The Record

Denver Geophysical Society

Volume 47 Number 1 February 2022

Upcoming Events

3DSS Icebreaker—March 22 @ 4:30 pm

3D Seismic Symposium—March 23
Ellie Caulkins Opera House 8am –4:30pm

April Luncheon—April 14 @ 12:00 pm
Location TBA

Student Challenge Bowl—April 21 (tentative)

May Luncheon—May 12 @ 12:00pm

June Luncheon—June 9 (Rockies game?)

DGS Golf Tournament—July 21
The Ridge at Castle Pines

August Luncheon—August 11 @ 12:00pm

IMAGE '22—August 22—September 2
Houston, TX

October Luncheon—October 13 @ 12:00pm

DGS Elections—October

November Luncheon—November 10 @ 12:00 pm

Holiday Party—December 8

In This Issue

Executive Corner

By Morgan Brown
Aspect Energy
2017 DGS President

Unconventional Resources have resurrected the US oil industry, but hollowed out the Denver Geophysical Industry. Allow me to expand on this provocative statement.

Years ago (2007-2013), I managed a seismic processing startup company. If you seek investment capital, the financiers would always ask: "What is the potential market size?" My research led me to the **"100-10-1 rule"** for conventional E&P: For every $1 spent on seismic processing, companies spend ~$10 on seismic acquisition, and ~$100 on land, drilling, and infrastructure.

A hypothetical example from the old days:

- Shoot 50 square miles of 3D seismic at $20K/sq mi ($1 million)
- Process the data ($100K)
- Lease 1,000 acres at $500/acre ($500K)
- Drill 7 wells at $1 million/well ($7 million)
- $2.5 million on completions and production infrastructure

$10 million => $1 million => $100K = 100-10-1. You can quibble with the numbers one way or the other, but you must concede that I am in the ballpark.

Continued on next page

Executive Corner *continued from page 2*

Working backward with the 100-10-1 rule, let's estimate yesteryear's geophysical **employment**:

- Denver capex $1 billion => $100 million acquisition => $10 million processing

- $100 million seismic acquisition supports =>
  - 100 surveys x 50 sq mi x $20K/sq mi =>100 acquisition geophysicists
  - 10 active crews x 50 crewmembers per crew => 500 crew members

- $10 million processing =>
  - 1 mid-size processing shop => 50 employees
  - 1 QC geophysicist per survey => 50 employees
  - 1 interpreting geophysicist + 1 geotech per survey => 200 employees

To summarize, in the good old days of conventional exploration, $1 billion of capex could support roughly 1,000 geophysical employees in the Denver area.

Unconventional resources have radically changed employment in the geophysical industry. An anecdote illustrates this point perfectly: In 2017 I visited a friend in Calgary, who was VP ops for a Montney Shale driller. He told me that their projected 2017 **capex was $750 million, but they only had a single 50 square mile 3D survey and one consulting geophysicist!**

After this meeting, it became clear to me that the 100-10-1 rule no longer applies. **Now, we're subject to the 1000-10-1 rule**. For the same total E&P capex, **the geophysical industry's slice of the pie is now ~10 times smaller**, as is the "necessary" number of geophysicists.

We used to believe that the oil prices alone drive DGS membership. Except for the crash of 2015-16, the price of oil has remained *reasonably strong for the last decade.* Yet the membership of DGS has declined precipitously from over 1,000 in 2012 to around 200 today. Of that 200, I reckon that 100 are retired, under-employed, or have left the industry. As predicted by the new 1000-10-1 rule, we now have about 10% of the employed geophysicists that we had 10 years ago.

My company recently posted a geoscientist job opening. WIthin 2 days, 160 people had applied over LinkedIn. I know many of the applicants personally, and they are good, experienced hands. I'm struck with pangs of survivor's guilt – if **these** people are unemployed or working a dead-end job, then **who the hell *does have a good job? Why do I still have a job?***

Continued on next page

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Information for Contributors

Your editorial contributions are encouraged, particularly about classes, seminars, personnel news, company news, or other items of interest to the geophysical community. All suggestions and manuscripts should be emailed to DGS at office@denvergeo.org. Targeted deadline for submissions is the first of the publication month (February, May, August, November) but exceptions can be made with the editor's approval. We reserve the right to edit all material according to standard practices.

Opinions expressed within are solely those of the authors. They are not to be interpreted as those of the DGS.

Executive Corner *contined from page 3*

In addition to the sheer headcount decline, geophysics has also suffered a significant decline in relevance and prestige. When I started grad school in 1997, oil prices were laughably low, yet there was still intense interest in geophysical technology, from acquisition to processing to computing to graphics. Seismic processing almost singlehandedly drove worldwide high-performance computing in those days! Startups were born and sold with regularity. In total, oil companies and vendors employed hundreds or thousands of R&D staff. SEG presentations were often standing-room-only, with vigorous debate and intense competition for intellectual property.

