-flex

accelerometers and fluxgate magnetometers. Robert Wylie – We haven't gotten them to work very well at high temperatures.

Sub-committee Activity Report: Collision Avoidance

(Steve Sawaryn)

- Presentation contains a timeline update for sub-committee goals, as well as guiding principles for the group.
- The work is divided up into 3 groups.
- Collision Avoidance Rule: Seeking a recommendation based on current, documented methods and understanding. The rule will be Separation Factor (SF) based, with SF = 1 targeted as the critical point to avoid ambiguity. Pedal Curve method is also being evaluated (there are concerns it is too conservative in some cases).
- Assurance & Verification and Procedures & Management are the other two groups.
- (Jon Bang presenting technical details) – Explanation of nature of Pedal Curve vs. an ellipse. See presentation for more details. The Pedal Point (point on the Pedal Curve) was explained as relating directly to the probability of collision, whereas the Ellipse Point does not directly relate to said probability.
- Steve has a concern that we are modeling incursion (passing into a particular region) vs. actual collision between the wells.

(Questions)

- Angus Jamieson – The pedal curve method can tend to dramatically overstate collision risks, as Steve just mentioned. I would advise staying away from it.

Novel Method for Wellbore Tortuosity Analysis (SPE 173103)

(Jon Bang)

- Tortuosity is defined as any deviation from a straight hole. Large scale tortuosity is part of a well plan; it generally does not cause any problem.
- Medium and small scale tortuosity can cause problems, such as high torque and drag, stuck equipment, reduced drilling length, excessive equipment wear, and premature failure of equipment.
- Dogleg Severity is commonly used to assess tortuosity, but it is not good enough. Too noisy at short survey intervals, and not informative enough at larger survey intervals.
- For the new method, survey spacing of 1 ft or less is needed, for instance from a continuous gyro.
- A single external parameter is used in the process: S is the length of the analysis window.
- One way to define tortuosity is by $T = (S-L)/L$, where L is the straight line distance between the endpoints of the analysis window. T is relative elongation, and is usually within [0, 0.001].
- Another definition is to look at displacement from a smoothed (linear) trend.
- A last method is to calculate the effective diameter of a straight cylinder that can fit through a hole section of length L.

- A field case was presented in which MWD-based dogleg severity did not show a problem, but stuck casing and premature pump failure occurred. The higher resolution continuous gyro dogleg severity and T curves showed high tortuosity. The effective diameter plot showed near zero effective diameter toward the bottom of the hole.
- Second and third field cases showed how the technique can be used to define optimal pump placement points.

(Questions)

- Roger Goobie – Are you running this on centralizers or stabilizers? Answer – It's centralized. Roger – Can I use this to detect a cuttings bed in a high angle well? Answer – Not in open hole. Ben Hawkinson – You can't typically run a gyro open hole.
- Steve Sawaryn – 3D curves are normally characterized in terms of curvature and torsion. Have you looked at using those? Answer – I looked at methods like that, but as I understand they have not been used for characterizing tortuosity in a way that is useful for application. Our parameters use all the information over the section (dogleg severity only uses the endpoints).
- Angus Jamieson – This is an excellent piece of work. I didn't do a paper on it, but I did something similar at 3 or 4 foot intervals. I worked out what the stresses would be on the pipe if you forced it to go into the wellbore so you could see the stresses versus measured depth. This showed that stresses can be less in high tortuosity wellbores with constant curvature than those where the dogleg severity varies wildly.

An overview of Surface Location Uncertainty

(Harry Wilson)

- This presentation is aimed at education for the uninitiated.
- The surface location is a single point survey, and as such has an associated uncertainty value. Sometimes this uncertainty level is significant with respect to the downhole positioning objectives.
- In order to determine the surface location uncertainty, you can ask the operator (not always successful), ask the rig positioning/land survey company, ask what survey method was used, and if all else fails, use conservative defaults.
- Often the operator's rig positioning spec isn't what is needed: they might give you the nominal rig positioning tolerance.
- There are two parts to surface location uncertainty: facility/sight position uncertainty and slot/wellhead position uncertainty. This are usually based on different surveying methods.
- For Compass (and perhaps other software), the default position uncertainty is zero. It doesn't annoy people. One problem is that people don't bother to change the default.
- For target sizing, facility and slot uncertainty are RSS'ed. For collision avoidance, the software differentiates between wells drilled from the same facility or other uncertainty.
- Sometimes naming conventions can become a problem and require compromise for the purpose of using the software.
- Including surface uncertainty for target sizing is recommended, but the customer actually has the call. It is mandated for collision avoidance calculations due to HSE risks.

(Questions)

- Robert Estes – Do we ever get into situations where lack of information about the surface uncertainty causes a re-survey of the site after the fact? Answer – That question can trigger the thought process that there can be gross errors in the positioning of the wells. When we started using semi-submersibles and GPS, the rig would be positioned on a single pass. That resulted in very inaccurate positions.
- Angus Jamieson – The reason that marine surveyors are loathe to say what the uncertainty is, is that transponder locations are known only through asking the owners of other facilities on which you place them. Further, tides can change positions significantly prior to spudding the well, depending on water depth. The marine surveyors run into the same problems that you've just described. Harry – We'd like an informed guess in that case.
- Harry Wilson – We also consider water depth as another source of uncertainty.

