DISKOS

20 years

of service for petroleum geology

EDITORIAL TEAM
Arnt Even Bøe
Elin Aabø Lorentzen

PRODUCTION
Print: Spesialtrykk
Paper: Arctic Volume 200/130 gr
Print run: 250

LAYOUT
Arne Bjørøen

ILLUSTRATION COVER
Lars Falck-Jørgensen

www.diskos.no

ISBN 978-82-7257-196-1

Arnt Even Bøe *has written all of the articles in this pamphlet. He has been a journalist for his entire adult life. Over the past more than 20 years, he has worked as an energy journalist in Stavanger Aftenblad, one of Norway's most dedicated newspapers when it comes to keeping their readers informed regarding the petroleum industry. He also has extensive experience as a commentator and editorialists in the Norwegian and international oil industry and about energy and industry in general. He retired from Aftenbladet as a journalist in the spring of 2011 and now works as an independent communications adviser, freelance journalist and author. He will publish his sixth book this Christmas, titled Time is Money, which describes the establishment of the Norwegian oil regime from 1962-1973 through interviews with the people who took part.*

Preface

This pamphlet is published in connection with the 20th anniversary of Diskos. The project is headed by the anniversary committee, which will be introduced later in the pamphlet. Through the experience gained by the authorities, oil companies and database suppliers, readers can make up their own minds regarding the significance of Diskos for the development on the Norwegian Shelf. Our ambition was to uncover the story behind Diskos, describe the present situation and outline the challenges of the future. Enjoy!

Anniversary committee

Contents

Diskos in brief

DISKOS
NORWEGIAN PETROLEUM DATA

The general rule is that all oil companies on the Norwegian Shelf are required to submit copies of all raw data related to seismic and drilling to the Norwegian Petroleum Directorate (NPD). The companies have to cover the cost of entering the data in Diskos, but this allows them to avoid expenses for storage and administration of the data. All members have access to their own data in Diskos, and to data in the licences in which they have an ownership interest. The authorities also encourage different licences that are drilling in the same geological formation to exchange the information they collect from the subsurface. This is a win-win situation for both parties.

DATABASE OPERATORS

Today, the Diskos databases are operated by CGG and Kadme. CGG operates the seismic, well and production database, while Kadme is the database operator for Trade (data exchange). All contracts run to the end of 2020, with an option to extend for a period up to three years.

MEMBERSHIP

Diskos is intended for the oil companies. Upon membership, they achieve several simplifications related to submission of required data to the authorities, own use and sharing of data in the licences or through swaps and sales. Today, all operators and licensees on the Norwegian shelf are members of Diskos, with the exception of the small company Skeie Energy AS.

All companies that report data to Diskos pay CGG fixed rates at upload, but only the members can retrieve the data again themselves. The rates are governed by the contract. The price for retrieving seismic is calculated based on volume. Well data is paid per wellbore on upload, but can be retrieved free of charge. The authorities, represented by the NPD, do not pay anything for retrieving seismic, but do not generate any income from Diskos either.

The Diskos members, together with general commercial players within exploration data, can also trade information on a voluntary basis or sell and buy from each other. The companies handle this part of the process themselves through the so-called "Geodata Trade Operator" (GTO) in cooperation with Diskos. The orders are then sent to Kadme, which checks the requests and is responsible for implementing the transactions.

Throughout the years, several models have been used for payment of the membership fee. Now, everyone pays the same, approx. NOK 400 000 a year, whether they are major or minor users. The membership fee is exclusively used for administration, joint projects and operation of the system, most of the funds go to CGG as the database operator.

The total value of the Diskos contracts, three with CGG and one with Kadme, is approx. NOK 250 million allocated over a six-year contract period. This figure is quite uncertain, as it is based on data volume forecasts.

ASSOCIATED MEMBERS

The 19 associated members (Non-Oil Companies) are generally companies that aquire seismic (Spec companies) and various consulting firms. They pay a fixed annual membership fee of about NOK 140 000. Otherwise, they pay the same as the oil companies to upload and extract data from the database, but as they cannot hold seats in Diskos' governing bodies' (Management Committee and Steering Group), they do not have any influence on the cooperation.

UNIVERSITIES AND RESEARCH INSTITUTIONS

The universities and Geological Survey of Norway (NGU) are also a type of associated member, but in another category: Universities and Government Non-Profit Research Organisations. They can become members for free and can download a certain volume per year at no cost.

NON-MEMBERS

Non-members do not have the same access to data as the others and must obtain the information from Diskos as a "public user". This means that they can request access to non-confidential public documents in the usual manner and request physical copies (digital data delivered on magnetic tape or USB drives). Since this service is more labour-intensive, it can cost up to 10 times as much as the members who receive data online.

THE 57 MEMBERS (at July 2015)

- A/S Norske Shell
- Atlantic Petroleum Norge AS
- Bayerngas Norge AS
- BG Norge Limited
- BP Norge AS
- Capricorn Norge AS
- Centrica Energi
- Chevron Norge AS
- Concedo ASA
- ConocoPhillips Norge
- Core Energy AS
- Dana Petroleum Norway AS
- DEA Norge AS
- Det norske oljeselskap ASA
- DONG E&P Norge AS
- E.ON E&P Norge AS
- Edison Norge AS
- Eni Norge AS
- EnQuest Norge AS
- Explora Petroleum AS
- ExxonMobil Explor. and Prod. Norway AS
- Faroe Petroleum Norge AS
- Fortis Petroleum Norway AS
- GDF Suez E&P Norge AS
- Hess Norge AS
- Idemitsu Petroleum Norge AS
- INPEX Norge AS
- KUFPEC Norway AS
- Lime Petroleum Norway AS
- Lotos Exploration & Production Norge AS
- Lukoil Overseas North Shelf AS
- Lundin Norway AS
- Maersk Oil Norway AS
- MOECO Oil & Gas Norge AS
- MOL Norge AS
- Noreco Norway AS
- North Energy ASA
- Oljedirektoratet
- OMV (Norge) AS
- Origo Exploration AS
- Petoro AS
- Petrolia Norway AS
- PGNiG Upstream International AS
- Premier Oil Norge AS
- Pure E&P Norge AS
- Repsol Exploration Norge AS
- RN Nordic Oil AS
- Skagen44 AS
- Spike Exploration Holding AS
- Statoil Petroleum AS
- Suncor Energy Norge AS
- Svenska Petroleum Exploration AS
- Talisman Energy Norge AS
- Total E&P Norge AS
- Tullow Oil Norge AS
- VNG Norge AS
- Wintershall Norge AS

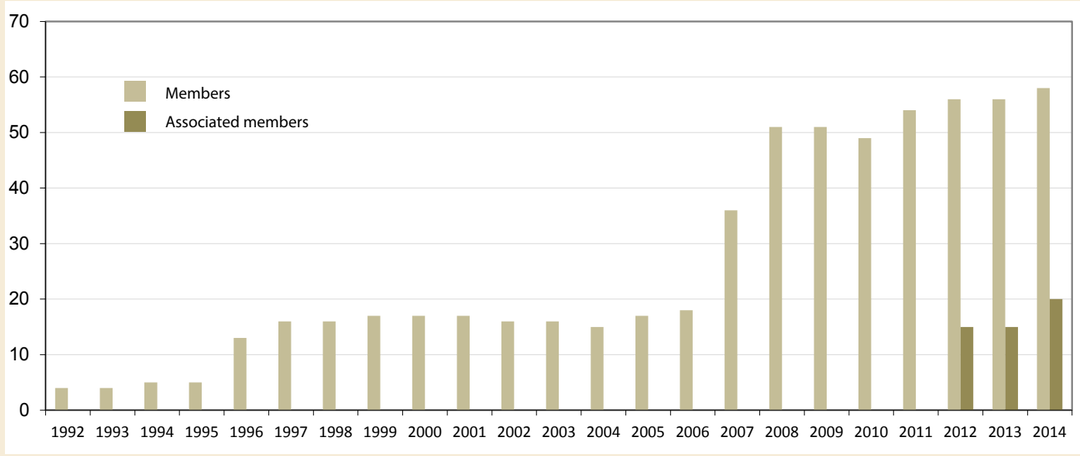
ASSOCIATED MEMBERS:

- CGG Services (Norway) AS
- Dolphin Geophysical
- EMGS ASA
- Envision AS
- Estimages Norge AS
- Exploration Geosciences
- Exploro AS
- First Geo AS
- Ikon Science
- Landmark Graphics AS
- Multiclient Invest AS (PGS)
- ORG Geophysical AS
- Rock Solid Images Inc.
- Schlumberger Information Solutions AS
- Searcher Seismic ASA
- Spectrum
- TGS-NOPEC
- Well Design Online AS
- WesternGeco AS

