

EAGE DAILY NEWS

2019 EAGE Conference & Exhibition

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Delivering Exploration Success

The search for the right tools includes automation, machine learning and AI.

BY MARK VENABLES, CONTRIBUTING EDITOR

We are amid the age of digital transformation for the oil and gas sector with automation, machine learning and artificial intelligence (AI) touted as the route to operational excellence. Despite the well-understood merits of these technologies, there is still uncertainty of their exact role in the success of oil and gas operations.

At the EAGE 2019 Wednesday debate, "New Technologies for Geoscience and Engineering," Michael Cousins, head of exploration at Exxon Mobil, posed the question 'What is success when it comes to exploration?'

"I'll give you three examples, Guyana, Zohr and Brazil subsalt," he said. "To achieve success, you need to fulfil two

criteria. First, you need to identify and capture the opportunity way ahead of your competition, and then you need to manage that portfolio."

"When it comes to utilizing new technology, the focus tends to be on the first task and gravitates toward 3-D seismic. But by the time you complete your 3-D seismic work, you will have lost the race to the next big opportunity. The ideal process should be to learn from the past [and] to look at the tens of millions of documents that exist to find the next Brazilian subsalt. Don't focus on 3-D but accessing the minds of the geoscientists that have come before."

Ulisses Mello, director research at IBM, conceded that AI has been around a long time but that the industry has never had the computing power that it enjoys today. "That will improve exponentially when we see quantum computing coming onstream in the next three years," he said. "Part of the solution is to automate reading. Take the medical sector, which at the moment publishes 6,000 papers every day. No one can read that volume; this is

See EXPLORATION SUCCESS continued on page 7

Plugging the Oil and Gas Skills Gap

The industry must spread a wide net to retain and entice future talent.

BY MARK VENABLES, CONTRIBUTING EDITOR

There is a growing confidence among oil and gas companies despite a recent dip in the oil prices. The feeling is that the industry is now on an upward curve after the price crash, and with the increased levels of operational efficiency, it is in a more sustainable position.

However, one concern is the challenge of replacing the workers that have left the industry over the past four years. "One of the challenges that we have in our industry is its cyclical nature; we have just experienced this with a huge downturn that has seen probably half of our workforce leave the industry," said Sophie Zurquiyah, CEO of CGG, speaking on a panel during EAGE 2019. "That is the big challenge when it comes to attracting people. We have 2,100 people right now, which is 40% less than we had a few years ago."

As far as skill sets, Zurquiyah says this has not changed; it is still people with master's degrees, usually physics, as well as experienced IT and high-performance computing people.

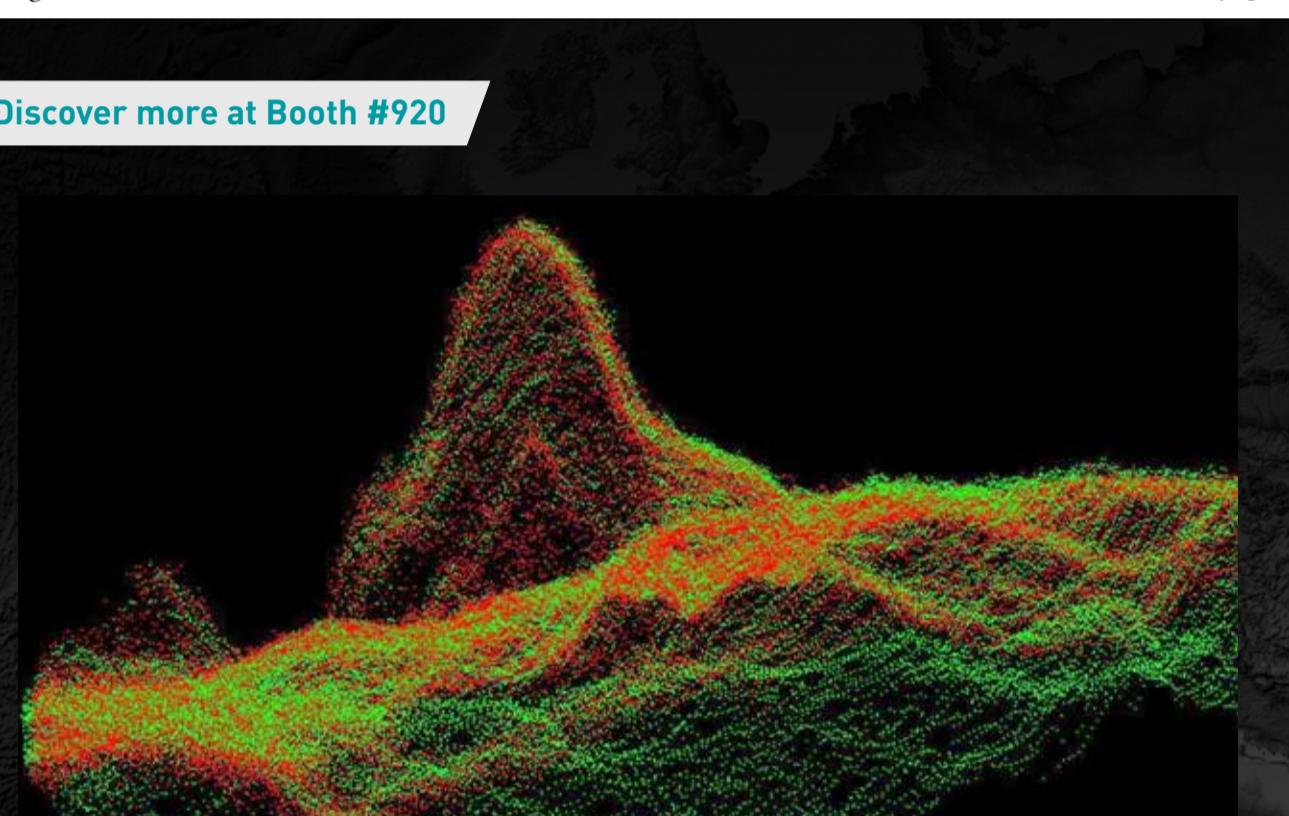
"We are not just looking at academic qualifications, we want problem solvers," she said. "What is more important to us in the age of digital transformation is the ability to adapt because of the constant change that we are dealing with. We are looking for people that are adaptable and able to adopt the digital technologies and cope with transformational workflows."

The turnover of staff at CGG is about 10% per year, according to Zurquiyah. When people leave the company, they analyze where to go, and many people choose to leave the industry, some moving to other digital companies that are trying to break into the oil and gas industry, she said.

"I would say it is not difficult to replace these people," Zurquiyah added. "We receive a lot of CVs. The main problem is that in some regions graduates consider our industry as one of the past and choose other options. But when you start widening the pool that you are recruiting from to other nationalities such as India and China, the challenges we face are the image of oil and gas and challenge from other sectors—the fight for talent is certainly global. You can overcome this by offering technical challenges to people."

