

"The challenges we face at Statoil are changing. On one end we have mature fields that continue to get more technically complex. On the other end, we have HPHT field developments that require cutting-edge technologies," said Statoil vice president Per Haaland. Shown here, Kviteseid is one such project that demands the industry's best technologies.

Statoil photo





Rune Johansen, Statoil photo



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Øyvind Hagen, Statoil photo

Evolving frontiers

Change is coming, and Statoil wants to be an implementor, not a follower

By Linda Hsieh, associate editor

WITH 22 DRILLING operations and seven well operations in Norway alone, **Statoil** is running near full capacity these days. Furthermore, it has plans to amp up activities even more in the next couple of years, according to **Per Haaland**, Statoil vice president.

The company is currently working with 10 floaters and 13 platforms on the drilling side, and with coiled tubing and wireline on well operations. Over the next couple of years, three additional rigs will arrive to work for the company. **Odfjell Drilling's** Deepsea

Bergen will commence operations in the Halten area in mid-2008. Two newbuilds — **Odfjell's** Deepsea Atlantic and **Aker Drilling's** Aker I — will be delivered in late 2008 and early 2009, respectively. The Deepsea Atlantic will go to the North Sea, and the Aker I will work in the Halten area.

“Contracting these two newbuilds is one way we’re implementing new drilling technologies,” Mr Haaland said. “We’re saying that we want to be a part of the fleet renewal, and we’re doing it through long-term contracts.”

Contracts for the newbuilds carry firm periods of four to five years for the Deepsea Atlantic and three to 10 years for Aker I. Contracting the newbuilds, which embody the complete HSE picture, is also critical from an HSE perspective as Norway continues to move towards tougher requirements. Mr Haaland added that Statoil has contracted the drilling rigs they need so far, so the next developments will need further capacity.

COMPLEX PORTFOLIO

With mature fields such as Statfjord and Gullfaks and frontier fields such as Kristin and Kvitebjørn — as well as everything in between — it's no understatement to say that Statoil manages a complex portfolio. "The challenges we face at Statoil are changing. On one end we have mature fields that continue to get more technically complex. On the other end, we have HPHT field developments that require cutting-edge technologies," Mr Haaland said.

Statoil currently has a platform development on the North Sea's Kvitebjørn. Production on that field was temporarily shut down in May to allow for drilling of two further production wells. Statoil is

Discovery at Ermintrude prospect

Statoil has made an oil discovery in the North Sea's Ermintrude prospect. Deposits are estimated at about 50 million bbls of recoverable reserves. Wildcat 15/6-9 in block 15/6 lies 10 km north of the Sleipner area. The well was drilled in a water depth of 114 m to a TD of 3,850 m below sea level. Drilling was halted in rocks of Triassic age.

The well was found to contain light oil in sandstones of mid-Jurassic age. A small gas find was also proven in sandstones of Tertiary age. According to Tim Dodson, Statoil senior vice president for exploration in Exploration & Production Norway, a sidetrack well will be drilled further up in the Ermintrude structure to establish if there's gas/condensate above the discovered oil.

Seadrill's West Epsilon is drilling in Ermintrude and will continue its Sleipner area exploration program afterwards. It is on a three-year contract with Statoil.

introducing managed pressure drilling on the field to control depletion, risk of fractures and lost circulation. The MPD technique used involves manipulating equivalent circulating density to stay overpressured through drilling. "We are excited to see how that will work out," Mr Haaland said.

Production on Kvitebjørn is expected to resume in the 4th quarter of 2007.

Also on the HPHT frontier is Statoil's subsea development on Kristin, considered one of the most demanding operations being carried out on the NCS due to its special reservoir conditions.

Due to challenges with the completions during the winter/spring season of 2007, Kristin did not complete the final high-deviation well in the first six months of 2007 as originally planned. The last completion on the original plan will most likely finish during July/August 2007, Mr Haaland said.

The drilling and completion program on Kristin will also be extended with two more increased oil recovery (IOR) wells. One well will be on the N-template, and the second well will be from a new four-slot template in the very south part of the field, called the Q-template. The Q-template will be installed during last part of June 2007.

"Fields such as Kristin and Kvitebjørn require everything that an organization has in terms of knowledge and capacity," Mr Haaland said. "If you don't treat these fields like the extreme development they are, they could be failures."