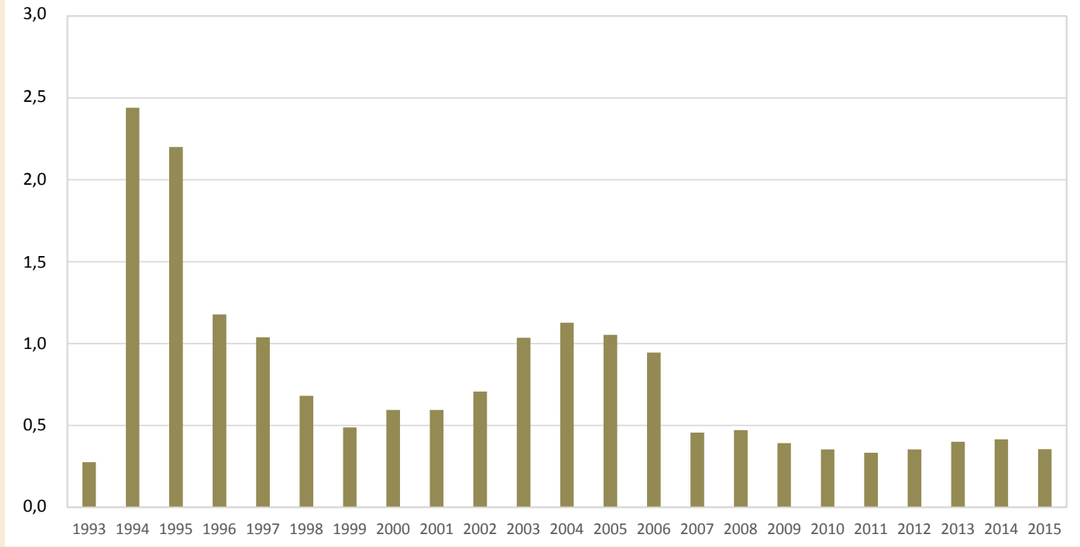
UNIVERSITIES AND RESEARCH INSTITUTIONS:

- University of Oslo
- University of Bergen
- University of Stavanger
- University of Tromsø
- Norwegian University of Science and Technology in Trondheim
- Geological Survey of Norway in Trondheim (NGU)

MEMBERS IN DISKOS



EACH MEMBER'S SHARE OF THE JOINT COSTS IN DISKOS



Diskos-veteran Kjell Reidar Knudsen:

- A typical Norwegian group effort

"Without the well-known Norwegian community volunteering spirit, we would have never made it this far. Everyone contributes and there is mutual trust," says Kjell Reidar Knudsen of the Norwegian Petroleum Directorate. He has held a central position in The Diskos National Data Repository (NDR) since the very beginning more than 20 years ago.

"Without the well-known Norwegian community volunteering spirit, we would have never made it this far," says the NPD's Kjell Reidar Knudsen, who was there from the very beginning and still chairs both the Management Committee and Steering Group. (Photo: Emile Ashley).

"The idea behind Diskos is that the oil companies should all cooperate on storing exploration data and compete in the interpretation of this data. The more raw data is collected and shared, the greater the possibilities for the bright minds in each company," says the Diskos veteran.

He meets people all the time in the international petroleum environment that are surprised by the trusting and orderly interaction between the oil companies and Norwegian authorities. In most other countries, oil companies typically compete on nearly everything. They are often untrusting of the authorities and fear corruption, or that the data will be lost in other ways. This often results in wasting resources and irrational management models. Therefore, the Norwegian model attracts attention.

In 1998, at the 15th World Petroleum Congress in Beijing, Knudsen held an extensive presentation on Diskos, among other things, titled: National Petroleum Resource Data Management.

"I believe it was also typically Norwegian that we started the work that brought us Diskos without a single cost-benefit analysis. For those involved from the NPD, Statoil, Hydro, Saga Petroleum and eventually Mobil, it was quite obvious that cooperation in certain areas, instead of competition, would reap major benefits for us all. By storing the data in the same place, everyone would gain easier access to larger data volumes when the confidentiality period ended, and it would also become easier before this time when licensees in the same production licence wanted to share information. The costs of reporting to the NPD, storage and quality assurance would also decline. It was just a matter of getting started," says Knudsen.

He believes it is unique in a global context that companies and authorities join forces to save money this way. Before, the NPD had to deliver copies of the information the companies were entitled to, but this was labour-intensive. Now, they simply log into the system and open access to the information once for everyone as the confidentiality periods end. "This also makes it cheaper for all parties," says Knudsen.

ROUGH BEGINNINGS

It is not easy to say when what eventually became the Diskos project really started, but many got a rude awakening when they read the Oil & Gas Journal in November 1991. Here, Chevron's chief geologist Lee Lawyers presented an overview of the geologists' work profile. It showed that they spent as much as 60 per cent of their work day looking for relevant data. In other words, they spent more than half their time at the office not processing or interpreting information – but finding it. This waste of time was a known issue in every oil company and the reason many of them took the initiative to increase the efficiency in storage and retrieval of seismic information and well data.

The NPD was also early in the game. In 1990, director of resources Arild Nystad established a separate department for data administration and asked department head Kjell Reidar Knudsen to take responsibility for this. This resulted in more streamlined data management internally in the NPD, and the launch of the High Quality Log Data project (HQLD) as the first joint project that benefitted the entire oil industry. At the same time, Statoil had invested in its internal Seismic data storage project, and Saga Petroleum and the NPD developed the software for the ILGI database together.

At Notodden in 1992, Tape Technology Norge (TapeTech Norge) and Norsk Hydro established the company Norsk Geodatasenter in one of Hydro's industrial halls where the industry locomotive's data information would be stored. TapeTech Norge's management consisted of Audun Espeland and Kjell Nedrebø in Stavanger. They wanted a lasting binding cooperation with the Norwegian oil companies.

The three Norwegian oil companies Statoil, Hydro and Saga Petroleum and the NPD already had a collaboration project on the Shelf (Exploration Technology Cooperation), and agreed in October 1991 to include a more systematic cooperation on storage of exploration data as well.

A group was appointed in 1992 to further develop the cooperation between the oil companies and the NPD. This was called the Geobank project, and it was made clear from the very start that an open tender process was necessary. A requirement specification was prepared for a system for storage of digital data, qualifying potential contractors and potentially discussing the practical aspects with regard to signing a contract.

The group was comprised of members from all of the involved players, and its work process was extensive. The group also used internal specialists

WELL DATA:

Well data is anything from detailed digital information and special reports such as Mud Logs, Site Survey Reports, Lithology, Stratigraphy and Biostratigraphy Reports, Conventional and Special Core Analysis, Core Photos, digital CPI-logs, Formation Pressure measurements, Well Test data and reports, Fluid Analysis Reports, Wireline and MWD Logs and Reports or more general reports such as Geological Reports, Completion Reports and Well Evaluation Reports.

USEFUL WORK

As regards the remaining 40 per cent of the geologists' time at work, Lee Lawyers' survey shows that it was distributed as follows: "Vacations 8%, Coffee Breaks 5%, Meetings and presentations 5% and Training 4%". This leaves just 18 per cent. This was the time the geologists spent on "Useful work", according to Lawyers' survey. No wonder oil geologists believed they spent more time looking for data than oil.

when necessary. The project had a budget of 0 kroner. Everything, including the members' travel expenses, was covered by the involved companies and the NPD.

The pre-project was headed by Stein Thorbjørnsen from Statoil. The members were Kristian Kolbjørnsen and Espen Løken from Saga Petroleum, Mons Midttun and Jo Bergan from Hydro, Kjell Reidar Knudsen and Kjetil Tonstad from the NPD and Gunnar Sjøgren from Statoil. The following year, in 1993, the NPD assumed project management for good, and Kjetil Tonstad was the first one out. He was succeeded by Hallgeir Vestøl in 1996, who passed the baton on to the current project manager for Diskos, Eric Toogood, in 1998. Elin Aabø Lorentzen was hired as the assistant Diskos project manager in 2012.

In the early 1990s, Norwegian and international media were constantly reporting on new fiascos in the data industry related to ambitions that exceeded the knowledge or feasibility. Many were talking about the burst IT bubble. This was why the project group was very concerned with keeping their feet on the ground. They constantly reminded each other that: "When you don't know where you're going, you usually end up somewhere else", says Knudsen.

In the autumn of 1993, the tendering process started for development of a specific software for storage and retrieval of vast volumes of seismic and well data. One of the most important requirements was that 100% watertight dividers were needed between the data submitted by the different companies. When this was in place, it would be opened for exchange and sale in a simple and secure manner. The winner of the software competition could also have the option to operate the system.

