

42nd ISCWSA Meeting – Houston, USA – October 1, 2015

Introduction

(Pete Clark)

- Brief delay due to technical difficulties with the projector.
- Briefly discussed the agenda.
- Noted retirement of Roger Ekseth in light of his great contributions to the group.
- Coffee breaks sponsored by ProDirectional.
- Networking event at Hearsay on the Green sponsored by MagVar.

Database Management – Information Sourcing & Integrity

(Shelly Peterkin)

- Going to discuss operator's drilling database.
- Data considerations include scope, standardization, optimization, and security (which includes data integrity), and end users.
- Drilling databases can be used for retention of historical data, asset inventory, operational planning, collision avoidance.
- Information in the database includes metadata (including API numbers), location information, magnetics information, North reference, and survey information (include the tools used for surveying).
- BSEE promotes the Legacy Data Verification process, which targets data collection of wells drilled prior to 2000. The purpose is safety, which is why many of these databases are public.
- There are both online regulatory databases and 3rd party database solutions that pull from multiple databases to provide easier access.
- End of well reports and vendors are additional data sources.
- Some common issues include incorrect surface hole locations and improper use of tool error models. Proper database management can help remedy these problems.

(Questions)

- Bill Allen (BP) – For those with incomplete databases or unknown data integrity in their database, are there any tools to help fix the database? Answer – There's no one size fits all solution. It depends on the needs of the customer. For instance, if an operator doesn't have a functional database in place, we can look to see what pieces are missing, and then help build a new database from scratch. Bill – I'm curious specifically if there's a tool to look at the macro set. Answer – There are tools to run queries on the database. You can use Data Analyzer if you are using an EDM database.
- Kevin McCaird – Do you have any experience working with (inaudible) types of databases. I'm curious about their security. Answer – We don't have direct experience with those types of databases.

- ?? – What do you recommend to be done to make sure gross errors show up immediately?
Answer – It would be nice if vendors were doing that, but we know they don't do it right now. Additional functionality could be built.
- Jeremy S. – Is there an easy way to get the raw survey data from the surveys in a database?
Answer – That's something you'd probably have to address with the supplier of the software.

Relief Well Drilling - Ranging Strategies

(L. William Abel)

- Discussed the term relief well in the context of the Santa Barbara oil spill. Objective was to draw the pressure off of the reservoir to get the flow to stop.
- Relief wells are drilled because they have to be drilled. Usually there is no other way that is considered viable.
- The ranging strategy is heavily influenced by the kill strategy.
- The time required to stop the flow has to be considered one of the top priorities. Pre-planning can reduce the time required to kill a well, which helps improve public image outcomes.
- Relief well objectives include making communication for a pump to kill operation, and to minimize time and risk.
- Choices are wireline (active ranging) and MWD (passive ranging). The main difference is radius of investigation and time per ranging shot. Active tools generally have greater range, passive tools do not require a trip out of the hole to get the data. Recommended to use both.
- One trade presented was intercepting with a high incidence angle, but small EOU vs. a low incidence angle and large EOU. For large EOUs, once can select an attack angle that will sweep through a large ellipse while holding a steady heading.
- Basic strategy includes drilling to point in space where MWD ranging should have found the well. If has not, consider using active ranging to re-log the interval.

(Questions)

- Lisa Grant – How has the increase in well density changed your strategy due to offset well interference. Answer – It changes where you want to aim for to avoid interference and collisions with other well.
- Neil Bergstrom (Devon Energy) – People shouldn't get the idea that these ranging services are commodity items. There are a huge variety of ranging services per contractor. Also, you want to make sure the contractors will work with each other.
- Phil Harbidge (Schlumberger) – I get asked about the top 5 priorities to be ready to drill a relief well. Answer – Have a contingency plan in place, know who to can do what regarding well control, continually update the plan, figure out how to make the response quick and efficient.
- John Wright – Regarding horizontal wells and active ranging methods, tools can now be pumped down the drill string, so you can get the same information as in a vertical well. Another thing is perpendicular intersection at the toe that may be a viable in some circumstances.