See PLUGGING continued on page 6

Discover more at Booth #920



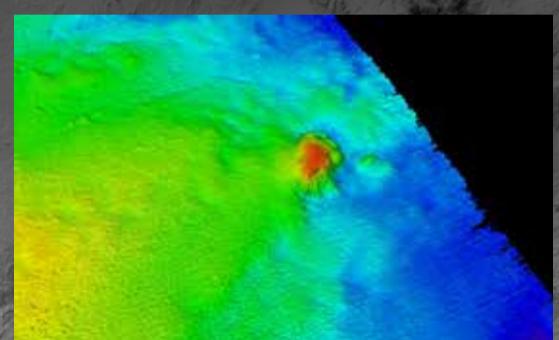
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SCHEDULE OF EVENTS

Thursday, June 6

07:30 – 15:00	Registration <i>Registration area</i>
08:30 – 17:10	Technical Program (oral presentations) <i>Conference area</i>
09:00 – 16:30	Exhibition <i>Exhibition floor</i>
09:00 – 16:30	IGLOO VR Experience <i>Exhibition floor</i>
09:00 – 16:30	Exhibition Theatre <i>Exhibition #540</i>
09:00 – 16:30	International Prospect Center Program <i>Exhibition #1440</i>
09:30 – 13:00	Career Advice Centre <i>EAGE Community Hub #1400</i>
10:45	Student Travel Grant Hunt Draw <i>EAGE Community Hub #1400</i>
11:15 – 11:45	Meet the authors: Jean-Jacques Biteau and François Baudin <i>EAGE Community Hub #1400</i>
11:45	Bookshop Raffle Draw <i>EAGE Community Hub #1400</i>

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Seismic Data Streaming From Vessel to Cloud

Faster transmission reduces turnaround time.

CONTRIBUTED BY POLARCUS

In fourth-quarter 2018, Polarcus successfully streamed more than 1.5 terabytes of data live over satellite link, from the vessel to the cloud. The test comprised of two data sequences acquired with Polarcus XArray triple source (10 x 150 m x 10,500 m streamers configuration). The line length was around 150 km with a shot point interval of 12.5 m. The test lasted for two days and more than 800 gigabytes of raw data were acquired each day. The data quality was validated onboard and merged with navigation into a SEG-Y dataset.

Using Bluware's Teleport solution and underlying VDS seismic format, combined with adaptive streaming, the data were transferred at one-fourth of the original size. This reduced the volume from 1.5 terabytes to approximately 400 gigabytes and transmitted to the cloud at an effective transfer rate of 22.5 megabits per second (Mbps) in two days.

"We were able to achieve a transmission efficiency of 95% over the 25 Mbps allocated bandwidth with an average transmission rate of 200 GB per day. This technology allows us to stream all seismic data to the cloud within 24 to 48 hours of acquisition," said Phil Fontana, chief geophysicist at Polarcus.

The transferred data were then processed and compared to the results with the original data. There was no loss in data quality recorded, indicating this solution can be applied to the acquisition/processing workflow effectively. Further testing is in progress to validate 10 to 15 times compression, opening the applicability to larger data sets. The next step is

the transmission of continuous data streaming from the vessel during the whole acquisition process.

"Our unique IP enables significant change in the industry," said Dan Piette, CEO of Bluware. "Polarcus' results demonstrate that the acquisition and processing workflow

can be improved to the point that a hydrophone could be seen in the future like any other IOT sensor. Also, a combination of edge, cloud analytics and machine learning can be applied directly to the signal!"

For more information visit Polarcus at booth 1010. ■



Hunting Micro-continents Offshore East Africa and in the West Indian Ocean

New 2-D regional multiclient survey will assess true hydrocarbon potential of this frontier region.

CONTRIBUTED BY CGG

As industry interest in hydrocarbon exploration offshore East Africa increases, attention is turning to frontier areas in the region such as the West Indian Ocean. At first glance, this area looks like a barren oceanic crust with little potential, but there is tantalizing evidence to suggest otherwise. CGG geoscientists have been sifting through the evidence to reevaluate opportunities offshore East Africa and in the West Indian Ocean.

The best indication that a marine frontier region has exploration potential is the presence of continental crust, where there is an opportunity for working petroleum systems to develop in thick sedimentary basins. In this setting, the best chance for continental crust is the occurrence of micro-continents.

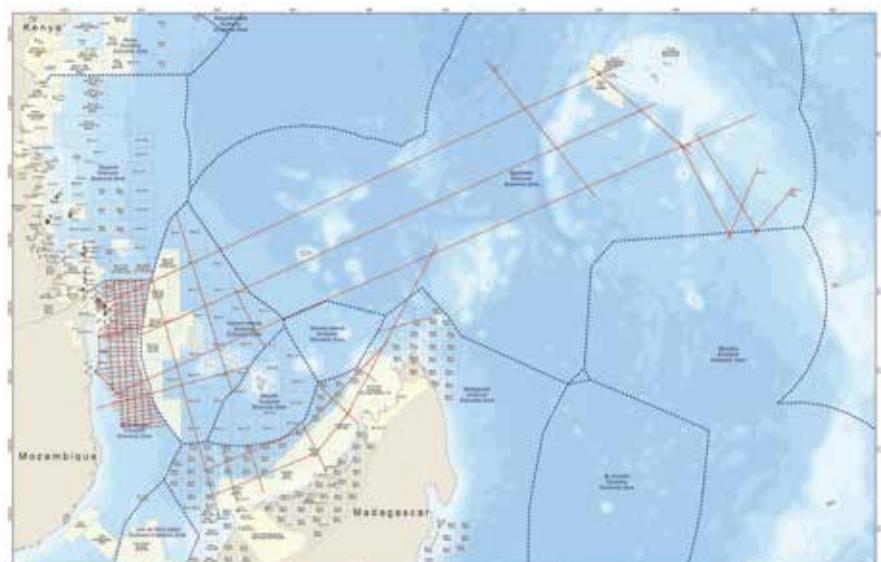
Legacy geophysical and geological data suggest that oceanic crust is pervasive throughout the West Indian Ocean, forming the Comoros and Glorioso Islands, Mauritius and much of the submarine ridge between Mauritius and the Seychelles. However, a number of recent investigations

show overwhelming evidence for the existence of slivers of continental crust in the West Indian Ocean.

An example of a micro-continent in this region is the Seychelles Bank, where exploration wells drilled in 1981, about 74.6 miles (120 km) west of the main islands, proved the presence of a working petroleum system with oil shows and a mature Lower-Middle Jurassic source rock.

Middle Jurassic source rock. Robertson Plate Kinematics reconstruction models of the West Indian Ocean show the complexity of the poly-phased breakup of Gondwana, and suggest that there may be many more continental fragments similar to the Seychelles Bank scattered over the region.

Further hints to the existence of continental crust come from more recent geophysical and geological data.