THE TECHNOLOGY ARRIVES

In February 1993, five companies were prequalified to enter into the contract. The Diskos organisation was formally established in June of the same year. IBM won the software contract that was awarded in December. The precondition was that IBM would own the software and have the option to export the concept to other countries. This was reassuring to the project group, which believed it was a guarantee that the data giant would really get serious. The programme was called PetroBank. IBM also won the operations contract and also included TapeTech and PGS as co-owners of the company that would operate PetroBank. The operating company was established after the summer of 1994 and was named PetroData AS. There were also some changes on the user side. In September 1994, the four Norwegian project participants got Mobil Exploration Norway Inc. to join the team through sharing knowledge about the company's advanced seismic robotics system Mobil View.

The strategy was in place and the goal was clear, but no one was happy with the name. The geodatabase project had to be replaced with something shorter and less of a tongue-twister. The five involved parties were asked to make proposals, which became the start of an extremely creative process where all possible abbreviations of the most incredible name compositions were launched. For a long time, it seemed as if the name issue was completely lost, until Saga Petroleum's exploration manager, Hans Chr. Rønnevik, solved it all when he launched: Diskos (see separate article).

14 COMPANIES + THE NPD

Everything was now in place and it was time for the formal establishment of the Diskos collaboration project, a joint information system for technical petroleum data. The official start was set for March 1995. In addition to the NPD and the four oil companies that started it all (Original Participants), Shell, Norsk Agip, Hess, Conoco, Elf, Total, Phillips, Enterprise Oil, RWE-DEA and BP/Amoco joined over the course of the year. The new data storage collaboration was also presented to the Norwegian media and was extensively discussed in newspapers and trade journals. (See separate article).

After Diskos was commissioned in March 1995, Knudsen was tasked with contacting the other oil companies' exploration managers to tell them that they could now participate in the established collaboration. The big advantage was that they could retrieve the data they needed online, while non-members had to "knock on the NPD's door" and go back home with the information on tape rolls or paper documents. The response was entirely positive.

All of the oil companies on the Norwegian Shelf have a standing invitation to participate in Diskos. Membership is voluntary and does not grant the companies access to other data than that which they are otherwise entitled to, but the incentive is that everything becomes much simpler when they have direct access to the database. The requirement for becoming a member is that the company is prequalified by the Ministry of Petroleum and Energy to be a licensee on the Norwegian Shelf.

PUBLIC, BUT CONFIDENTIAL

One of the issues that had to be dealt with quickly was how Diskos was to be organised. A limited company or foundation were both relevant, but neither were chosen. "Diskos is defined as a collaboration project with the Norwegian Petroleum Directorate as the coordinator and legal entity," says Knudsen. This is a precondition in order for the Freedom of Information Act/Petroleum Act to be used as the basis for sharing data reported by the companies after a mandatory confidentiality period.

Since the NPD is an administrative agency, official regulations must be followed on all points, e.g. in connection with tenders for procurements, accounting procedures and disclosure regarding correspondence.

The rules regarding a duty of confidentiality are listed in the regulations to Act relating to petroleum activities which states that raw data from seismic and wells from licence groups are protected from public access for two years. General seismic is kept confidential for five years, while seismic aquired by commercial players for sale, is protected from public access for ten years. The most valuable asset of all, interpreted data, is kept confidential for 20 years before other companies can freely use the information in the hunt for new or more oil in the same area.

The authorities' overlying resource strategy lies behind these rules. In order to encourage the initiators and investors to conduct as much activity as possible, they gain exclusive rights to the data for a certain period. When the owners have extracted what they believe to be the potential, others can reuse the same information, re-interpret them and use them to establish new plays. This reuse strategy has been highly successful and has contributed to several major discoveries, including Johan Sverdrup. (See separate article).

Diskos also works to help relieve the National Archives of Norway, which would otherwise have had to physically store a lot of the data and correspondence regarding the oil activities. This would have required new, large and costly bases and storage premises. Instead they can now let Diskos do the job as Norway's national archive for this part of the petroleum activities.

QUALITY CONTROL AND UPDATES

Kjell Reidar Knudsen has been hands-on from the preparations via the establishment of Diskos, all the way up to the present. He still sees vast possibilities for further developing the collaboration project. As regards improvement items, he notes additional quality control when data is uploaded, as well as updating metadata. There is still some room for improvement here and the work is fully underway. New geophysical data types have also arrived, which are well-suited to storage in Diskos.

MANAGEMENT COMMITTEE

Is Diskos' top governing body and has a representative from each member. All members have a vote, while the NPD, which always holds the chair, has two votes in the event of a tie. The cases are usually settled by consensus, or in voting by simple majority and the NPD's casting vote has never been necessary so far. The Management Committee usually meets four times a year to address matters facilitated by the Management Group and project management. Kjell Reidar Knudsen has been the chair of MC since its inception in 1995.

STEERING GROUP

If the Management Committee is considered a municipal council, the Steering Group could be the executive board. A representative from the NPD is the permanent chair of the group, which also has two other permanent members: Statoil and ExxonMobil. The three last members in the group are selected for two years at a time. Currently, they are Lundin Norway, Svenska Petroleum and MOL Norge AS.

The NPD can also have a casting vote in the Steering Group, but it has not been used here either. Kjell Reidar Knudsen is the NPD's representative here as well. The Steering Group was established when Diskos started and meets at least six times a year.

DISKOS

The permanent name of the collaboration project.

PETROBANK

The name of the software programme that was developed for Diskos by IBM. In 1998, PGS bought the rights to PetroBank and in 2011, Landmark (Halliburton) purchased the software from PGS. PetroBank was used by Diskos until 2014. From 2015, software and operation of Diskos is handled by the French CGG. The PetroBank name is therefore no longer in Diskos.

PETRODATA

The name of the first operating company. Kjell Arne Bjerkhaug was PetroData's first head. The company was originally owned by IBM, PGS and TapeTech. Later, in 1998, PGS also acquired PetroData. In 2004, Schlumberger took over operation of Diskos. The Petrodata name is thus also no longer in Diskos. Landmark took over operations in 2009.


Ny database i Stavanger:
1000 geologer sparer 200 mill.
Stavanger Aftenblad 16/3-95

Kan bli eksportsuksess
FINANSAVISEN 22/2-95

NYTT OM NAVN
Ny mann på listen
Finansavisen 13/3

Press coverage of Diskos

On 22 December 1993, the Norwegian Petroleum Directorate organises a press conference in Stavanger where resource director Arild Nystad says that Statoil, Hydro and Saga Petroleum, in addition to the NPD, will join forces to establish a new joint geodatabank that could result in savings of at least NOK 50-100 million annually. When all 15-20 companies on the Norwegian Shelf join Diskos, savings could reach between NOK 250-500 million a year.

The NPD's resource director Arild Nystad tells the press that the new Geodatabank, which will be located in Stavanger, will yield major savings through more efficient processing of the vast data volumes from the Norwegian Shelf. The resource director says that the time saved by geophysicists in searching for relevant data can instead be used to find the 400 oil and gas fields that are still undiscovered on the Norwegian Shelf.

In order to illustrate just how vast these data volumes truly are, Nystad explains that 142 semi-trailers would be needed to carry all of the information that is stored in the NPD and oil companies relating to the Norwegian Shelf. Nystad imagines that the technology being developed could be exported to international oil activities.

Head of Section Jon Stærkebye in Saga Petroleum says that the company has 200 geo-full-time equivalents and that 100 of these can be freed up when the new system is ready to use. This does not mean lost jobs, but rather that the company's exploration capacity will increase by 100 full-time equivalents.

THE OPENING: The official opening of the Diskos database took place on 15 March 1995 in the NPD's offices, and was conducted by Stavanger's Mayor, Leif Måsvær (Christian Democratic Party), on the right. The others in the photo are, from left; Kjell Arne Bjerkhaug, CEO of Petrodata, Ed Petrozelli, CEO of IBM Worldwide Petroleum, State Secretary in the Ministry of Petroleum and Energy Gunnar Myrvang (Labour Party) and Head of the Norwegian Petroleum Directorate Fredrik Hagemann.

"This work is innovative in a global context and will strengthen the competitiveness of the Norwegian Shelf and the three oil companies," says Kjell Arne Oppebøen in Norsk Hydro.

Head of department Kjell Reidar Knudsen in the NPD explains that it is often a long process to find what data exists, where they are stored, which versions are available and who is authorised to obtain them. The NPD will therefore collect data from 750 wells in a new joint database where shared quality assurance, standards and rights will make it much easier for users who can log on online to find what they need.

IBM received NOK 10 million to develop the software for the new databank, which will be operative from 1995.