Geophysics holds a lofty position in conventional E&P. Only a fool would drill a conventional well without 3D seismic. In conventional prospecting, seismic comes first, then leasing, then drilling. No seismic => no leasing/drilling. Conversely, in the world of unconventionals, seismic is usually shot **after** the land and drilling plan are locked in…if it's shot at all. No seismic => no problem? While many unconventional drillers do utilize 3D seismic, most only use it to geosteer. It's an important function, but nonetheless a *support function in the grand scheme of things, not a primary business driver. We all hold out hope that reservoir characterization will elevate seismic's standing like AVO did, but this hasn't definitively happened yet.*

Just when you thought this article couldn't get any more dour…I will share some rays of light.

- Supply & Demand - By strangling E&P financing, imposing ESG constraints, and firing experienced hands, governments and companies have successfully (if unintentionally) reduced the future supply of oil & gas. Unfortunately, they forgot to tell the market to reduce its demand fast enough. Shocker: prices rise! Will the world indefinitely tolerate high oil & gas prices while it awaits the "clean energy revolution", or grudgingly increase supply by increasing exploration? Which do you think is more likely?

- Helium - It's quietly heating up and needs seismic.

- Geothermal - also heating up (pun not intended). Seismic has been historically under-utilized… can we use it to drive a step-change risk reduction?

- Geotechnical - If you do site work on unconventional production facilities, you are no longer on the "10-1" side of the 1000-10-1 rule; you're on the "1000" side!

- CCUS (Carbon Capture & Underground Storage) - While I am personally skeptical that this will ever gain real traction, I hope I'm wrong, because CCUS demands the best in geophysical technology - both 3D/4D seismic imaging and reservoir characterization.

- Geophysics is not just seismic - My (and most DGS members) career has centered on reflection seismic, but the unconventional trend has increased the prominence of microseismic, geomechanics, injection-induced earthquake detection, etc. Geophysics must compete for primacy in these realms with engineers, but we may win.

- Conventional E&P - My company focuses on conventional plays, because we work internationally. Still, at a certain sustained price, lower 48 conventional exploration activity will take off. At what price, I can't say. And I think it's really the **gas** prices that will drive conventional exploration. After spending 15 years in the doldrums, gas prices may have jumped up to a higher plateau (fingers crossed!).

I don't see the DGS ever reverting to the glory days of 1,000+ members, huge sponsorship interest, and standing-room-only 3D Seismic Symposiums. However, I am calling a bottom. History will prove me right or wrong.

I used to present at the Permian Basin Geophysical Society before the unconventional craze. The 1980's crash decimated Midland's geophysical community, and only a core group remained. Yet they would still manage to draw 40+ people to the PBGS luncheons. Heck, Decker Dawson himself would sit in the front row! I admired the resilience and cohesion of the PBGS. They pulled together in trying times, attempting to maintain fellowship and a seat at the table for geophysics. I would be honored to see the DGS pull together in a similar fashion. This is **your** society. Tell the DGS Executive Committee (office@denvergeo.org) what it takes to make the DGS more important to your career and life.

In Memoriam

Floyd Presley Wilson, Jr.
December 14, 1939 – February 15, 2022

Floyd Jr. was born in Alexandria, Louisiana in 1939 to Floyd P. Wilson, Sr. and Ona Estelle Galloway Wilson. The family moved to Magnolia, Arkansas where Floyd Jr. attended school including earning his Bachelor's Degree in Geology from Southern Arkansas University. He was preceded in death by his parents.

He began his seismic career with Seismograph Service Corporation traveling across the southeast United States.

Floyd was a legend in the oil and gas industry. A geologist and seismic geophysicist, he was a member of the Society of Exploration Geophysicists for over 58 years, a member of the American Association of Petroleum Geologists and a member of the First United Methodist Church in Malakoff, Texas.

He met the love of his life Selwyn Dawn Stallings in Corpus Christi and they wed in 1964. Floyd was employed by Petty Geophysical Corporation/Petty Ray Corporation for the next 10 years. In 1975, Floyd and Selwyn moved to Denver to work with CGG, French seismic company. He fulfilled his dream of starting his own company in 1979 when he began Wilson Geophysical, Inc. and retired from WGI in 2019.

They had three children – Bart Wilson (Paige), Matt Wilson (Taffney) and Beth Trimble (David) who blessed them with seven grandkids – Taylor Wilson (Daniela), Peyton Wilson, Kailee Macatee (George), Mason Wilson, Haley Wilson, Wilson Trimble, and Aubrey Trimble; and one great grandson George Macatee.

Floyd loved and enjoyed his children, grandchildren and great grand-child, sharing with them his love for fishing, hunting, the outdoors and family. He valued his friendships and touched many people with his love of life. A great story-teller until the end – he would reminisce about the 'old days' growing up on a farm with cattle, doodle-bugging from the coast in the south to Wyoming, hunting and scuba adventures, and traveling with family. He taught his children, and grands, to have a strong work ethic, but enjoy life – work hard, play hard. His true legacy was his integrity, compassion, kindness to all, humor, and never-ending love for family.