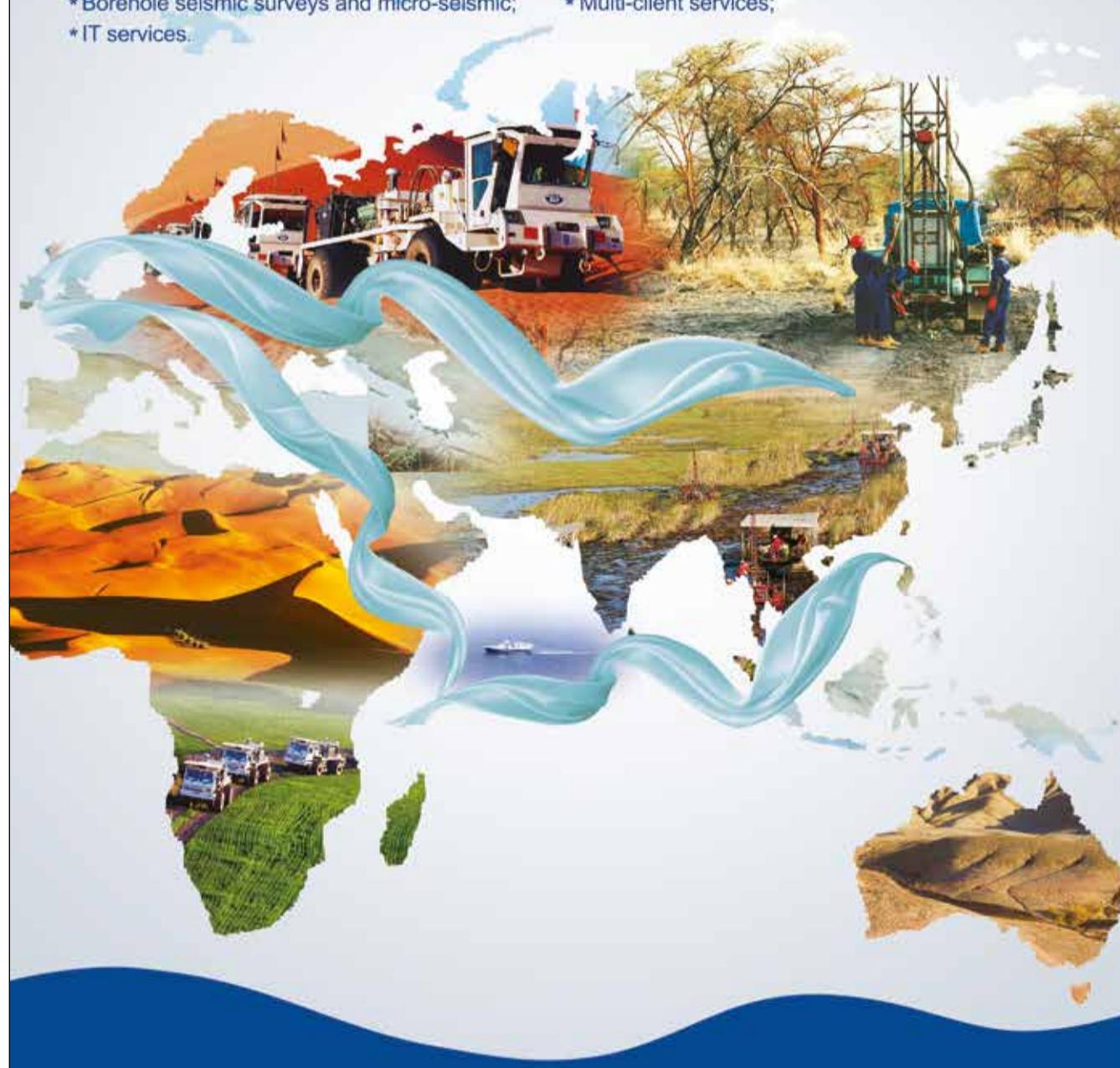


The map shows the location of CGG's proposed East Africa regional multiclient survey. (Image courtesy of CGG)

BGP – Beyond the Belt and Road

BGP is a leading geophysical contractor, providing geophysical services to our clients worldwide. BGP currently has 57 branches and offices, 6 vessels and 19 data processing and interpretation centers overseas. The key business activities of BGP include:

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 - * IT services
 - * Geophysical research and software development;
 - * GME and geo-chemical surveys;
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Nearer, Denser, Longer: The New Solution for the Barents Sea

Custom acquisition and imaging considerations address exploration challenges.

CONTRIBUTED BY PGS

With smarter acquisition and imaging solutions for resolving mixed target depths in the Barents Sea, PGS is diving deeper with full waveform inversion (FWI) velocity model building. Newly available fast track images from the survey prove industry-leading image resolution.

In 2018, the PGS ultrahigh-capacity vessel Ramform Atlas acquired an innovative ultrahigh-density, variable streamer length survey over parts of the shallow Finnmark Platform and the deeper Hammerfest Basin. This seismic survey (1,583 sq miles (4,100 sq km)) is unique with respect to spatial sampling, streamer spread design, and offsets provided for exploration objectives. The PGS-TGS joint venture survey was acquired with multisensor GeoStreamer technology.

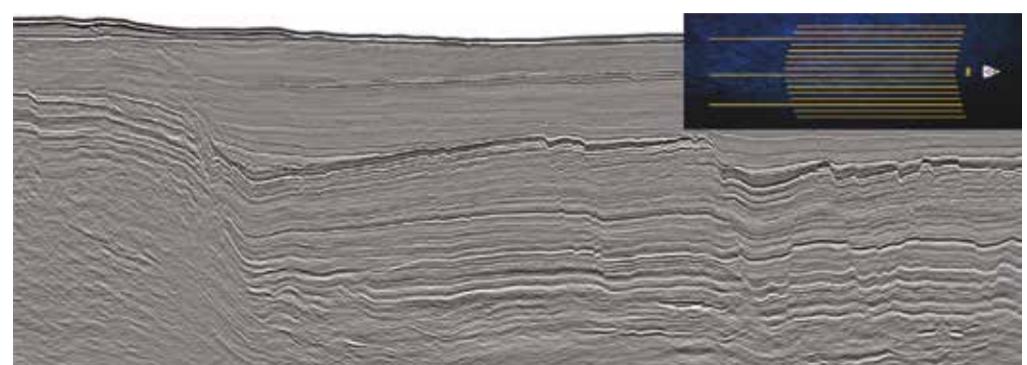
The southwestern Barents Sea is characterized by a complex geological regime, with a heterogeneous overburden and different target depths. The combination of relatively shallow water depths and a hard, rugose seafloor creates a tremendous amount of noise. This complicates using reflections in FWI for velocity updates. A key challenge in producing an accurate image of the subsurface is creating a reliable velocity model. Refraction-based FWI has become the standard tool for velocity model building in the Barents Sea. However, until now there has been a lack of recorded long offsets and model depths have been limited. Identifying porous carbonate buildups and sands has previously been difficult on legacy seismic data.

High-resolution imaging and long offset velocity survey
The multisensor streamers, towed at a depth of 82 ft (25 m), provide true broadband data with a high signal-to-noise ratio of the low frequencies for FWI and quantitative interpretation (QI). A unique configuration with a variable streamer length was deployed to enable optimal imaging

of both shallow and deeper targets and to provide long offsets for FWI. While the dense streamer separation of 184.5 ft (56.25 m) was configured up to 4.3 mile (7 km) offset, three out of the 16 streamers were deployed with 6.2 mile (10 km) streamer length (i.e., a high-density spread with sparser long offset tails). On the near offset end, the inline offsets were reduced to 288.7 ft (88 m), and further optimized by a U-shaped staggering of the streamer front ends.

For the Hammerfest Basin survey, a high-density 16 x 184.5 ft multisensor streamer spread was combined with a triple-source configuration providing dense crossline sampling and a very broadband signal.

Diving deeper to reveal hydrocarbon potential
In a pre-survey study, the effect of various long offset streamer separations on the FWI inversion was thoroughly analyzed. The study concluded that dense streamer spacing is not required for the longer offsets to obtain stable FWI updates. Thus, only three out of the 16 streamers were extended to an offset of 6.2 miles. Impressive velocity model building results from the ongoing processing and imaging effort show that refraction-based FWI provides updates up to 3.1 miles (5 km) depth when the 6.2 mile offset range is used. The high-quality GeoStreamer data allow the FWI to start at frequencies as low as 2 Hz.