- Mark Williams? (Scientific Drilling) – Are there other strategies for reducing the EOUs, such as looking for the same gamma markers? Answer – EOUs can be thrown away after you acquire a ranging signal.
- Roger Goobie (BP) – Is there a strategy that you use to do a ranging interpretation prior to getting to the edge of the EOU to prevent accidental intersection. Answer – You just range as you go, starting at the near side. When the two ellipses touch, it's caution.
- ?? Duke (Southwestern Energy) – Thinking about the shale wells being drilled from pads, being able to locate a well in the middle of that pattern is really tough. Is there a pattern of drilling (inside out for example) that increases the probability I can locate a well. Answer – The interference doesn't have a great distance to it. How far apart are the wells? Duke – 300 to 600 feet. Answer – You could put some hot spots or markers in the wells. Neil Bergstrom – Leave enough surface spacing in your pad design to be able to get to a problematic well. John Wright – The last casing shoe prior to entering the reservoir is where you are going to have to range to. So how far apart at the wells at that point?
- Ludovic Macresy (Path Control) – When you don't see the well in the locate phase, you know you can move forward the distance of the ranging detection. Also, if your ranging detection is greater than your EOU, you should always see it on first pass. Is there a way to do a test on the ranging technology to determine the effective ranging detection radius prior to running down hole? Answer – You almost have to rely on what the vendor says if the vendor has had success in the past.

Sub-Committee Activity Report: Collision Avoidance

(Steve Sawaryn)

- The quest that we set ourselves on was to look for a standard collision avoidance model that we can use to build on as an industry.
- We decided as a group on what we were trying to achieve and what criteria would be used to make decisions.
- We had some people contribute material on analysis of specific techniques.
- Presented a presentation on the Pedal Curve Model. A crossover can result in anomalous behavior from the pedal curve.
- The Pedal Curve is the most common method used in the industry, so it's important to recognize its shortcomings. One of the areas needing more standardization is the relation of the Pedal Curves to probability of collision.
- The Pedal Curve is not intuitive, it is inconsistent, it does not consider the direction of approach, and azimuth error is included when only inclination should be considered.
- As a result of a vote, a significant majority (about 80%) decided the Pedal Curve Method should be the basic model, and we need to fix the shortcomings with that model.
- Might have a day and a half meeting for the next ISCWSA meeting.
- Please don't go say the collision avoidance model is fixed yet. There is still much work to be done.

(Questions)

- None.

Active Acoustic Ranging

(Benny Poedjono)

- Main focus is salt drilling. Active magnetic ranging is not very useable in salt. Passive magnetic ranging can be used. However, salt is ideal for acoustic ranging.
- Basically putting a seismic excitation and sensing system in a well.
- Uses a monopole source to create a compression wave, and a dipole source to create a shear wave.
- Currently conveyed on a wireline tool. Each firing requires collection of 104 receiver data histories.
- There is an azimuthal measurement capability with 22.5 degree resolution. There are 13 receiver stations with 8 azimuthal receivers each.
- Distance measurement requires formation information to use speed of sound information. Often used in conjunction with passive magnetic ranging.
- Data traces are matched to the data that you have, including the offset well survey.
- Theoretical range varies from 82 ft (@120 us/ft) to 165 ft (@60 us/ft).
- Possible to get down to 10 degree accuracy and 0.5-1.0 ft in distance.
- Acoustic distance is perpendicular to the target well, not your well.
- Combining the shear and compression data increases the radius of investigation and the resolution in close proximity.

(Questions)

- Angus Jamieson – One of the big issues with active ranging, is that at significant distances in a crowded field, the active system will light up all the wells in a field. Can this tool distinguish the wells? Answer – Yes it can. Especially if there is a good azimuth change and they are farther away.
- Kevin McCaird – It looks like there's a shadow of the open hole there. Answer – Yes you can see it if there's enough contrast.
- Lisa Grant – To build on Angus's comment, this is really fantastic from the perspective of offset well interference. Does this work in non-salt formations where there will be more noise? Answer – This is a very good point. We would combine it with a resistivity tool if necessary.
- Son Pham – I heard a rumor that this was applied to an open hole intercept in US land, and that were you were able to verify the hole was not collapsed? And are there issues when the tool is too close? Answer – We use anisotropy with compression and shear together. If there is a wellbore there, the shear will be different in the wellbore. So we can determine that. A distances on the order of 1 foot, this tool can't see. But we think we can develop another technique to help that. There is currently a limit to how close you can go.
- Ludovic Macresy – Will this work better if we are parallel to the target well, or if we have more incidence angle? Answer – A parallel is a little more difficult. We prefer to be at a 10-15 degree incidence angle. But this is only for location.