INFILL DRILLING

In recent years, Statoil has focused on through-tubing rotary drilling (TTRD). This technique of drilling sidetracks from wells through the existing production tubing has provided substantial cost

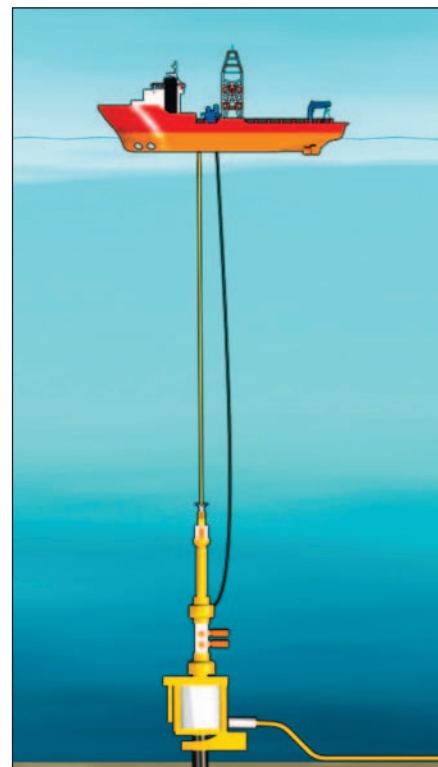
reductions. According to Statoil, savings are approximately NOK 10-20 million per operation performed on production platforms. On subsea templates, that number rises significantly — to the range of NOK 100 million. Statoil first began performing TTRD from floaters in 2006, Mr Haaland said, and it has proven a cost-effective way of making well targets.

In contrast with through-tubing rotary drilling, he said, coiled tubing has less downhole power and is less robust. It didn't pay off after several attempts, and its use has been reduced at Statoil.

MAINTENANCE

For Statoil's more mature subsea wells, maintenance has become increasingly important. One instrument they've found is purpose-built, riserless well intervention vessels. These vessels perform light well intervention tasks that involve wireline-based workovers of subsea wells. The wireline is run directly through the sea to the well through a gate and safety valve, enabling work in a pressurized well. The need for risers is eliminated.

The Island Frontier, a light well intervention vessel operated by Norway-based Island Offshore Management, was first



Statoil photo

Using light well intervention vessels such as the Island Frontier, Statoil hopes to take the hydrocarbon recovery factor of subsea wells from 43% to 55%.

used by Statoil in 2006. Construction of a second purpose-built vessel, the Island Wellserver, began in early 2006 and is scheduled to take over intervention work for Statoil in early 2008. Initially it will be used for water depths up to 400 m (1,312 ft), but Mr Haaland believes that, like the MPD applications on Kristin, light well intervention will move to Statoil's deepwater portfolio as well when those wells have matured.

According to Statoil, the goal in using these vessels is to take the hydrocarbon recovery factor of subsea wells from 43% to 55%.

On the equipment side, Mr Haaland pointed out, the maintenance of aging drilling facilities is another challenge that Statoil is undertaking gradually.

VOLVE FIELD

One technique Statoil is using on the Volve field is utilizing a rig as a combined drilling and production facility. In early May, **Maersk Contractors'** Maersk Inspirer, one of the world's largest jack-ups, was mobilized to Volve, one of the NCS's smallest oil fields in the North Sea.

According to Statoil, an independent development of Volve means additional resources can be phased in later. "The idea is to have the rig on Volve for six to 10 years, drill the initial wells, then perhaps drill more wells as we build up more knowledge about the field. When the field is drained, the whole installation can move to other field developments. In essence, we have hired an integrated and movable drilling and production platform," Mr Haaland explained.

Production on Volve is expected to begin in the third quarter 2007.

TECHNOLOGY ADVANCEMENTS

To stay on the forefront of technological advances, Statoil has increasingly move towards multilateral wells and smart completions. Because investments need to be made upfront in the completion design, Mr Haaland said, a different way of looking at increasing recovery is required. By manipulating the flow characteristics of the well into the completion, different zones in the reservoir can be more efficiently drained.

"Experience will tell us if the actual reservoir development will follow the simulations and whether the equipment will operate as predicted for its lifetime," he said.



Odfjell illustration

The semi Deepsea Atlantic, scheduled for delivery in early 2008, is designed for harsh-environment drilling and can operate in sensitive areas such as the Barents Sea. Its contract with Statoil has a fixed duration of four or five years.

Norway-based Odfjell Drilling tackles rig communications for the future

The sixth-generation semi Deepsea Atlantic, contracted by Statoil, is being built by Daewoo Shipbuilding and Marine Engineering in South Korea, with construction follow-up from the manager, Odfjell Drilling, for rig owner Odfjell Invest Ltd.