Managing Main & Crustal Magnetic Fields and New Developments in Global Magnetic Modeling

(Stefan Maus)

- The largest source of lateral error in MWD is the magnetic reference field uncertainty.
- An analysis of the effects of various magnetic corrections on lateral position accuracy is included in the presentation.
- There is a significant advantage to using a geomagnetic model that is updated annually, vs. every 5 years (IGRF).
- The crustal field has longer wavelengths than is commonly thought.
- In the magnetic field models, the magnetic field is calculated as the gradient of a scalar potential. The potential satisfies Laplace's differential equation as long as you are external to the magnetic source. Harmonic functions satisfy the equation. Spherical harmonic models can be used for the main field model.
- The standard model for MWD models is the BGGM, which is now modelled to degree 50. The MVSD model goes up to degree 133 because that is the maximum wavelength that can be accurately determined by satellite data.
- For high definition models, ellipsoidal harmonics should be used. This is used for the HDGM (degree 720) and MVHD (degree 1000). The MVHD model allows resolution of some crustal anomalies on the wavelengths of importance to oilfields.
- Inclusion of IFR data requires specification of boundary conditions due to the fact that total field is generally all that is available. Solution of Laplace's equation takes the form of the FFT method or the equivalent source method. One base assumption is that the magnetic potential is zero on the boundaries (equivalent to assuming that all anomalies are inside the boundaries).
- The zero boundary potential assumption is not correct, and this is not just of academic concern. The solution is to eliminate the boundary by filling the data in to a global model. Satellite data is used to fill in the longer wavelengths. Thus the IFR model is computed as a global model with very high resolution that is valid locally.
- The technique was tested in North Dakota, and verified by ground shots.
- Note that even surface directional measurements need downward transformation which solves Laplace's equation.

- What about secular variations? It is wrong to take the crustal anomaly and add it to the main field model for a certain date. A safer method is to start with a complete field for a give reference date, and then use the value for any model on that date as a baseline for comparison to that model on future dates. It is important that the degree of the model not change across the time interval of comparison.

(Questions)

- Roger Goobie – If I have a pore pressure model when I drill a well I can validate it in many ways. What's the validation process for this type of model? Answer – That's actually very difficult because going out to take ground shots takes quite a while. You can validate them against aeromagnetic data that were not used for the model. But I think the ultimate test would be to compare the trajectories from MWD with gyros.
- Robert Wylie – What is the grid accuracy of the aeromagnetic surveys? Answer – They guarantee 5 meter absolute accuracy. Older data can be off by a mile. As long as GPS is used, the positional uncertainty is negligible.
- ??? – If I have an IFR survey from the year 2000 and I apply it to a BGGM model from today, and I doing something wrong? Answer – I would add the IFR survey to the year 2000 model to get the total field, and then add that anomaly back on top of the 2014 model.
- Robert Estes – You showed a survey map of Ft. McMurray with up to 1000 nT of crustal anomaly. What sort of anomaly would you expect to see along a single well? Answer – It could be hundreds of nT from the beginning to the end of the well.
- Patrick Knight – What altitude was the Alberta survey run at, and do you know if you're getting any effect from those wells? Answer – That's cultural noise that shows up in the data, but the cumulative effect of the iron in the ground doesn't have that large of an effect. By definition you cannot get a totally accurate reading over those man-made objects. But even a ground survey has that problem. Patrick – Have you done any comparison between early aeromagnetic surveys and the new one to see if there's any significant difference? Answer – We have not received the data yet.

Webmaster's Report

(Ross Lowdon on behalf of Phil Harbidge)

- Phil sent an update and his apologies for not being here.
- He has updated the missing collision avoidance documents, and mirrored the website as promised.
- We've had over 6,000 hits since the last meeting.
- Ross suggested videoing the presentations to put on the website.
- Please send your feedback to Phil (pharbidge@slb.com)
- There's a new mobile friendly ISCWSA site for the committee to review (www.iscwsa.wordpress.com).

Treasurer's Report

(Robert Wylie)

- Amsterdam was a break-even event (we are awaiting a bill from the SPE, which is accounted for).
- There are about 51 attendees here today. There will likely be a loss of $2k USD for this meeting. No meeting sponsors, but MagVAR is sponsoring the after-meeting networking activity (thanks to MagVAR for this).
- Current balance is about $48k.
- Ross Lowdon – Expect a bill from the SPE in about 18 months. Robert – That's why we're holding the money in reserve.

Closing Statement

(Son Pham on behalf of Pete Clark)

- Next session will be in Houston in conjunction with the ACTE. We will need to elect a new program chair at that session.
- Thanks to the SPE, participants, presenters, sub-committee chairs and members, officers, and MagVAR for the networking event.