A fast track seismic section extends from the Finnmark Platform in the southwest into the Hammerfest Basin in the northeast. The initial depth migrated fast track data shows clear improvements in resolution and structural imaging compared to vintage data available in this complex area. The innovative acquisition configuration is also illustrated. (Image courtesy of PGS)

The key pre-processing steps in the high-resolution imaging workflow were 3-D wavefield separation and source-side deghosting. In addition, the triple source data was deblended using a method enabled by the proprietary shot dithering applied during acquisition. The ultradense spatial sampling and the detailed velocity model derived from FWI lead to the resolution of very thin beds in the Late Jurassic section. Frequencies as high as 200 Hz are imaged.

Tailored acquisition and imaging solutions provide the right seismic data in order to unlock shallow and deep targets in the Barents Sea. High-capacity vessels like the PGS Ramform fleet offer the advantage of operating with highly effective spreads with variable streamer lengths, e.g., including a sparse set of long streamers for FWI-based velocity model building. This acquisition and imaging concept offers the flexibility to address exploration challenges in other basins around the world by adding sources or operating with wide tow source configurations. ■

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New solution facilitates improved seismic exploration.

CONTRIBUTED BY BGP

It is proven that extending frequency bandwidth, especially low frequency, can increase the energy of transmitted signal and improve the imaging of deep strata, thereby conspicuously improving the resolution of seismic data. Accordingly, extending the frequency bandwidth of seismic excitation signal has become the most urgent demand in the seismic industry.

BGP's EV-56 high-precision vibrator operates on low frequency source. Through its new design of hydraulic servo system and shaker, that higher accuracy of the vibroseis and the control model has been realized; the distortion of the output signal is greatly minimized while the low frequency signal is rendered much more stable. Furthermore, with the bandwidth of the sweeping frequency extended from 1.5 Hz-120 Hz to 1.5 Hz-160 Hz, the high frequency signal has also been broadened, catapulting EV-56 as one of the leading large-scale broadband seismic signal excitation sources in the global seismic industry.

The EV-56 has been employed in many projects in and outside China, with each project achieving significantly improved data quality, especially the imaging of deep targets.



The high-precision vibrator EV-56 is shown working on site. (Image courtesy of BGP)

The exploration of special geological targets such as igneous rock and natural gas hydrate is epoch in the history of the seismic industry, as the masking problem to the overlying geological targets in the shallow igneous rock area has been successfully solved. This has resulted in a breakthrough in seismic data acquisition.

In another area, with very complex wave field, the signal-to-noise ratio of the existing data is very low resulting in poor imaging. From 2017 to 2018, high-density and broadband 3-D seismic surveys were conducted with high-precision vibrators in this area. Through preliminary processing and analysis, effective seismic data with frequency above 90 Hz can be generated. Compared with the conventional vibroseis in the adjacent working areas, the high-precision vibrator can be extended by 15-20 Hz at the high frequency end above 1s in the shallow layer, and 5 Hz-10 Hz in the middle and deep layers from 1s to 2s.

To learn more about EV-56, visit BGP booth 1030. ■

PLUGGING (continued from page 1)

A crucial consideration is the continuing talent pipeline, and for that it is vital that academia continues to provide good quality candidates. One of the top European universities for earth science is Imperial College London, where Ann Muggeridge is professor in reservoir physics and EOR. "I think this is a great time to be an earth scientist and engineer," she said. "There are huge challenges that need to be faced in the world. We have a growing population that needs more energy and more raw materials, but at the same time we want the world to be more sustainable."

"We are at the bottom of the food chain in providing those raw materials, so there is a real need for geoscientists and engineers. But the challenge is recruiting people for our earth science degrees, and I think that is across the board in the U.K. There is a falling number of 18-year-olds at the moment, which is resulting in fewer people attending university. But what we are seeing is that there is a greater fall in the number of people wanting to do earth science; there are more people applying for physics and engineering but with earth science and petroleum engineering the numbers are down."

"Some of that is due to awareness of geology as a topic. It is not taught in schools so people interested in earth science may opt for geography. There is also the influence of parents who tell their children that there is no job at the end of it," Muggeridge said.

As far as oil and gas majors are concerned, there appears to be no real challenge for recruitment. "We have absolutely no trouble when it comes to recruiting the talent that we need," said Michael Cousins, head of exploration at Exxon Mobil. "People that we employ want the same things today as they wanted 20 years ago. They want to be listened to, valued and they want to have access to the latest technologies. We have to make the industry attractive to them, which is all about telling a compelling story, which is something that the oil and gas sector has not always been good at." ■

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PAM System Deployed in the UK

Frequency bandwidth allows detection of porpoises.

CONTRIBUTED BY SERCEL

Sercel's QuietSea Passive Acoustic Monitoring (PAM) system has been successfully deployed in the U.K., following approval by the U.K. Department for Business, Energy & Industrial Strategy (BEIS) and the Joint Nature Conservation Committee (JNCC) of its use for a seismic survey operated by CGG in waters off the Shetland Islands.

QuietSea is a fully integrated PAM system that overcomes many of the limitations of its present-day competitors. The sensors are designed to fully integrate with seismic acquisition or navigation systems, and are incorporated with the hydrophones in the Sentinel streamer. By eliminating the need for deployment of separate PAM antennas at sea, QuietSea reduces the risk of accidents during deployment, retrieval and operation, thus significantly reducing operational downtime and possible equipment replacement costs.

Prior to deployment in U.K. waters, QuietSea stepped up performance with the extension of the frequency bandwidth to 180 kHz, allowing the detection of porpoise click trains.

"We have worked closely with Sercel and CGG over a number of months to be fully satisfied that the QuietSea system would be fully effective at detecting cetacean species

of specific concern in the region of deployment," said a member of the Environmental Management Team at BEIS. "Sercel and CGG proactively engaged with us, as the appropriate regulator, and with our conservation adviser, the JNCC, whose guidelines are a standard condition for oil and gas industry geological surveys in the U.K. Subsequent to extensive testing and research, we were pleased to approve its use in U.K. waters."

"We are delighted to receive this new recognition of QuietSea by a major industry regulator, extending its deployment to U.K. waters," said Pascal Rouiller, Sercel CEO. "Our automated detection tool provides undisputable added value over conventional marine mammal monitoring. QuietSea's localization accuracy and reliability undoubtedly contribute to the conduct of safer and more productive marine seismic operations," he added. ■



QuietSea allows the detection of porpoise click trains. (Image courtesy of Sercel)

EXPLORATION SUCCESS

(continued from page 1)

where AI can help. Computers are very good at repetitive work but not good at making judgements, so we are an enabler to help handle data."

The real consensus came with the acknowledgement that lowest cost will always win. "We know that the world needs energy, and we are a long way from an age where no fossil fuels are required," said Francois Alabert, vice president geotechnology solutions at Total. "In the meantime, we have to find a way to explore for oil and gas resources that fit in the sweet spot, low environmental impact and low cost."

Cousins fully concurred with this sentiment. "Put aside the predictions on demand, which are always wrong; it is the lowest cost of supply that will win every time," he added. "The company that utilizes new technology to find reservoirs at the lowest cost and can produce at the lowest cost will be the winner."

There are numerous examples of new technology that are changing the way that the oil and gas sector operates. BP has two crucial areas from within its organization that are already reaping rewards, according to the company. Its initiative called Connected Upstream connects people with data, physical and digital assets and connects machines with business decisions. With a live data ecosystem, people are connected to the data using the cloud and it allows access to anyone from anywhere, rather than it being isolated in a silo.