- Bill Elks – If you're outside salt, what kind of distances do you get? Answer – We would need to do the modeling to figure that out. We need a good 6 feet of homogeneous formation to get a good distance. Maybe 10-15 feet?
- Lisa Grant – What happens if the well is flowing? Answer – It could be challenging if the borehole is not homogeneous and the flow is turbulent.

A real-time magnetic disturbance model to improve drilling accuracy in low and mid latitudes of the Earth

(Manoj Nair)

- The current magnetic model is comprised of the main magnetic field, crustal magnetic field, and the external magnetic field (from the magnetosphere and ionosphere currents). There is also interference from magnetic drill string components, as well as sensor error sources.
- NOAA's real time disturbance field model now offers 1 minute updates.
- This talk covers magnetosphere current induced by solar wind, specifically the ring current. It sits about 6 Earth radii away from earth, but exerts a strong influence.
- The model is updated in real time using USGS real-time Dst index and the NASA solar wind measurements from the ACE satellite.
- geomag.colorado.edu makes the data available in calculator form. There is also another access method.
- An example of field variations during a solar storm in March 2015 was presented. The magnetospheric current effect was nicely verified. The ionospheric variation component is not part of the model.
- The real-time model can really improve the magnetic field models for dip and total field strength at low-latitudes. The same is not true for declination.
- Further improvements are planned, including incorporating ionosphere daily variations.

(Questions)

- Benny Poedjono – This is still in the early stage, but I can see this is moving in the right direction. Also, we've been collecting a lot of data around Hawaii to improve the 3D electromagnetic induction model.
- Stefan Maus – Your group already has a model for the daily ionosphere variations. What is the time frame for incorporating that? Answer – 3 or 4 months from now.
- Adrian Ledroz – Is this to be used for a new MWD error model, or is it just to feed existing models. Answer – We do not have a plan to introduce a new error model.

Geomagnetic Referencing Accuracy at High Geomagnetic Latitudes: Critical Observatory Distance

(Ciaran Beggan)

- The UK Government has recently funded a project that BGS is involved in. There is a plan to drill two boreholes in the UK, with an open call for experiment suggestions to be done in the next few years. Please inquire further if you have ideas.

(Ellen Clarke)

- Motivation for the presentation is to determine how far away from an observatory one can be and be able to use IFR2. Focusing on higher latitudes.
- A side benefit is that it will give us a better handle on the uncertainties on IFR1 (crustal field).
- As more sources are included in the magnetic model, the uncertainty will decrease. As you move further from an observatory, the accuracy of IFR2 will decrease.
- The distance at which the IFR2 uncertainty has grown to be equal to the level of the IFR1 uncertainty is called the critical observatory distance.
- The study extracted the external fields from the time histories of a large number of stations and variometers. This involves removing the trend and offset from all component data.
- Then one minute residuals were calculated between pairs to see what the differences were.
- For a specific pair of stations, using one station to predict the external variations at the second one reduces the uncertainty below IFR1 levels by a factor of 3 to 6.
- IFR2 uncertainty appears to increase in the autumn, as compared to the winter months. As expected, a solar maximum yields more uncertainty than a solar minimum.
- There does not appear to be a nice linear line describing IFR2 uncertainty vs. distance from an observatory, though there is a trend.
- One example looking at total magnetic field from 2003 gave a critical observatory value of about 375 km.

(Questions)

- Phil Harbidge – On the slide depicting solar min/max differences, the uncertainty is not monotonically increasing. If you processed along the line of non-monotonic uncertainty increase, would that reduce uncertainty? Answer – We don't know if the pairs in that area of the plot of at the same latitudes.
- Bill Allen – A lot of this is point to point. Did you look at 3 points? Would that allow you to push observatories farther apart if you had that third station? Answer – I think we will extend this study to do that. It is definitely worth doing, and we are working up a set of software to allow us to do that.
- Stefan Maus – When speaking of external fields, there's also an induced field from currents in the ground. Have you considered that the differences could just be differences in conductivity in the sub-surface? Answer – You have good point. We have not tried to address that concern in this study. It contributes to our uncertainty and is covered in our study, but is not broken out specifically.
- Neil Bergstrom – The selection of pairs is different on the solar max and min plots. Answer – Yes, we only required that a pair have 1 year of overlapping data. So not all pairs span both solar events.
- ?? – Did you account for computer time stamp errors? Answers – We kept it consistent on each machine/time series. The time stamp of the 1 minute data is very accurate.