In lieu of flowers, please make donations In Honor of Floyd Presley Wilson, Jr.
American Heart Association | To be a relentless force for a world of longer, healthier lives
Parkinson's Foundation: Believe in Better

3D SEISMIC SYMPOSIUM

PRESENTED BY THE DENVER GEOPHYSICAL SOCIETY

DGS to Host 27th Annual 3D Seismic Symposium

On Wednesday, March 23rd, 2022, the 27th Annual Denver Geophysical Society's 3D Seismic Symposium will be held as a live event at the Ellie Caulkins Auditorium, Denver Center for the Performing Arts Complex in downtown Denver, Colorado. A happy hour will be held at the Ellie on Tuesday, March 22nd as we welcome exhibitors and attendees back to the 3D Seismic Symposium.

With a theme of *Reflecting on Our Future*, the 3DSS committee is excited to welcome friends, colleagues, sponsors, and exhibitors with an exciting opportunity to reconnect, network and engage with a broad technical program.

The 2022 program will feature Alex Cranberg, Founder and President of Aspect Energy, LLC as our Keynote speaker as he presents "3D and Me: Surveying the Past 30 Years".

Kicking off the program with his insights into exciting geophysical technology developments and how geophysics brings value to the business, Klaas Koster, past SEG President and Worldwide Chief Geophysicist and Fellow at Occidental Oil & Gas, with kick off the program Wednesday morning at 8 am.

Technical program

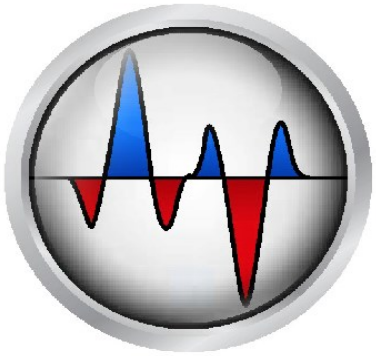
The program is a rich mix of case studies from Appalachia to the Permian to the Rockies as companies continue to push integration in workflows and drive efficiency and predictability of well results. On the technology front, advances in wave equation based AVO and direct probabilistic inversion will be presented along with approaches to computer aided interpretation and machine learning, allowing geoscientist to dig deeper into data sets and further understand well results.

Registration is now open!

Did you know that your 2020 3DSS registration carried forward into 2021 and will carry forward into our 2022 event! What a deal! Look for details from the Denver Geophysical Society after February 7th for a coupon code to get 100% credit for your 2020 registration.

If you registered in 2021 or are registering for the 2022 program for the first time, you will need to register via the website https://denvergeo.org/events/27th-3d-seismic-symposium/. DGS member registration is $250 and non-member registration is $300. Rates increase $50 on Saturday, March 5th!

Please contact committee chairs Brad Birkelo and Sarah Gach for more information at 3DSSchair@denvergeo.org



3D SEISMIC SYMPOSIUM

PRESENTED BY THE DENVER GEOPHYSICAL SOCIETY

2022 DENVER GEOPHYSICAL SOCIETY 3D SEISMIC SYMPOSIUM SCHEDULE

8:00 AM	OPENING			
		Speaker/Authors	Company	Title
SESSION 1	KICKOFF	Klaas Koster	Occidental Oil & Gas	The Bright Future Of Geophysics
	Permian	Bruce Karr*, Andrew Lewis, Ron Bianco	FFG and Fasken Oil and Ranch	Permian Reflections: Past, Present and Future
	Appalachian Basin	Ben Dellenbach*, Brad Birkelo, Jessica White	BKV Corporation	A Volumetric Workflow for Marcellus Infill Development Planning
	Morning Break			
SESSION 2	Various	Hansel Gonzalez	Delft Inversion	Wave-Equation-Based AVO Seismic Inversion - Technology Introduction & Case Studies
	Mannville, Canada	Raul Cova	Qeye Labs	Direct probabilistic inversion: Improving interpretation of the Mannville sequence by injecting geology back into geophysics
	Permian	Andrew Keene*, Samuel P. Heyman, Rob Hissong, Jason Ward, Jeff Zawila	SM Energy Company	Improving drilling efficiencies by utilizing 3D seismic inversion data and advanced wellbore planning, Permian Basin, Texas
	Lunch Break			
SESSION 3	KEYNOTE	Alex Cranberg	Aspect Holdings	3D and Me: Surveying the Past 30 Years
	N/A	Bob Springman* and Scott Boyer	GTSeis	Correct Reservoir Size Estimation with Depth Imaging: more than just a single process
	SEAM Model, Arkoma	Hojat Lotfipour, Weizhong Wang, Steve Syme	GeoTomo	Application of near-surface velocity model in seismic subsurface imaging
	Teapot Dome, Wyoming	Alfredo Fernandez*, Vianney Savajol, Jake Marson, Christi Gell	Eliis Inc.	Model-Grid: a novel approach of computer-aided seismic interpretation workflow for fast-paced decision-making environments. A US onshore case study.
	Afternoon Break			
SESSION 4	DJ	Yanrui Ning*,Ge Jin, Xiaoyu Zhu, Ali Tura	CSM	Integration of Production Communication and Hydraulic Fracture Connection in DJ Basin
	Permian	Richard Van Dok* and Brian Fuller, Ron Bianco	Sterling Seismic and Fasken Oil and Ranch	Design, acquisition and processing of three Permian Basin 3D VSP surveys to support the processing and interpretation of a large 3D/3C surface seismic survey
	Colombia, SA	Deborah Sacrey	Auburn Energy	Machine Learning Analytic Applications to an Exploration Well in Northwestern Colombia, SA
4:30 PM	HAPPY HOUR			