For Total, the challenge is to get more data from the well. "We have to design a field with a relatively small amount of data, so the challenge is to get more data from down the well," Alabert said. "For this we need miniaturized and cheap sensors that can communicate from the bottom of the well to the surface. If we have this information, we can perform real-time analysis and this will be a game changer. In the future I can see a place for Nano technology with Nano sensors that swim along the flow." ■

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BOOTH NUMBER 330

MINDS OF ENGINEERS.
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Depth-enabled Seismic Characterization Workflows

Deeper integration across subsurface disciplines delivers robust models for well planning, field development and production optimization.

CONTRIBUTED BY IKON SCIENCE

Ikon Science has released a suite of new depth domain seismic processing and inversion capabilities. The new solutions allow users to remain in the depth domain during the process of seismic data conditioning, relative colored inversion workflows for lithology and fluid prediction, and joint impedance and facies inversion.

"Ask geoscientists, engineers, drillers," said Michel Kemper, Ikon Science's chief scientist, "and they will tell you, unsurprisingly, that the subsurface is modeled and drilled in depth. However, whether the seismic is two way time (TWT) or depth indexed, seismic inversion products (impedances) are ubiquitously derived in TWT."

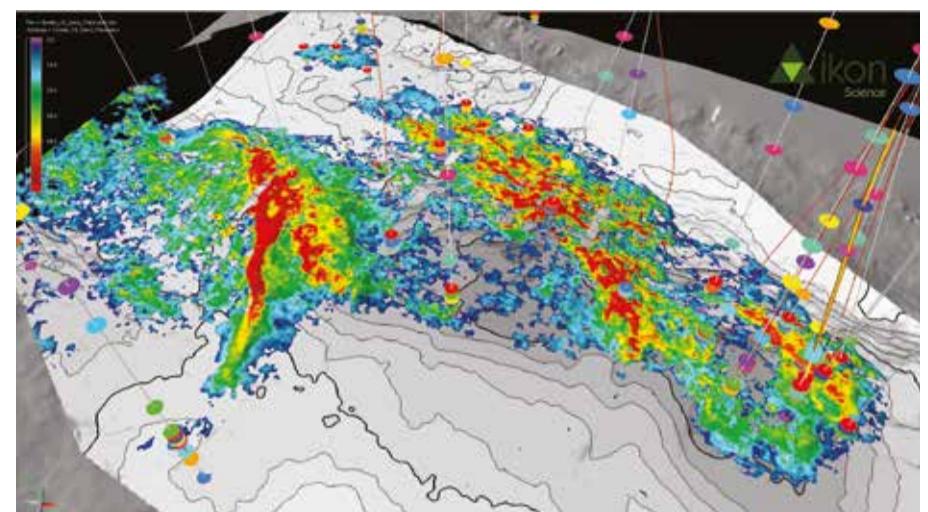
"There are a number of reasons why a new approach to depth domain seismic characterization is required," he said. "Firstly, facies (or rock-type) based seismic inversion systems have become increasingly de rigueur (Kemper and Gunning, 2014), meaning that not only impedances are derived, but also facies. Whilst subsequent time to depth conversion of the impedances (continuous quantities) is feasible, such a domain conversion of discrete facies is not possible without strong aliasing effects. Secondly, for 4-D inversions, the natural and technically most robust domain is depth."

Historically, the vast majority of seismic data have been processed in their native TWT domain; however, over the last 10 to 15 years, industry has seen dramatic improvement in depth processing/imaging and true amplitude recovery. With associated improvements in the velocity models, depth domain datasets are delivering increasingly robust and predictive depth models. As a result it is becoming more commonplace for seismic interpretation to be undertaken exclusively in depth.

RokDoc 6.6.3 now provides users capabilities to apply seismic data conditioning algorithms to optimize depth

domain datasets prior to amplitude versus offset (AVO) analysis and inversion. Users can select from a variety of algorithms including phase, amplitude and frequency balancing, trace alignment/trim-statics and other trace alignment processes. Processes are run in the required domain while results are presented to the user in depth. Where seismic depth predictions do not fit well data, users can warp the data using a variety of approaches to fit with known well control. Colored inversion, a highly accessible inversion approach adopted by many generalist users and interpreters can be performed on the fly using output recipes from the seismic data conditioning workflow. Using this approach, many parameters can be trialed and fine-tuned before final 3-D depth volumes are processed and output to conventional interpretation systems.

Ikon's Joint Impedance and Facies Inversion technology, Ji-Fi, now operates in a fully depth native mode—all of the model inputs (compaction trends, stratigraphic surfaces, fluid contacts, age field, etc.) are defined in their natural domain, helping to break down barriers between geological and geo-physical domains. Information from geomodeling and flow simulation models can be readily incorporated into the prior model for inversion. The Ji-Fi algorithm then delivers images of facies and (rock physics consistent) elastic properties in the depth domain, while honoring the requirement for wavelet stationarity by performing convolution in the TWT domain, without loss or corruption of information in the



Reservoir characterization in Ji-Fi shows depth inversion net pay thickness. (Image courtesy of Ikon Science)

process. Because Ji-Fi does not use variograms and geostatistics, it provides an alternative, considerably less biased and more data-driven approach to deriving properties from seismic for use in geomodeling.

Ikon Science has seen a significant degree of success in the utilization of 3-D geomechanical models for diagnosis/prediction of drilling experience and production performance in both conventional and unconventional settings. Construction of 3-D geomechanical models must necessarily be performed in depth, because it incorporates inputs from pore pressure/compaction models and fracture gradient models along with information on stress orientations.

RokDoc now provides a solution whereby pore pressure experts, geomechanics and geophysicists can come together to deliver a new breed of predictive subsurface models. ■

Expanding the Limits of Radio Technology

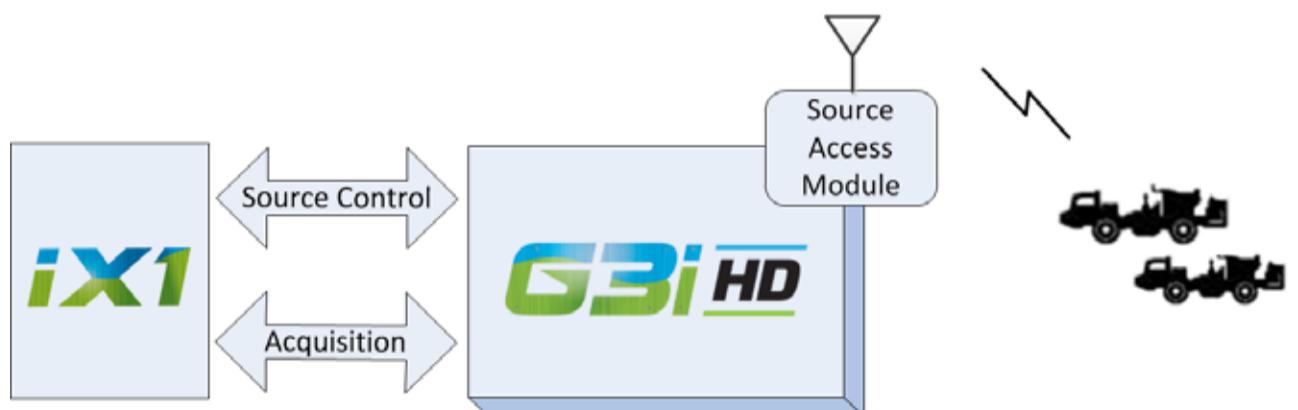
Innovative communication method extends the reach of source operation on large-scale 3-D seismic surveys.