Sub-Committee Activity Report: Error Model

(Andy McGregor)

- The error model committee has grown to 61 people. That number is unworkable, so we verified the active members of the list. That brought us down to about 20 members. We will work on putting more detailed minutes on the website.
- Spreadsheets and reasoning behind Rev4 error models have gone up on the website.
- Working on consolidating error model documentation. Created an outline for this effort.
- Also working on recommendations on how to handle inclination only surveys. This is captured in a document to be put on the website.
- Currently analyzing the effect of correlation of error sources on anti-collision calculations.
- Current models do not account for the effect of longer than recommended course length between surveys. Jerry Codling studied the effect of this and took a whack at developing a model term to account for this effect. This is still being thought through.
- The question arose concerning whether there should be a way to handle ranging data in an error model. This is an open question.
- Some MWD suppliers also brought up the question of the math behind the lumped terms in the error models. Some people are working through the math.

(Questions)

- Angus Jamieson – In the North Sea, the OWSG error model has what seems like an excessively large z axis interference values which results in excessively large azimuth values. Answer – This was almost discussed.

Election for Program Chair

- Ed Dew, Jonathan Lightfoot, and Lisa Grant are the nominees.
- Each nominee was given an opportunity to speak and provide some information about their background.
- Voting limited to 3 votes per company.
- Jonathan Lightfoot was voted the new Program Chair.

BSEE Wellbore Surveying Technology Project

(Jim Rice)

- BSEE is attempting to gather information regarding wellbore positioning and ranging technologies. It wants to gather its information to inform its future regulatory decisions.
- There is a focus on tools that operate at 350 degrees F and up, as well as on relief well technologies.
- The approach includes gathering data on survey equipment and procedures, survey data management, and wide area standards.
- Jim is working with Gordon Richardson, who will be the technical expert on the project.

- The final report is due in August 2016.
- Wants to hear from both service companies and operators.

(Questions)

- Robert Wylie – What is the geographic coverage of this effort? Answer – BSEE is responsible for offshore US.

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

(Neil Bergstrom and Lisa Grant)

- There are now about 70 members on the mailing list. A large number of operating companies are represented.
- Meetings are held in Houston, but a teleconference option may be used in the future to make it easier for non-Houston individuals to contribute. Meetings are usually attended by 12-20 individuals.
- Top 6 priorities of the group membership are all related to standard practices.
- Movement afoot to create API recommended practices, encompassing minimum requirements for good survey practices.
- Highlighted the ISCWSA LinkedIn group.

(Questions)

- Kevin McCaird – How will the standards information be presented to the industry? Answer – We want to create a framework, but keep flexibility for individual companies. We don't want to be too prescriptive. New ideas go into SPE papers as new though. Kevin – Where can we actually read the recommended practices? Answer – API.
- Jim Rice – This is exactly what we're looking for. Can you talk timing? Answer – What you put up there accelerates our timeline.

A Portable Real-time Disturbance Field Monitoring Station

(Jonathan Wrobel)

- The disturbance field averages from magnetic storms (standard deviations) range from 0.05 to over 0.4 degrees for declination. Charts for dip and Bt were also presented.
- Time series data shows even greater spikes. For instance 500 nT change from 1 minute to the next in Alberta, Canada.
- It is not uncommon to see 5 degrees of declination from the disturbance field at high latitudes.
- Current best practice for IFR2 is to interpolate between fixed observatories. But most of the time this IIRF service will utilize only a single observatory.
- A study similar to Ellen's study shows a ~600 km useful radius from an observatory for IFR2 (IIFR).

- Another option is to use a real-time disturbance field monitoring station (variometer). The portable station data is uplinked via satellite, to a real-time operations center. There they can be associated with MWD data from the rig and sent back to the rig.
- Two validation deployments have been conducted. One was in Boulder, CO, and was compared to data from the nearby Boulder observatory.