"SAVING NOK 200 MILL. A YEAR"

15 March 1995 marks the official opening of the new oil database, Diskos, at the Norwegian Petroleum Directorate in Stavanger. Newspaper Stavanger Aftenblad writes "1000 geologists save 200 million" and goes on to say that 12 oil companies have merged their databases so it is easier for everyone to store and find information. Where geologists previously had to spend days and weeks to locate information, it now only takes a few minutes, according to the coverage.

IBM created the programs and operates the database. The head of the company's international oil data activities, Ed Petrozelli, tells the paper that the problems they have solved here are common for the entire international oil industry, and he envisages a significant major market for the newly developed technology.

State Secretary Gunnar Myrvang (Labour Party) in the former Ministry of Trade and Energy opened the Diskos database and said that it was a good fit with the Government's ambitions to reinforce the competitiveness of the Norwegian Shelf and that it represented cutting-edge data technology. The only one who was not entirely satisfied, according to the paper, was Saga's exploration manager Hans Christen Rønnevik. Since the company was located in what he called the "Oil Shadow" (Oslo), he expected that it would take just as long to get the information up on a screen there, as if it was sent by plane. They could avoid this if they were allowed to use NSB's data link along the Sørlandsbanen (Southern Rail Line) at a competitive price. (See separate article on Rønnevik).

In addition to the NPD, Statoil, Hydro, Saga Petroleum and Mobil, the companies Agip, Enterprise, Amoco, BP, Shell, Conoco and Phillips also participate in the Diskos collaboration. All of the oil companies are invited to join the collaboration, where expenses are split equally.

Newspaper Finansavisen writes that Diskos will be the world's largest civilian database, containing 300-400 terabytes of seismic data from the Norwegian Shelf. IBM's head of petroleum in Europe, Gordon Phillips, says they are convinced that the PetroBank software will become a huge export success.

Controversial scientist and erotic discs

The name Diskos could be perceived as an answer to a prayer from all of the homeless exploration data that was floating around in the various companies: Disc us! But Hans Chr. Rønnevik is quick to dispel this. The name comes from one of archaeology's most controversial mysteries.

"I was at home watching a television show about unknown Norwegians that were famous abroad, when Kjell Aartun's name popped up. I was captivated by his controversial interpretation of the ancient text on a discus and saw clear parallels to what us geologists are doing, different interpretations of the same material," says Hans Chr. Rønnevik, who proposed the Diskos name.

Kjell Aartun was born on Sjernarøy in 1925, and took an education in theology and philology. He is also a government grant holder in Semitic language and cultural science. He is known for a number of controversial works regarding rune interpretation and Minoan civilization. According to Wikipedia, his theories suggest that all rune inscriptions from the Viking Ages and before, such as the Oseberg burial mound discovery, are written in a Semitic language, and that the content is highly erotic texts that refer to an Oriental fertility culture.

Based on this, Aartun believes that Norway was populated by Semitic tribes around year 2000 BC, and that they introduced a Semitic language. This was replaced by Old Norse around year 800 AD, without leaving any traces. According to Aartun, an ancient Nordic language (which has been partially reconstructed using the rune stones) therefore never existed according to Aartun.

The very first Diskos logo – illustrated with the Discobolus from the classical era.

Hans Chr. Rønnevik suggested the Diskos name (Photo: Emile Ashley)

He also believes that he solved one of epigraphy's and archaeology's greatest mysteries related to the so-called Phaistos Disc. It is a round, fired clay disc of about 16 centimetres in diameter and 2 centimetres in thickness, full of hieroglyphics on both sides. The 241 tokens are etched in a spiral towards the centre. The disc was discovered in 1908, is assumed to originate from the Minoan palace on the Greek Island of Crete, and is most likely 3000-3500 years old.

For many years, a stylised sketch of the Phaistos Disc served as Diskos' logo.

Diskos' current logo.

According to language professor Kjell Aartun, the Phaistos Disc contains a highly erotic fertility ritual with two participating partners, the feminine and the masculine, with parallels to the Song of Solomon. However, experts disagree on the answer to the riddle and note that the signs on the disc lend themselves to multiple interpretations, just like exploration data from the Continental Shelf…

To celebrate the start of the Diskos project, 25 numbered copies of the Phaistos Disc were made of platinum. Then Minister of Petroleum and Energy, Jens Stoltenberg, received number one, the head of the NPD at that time received number two, and Hans Chr. Rønnevik received number three.

In its first years, the Diskos logo was the famous nude Discobolus from the classical era, while it was later changed to the Phaistos Disc, i.e. a disc with symbols. The logo was changed again in 2013, the round disc shape is still in place, but the disc now contains the tail of the seahorse in the NPD's logo. This shows the close link between the NPD and Diskos, and emphasises Diskos' role as Norway's national archive for petroleum data.

The original Phaistos Disc (Photo: Aserakov)

The combination of old information from Diskos and new, with a dash of creativity and optimism, is Hans Chr. Rønnevik's recipe for success. (Photo: Emile Ashley).

Hans Chr Rønnevik:

From Diskos and Edvard Grieg to Johan Sverdrup

"Much of the secret behind new discoveries in mature areas involves delving into old data with renewed enthusiasm and to putting the information into an updated context," says Hans Chr. Rønnevik, exploration manager in Lundin Norway. And goes on to explain how Diskos contributed to the Johan Sverdrup discovery.

The Southern Utsira High was long one of the greatest mysteries on the Norwegian Shelf. In its heyday, it was a sort of tropical island with dinosaurs, palm trees and sandy beaches. Millions of years ago, however, the characteristic height sunk into the ocean and was eventually pushed more than two kilometres down into the seabed. When the geologists started looking for oil in the North Sea a few decades ago, they rediscovered the tropical island and found what they were looking for in the northern end. They found Balder, Grane, Heimdal, Jotun, Ringhorne and Sleipner here. But no such luck in the south.

HUNTING ELEPHANTS

All of the dry exploration wells caused the other oil companies to write off the area, accordingly nicknamed the "oil shadow". But newcomer Lundin Norway had a different idea. The company's exploration manager, Hans Chr. Rønnevik, was certain that there was also oil to be found in the southern part of the High. Perhaps even an elephant.

He was already quite familiar with the area. In his time in the NPD, he headed the group that gave the Utsira High its name. As exploration manager in Saga Petroleum and DNO, he never gave up on the area, and when Lundin Norway was established with Rønnevik as head of exploration in the summer of 2004, the hunt on the southern Utsira High was back on.

They traversed all of the abandoned trails once more. In Diskos, they found information about two old Statoil wells in the area (16/1-14 and 16/1-15). The first contained gas-fractured basement rocks, while the other contained oil traces on top of a 250-metre good sandstone column. The old data was linked with new, cleaned-up seismic, new computer programs and new enthusiasm, and allowed Lundin's geologists to uncover new tracks in the old hunting grounds. They led the company to the Edvard Grieg field, which proved that there was, indeed, oil on the southwestern Utsira High.

But Lundin's big game hunters did not stop there. They followed the tracks further east. Combined old information from Diskos with new, threw in a dose of creativity and optimism, and turned the geological understanding of the Norwegian Shelf upside down in 2010. Because here, in the "oil shadow" on the southern Utsira High, in the middle of the thoroughly explored North Sea, they made one of Norway's largest ever oil discoveries: Johan Sverdrup. The rest is history.

"ENDLESS TIME AND MONEY"

Hans Chr. Rønnevik remembers the challenges well when the Norwegian companies Statoil, Hydro and Saga, in addition to the US company Mobil and the NPD started the data collaboration more than 20 years ago. Mobil was invited along because the company was near the top of the class within data acquisition and storage, and because the Norwegians wanted to prevent the project they had such high hopes for to be perceived as a uniquely Norwegian thing, according to Rønnevik who outlines the dilemma of the time as follows:

"Increasing use of 3D seismic increased data volumes significantly, and the licences on the Shelf were spending 'endless' time and money on storage, copying and retrieval. In a licence with ten partners, ten sets of data were stored in ten different locations and with just as many security copies made," says Rønnevik. The benefit of collecting all of the data in one place was obvious. The challenge was keeping the different users separate. They were able to do this in the Banks' Central Clearing House. It had to be possible for exploration data as well. In addition, it should be possible for anyone, anywhere in the world, to use the standards for storing data.

IBM was tasked with the challenge, but the principals demanded that they develop the system in Norway so the users always had control over the project. The IT company lived up to its good name and reputation and delivered as promised. "We got the product we wanted," says Rønnevik today.