CONTRIBUTED BY INOVA GEOPHYSICAL

Seismic surveys are conducted in a variety of very difficult terrains, each with unique field operation challenges. Terrain not only dictates the most appropriate acquisition system architecture to be deployed but also plays a role in determining field logistics as well as equipment communication method, if required. Additionally, the trend toward greater source and receiver density coupled with longer offsets is becoming increasingly common, expanding the scale of seismic programs. Against the backdrop of these challenges, seismic contractors are pressured to conduct surveys with an emphasis on productivity to achieve economic expectations.

High-productivity vibroseis source techniques offer examples of creative approaches that overcome some of the operational challenges while maintaining—or more often improving—geophysical imaging in a highly efficient manner. Some of these techniques require continuous communication from vibroseis fleets to a central recording truck. This requirement introduces technical issues due to communication range and terrain-based impediments that impact wireless signal path. Managing these issues by pushing the limits of current wireless technology alone erodes efficiency gains due to the need to relocate the central recording truck, add radio repeaters, or both, negatively impacting production.

HyperSource is an innovative approach to overcoming current radio technology limitations and is a new feature available in INOVA's G3i HD cable acquisition system with iX1 acquisition software. HyperSource consists of a hybrid wired and wireless communication network available for access by distant source crews on a project, operating where logically convenient for efficient production. In a high-productivity vibroseis example this might consist of multiple vibroseis fleets operating within or even beyond the perimeter of the active patch tens of kilometers from the recording truck. HyperSource utilizes G3i HD's existing receiver cable telemetry network to extend source radio coverage to an area of the laid out spread where production is taking place. A standalone Source Access Module (SAM) is connected into the G3i HD receiver telemetry cable in proximity to



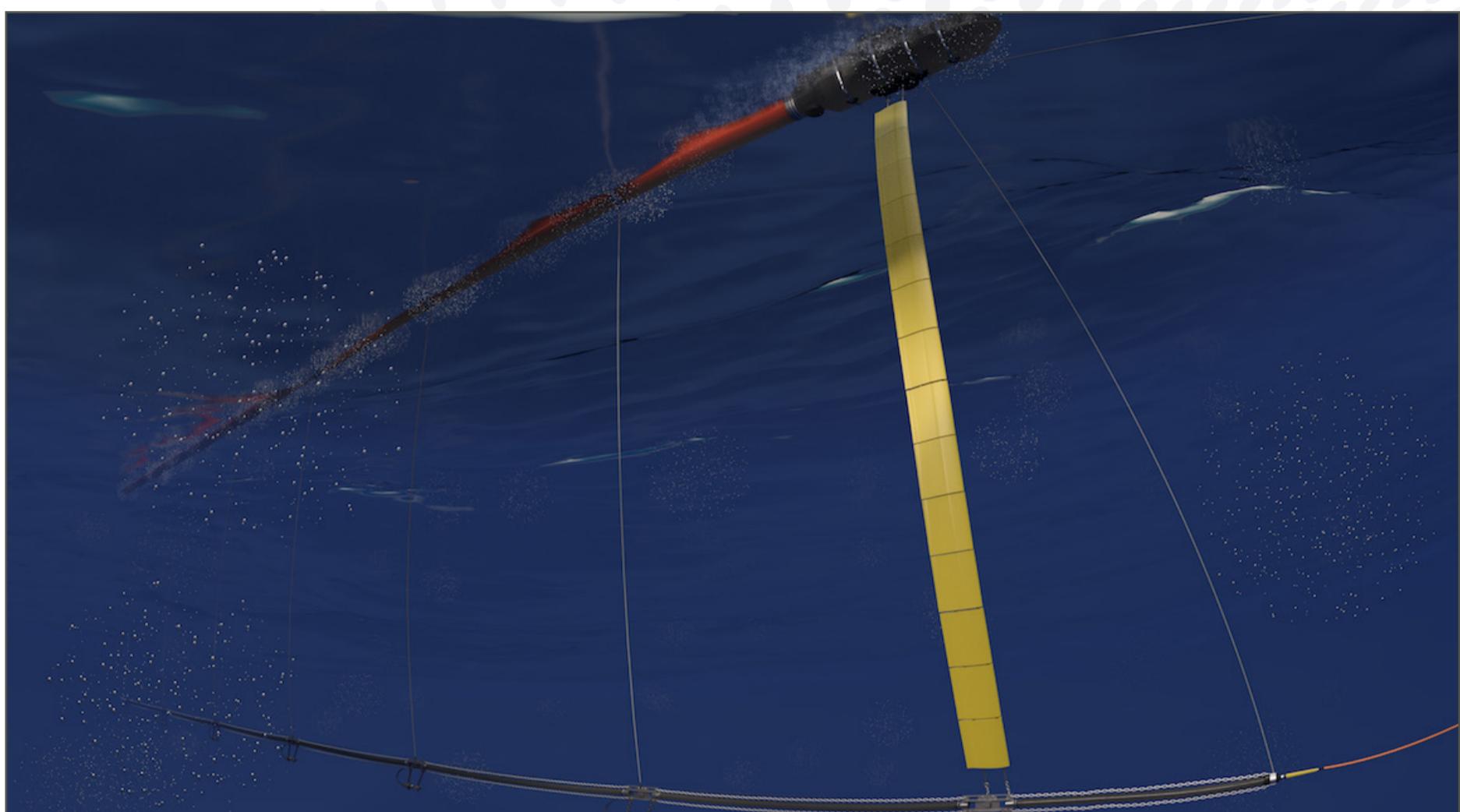
The image shows an overview of the HyperSource solution. Source crews separated by large distances from the central recording truck or with surface obstructions between them remain in constant communication. (Image courtesy of INOVA Geophysical)

source production. From a SAM to source fleets current wireless communication technology is utilized.

High-productivity vibroseis is most often associated with desert operations. However, deserts are not always flat and can contain massive sand dunes or other rocky outcrops that impede radio signal path. A suite of optional HyperSource field components allows the user to configure an alternate wireless link to avoid obstructions that may block the wireless signal between SAMs and source crews. Like SAMs, all supporting field components of HyperSource are autonomous units and can be readily moved or added where needed on the project without impacting production that may be ongoing in other areas of the survey. Source crews can move freely through a remote production area, maintaining continued communication with the recording truck by seamlessly traversing the HyperSource coverage area.