Editor's Comments

- Xan Davidson

Thank you to all the members who replied to my call for input. Many of the suggestions focused on communicating what's happening locally; whether, within the basins in Colorado, or what's happening to our members, keeping it local was the biggest input. As the Denver Geophysical Society, I think we can accomplish that. Some of the suggestions were centered on knowing what's going on with our members and local events. We'd be happy to add a section that updates the community when someone changes jobs, gets a promotion or wants to highlight a geophysical related event. However, for that to be successful, we will need your input on those matters. So, we are working towards getting that setup and available to be included in future issues. If you would like to contribute content to The Record for either a technical article, an opinion piece, or you know someone who might be willing, please let us know. This newsletter isn't a one person operation and not having to solicit content and harassing, I mean begging, people to contribute makes my life easier. Thank you!

Keep it Professional

Do you have news you would like to share with the community? A job change or a new promotion? Anything that's industry/job related, we would love to share your news. We aren't necessarily looking to share that Bob is now a grandfather but we would love to celebrate your accomplishments. Send 2-3 sentences with your name and what your news is and we'll add it to the next newsletter. For consistency, DGS reserves the right to edit and limit what gets published. So, if you really want your news shared, remember to "Keep it Professional."

HELP!

Technical Article

We are looking for technical articles and content for The Record. If you have a work in progress, a technical article, or a talk that you've written into an article, we'd love to consider it for publication. Please contact us at office@denvergeo.org to discuss your submittal. We look forward to reestablishing a tradition of quality technical work in The Record.

We do not restrict additional publications of your article, either in part or whole. Please note that if you have published it elsewhere, you will need to verify to us that DGS will be able to be publish the article. We will need information on where it has been published, when, and by whom.

STUDENT CORNER

We have received feedback from our members that updates on Colorado university geophysical programs is of great interest. We are, therefore, starting the Student Corner to highlight the university programs, and in particular the students of these departments. If you are or have a student or a department, research group, or project that you would like highlight in The Record, please reach out to office@denvergeo.org, and we can discuss inclusion in the Student Corner.

The general idea behind the Student Corner is to highlight work and achievements, but not as a technical article. We hope to leverage the column to make programs and projects more visible to our community, and highlight students and their accomplishments. It's also a great opportunity for students to make themselves known to our membership in preparation for entering the work force and build critical networking opportunities.

Prospects

As another addition to The Record, we are starting a prospects listing section. If you or your company have a prospect you would like featured in The Record, please send a copy of it and information to office@denvergeo.org.

Prospects

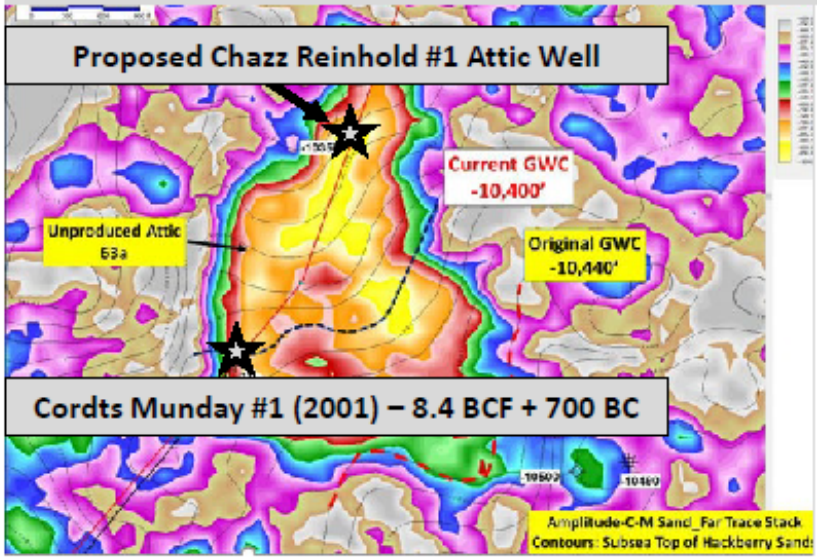
Aspect Energy
Chazz Reinhold #1
Hackberry Sands, Jefferson County, Texas
6.6 BCF & 550 MBC Reserves

Terms	20% back-in after 1X payout w/ 1.5% ORRI. Deliver 73.5% Net.
Leased	100%
Location	Jefferson County, Texas
Target depth	-10,400 ft
Net Thickness	40 ft
Area	63 acres
Reserves	6.6 BCF & 550 MBO
NPV10	$13MM

About Aspect Energy

Aspect Energy is a privately held company with over 25 years of E & P experience in the US Gulf Coast and worldwide. Aspect's innovative approach to 3D seismic interpretation and processing has led to a drilling success rate of near 60% and generation of $1.9 billion PV10 value. Focus on international exploration in recent years has led Aspect to divest remaining US assets and prospects.