PROBLEMS THAT WERE RESOLVED

When Diskos was launched at the press conference in Stavanger 1995, Saga's exploration manager Hans Christen Rønnevik was both happy and satisfied. The three-part collaboration between the oil companies, IT companies and authorities was a success. But Rønnevik had a concern: With the transmission technology of the time, it would take much too long for Saga's geologists in Oslo to retrieve the data from Ullandhaug.

"It's just as fast sending discs by plane," said Rønnevik to Stavanger Aftenblad and expressed a desire to be able to use the data link along Sørlandsbanen (Southern Rail Line) at a competitive price. Twenty years later, dismantling of the telecommunications monopoly and fibre optic development has solved all transmission issues.

USERS DECIDE

Though the data volumes will increase substantially, he sees no issues regarding the technological challenges related to this. They will be solved. Diskos' future is thus fully dependent on the people who use it:

"The most important precondition for continuing the 20-year success is that users continue being faithful to the original concept. That they add all types of data as assumed in order to prevent black holes. You need to give to receive, in line with the Norwegian community spirit. Only this will allow Diskos to be developed into a global database for the Norwegian Shelf," says Lundin's exploration manager Hans Chr. Rønnevik.

Lundin Norway followed the traces from the Edvard Grieg field and discovered Johan Sverdrup on the southern Utsira High (Statoil sketch from development plans for the giant field).

Diskos throughout the value chain

Statoil uses Diskos in all steps of the value chain, from the idea stage in the exploration process all the way until the production phase.

"The exploration process in Statoil starts with uploading data from Diskos. We add new data along the way as it becomes available and keep the projects up-to-date all the way to the production phase. This allows us to take the lessons and success formulas from start to finish," says Erik Finnstrom, Senior Vice President Exploration Excellence in Statoil.

Like every other member, Statoil uses Diskos to store all of its seismic data and well data in a joint solution for the Norwegian Shelf. The company also uses the Diskos functionality to store all international seismic data, information that is not shared with the NPD and other companies. This allows Statoil to reap the technical benefit from the Norwegian Diskos solution in its international operations as well.

"Specifically, it means that we installed a copy of the previous Diskos database, Petrobank, with an external supplier. This allows us to work with a consistent data storage solution on both the Norwegian Shelf and internationally. In other words, we have brought Diskos out into the world," says Finnstrom.

What are the greatest advantages of Diskos?

"It is crucial for us to know that all of the data has been carefully quality-assured, consistently stored and is easily available. In brief, Diskos is a great and secure solution for Statoil."

What are the savings?

"In simplified and secure solutions when it comes to distributing the most central data types directly to other companies; both our partners and our suppliers."

How could Diskos improve?

"The system is based on a commercial agreement between the Diskos companies and a supplier. This must be administered and occasionally updated and changed. When a new tendering process results in a new supplier, as Diskos recently underwent, the challenge is maintaining continuity and the quality of services that have worked well for more than 20 years. It is important to secure and test the integrity of new solutions before they are implemented. At the same time, the supplier shift allows for new opportunities to further develop what we deliver to serve the best interests of the users," says Finnstrom.

How do you picture Diskos in five years?

"Diskos needs to remain competitive and closely follow the general development in IT. We are seeing that data storage is becoming increasingly cheaper and that the general international trend is moving towards cloud systems. Though this is not necessarily the solution for Diskos, it needs to deliver corresponding functionality and the ability to store large data volumes cheaply. Those who do not keep up with this development will soon find it hard to survive," says Statoil's Erik Finnstrom.

Erik Finnstrom, Senior Vice President Exploration Excellence in Statoil, believes the Diskos solution provides Statoil with secure and consistent data storage (Photo: Ole Jørgen Bratland, Statoil)

Lukoil experts impressed with Diskos:

"Lukoil's international experts were very impressed with the vast data volumes Diskos allowed them to access," says Egil Bergsager, senior adviser in Lukoil. (Photo: Emile Ashley).

-Second to none

Russian Lukoil is one of the latest newcomers on the Norwegian Continental Shelf. The international oil giant is clear about its opinion of Diskos: Second to none.

Lukoil Overseas North Shelf was established in Norway in April 2012 after Norway and Russia reached agreement on the demarcation line in the Barents Sea two years previous. Lukoil decided to join in the previous licensing round (22nd), where it received partnership in two licences in the Barents Sea.

One (PL 708 – 7130/4,7) is located in the eastern part of the Finnmark platform, not too far from the demarcation line, and Lundin Norway is the operator (40 per cent), while Lukoil, North Energy and Edison each have 20 per cent. The goal is to start drilling in November of this year. The other block (PL 719 – 7321/8,9) is located more centrally in the so-called Fingerdypet and is operated by Centrica (50 per cent), with Lukoil (30 per cent) and North Energy (20 per cent) as partners. A decision has not yet been made on drilling here.

The newcomer in the north is quite a force to be reckoned with. With approx. 20 billion barrels in oil reserves, Lukoil is one of the world's largest publically listed oil companies, among the so-called IOC. Lukoil Overseas North Shelf has offices in Oslo with 21 employees. The office is managed by Leonid Surguchev, who started working for Rogaland Research in 1990 and has lived in Norway since. He held a central position in Rogaland Research, later IRIS, until he became CEO of Lukoil Overseas North Shelf.

"Lukoil believed that the other companies, with years of experience in interpretation and geology in the North Sea and Norwegian Sea, were miles ahead here. We have more equal footing in the Barents Sea, which we are currently focusing on, we have more

equal footing, while we can also use our experience from the Russian sector. The Norwegian part of the formerly disputed area in the Barents Sea corresponds to approx. two-thirds of the Norwegian part of the North Sea. Lukoil is optimistic with regard to the opportunities for commercial oil discoveries," says senior adviser Egil Bergsager in Lukoil Overseas North Shelf.

"Like all other major oil companies, Lukoil has designated international expert environments which the subsidiary in Norway takes advantage of when preparing applications for the licensing rounds. Many of these experts, who live in Moscow and Dubai among other places, had their first encounter with Diskos in connection with preparing for the 22nd round on the Norwegian Shelf. Oil administration varies from country to country, with advantages and disadvantages. In Norway, our experts were very impressed with the vast data volumes which Diskos allowed them to access, and how it easy it was to find exactly what they were looking for. The Lukoil experts' verdict was clear: Diskos is Second to None. This may sound a little like bragging, but the conclusion comes from people with extensive international experience, who know what they're talking about," says Bergsager, who is one of the veterans in Norwegian oil activities.

Lukoil Overseas North Shelf AS considers Diskos an important collaboration between the Norwegian Petroleum Directorate, the oil companies and the IT industry. The result is innovation and development that strengthens the Norwegian Shelf within resource management and safety and also gives players support for investments.

"Diskos is our most important tool when it comes to obtaining up-to-date information as a basis for the activity on the Norwegian Shelf. It provides efficient access to all types of seismic and well data from the entire Shelf and helps us with quicker interpretation, and to make better decisions. The experts use the information from Diskos in old and new projects efficiently and confidently and thus avoid additional costs related to unreliable or homemade ad hoc solutions. For us, the result becomes streamlined project planning and decision-making processes. Diskos helps us control the flow of data, so it doesn't overwhelm us," says senior adviser Egil Bergsager.

Lukoil Overseas is among the 40 companies that have submitted proposals for blocks they want to have included in the 23rd licensing round on the Norwegian Continental Shelf. The nominations cover 160 blocks, 140 of which are located in the Barents Sea.

LUKOIL

Lukoil is the world's largest publically listed oil company by oil reserves, and number three (behind ExxonMobil and BP) by oil and gas reserves. The company has a total oil production of about 2.3 million barrels per day. The latest addition was the ownership interests in the West Qurna field in Iraq which started producing in April of last year, on time and on budget. The field increased Lukoil's total oil production by about 400,000 barrels of oil per day.

Lukoil has operations in 39 countries, including the US where it e.g. has petrol stations and more than 100 employees at its Houston office. The international operations comprise the entire value chain including exploration, development, production, oil refineries and petrol stations. The total number of employees is about 150,000 and the company is headquartered in Moscow.

Lukoil was founded in 1991 through a merger of the three companies Langepasneftegaz, Urainefteggaz and Kogalymneftegaz, and the name LUKoil comes from the first letter of the three previous companies.

CGG's Global Director of Technology Solutions:

- Instant access to everything

"We have extensive international experience in handling large geoscience databases spanning hundreds of petabytes. This allows us to offer Diskos members significant savings and increased productivity, while enabling them to share all exploration data from a single site with immediate access," says Kerry Blinston, Global Director of Technology Solutions – Data Management Services in CGG.

"We have spent most of our time since winning the contract in December 2013 on implementing our systems in Diskos, building up an infrastructure, purchasing, quality assessment and data verification, copying and loading. Operation of the database started in January of this year, and the contract runs to the end of 2020. The system also includes production data, in addition to seismic and well data.