Thus far, HyperSource has been presented in the context of high-productivity vibroseis operation in desert terrain, though HyperSource can be used on more traditional seismic projects, as well. For example, G3i HD with HyperSource option can be deployed on smaller-scale projects where radio signal path is a problem, such as heavily forested terrain requiring impulsive, vibroseis or hybrid source production. HyperSource extends the production area source crews can operate, allowing unconstrained mobility in production areas that may otherwise be inaccessible due to radio telemetry limitations. HyperSource minimizes radio telemetry constraints on source operations allowing production to progress more efficiently without the burden of relocating critical portions of the acquisition system or by installing radio repeaters, which add to operational cost. ■

Reduce Marine Survey Cost and Time



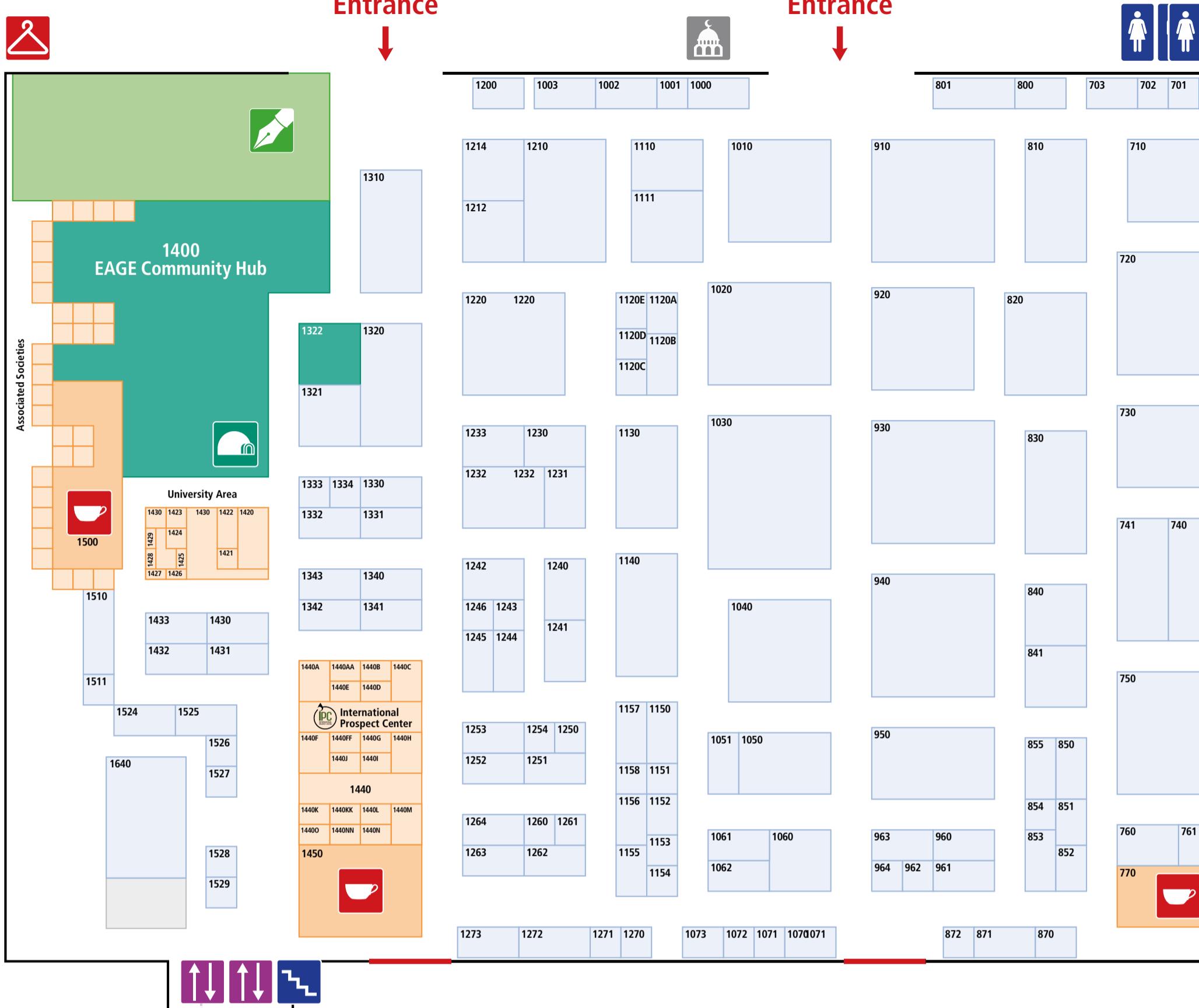
SailWing™ enhances safety, reduces costs and improves time management of marine seismic surveys. The foil-based marine diverter is a tested and proven technology, providing control of gun strings to maintain even separation and improved source geometry. SailWing operates closer to the center line of the vessel, enabling operators to achieve faster tows and shorter turn times. **Powering Data-Driven Decisions**

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Exhibition area



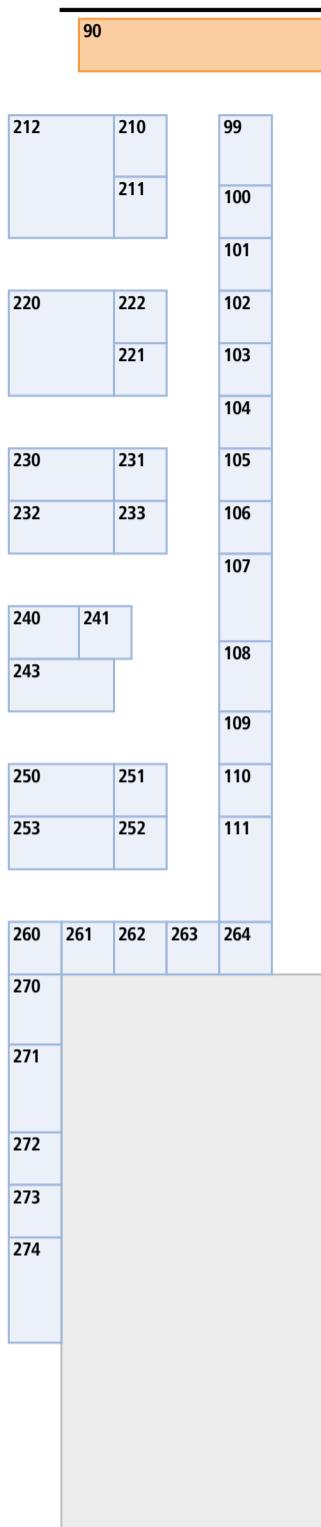
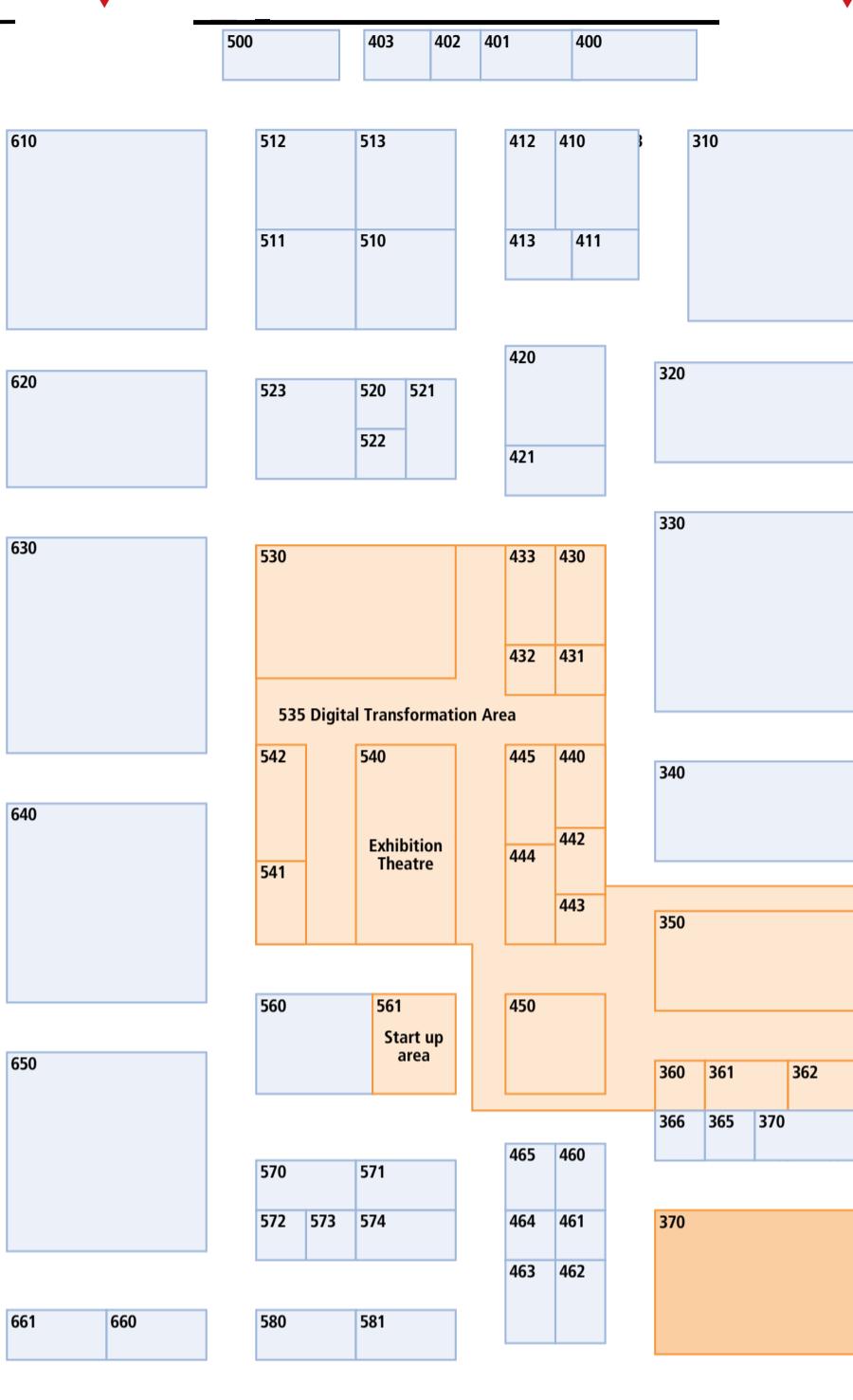
Exhibitors in alphabetical order