Cordts Munday Anomaly



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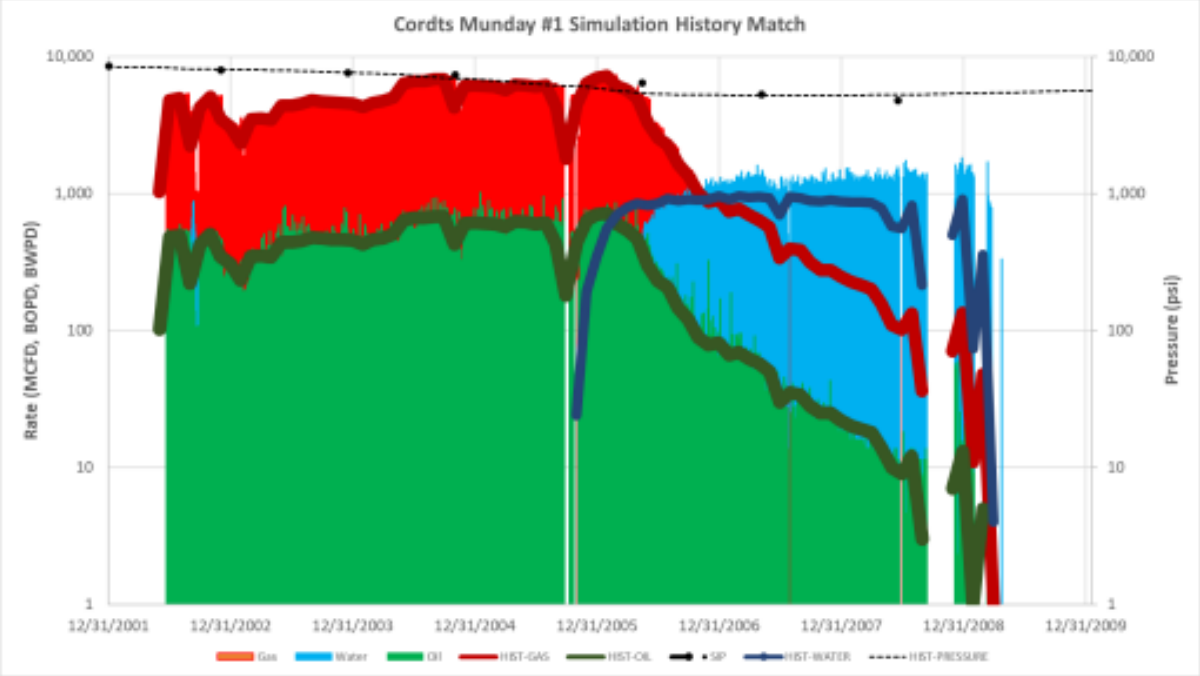
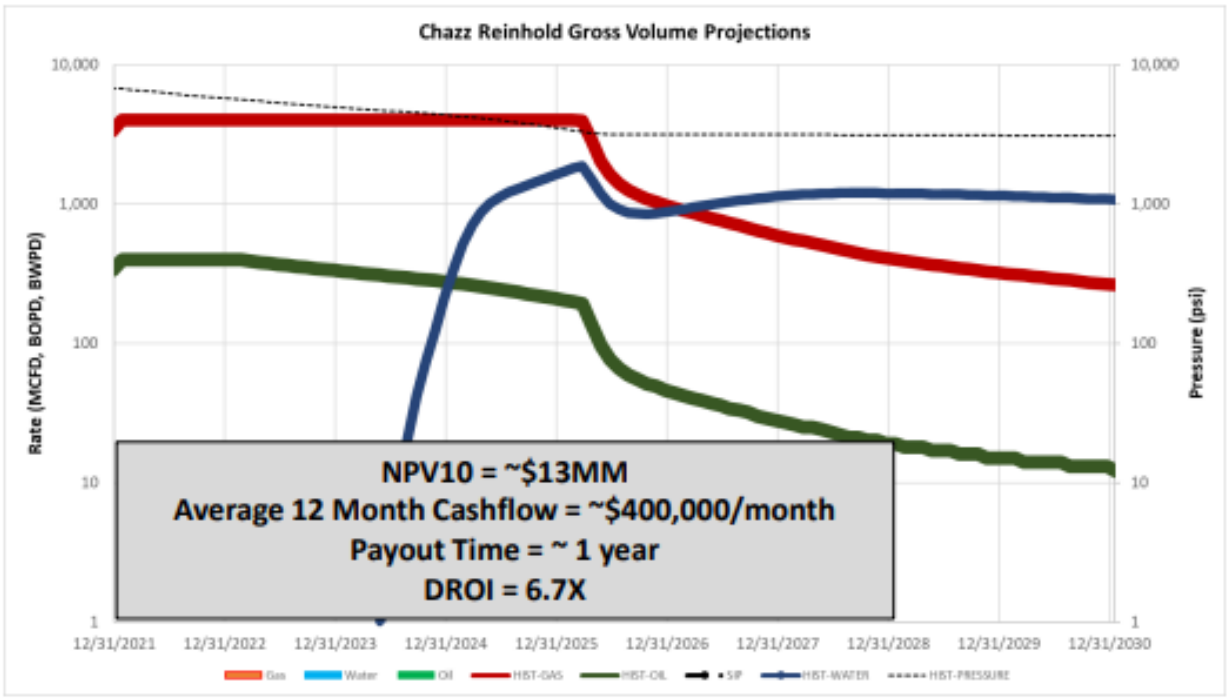
Chazz Reinhold #1
History Match and Economic Summary
$13MM NPV10 w/ 6.7X DROI