Kerry Blinston splits the start-up process into three parts:

1: In January 2015, transfer of the Diskos data from the previous operator's (Landmark) data centre to CGG's data systems was complete, following value estimation, verification and copying.

2: The next critical step was to move all of the data over to CGG's infrastructure, with back-up copies. In a process like this, it is extremely important to make sure there are no weak points, and that the data remains under constant protection against any and all types of incidents or catastrophic events.

3: It quickly became apparent that there was a need to replace or supplement all of the relevant systems to ensure optimal utilisation. This came as no surprise to CGG. This is exactly what Blinston and his eight colleagues at the office in Stavanger have been working on since February of last year – and the work is still proceeding at full speed. CGG has offices at Ipark in the Norwegian Petroleum Directorate's neighbourhood at Ullandhaug.

The faster we identify the needs of the future, the earlier we can meet them," says Kerry Blinston, CGG's Global Director of Technology Solutions. (Photo: Emile Ashley).

PARTNERS

To ensure the best possible performance of the contract, CGG has selected two main partners for the Diskos contract. Kadme, a Norwegian software company, is familiar with Diskos from previous work, and will add local expertise to the project.

The other main local partner is Evry, a major

Nordic IT company, which will be responsible for the physical IT infrastructure and will host the Diskos solution. Evry is located at Forus, and Blinston says that the company lives and breathes IT infrastructure, is familiar with the local market, and has offices that are well-suited for these tasks, both in terms of practicality and security.

Some of the data from the members comes in to Evry via the internet, but most is received in physical format, as tapes that are loaded into large disc and tape robots. These are controlled by CGG from Ullandhaug as regards description and ownership, etc. before they are loaded into the databases where users can extract copies. The primary data storage is in Green Mountain Data Center, the former underground submarine hall on Rennesøy island near Stavanger, while the back-up-storage facility is at Evry at Forus.

The CGG contract has increased automation as regards uploading and downloading data. While these were previously manual operations to some extent, the data parameters are now quality-assured instantly online. Use of more fine-grained standards also makes it easier to retrieve the data, and to understand it. These improvements also make it easier for the NPD to check that it is receiving all the information it should be getting according to the companies' own descriptions of the operations.

"Another good news in the contract with CGG is that standard downloading of well data is now free. Even though it was not particularly expensive before either, we don't need to charge for services that don't cost us anything," says Blinston. However, users will have to download the information themselves.

"My job in CGG is mainly linked to the so-called Technology Solutions business, where the customers can benefit from several of the services we offer, just like for Diskos. In short - Data Management Services handles that data throughout its entire lifecycle. We extract the raw data, perform quality control and manage the data bases, standardise, analyse, interpret and follow up the data on behalf of the users all the way to the end of the process when the data is destroyed," says Blinston, who lives in Wales, but commutes regularly to Norway and CGG at Ullandhaug.

CGG

Is a fully-integrated geoscience company that provides geological, geophysical and reservoir data to companies around the world. Its customers are mainly oil and gas companies, and a few mining companies. The group employees more than 9800 people worldwide and is headquartered in France.

CGG has three main priority areas:

Equipment division – designs and builds hydrophone cables and other special equipment for its own seismic vessels. Its customer list also includes most of the worldwide seismic fleet.

Acquisition division – collects seismic information from the sea, air and land in the search for both conventional and unconventional hydrocarbons.

Geophysics & Reservoir division – collects data from vessels and wells for processing. In addition to offering data to others, CGG can also interpret the data for its customers using its own specially developed software.

SIGNING OF CONTRACT: NPD signed the new Diskos contract with CGG on December 3, 2013. Back row from left : Henri Blondelle (CGG) , Ian Moores (CGG), Jan Bygdevoll (NPD) , Kjell Arne Bjerkhaug (KADME) , Ola Thuen Neergaard (PWC) . Front row, from left : Elin Aabø Lorentzen (NPD) , Eric Toogood (NPD) , Kjell Reidar Knudsen (NPD) , Bente Nyland (NPD) , Kerry Blinston (CGG) , Stephen Gallant (CGG) , Morten Taksrud (PWC). (Photo: Rune Goa).

WORKFLOW

"We have pledged to offer our users a broader range of functions than they currently have. Many are sceptical when it comes to applying solutions they don't use themselves, but our experience is different. When they start to use the new systems, that's when they realise what they have been missing all along. A lot of this is already included in the contract; however, in time CGG will also offer new services based on what the Diskos reference groups define as essential to advance the programme. The faster we identify the needs of the future, the earlier we can meet them," says Kerry Blinston.

One of the solutions CGG is working on is to let the customers integrate metadata and common functionalities into their own user interface enabling them to evaluate and order data from their own systems. One such example is geographic map packages linked directly to the desired data. It's all about having the fewest possible steps to achieve maximum information. Blinston calls this "workflow integration", in contrast to systems where users have to log on to the respective databases to search for and extract data via discs or tapes. Now everything can be done directly from the user's own keyboard. CGG and it's partners develops the technology that is part of the contract, but the customers have to find out the best way to use it.

HOCKEY STICK CURVE

After 20 years of operation, Diskos is one of the world's largest national databases when it comes to seismic, well and production data. Recent years have seen explosive development in the volume of data which takes the graphic form of a horizontal hockey stick. As of the end of 2013, the database contained 400 terabytes. The following year this had risen to nearly1.2 petabytes and by year-end 2015 the figure will probably be around 2.2 – 2.5 petabytes. This represents a 5-6-fold increase over two years. It is estimated that the data volume could grow by another 20-30 petabytes during the course of the six-year contract.

"Not a problem," according to Blinston, who tells us that CGG has built a new, flexible infrastructure architecture which meets all the requirements for greater volume, cost-efficient storage and frequent connections from users. These solutions have been custom-developed for Diskos, but also contain elements from CGG's activities elsewhere around the world. The challenges have been solved through extensive use of automation and new price models based on how often the data is used. The challenge associated with all of the data that is not used as frequently is how to store them at a low cost, but in a way that still allows rapid access when requested. Data that is used often must be available immediately – and therefore costs more," Kerry Blinston explains.

CGG has two types of operational software that work together to resolve all of these issues. One of them is Kadme's WhereOil program which crawls through CGG's databases and shows users what is available. After they make their order in WhereOil, it is forwarded to CGG's own custom-developed Trango software, which is the operational part of the system that completes the job.

BIG DATA

In addition, CGG also works extensively with so-called big data technology. The basis here is that

BIG DATA

Big data can be defined as data sets that are so large or complex that normal data processing and applications are insufficient. The Gartner information technology company defines Big Data using 'three Vs':

- Volume (major).
- Variation (of information).
- Velocity.

In conclusion, Big Data is large and varied data volumes that are constantly changing.

BACK TO PRESTACK

The background for the enormous growth in data flow into Diskos is that the Norwegian Petroleum Directorate ordered the companies to enter all raw data, called field and prestack data, in 2012. Some companies were already doing this, but most limited themselves to poststack data, which is a processed and compressed version of prestack, and which thus contains less information. The NPD's instruction increases the total volume of data entered into Diskos by a magnitude of 10-20.

Since the change is so recent, the loading has barely gotten started. But most of the field and prestack data that is in Diskos now has yet to be released, although it is available to the partners in the licences. So far, however, the oil companies have taken a somewhat 'wait and see' attitude to using the prestack data, often due to increased complexity and lack of access to relevant software. Many geophysicists are also unfamiliar with the technologies and techniques needed. We are also talking about large servers and high-speed connections that are often quite costly to install.

According to Kerry Blinston, CGG is working on developing cost-efficient technology to encourage companies to increase their use of prestack. Put simply, the users will no longer have to extract the entire prestack package, but rather define which parts they want. The original 15-20 terabyte files can then be reworked and converted into smaller files that make it easier for users to extract information.

This is how Kerry Blinston and CGG want to refine and develop the 20-year-old Diskos concept: the more data available, the better the chance of achieving good results.

most of the data is captured or locked in different file systems that cannot easily be coordinated. CGG has undertaken an international effort to break down these barriers and has arrived at a mix of manual and automatic processes to extract synergies the human brain does not have the capacity to discover.

"This is not part of the contract, but it is part of our vision. We don't think all companies will want to spend a lot of money on this type of analysis now, but if we can find and visualise interesting and predictive geological patterns and trends, the companies could achieve substantial time savings and security benefits when they design their drilling programmes. We cannot offer this service right now, but if anyone wants it, we could have it up and running in 12-18 months. How long it might take before the system is in regular conventional use will depend on the price of oil and other trends in the oil industry. But I am thinking 2-4 years. That means that Diskos has the chance to be the first in the global oil industry to start using this system," says Blinston, who notes that this analytical tool is already used in other sectors, such as the aerospace who cooperate on aircraft engine maintenance.

