

World Class Drilling Operations

Text and photos by Torgeir Anda, Aker BP



Tor-Ole Jøssund
Leader of the Ivar Aasen petroleum technology team

Ivar Aasen's start-up is a huge milestone for Aker BP. As operator, the company has completed the development in a challenging period for the industry. It is therefore particularly satisfying that the project was delivered within total budget and on schedule.

Around 17 million working hours were invested in the project and there were no serious HSE incidents. This means that the project has satisfied the four main goals:

- no serious incidents
- a high-quality delivery
- delivery on time
- within budget.

Drilling operations on Ivar Aasen have been world-class in terms of the speed of the drilling, its high quality and good safety. Statistics from Rushmore confirm this (Pic 1). The excellent progress on drilling operations has so far contributed close to NOK 2 billion in savings for the project. This has been an important factor in the completion of the project within the total budget. The drilling has taken place in close cooperation with the Department of Petroleum Technology and the Department of Drilling and Well Operations, along with Maersk Drilling, Schlumberger and other service companies.

The wells on Ivar Aasen are drilled using geo steering. Maersk Interceptor's every move on the Ivar Aasen field is closely monitored from a dedicated office in Trondheim – two kilometres into the ground and two kilometres horizontally through shale, conglomerates and, preferably, through oil-bearing porous sandstone. The sandstone's density and resistance are measured here. The information is checked against the seismic data and interpreted on a continuous basis. Geo steering and close follow-up have contributed to optimising the well locations, which is an important factor in maximising reservoir exposure and achieving the best possible production from the wells.

Best equipment

Maersk Interceptor is the name of the rig that are used on the Ivar Aasen field. It is an impressive sight, with three 'legs' extending almost 200 metres. There are deck spaces the size of football pitches, steel rope as thick as a footballer's calves, with a smoking room for 'non-smokers', a laundry, tanks, winches and drill pipes. The equipment on board is all state-of-the-art. The drilling machine, with its 2,300 horsepower, is the biggest ever made. The degree of automation has increased even further – everything is controlled from the most modern control rooms. Most of it is operated as if it were a computer game. However, it is first and foremost a tool for recovering as much oil from the field as possible – at the right time. The rig can operate in depths of up to 150 metres – the depth on the Ivar Aasen field is 112 metres.

Chaos pilots

The project started drilling five pilots in order to learn more about what is hidden deep below the depths. This clarified whether the reserve estimates for Ivar Aasen could increase or whether they were lower than current estimates. It is the petroleum technology team, known as 'Petek', which is directing where to drill the pilots and they know what questions they want answers to. The test pilots determined whether there is gas in the uppermost section of the reservoir on Ivar Aasen. If gas was present, this will reduce the volumes and hence the value of the field. The drilling of pilots also provided more extensive information at an earlier stage, resulting in swifter clarification of geomodels and drainage strategies programme.

The pilots were a success and provided a lot of new information. The drilling went so swiftly that there was time to drill five pilots, resulting

in important knowledge. The leader of Petek Tor-Ole Jøssund emphasises that a model is always a simplification: *'When we drill, it always turns out differently than we expected. It is more surprising if we do not encounter any surprises. The only thing we know in advance is that we have probably got it wrong. It is always different than we thought. The most important thing in that situation is to know what to do about it.'*

All the knowledge led to a reassessment of the reservoir. Although the volume of hydrocarbons in place (STOIP) was smaller, the reserves amounted to between 200 and 210 million barrels because the properties of the reservoir were better than expected.

Geosteering

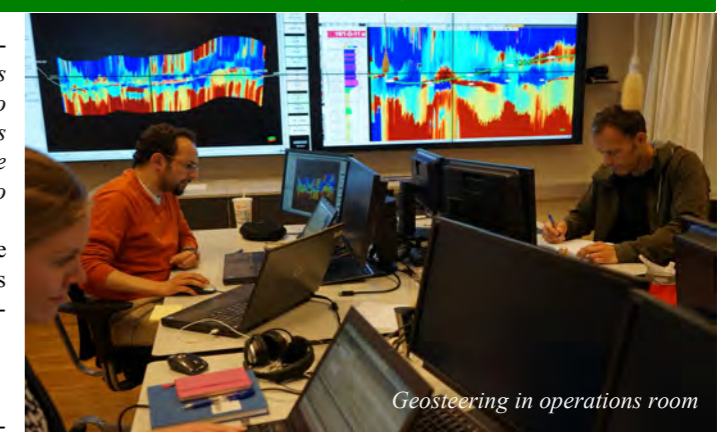
After five swift pilot wells, it was time to drill production and injection wells.