(Questions)

- Lee ?? – Do you deploy it for the customer, or does the customer deploy it. Answer – It's a service provided. We find a suitable area to deploy the station. You could use an IFR1 model for site selection.
- Ed Stockhausen – What should the directional driller do if the well moves on him from latent reception of data from the disturbance field update? Answer – During a magnetic storm, you magnetic vector shifts wildly, affecting your QC criteria. The idea is to apply the disturbance field offset very quickly.
- Robert Wylie – How do you QC the validity of the correction you are going to make? Answer – You can monitor and calibrate the processing. But the strength is really in numbers. You might use a network of these, at least two, so you can look for uncorrelated disturbances between the two.
- Ellen Clark – Are you applying 1 second data to the downhole data. Answer – That's actually a knob that one can change. It support anything from 8 hours down to 1 second. Ellen – Do you know the timestamps of the downhole data you are calibrating? Answer – There is some time smear in the time stamps of the downhole data. Ellen – The downhole time stamp isn't accurate to 1 second, so why do you need to use 1 second data. Answer – Typically we use a 10 second interval. Ellen – You use a model to get the absolute model. How do you know you have the correct absolute level in the field? Answer – Disturbance corrections are not very sensitive to the overall field level.
- Mark Willerth - ?? Answer – 1 to 2 weeks is how long you'd prefer to have this run for (before use?).

Incidence Angle Management for Intentional Well Intersection

(Pete Clark)

- Chevron.com, on the right hand side, has a link to an engineering feat. They drilled two wells that intersected for drilling a pipeline under an offshore canyon.
- Phases for intersection include navigation, detection, traverse and close, and intersection.
- Looked for an incidence angle of less than 3 degrees. Approach from below offset well.
- The lateral detection limits of the ranging technology generated a detection corridor that should ideally be larger than the combined lateral position uncertainty.
- Available technology included active magnetic ranging, using a rotating magnet. There is a wireline placed in the offset well, preferably in a non-mag section of casing.
- This project involved diametrically opposite wells. Make sure you have a long landing strip so that you have a second chance if the first intersection doesn't work.

- The intersection well was drilled in an S shape, from offset right, to over, to offset left, to back directly over. At the time of the intersection, the directional driller only needs to focus on building inclination.
- Intersection from below gives you better directional control.
- The process requires simultaneous operations on two rigs. A clear decision making flowchart becomes a necessity.
- Magnetic data is acquired while drilling, with the relative position calculated during the connection.
- The probe is pumped down in a drillpipe and was laying on the bottom of its wellbore. This non-centralization must be accounted for in relative position calculations.
- MWD QC was visually verified using BDip acceptance criteria.
- We were not able to ream out doglegs.

(Questions)

- Robert Wylie – Geological markers? Answer – If you had the chance you’d wish to use the geological markers.
- Ed Stockhausen – In places where there is a lot of geological uncertainty, it’s probably good to have a geologist somewhere. Also, building to intersect in an unconsolidated zone is something to avoid. Put geology in your plan.
- John Wright – With the range on the rotating magnetic technology, it may still not be good enough if you are coming from very long distances. We tested single wire and saw the well to 200 meter distances. Answer – Yes you’d want to back up the rotating magnet system with a single wire active magnetic ranging system. I can’t claim that we have any better understanding of the range of the rotating magnet. We saw it on the first try.
- Mahmoud Elgizawy – What would you do if there’s a disagreement between your two survey management groups? Answer – The groups worked together very well. Differences were resolved with discussions between them. The differences were slight.

Sub-Committee Activity Report: Education

(Steve Mullin)

- 14 people were at the meeting yesterday.
- The education committee has two branches. One of those is our support of UHI, which Angus will speak on.
- The other branch is putting on SPE workshops and topical lunches. We have some coming up in November: November 9-11 and November 12.
- The workshop sign up is on SPE.org under the events tab.
- We need to improve the content on the ISCWSA.net website regarding what each sub-committee does. David Gibson is going to head up that effort. Please contact him if you have any ideas (david.gibson@lodestar.com).

(Angus Jamieson)

- We have brochures with Angus's picture on the front.
- We have had 20,000 downloads of the e-book from around the world.
- If you are willing to write a chapter for the e-book, please let Angus know. There are 7 new chapters in preparation.
- There is a new online course discussed in the brochure with Angus's picture. The objective is to widen knowledge within the industry, as well as to deepen the knowledge base.
- Let Angus know if you think any topics are missing.
- If you sign up for the course, you can do it at two different levels. Both are the same cost, and both give access to all levels. It's just a matter of deciding which test you want to take.
- If your company wants to send more than a handful of people, we suggest the group leader go through the course with full tutoring, and the other individuals might be subject to a discount, because we would only be grading the exams.
- I only have seven people signed up to be online tutors. I could use a few more.