Odfjell Drilling is a leading drilling and well service contractor in the North Sea with almost 35 years of experience. It has current operations on 14 platforms in the North Sea, including 11 in the Norwegian sector for Statoil, Hydro and ConocoPhillips, and three in the UK sector for Talisman. Odfjell also operates 3 semisubmersibles in Norway, including the Deepsea Bergen working for Marathon Norge on the Alvheim field, and Deepsea Delta and Deepsea Trym, both working for Hydro.

Construction of the Deepsea Atlantic is ongoing in South Korea, with delivery scheduled for 2008. A second newbuild will be delivered in June 2010 with the project name Deepsea Rig, and is still uncommitted. The rigs, of identical design, are built for harsh-environment drilling in water depths from about 70 m to 3,000 m (200-10,000 ft) with riser storage for up to 3,000 m (10,000 ft). They will be DP3, dual-derrick rigs equipped with a HPHT deepwater BOP/MUX control system. Both are suitable for drilling in environmentally sensitive areas such as the Barent Sea, with design emphasis on zero-discharge systems, low emissions and electrical solutions to reduce onboard

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oil volumes to mitigate pollution risks.

Both rigs also will be positioned to be leaders in what Odfjell's operations manager Simen Fugelli calls a trend for the future — integrated operations. The newbuilds' designs incorporate centers to support onshore operations, where real-time data can be shared and real-time decisions made.

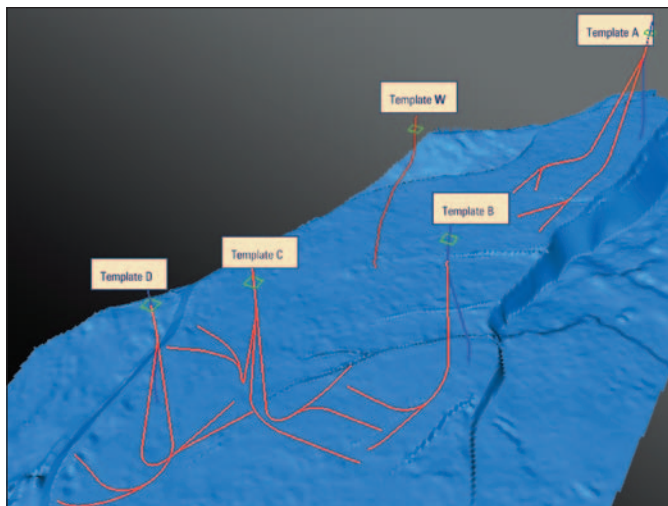
"These will not be ordinary offices," Mr Fugelli said. "They will have full video-conference systems, portable video systems, monitors for offshore equipment that send data directly onshore to be analyzed, and they will have the possibility to connect software directly onshore, where they can do software modifications on the rig."

In combination with Odfjell's onshore support center, specialists in different locations can take virtual journeys through video screens, communicate and collaborate.

Such integrated operations are already taking place on several Odfjell rigs in the Norwegian sector, and Mr Fugelli said the company is working on bandwidth issues in the UK sector to bring those rigs on as well.

"This is communications for the future," he explained. "The entire industry is moving towards that. In the future it will be worldwide because it provides cost savings and other benefits even for low-cost countries."

Check on www.drillingcontractor.org for an Odfjell Drilling video about onshore support centers.



Statoil plans to install fiber optic cables to the subsea template on the Tyrihans field. This will provide floating rigs the capacity for large data transfers once they dock into the cables.

Statoil illustration

On another front, the industry continues to move towards more sophisticated data transfer between the downhole instrumentation and the surface. So far, fiber optic cables have been installed from all of Statoil's platforms to shore to enable transfers of large amounts of data. In 2008, Statoil plans to install fiber optic cables to the subsea template on the Tyrihans field, Mr Haaland said. Floating rigs will then have the capacity for large data transfers once they dock into the fiber optic cables.

Statoil also is pushing the envelope on extended-reach drilling, with some of the industry's longest step-outs at 10,000 m (32,808 ft) on the Gullfaks field.

"These ERD projects are examples of technologically and operationally demanding wells that require us to train regularly in order to keep personnel competence at a high level," Mr Haaland said. Especially for those used to working with bigger margins, "they need to learn how to deal with small-margin

operations. Operations have to be fine-tuned," he said.