For dummies

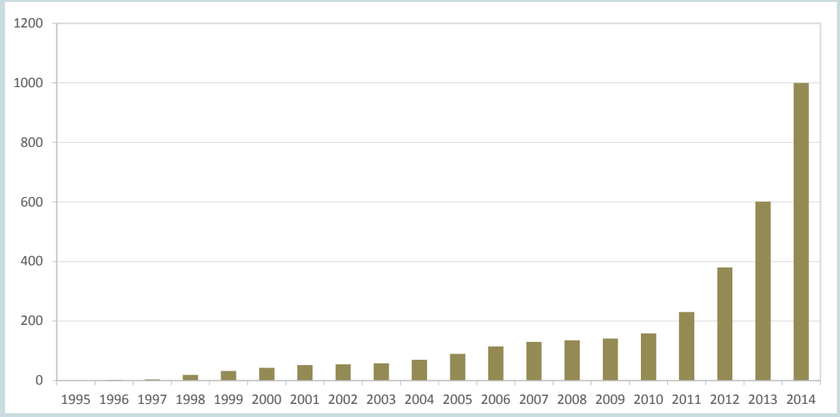
FIELD DATA: All raw data aquired by a seismic vessel.

PRESTACK DATA: Field data that is somewhat processed and compressed and thus contains somewhat less information. The trend is toward more use of prestack, which is 10-20 times larger in volume than a poststack.

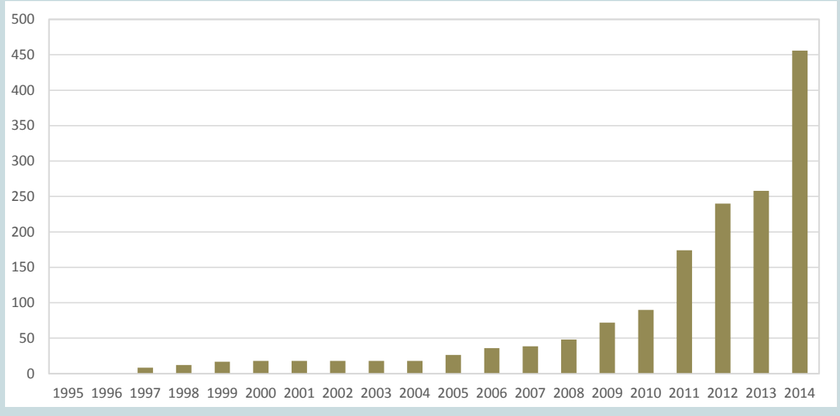
POSTSTACK DATA: Processed prestack data, with even less information. So far the most common basis for the oil companies' interpretations and analyses.

Prestack and poststack data is used in connection with both exploration and production.

DATA VOLUMES IN DISKOS (TERABYTE)



DATA DOWNLOAD (TERABYTE)



Project manager Eric Toogood:

- Diskos goes next level

"We have big expectations for the new partnership agreement with CGG. The goal is to build on 20 years of success and bring Diskos to the next level," says Diskos manager Eric Toogood, and points out several focus areas for the upcoming years:

Metadata and navigation data are essential for effective exploration. Metadata deals with obtaining maximum information about the data, and the navigation data tells us exactly where on the globe the data originates. The more the users know about where, when, how and under what conditions the information was collected, the greater are the possibilities for placing the drill exactly where the oil is.

"Specifically, we can take a basis in a seismic vessel at sea," explains Toogood. The sound waves that return and that are being interpreted are affected by a number of factors, such as where in the sea the ship is, the weather, wave height, ocean currents, temperature and salinity/density of water. All of this information can help in its own way to improve the quality of a geologist's interpretation work.

There are a lot of stories from all over the world about wells that missed the reservoir by just a few metres, this has happened in Norway too. When each drilling operation costs hundreds of millions, efficient handling of metadata is essential, and could also result in major savings. "There are also examples of companies drilling in the wrong place in the block, but who still found oil, but this is most definitely the exception," says Eric Toogood with a smile.

When offering a simple illustration of the useful value of metadata, he references Stavanger Taxi's app for ordering a taxi. Many find that it lists the neighbouring house as the pickup address. This usually ends well for the person waiting for the taxi, but is a little too inaccurate for the oil explorers.

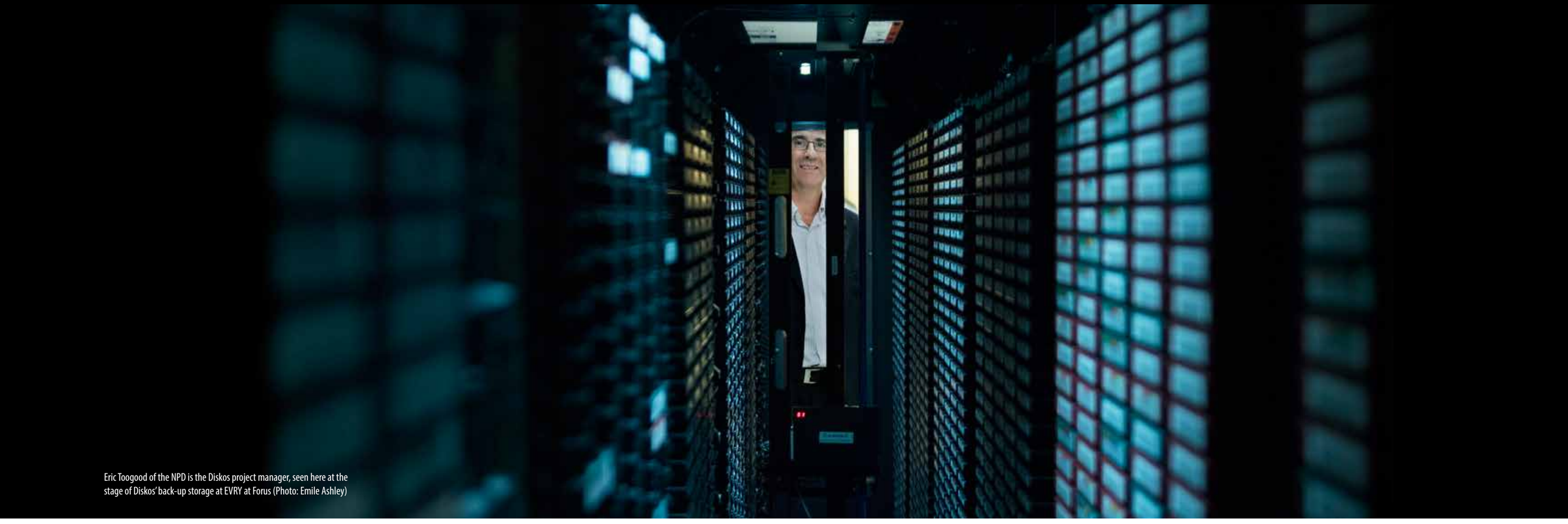
Another technology that could take Diskos further is related to the Big Data term. The Diskos database is one of the largest of its kind. It contains well data from the first drilling operations in 1966 and seismic data from 1980 (data from before 1980 has mostly been re-shot, with better quality). Up to today, the information has been collected using varying methods and technologies from the North Sea, Norwegian Sea and Barents Sea. The goal is to use all of this information at the same time, across the ocean areas, and have the geologists on the lookout for similarities in patterns and trends that are hidden to even the most trained eye. When Big Data combines data storage structure and new software, it could result in information from the North Sea providing new plays in the Barents Sea, or the opposite.

Eric Toogood believes everyone benefits from the Diskos business model. (Photo: Emile Ashley).

LIVING DATA

Few other technologies have undergone bigger changes over the past decades than those relating to data. Most people over a certain age probably remember the Commodore PCs or other artefacts from the early ages. Much of this initial technology and equipment is no longer useable with the consequence that the relevant data is also no longer accessible. It is therefore an important challenge for Diskos to keep the old data alive so it can be used regardless of the technological development. It is impossible to predict just what the needs will be in 50 or 100 years from now. The only thing that is certain is that no one can rule out that the data from the Norwegian Shelf could also be an invaluable resource after the oil age.

The project manager notes that, just a few



Eric Toogood of the NPD is the Diskos project manager, seen here at the stage of Diskos' back-up storage at EVRY at Forus (Photo: Emile Ashley)

decades ago, hardly anyone imagined that the seismic and well data of the time would be used to locate potential CO2 storage sites in the subsurface. However, this is exactly what happened when the Norwegian Petroleum Directorate, tasked by the Government, made a CO2 atlas of "available and sealed" reservoirs as a step in the carbon capture and storage debate.