Economic model, volume projections, simulation assumptions are available upon request

Monthly Luncheon Talks

Thank you to everyone who has given a talk or is signed up to give one.

February's Talk:

Bayesian Facies Classification Using Depth Trends and Elastic Values From Simultaneous and Facies-based Inversions: A Montney Case Study

Joaquin Aristimuno, Ikon Science

Abstract:

In this work, we present and compare the results of applying a Bayesian facies classification using two types of Seismic Inversions: Simultaneous and Facies-based at the Montney formation.

The estimated elastic parameters are quite similar between facies-based and simultaneous inversion at the well locations that were used to build the Low-frequency Model (LFM) used for Simultaneous Inversion. Different absolute values, and therefore classification, were obtained when doing simultaneous inversion and using different well sets to build a different LFM. The methodology applied in both methods are quite different, where the facies-based inversion method provides a LFM.

Joaquín is part of the Technical Sales and Customer Support team for Ikon Science. He has experience in seismic acquisition, seismic processing, and reservoir characterization at companies such as Petroleos de Venezuela, Schlumberger, Shell, Imperial Oil / ExxonMobil, Devon and Canadian Natural Resources. He has worked in basins in Venezuela, Mexico and Canada, conventional and unconventional fields including heavy oil. He got his bachelor and Masters Degrees from Universidad Simon Bolivar in Caracas, Venezuela.

January's Talk:

How AI Derived Sonic Logs Can Improve the PSDM Model Building

Marianne Rauch*, Mike Perz, TGS

Abstract:

Machine learning applications have started to infiltrate the geosciences especially in the fields of log estimations, interpretation of salt bodies and fault definitions, seismic processing such as automated first break picking and velocity analysis and prestack inversions for rock property estimations. Our industry is known for big datasets that are very suitable for this task. We are showing an onshore example of how we utilize sonic logs that have been estimated through a gradient boosted trees machine learning process in our PSDM velocity modeling building and how we are benefitting from these additional data points.

Marianne received her PhD in Physics in 1985 from Uni Graz in Austria. She started her oil career as a research assistant at Curtin University in Perth, Australia more than 30 years ago and has been active in geophysics ever since. Marianne lived in many places and worked on-shore and off-shore basins all over the world. Her main specialties are DHI, seismic processing, depth migration, potential fields and researching new technologies and methodologies. She likes to do applied research, mentor and teach and is a seasoned presenter at conventions and workshops. In 2020, she received the Special Commendation Award from the SEG. Marianne is very active in the geoscience community and currently serves as the Chair of the SEG grav/mag group, is the 1st VP of the GSH and is part of the technical committee of the URTeC 2022. She is the Principal Technical Advisor, TGS, Houston.

April's Talk:

April 14, 2022 at 12:00 pm. Meeting venue to be announced. Watch your email for more information closer to April.

Characterization and Tectonic Synthesis of the Greater Permian Basin: implications for fault mapping and hazard assessment in the Midland Basin

E. Horne*, P. Hennings, A. Calle, K. Smye, C. McKeighan

Abstract:

The Midland Basin of West Texas is an important petroleum producing region that has experienced an increase in the rate and magnitude of seismicity, with 38 ≥ 3.0 Mw events between 2019-2021. Earthquakes have occurred in spatiotemporally isolated clusters and are linked to oilfield practices, including the disposal of wastewater (SWD) and hydraulic fracturing. Specifically, SWD into deep and shallow formations have increased from 2015-2021 and many of the recent earthquake sequences are spatiotemporally coincident with horizontal drilling locations. To understand the causal factors of earthquakes in the region and assess the evolving hazard, we present a new *in-progress* semi-regional fault interpretation and the results of carrying out a Fault Slip Potential (FSP) analysis.