AAPG Datapages	1158	Eliis	1050	Geotek Ltd	222
Advanced Energy & Environmental Technologies, Inc	462	Elsevier	231	GeoTeric	950
Advanced Logic Technology	1320	Emerson	830	GeoTomo LLC	520
Airbus	1250	EMGS ASA	841	Geovariances	852
Alcatel Submarine Networks	523	Engenius Software	521	Getech	1331
All-Russian Research Geological Oil Institute	1061	EPI Group	232	GiGa infosystems GmbH	413
Amplified Geochemical Imaging GmbH	412	Esri	361	GK Processing	962
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Dassault Systemes	760	GEO	233	Innoseis	1330
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DMT GmbH & Co. KG	1320	Geomatrix Earth Science Ltd	703	iSeismic AS	964
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EAGE Community Hub	1400	Geospace Technologies Corp.	640	Lynx Information Systems Ltd	1261
EIWT	1154	Geotec SpA	211	Magseis Fairfield ASA	1040



Entrance

Entrance



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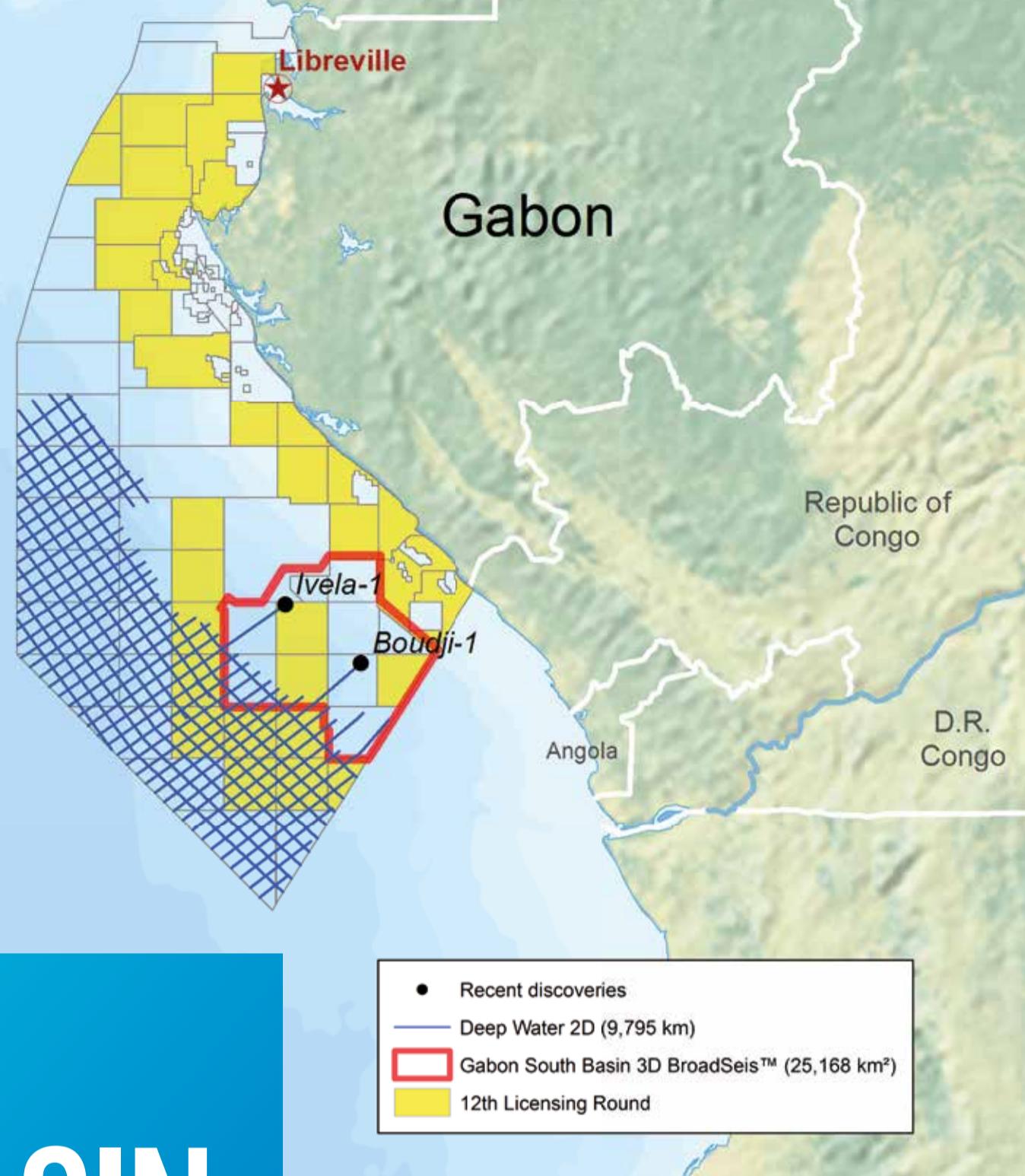
International Prospect Centre

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GABON SOUTH BASIN

Data for Gabon's offshore 12th licensing round

CGG has acquired 9,795 km of long-offset, 2D data to help define the full extent of existing and new plays in the Gabon South Basin and to understand the thickness variations in the sediment overburden for source rock maturity analysis.

The data is being processed through an advanced broadband workflow. This not only increases resolution and improves characterization of the turbidite systems, it also provides deep penetration of low frequencies to help describe the nature of the deep crust.

Visit us on booth #720 for further details.

The right data, in the right place, at the right time