Though this is not relevant in Norway, Toogood also references all of the knowledge 2-300 years of mining industry in the UK has generated without this being captured. Had this information been available today, it would most likely have made interesting contributions in the hunt for shale oil and gas, as an example.

WORKING IN THE CLOUD

Over the next 15 years, Toogood pictures a major increase in data volumes from the Norwegian Shelf as a result of the changes in the NPD's reporting requirements and the steadily improving acquisition methods, for example in the continuously increasing volume of information per seismic second. This requires greater transmission capacity. So far, this interaction has been solved using increasingly thick fibre cables, to put it simply.

The principle is that the user, for example at Forus or Lysaker, uploads large data volumes from the storage at Rennesøy. With ever increasing data volumes in storage, this technology could become a bottleneck with regard to time. The solution could also be that the users, regardless of where they are located, work directly with the Diskos database where they also have their own storage. Somewhat like the cloud system for PCs and phones.

Diskos also contains quality-assured production data from the various fields on the Shelf. Before, only the NPD and licensees had access to this information, but members can now also gain access. Detailed information about how production has developed from the start may be very interesting to companies that are considering buying in to the fields.

INCENTIVES

The business model was made so it provides CGG with financial incentives to offer additional services in competition with others. This opens the door for even more and improved use of the stored data. The authorities' mindset is that the more information is reused in different contexts, the cheaper and more efficient the exploration processes become – benefitting both companies and the authorities.

The fixed price system also entails that CGG needs fewer people to serve the users, which results in more profit. This means an increasing degree of self-service, which rewards companies with insight and efficiency.

"All of this reinforces the impression that everyone is in the same boat, both large and small users," says Eric Toogood, who has the definite impression that all parties are satisfied with the current practice.

"The Norwegian Petroleum Directorate will not earn a profit from Diskos. In order to get the greatest possible activity in and out of the database, the authorities are concerned with keeping costs low. Luckily, things are moving in the right direction," says project manager Eric Toogood, and compares the development with what happened within telephony. Before, people limited calls as much as possible and were hesitant to make long distance calls. Now that prices have dropped so much, very few give it any thought when they need to reach someone or something on the phone.

In line with the development in the data industry, Diskos has also benefitted from substantial capacity increase with associated declining prices for data storage, both on disc and tape. Where before truck loads were needed to move storage media, now tape cassettes that store up to 250 times more information than the old are used. Diskos data is currently stored both on disk and tape, disk provides quick access to data that is used frequently, while tape is suited well to store large volumes that are less 'active'. The administration of data storage between disc and tape is optimised to reduce total operating costs.

THE NPD AS ADMINISTRATOR

Over its 20 years, the Diskos membership base has increased from 16 to 57 oil companies. The NPD has been there all along, and administers Diskos, which has two employees, project manager Eric Toogood and assistant project manager Elin Aabø Lorentzen. Their primary task is as the link between the members and CGG and Kadme, who won the contracts in 2013 and took over responsibility for development of the programmes and operation of the databases from 1 January 2015.

According to the current payment scheme for data, Statoil and the other major and well-established companies have the largest expenses related to Diskos because they add and retrieve the most data, both historically and currently. Generally, the scheme may seem more beneficial to smaller newcomers who, by buying into a licence, gain access to vast data volumes they have never before seen. But nothing is free. According to Eric Toogood, the seller of the ownership interests has already added the value of the Diskos access into the price paid by the newcomer. It is a win-win for the "old" companies in the licence if the newcomer meets its own expectations, puts old data into a new context and adds significant assets to the partnership.

Anniversary committee

Vidar Danielsen, Lundin Norway AS

Vidar has a civil engineering degree from the Norwegian Institute of Technology in 1981 in petroleum prospecting and has worked in both oil and oil service companies since. In a Diskos connection, Vidar has been both a user and participant in the establishment of the Diskos bank. He was also responsible for IT infrastructure which the bank was run on for a period.

Vidar on Diskos:
Diskos gave the Norwegian Shelf an advantage ahead of other oil provinces without a corresponding organisation of data of known quality. The fact that all operating companies on the Norwegian Shelf are required to report their data to the NPD via Diskos means that the bank contains all new data. By releasing data according to set rules, the information is made immediately available to Diskos members for further use. In the years ahead, expansion of data types that are stored in Diskos should be prioritised. This will ensure access to more of the data that is collected, which will be useful in the further exploration of the Norwegian Shelf.

Frode Weibell, Wintershall Norge AS

Frode has experience from seismic processing in Western Geco. He has been a project manager in Schlumberger SIS and worked as a Data Manager in E.ON E&P between 2009-2012, responsible for data management and organisation of subsurface data. Frode currently works as a team leader for Information & Data Management in Wintershall Norge AS. He has held various roles in Diskos since 1998, e.g. as a company representative in MC, member of Diskos' Steering Group and as the initiator behind the Data Management Collaboration Group in 2011.

Frode on Diskos:
Through my 18 years in the Diskos community, I have seen the incomparable value of having a joint platform, which facilitates one shared national library of data, where the format and standard were defined at an early stage. The data quality (format and standard) on the Norwegian Shelf can therefore be considered the best in the world. I use the Diskos community actively to learn and influence the processes to benefit myself and others.

Elin Aabø Lorentzen, Norwegian Petroleum Directorate

Together with Eric Toogood, Elin constitutes the NPD's Diskos Management Team, which works on behalf of all Diskos members and is the link between the companies and the database operators. She has worked in the NPD since 2003 and has held many roles throughout the years, within management, document administration, information management and IT-related projects. Elin has a bachelor in library and information science.

Elin on Diskos:
The key to Diskos' success is collaboration. From the start, companies and the authorities shared the goal of achieving a joint solution and they succeeded thanks to good cooperation. In order for Diskos to be sustainable for at least another 20 years, it is important that the solution develops in line with the times – that it takes new technology and new data types into account. But most important of all are the people behind it all and the goal of a national database with petroleum data that is quality controlled.

Kjell Reidar Knudsen, Norwegian Petroleum Directorate

Kjell Reidar has a degree in petroleum engineering from the Rogaland District College (now the University of Stavanger) in 1974. After two years heading a water drilling project in Africa, he was hired as a reservoir engineer in the NPD in 1977. He has worked as head of section of various departments until 1991, when he became head of the newly established data management department. After the reorganisation in 1998, he was on the management team in the Resource Division. He is now a senior adviser. Kjell Reidar has been the NPD's permanent representative in the Diskos Management Committee and Diskos Steering Group since they were established more than 20 years ago.

Kjell Reidar on Diskos:
In my opinion, Diskos is the perfect example of a win-win solution. The authorities save major resources that would otherwise have been spent on administering and maintaining a vast data archive, and every company that is a partner in a production licence does not have to store copies of the same data. Diskos also provides everyone with a good overview of which data is available and makes it easy to download data when needed for technical interpretations and analyses.

Gunnar Sjøgren, Norwegian Petroleum Directorate

Gunnar has a degree in philology from the University of Bergen. After working ten years for the government (education and National Archival Services of Norway), he was hired by Statoil in 1992, and was responsible for preparing and uploading all of the company's data into the Diskos database. From 1998 to 2005, Gunnar worked for Petrodata and was responsible for operations, sales/marketing and business development. He was also used extensively by PetroBank for international marketing. In recent years, Gunnar has worked most on communicating Norwegian experiences from the petroleum sector to "new" petroleum nations; Latin America, Africa and the Middle East. Data Management has been key in this work.

Gunnar on Diskos:
The Diskos collaboration has been very significant for the position of the Norwegian Shelf in international petroleum development. The unique access to data which characterises the petroleum development in Norway is without equal globally and an important reason why petroleum production remains at such a high level, and that a large number of companies are active on the Norwegian Shelf. The access to vast volumes of public data and the active administration of petroleum resources, is a shining example for a number of countries all over the world.

Eric Toogood, Norwegian Petroleum Directorate

Eric has an education in library and information science from the Norwegian Library College (now the Oslo University College) and has been in charge of Diskos since 1999. He has more than 30 years of experience in the oil industry from various management positions within data and information administration and has worked for the NPD since 1987.

Eric on Diskos:
Diskos has grown since the beginning in 1995 as a relatively small but sophisticated database with few users, to the current application with more than 70 participating companies that have online access to essential exploration data. The focus has always been on quality based on databases that are as historically exhaustive as possible. Security is a main priority so that no data is lost. The business model is cost-effective for users, while it also provides the operator with incentives to continuously improve the systems.

DISKOS

NORWEGIAN PETROLEUM DATA