There are three orders of deformation observed in the Midland Basin. These include 1st order, basement-rooted regional faults, which define the boundary between the Midland Basin and Central Basin Platform. 2nd order structures include basement-rooted, local, fault-bounded uplifts and fault related folding. 3rd order structures are interpreted to be segmented, parallel trending, high-angle fault zones, which locally accommodated strike-slip motion. Within each hierarchal group, faults are characterized by trend and structural style, as well as vertical extent. 1st and 2nd order faults are basement-rooted high-angle (~65 ± 5°) reverse faults that trend NNW-SSE and accommodated primarily dip-slip motion. 3rd order fault segments are steeply dipping (~80 ± 10°) and trend WNW-ESE and WSW-ENE. These faults are interpreted to have locally accommodated left and right lateral strike-slip movement, and subordinate (NE-SW) normal and reverse dip-slip, right lateral strike-slipping faults formed in locations of competing strike-slip faults. Additionally, these segments formed kinematic linkages between 1st and 2nd-order fault zones. Deformation along first order structures remained active through the early Wolfcampian, with syntectonic deposition through the Wolfcamp D. 2nd order and 3rd order fault zones may have remained active, but observable dip-slip motion dissipates after Strawn deposition. Karst in Paleozoic strata accompanies 3rd order fault and fractures zones. FSP results show that 3rd order faults are sensitive to reactivation under modest increases in pore pressure. Karst may have a profound impact in hydraulic connectivity along sensitive 3rd order fault corridors.

Elizabeth A. Horne (Lily) is a structural geologist at the Bureau of Economic Geology, UT Austin. She has a geology M.S. from Colorado School of Mines and a geology B.S. from Utah State University. Her research interests include integrating field and subsurface datasets to generate three-dimensional (3-D) fault models that can be used to better understand the kinematic evolution of various structural systems, as well as determine mechanisms for modern seismicity, both natural and induced.
Elizabeth A. Horne – Center for Integrated Seismicity Research (CISR), Bureau of Economic Geology, Jackson School of Geosciences, UT Austin; lily.horne@beg.utexas.edu

May's Talk:

May 12, 2022 at 12:00pm. Meeting venue to be announced. Watch your email for more information closer to May.

Testing XLE in the DJ Basin: A Fiberoptic Case Study

Jessica Barhaug*, J. Bussey, B. Schaeffer, J. Shemeta, M. Lawrence, J. Bosco-Tran, P. Stark

Abstract:

Based on the successes of Extreme Limited Entry (XLE) in other basins, Great Western Petroleum (GWP) constructed a design of experiment to test XLE in the first zipper group of a two-zipper group pad. The goal was to find a design that would yield the same production, but with less cost. Increasing stage length provides a significant cost saving and with XLE, production should be maintained. Based on the results from zipper one, the best design could then be implemented on the same pad in the second zipper group. This allows for a direct comparison of hydraulic fracturing designs, minimizing geologic impact. This study was comprised of several datasets with the primary focus being on Distributed Acoustic Sensing (DAS) using wellbore fiber optic cable. An opportunity was seen to not just gather data, but to test the data quality of the latest deployment methods, specifically a pump-down single-use fiber optic cable. This is a cost effective and minimal footprint option for data collection. This project included three acquisition methods for the DAS: 1) a permanent fiberoptic line cemented on the outside of the casing, 2) a wireline retrievable fiber optic line, and 3) a pump-down dissolvable single-use fiber, all deployed in three unique wellbores. The permanent fiber optic well was used to compare the uniformity index of different completion designs. This DAS acquisition also provided offset strain and microseismic in the first and second zipper groups. The wireline retrievable fiber optic cable and single-use fiber optic cable deployments provided offset strain and microseismic for the wells in the first zipper group. High level observations resulting from this project include:

- The data quality associated with the single-use fiber looked comparable in data quality to the other fiber optic deployment methods.
- The Uniformity Index was high for most designs, even with stages as long as 450 ft and cluster spacing as tight as 7 ft.
- Results from the offset strain and microseismic analysis from tighter and more clusters per stage showed less interference than what was seen with our legacy design stages
- RTA shows that compared to a pad with similar well spacing, the production is better with the new hydraulic fracture design

Jessica is a Senior Reservoir Engineer focusing on field studies and data analytics at Great Western Petroleum. Previously, she worked for WPX Energy as a Senior Completions Engineer in the Williston Basin, where Jessica was one of the lead engineers for a completion and spacing optimization program. As a Completion and Production Engineer at Schlumberger, she worked a variety of technical projects, including the design, execution and evaluation of hydraulic fracturing treatments, rate transient analysis, production history matching and microseismic monitoring and evaluation. She received her M.S. in Petroleum Engineering and B.S in Environmental Engineering from the Colorado School of Mines.

DGS Meeting Notes – January 11, 2022

Attendees: *Mark Davidson, Janel Andersen, Jeff Zawila, Kent Campbell, Xan Davidson, Jess Vahling, Joel Scott, Morgan Brown*

Minutes from November approved.

Treasurer's Report –

$7,469.52 – total December revenue (split between Paypal and eFirstbank)

$80,006.36 to $81,745.70 in eFirstbank, $3,807.08 to $1,489.88 in Paypal

$5,279.64 transferred to bank from November net revenue

$4,285.42 – total December expenses

$3,184.10 – net December revenue

Motion to accept treasurer's report – seconded and approved.