(Questions)

- None.

Sub-committee Activity Report: Well Intercept

(Roger Goobie)

- Nineteen participants in the meeting yesterday.
- Re-wrote the mission statement to incorporate more than just relief well drilling.
- Assigned individuals to add word definitions to the lexicon.
- Introduced/reviewed some existing sources of regarding relief well planning and execution. Halliburton is seeking a copyright release for their guide to allow for distribution to and use by members of the sub-committee. The useful information is to be incorporated into the well intercept guide.
- Working on updating a well intercept guide. Sections have been assigned to sub-committee members. Updates will be coordinated between ISCWSA meetings.
- Discussed updating the bibliography to provide sources of information locatable from one place.
- Also discussed using the SPE paper 173097 as a basic framework for relief well geometric planning. But first terms need to be agreed upon in the lexicon. Future work.
- Milestones were set by Roger for the next three meetings.

(Questions)

- None.

An overview of Driller's vs. Geological Target

(Pete Clark)

- The presentation is about target sizing. A simplification of the reservoir target can be used for geometric planning. Usually targets a geologic layer.
- Multiple geologic targets may be located within a field.
- Target modifiers can be geologic faults, lease boundaries, and offset wells.
- Hard lines are boundaries that must not be crossed. Soft lines may perhaps be crossed, but this should be discussed with the geologist.
- The directional software can describe targets as a point, a 2D shape, or possibly a 3D extrusion of a 2D shape. 2D objects can often be tilted by dip angle and oriented as by strike.
- There is positional uncertainty in the wellhead position measurement, the wellbore position, and in the geologic target location. However, the geologic position uncertainty is assumed to be correct.
- One way to account for positional uncertainty is to subtract the lateral uncertainty from the sides, and the radial uncertainty from the front and back. This new box is called the driller's target. This does not yet account for TVD uncertainty; perhaps due to formation evaluation measurements while drilling.
- Target sizing must account for uncertainty level (1-sigma, 2-sigma, etc...) when going from the geologic target to the driller's target.
- Target erosion is another term for moving from a geologic target to a driller's target, and it has different rules for different target types.
- In the case where the position is inside the geologic target but outside the driller's target, you can't be sure you're hit the target.
- Geosteering is an aid to, rather than a replacement for target sizing. There is poor integration between the two.
- It is important to include vertical uncertainty if no geologic depth confirmation is available.

(Questions)

- Bill Allen – We do the same sort of thing as depicted on slide 14. A lot of times that rectangle is provided without an understanding of the uncertainty in the seismic data. Geologists often give drillers the worst case target, rather than a statistical description of their interpretation uncertainty. For instance, worst case fault location. Answer – Yes, I agree.
- Angus Jamieson – If you have the conversation with the geologist and get them to estimate the geologic position uncertainty, you can address this. That conversation would save huge amounts of money by allowing for larger driller's targets.
- Ed Stockhausen – In the Marcellus Shale, there's a 6 foot zone they'd like to stay within. And they have 40 foot TVD uncertainty in where that zone is. Geologic uncertainty can be decreased by accounting for various geologic markers as you go. You should have pre-planned decision points.

Webmaster's Report

(Phil Harbidge)

- The main website for the group is ISCWSA.net.

- Minutes and new documentation has been added to the websites.
- There is also the LinkedIn group that Neil Bergstrom has set up.
- There is now a Twitter account, with 1 follower.
- There are 5 websites containing ISCWSA related information (see presentation for the list).
- Membership is still growing as evidenced by the SPE numbers.

Treasurer's Report

(Robert Wylie)

- There are at least a dozen operator companies represented in the room today, which is fantastic. Credit the OSWG for that.
- London net income was a loss of \$1,959.
- The estimated net income for today is about \$3,520
- We had 143 people in attendance today.
- Coffee breaks were sponsored by ProDirectional.
- Networking reception was sponsored by MagVar.
- The SPE sponsored the meeting space.
- Estimated available balance is \$46,539.

Closing Statement

(Pete Clark)

- Thanks for allowing me to serve as Chairperson.
- Please give us feedback so we can get better.
- Handoff to Son, who takes over as Chairperson now.

(Son Pham)

- Thanks to Pete, who works exceptionally hard for the group.
- The sub-committee meetings are staffed by an extremely strong team.
- Next meeting likely to be help along with the IADC in Ft. Worth in March.