Two kilometres into the ground and two kilometres horizontally through shale, conglomerates and preferably oil-bearing porous sandstone. The sandstone's density and resistance are being measured. The information is checked against the seismic data and interpreted on a continuous basis. There are darcy and net gross, sections and faults. The changes cannot be too sudden, as sand screens must be installed that are not very flexible: Should we drill straight forward, should we go up or down? The cost of every hour runs into millions, but if things are done correctly, hundreds of millions can be saved or made. It is like guessing the next card in a deck – up or down. Tor-Ole Jøssund was responsible for ensuring that the decisions made are the right ones: *'It's like driving a car while only looking through the rear-view mirror. The information we receive from the drillbit is often one hour behind – we are always about 30 metres behind. This means that we have to make choices that in hindsight may prove to be wrong. You do not get the full picture until the next day. That is the nature of geosteering. Ivar Aasen is just as uncertain and complicated as we had envisioned. It will not be plain sailing to produce the oil from this field – but we will manage. The management has told us to lead the way in Petek on the Aasen field. What we do here is world-class; I do not know of anyone else doing the same as us. Here we make important decisions 24 hours a day, 7 days a week – including on public holidays.'* *'The Petek team cooperates very well with the drilling team. They are efficient and do an excellent job. We are one excellent team. I'm really proud of what we've achieved together.'*

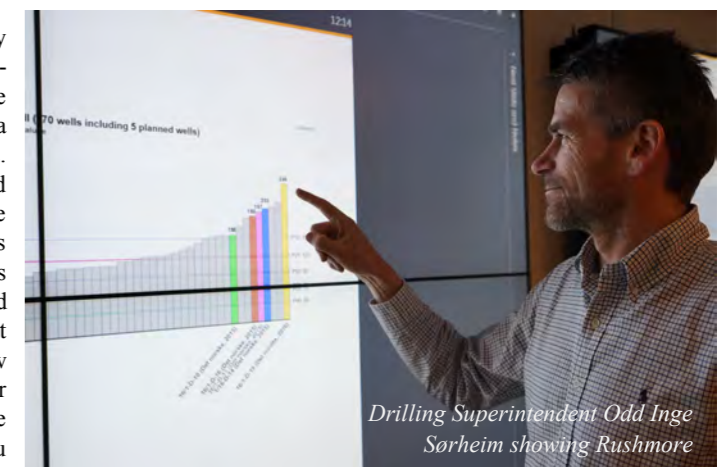
Probably the best

'We shouldn't really say it out loud, but we've probably set a world record in drilling on Ivar Aasen.' Nonetheless, Odd Inge Sørheim is proud of having drilled 246 metres on Ivar Aasen in one day. Now the goal is to be even better.

We are in the control room for the drilling team in the Fønix building in Trondheim. Drilling Superintendent on Ivar Aasen/Maersk Interceptor, Odd Inge Sørheim shows graphs that he believe says it all. A total of 246 metres of drilling progress per day for D-19 and an average of 201 per day for all the six wells combined. The average on the Norwegian continental shelf is about 100 metres: *'The figures don't lie; they show that we're twice as good as the average. That's not bad, but we could do even better.'* When it comes to completion of the drilling holes, so that they can produce the oil, the results are perhaps even more impressive. It took 9 days on average on Aasen, compared with an average of 21 days on the Norwegian continental shelf. There is certainly nothing ordinary about it. Maersk Interceptor has completed 528 metres a day, while the average on the continental shelf is 234 metres. *'There's no doubt that we're the best – by far. I'm sure our completion speed constitutes a world record.'* *'Of course, we have a great rig with an excellent crew, but so do others – without achieving results like these. The success is because we have chosen to work in an integrated team together with Schlumberger, TechnipFMC and Maersk. We all work together and quickly deal with problems as they arise.'*



Geosteering in operations room



Drilling Superintendent Odd Inge Sørheim showing Rushmore



Maersk Interceptor