Jeff brought up question about investment of money into higher interest account, discussion from Kent discusses it has been done historically – but not anymore. Decision was made not to invest again after years of lost money from overhead/expenses/etc.

Joel suggests setting Jess Vahling and Jeff Zawila for payments.

3DSS Updates –

Program set in terms of talks – concerned about COVID protocols impacting public spaces, also needing some work into setting up arena/menu/etc. Discussion of getting Jeff/Mark involved.

The Record –

Lost editor halfway through 2021, had some troubles getting it out on a regular schedule.

Mark suggests revamping to get it quarterly, technical content, student sections to highlight universities, etc. Xan wants to know what we are missing and what we'd like to bring back. Advertising declined for a few reasons: seismic industry declined, as well as output of *The Record* became inconsistent. Perhaps first edition in February, second in May, third in August, then a last one in October/November.

Everyone needs to consider who to tap for technical articles – feed to Xan and Mark.

Luncheons –

DERL is not available as hosting location any longer – Mark and Jeff agreed to do January and February remotely. We can either stay with Wynkoop, or change days and go with DERL.

Discussion of Appaloosa downtown, trouble with their event manager. In addition, catering need for DERL. Mention of Granite Towers newly renovated 3rd floor. Tabled for now.

Trainings –

Feed recommendations for speakers/trainings to Jeff. Potential to look at Q3 2022 for a training.

Committees –

Membership Committee; Secretary is Chair: Look for new members. Consider student membership more. Organize social events, maybe outside. Remove non-members from directory/email. Subscribers vs. Members distinction in the past – but if addresses are bad, wipe off the list.

Nominations Committee; Joel, Angie, and Morgan: Get nominations for next year's executive committee. Joel is taking point.

Honors and Awards Committee: Not very recent, but there is a deadline to propose nominees. Anyone can nominate, 30 day con-

DGS Meeting Notes continued

COVID –

Meetings continue to be remote for foreseeable future.

Midday Wednesday meetings, day before luncheon standardization.

Open suggestion from Mark: do we need an executive director, or should we look to change bylaws? Tabled for now – Mark to continue to investigate.

Kent suggests looking at LinkedIn activity, pushing out events, etc. can be commandeered by Mark/Jeff. We have more than 400 people looking online.

DGS Meeting Notes – February 9, 2022

Attendees: *Mark Davidson, Xan Davidson, Jess Vahling, Jeff Zawila, Joel Scott, Morgan Brown, Andrew Keene*

Minutes from January approved.

Treasurer's Report –

$5,310.12 – 3D Seismic Symposium Sponsorships, Membership, etc.

$554.12 – Expenses

$4,756.00 – Net January revenue

Holiday Lunch Financials *- ~$1,200 negative (under budget)*

Jeff and Jess are working together to ensure payments are approved on agreed-upon times.

3DSS Updates –

Still no green light to publicize talks/titles/program. In process of cleaning up sponsorship and booth attendees, but looks good and on track.

Moving the student challenge bowl to April, but use the time in building to host an icebreaker in Ellie the night before the event. The cost of that will come out of the symposium cost. RMAG foundation offered to cover the student challenge bowl, committee accepted their proposal, so we already have that sponsorship. Emails are bouncing – Andrew to work on.

Google Docs Overview –

All officers have links to get in from Joel. There are two folders – general files and DGS procedures. Joel has created documents with How-To's, Financial Data, Historical categories, etc. Jess to begin uploading treasurer reports and Andrew to insert minutes.

The Record –

Question from RCP on publication rights: do we have a formal doctrine on publishing with exclusivity or not? Morgan does not feel so – and Mark elaborated that authors may need to clear published piece with other organizations before publishing with us, but not the other way around (those who publish with us do not need to check before going elsewhere).

No need for a formal vote before publication, but will circulate before distribution.

On advertising: A full page is $500 for 12 months, and half pages are $375. Proposal to do a full page for at $500 and Morgan suggests we keep prices low. Mark agrees and wonders if we even drop prices to ~$100 per year for a full page. Jeff feels $100 is too low. Joel reminds us to consider including business cards again at lower price, and limiting advertising space (defining space). There is a lot of discussion on advertising rates/payment options/etc. Morgan suggests posting prospects in the DGS – and more discussion on opening submissions up to allow for E&P companies to participate in money/space donation.

Mark concludes that we get a webpage going to encourage advertising for the February issue. Also call for emails and contacts for The Record's contact page. Question of whether to move publishing software away from Microsoft for the future – but will be tabled for now.

Consider more nominations for next year's excom.

Student Challenge Bowl moved to April – Andrew and Scott Cook to head up.

Luncheons:

Going with Wynkoop for April luncheon, consensus to go in person due to trending cases and mask mandate lift.

Excom meetings moving forward – March in person downtown – Jeff to get Mark our SM Energy schedules and we will find a date and place!

Andrew got keys from Bret for PO Box, and we need to pay PO Box invoice.

Meeting adjourned.

The Record plans to publish February, May, August, November with a special elections issue. Please note that purchasing the yearly rate after May will carry your advertising into 2023.