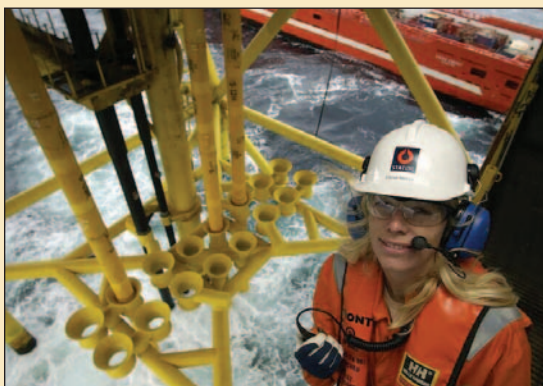
That competence for the optimal management of a project's planning and execution has become critical as large numbers of new personnel enter the industry and newbuilds get delivered. "Knowing that there is higher turnover and less experience, we should put in compensating measures into the employees," he said, such as specialized training.

Finding people willing to work in the oil and gas industry doesn't appear to be a problem, at least in Norway, because the public still sees it as a preferred industry. "The challenge is to find the competence fitting into the industry."

LOOKING AHEAD

Within Norway, Mr Haaland said, Statoil will continue to develop the Haltenbanken area with a combination of standalone field developments and tie-backs to existing processing facilities. While the Heidrun and Norne fields have passed peak production, Kristin is being developed, and the Ormen Lange gas field is scheduled to come on stream in autumn 2007.

Production goals



Statoil photo, Øyvind Hagen

A worker is pictured working on the Kvitebjørn field.

2006 and is expected to increase in 2007. In the first quarter of 2007, total oil and gas production was 1.199 million boe/day. Statoil has plans to maintain production of 1 million boe/day until 2015 on the Norwegian Continental Shelf.

In early May, Statoil modified its oil and gas production forecast for 2007 from 1.3 million boe/day to 1.15-1.2 million boe/day. The shortfall is largely attributed to delayed ramp-up of new fields and delays in projects and activities.

Statoil production on the NCS averaged 958,000 boe/day in

Statoil also will continue to move north towards the Barents Sea. In the spring 2006 licensing round, the company was awarded five licenses, three of them as operator in the Barents Sea. "This

means an increasing focus on strict environmental issues," he emphasized.

Internationally, Statoil is currently drilling in Venezuela and Algeria. Seven exploration and appraisal wells were completed in the first quarter of 2007.



Maersk Contractors photo

The Maersk Inspirer, one of the world's largest jackups, was recently mobilized to Volve, one of the NCS's smallest oil fields in the North Sea. Statoil intends to use the rig as a combined drilling and production facility.

Miranda and Cordelia in deepwater block 31 offshore Angola were oil discoveries, and Hassi Mouina on land in Algeria was a gas discovery.

Further expansion of operations outside Norway are planned, with locations in Nigeria, Libya, Brazil, Indonesia and Tanzania. Statoil also will enter the Gulf of Mexico deepwater market in summer 2008 with a Maersk newbuild. The deepwater semisubmersible, under construction in Singapore, will be able to operate in water depths up to 3,000 m (10,000 ft) and be capable of drilling up to 10,000 m (30,000 ft). Contract duration is four years.

Regardless of location, Mr Haaland said, Statoil will focus on operational cost in the future, due to the gradually smaller fields. "That's where our challenge is, to find out what technical solutions we can get at what cost. Hopefully, technology can help us get to smaller pockets of reserves."

POTENTIAL SOLUTIONS

One important technological solution is in the well design itself. Mr Haaland believes that combining monobores and casing drilling will reduce/eliminate drilling flat spots. "Typical drilling time on bottom is only 20%; the rest is moving pipe. I'm convinced that we can use monobores and casing drilling together to improve efficiency," he said. "Playing with well design also provides other opportunities for things like well length and well dimensions."

Statoil completed its first expandable casing operation last year and is currently working on developing casing drilling.

Completions solutions are needed as well, and Statoil has used screens and

Gjøa field

A PDO for the Gjøa field in the North Sea was submitted in December 2006. Startup is planned for autumn 2010. The field will be developed using subsea templates and semi-submersible platform processing. The field development, which lies north of the Troll field, will open up a new part of the North Sea.

swell packers for zonal isolation as an alternative to complex smart completions.

INTEGRATED OPERATIONS

Another key trend for the future, Mr Haaland said, is that the Norwegian sector will move into the integrated operations environment. This means the infrastructure, connections to platforms and telecom capabilities will gradually move more and more work onshore.

"As much as possible will be done onshore, and offshore will be pure execution. The challenge is being able to use the large amounts of data coming in," he said. "That's how I think this part of the world will develop."

Although no one can predict exactly what changes are in store for the E&P industry, they are definitely on the way, Mr Haaland said. "I'm 100% convinced that in 20 years, we'll be working in completely different ways than now. Something will change us. Whether we like it or not, change is coming." ♠