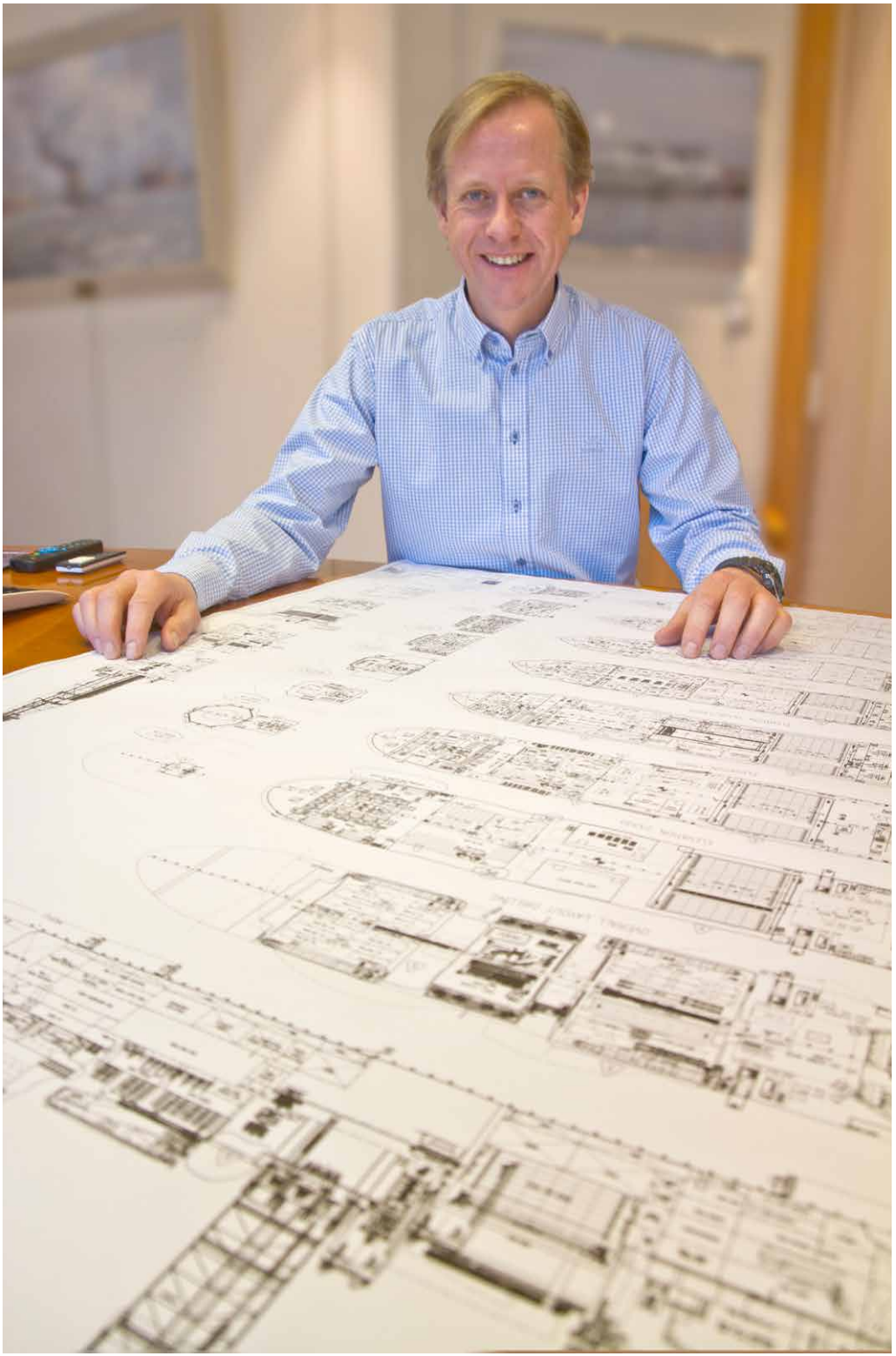

# Independent and connected

As a technology coordinator for the design of new drillships to be chartered to Brazil's Petrobras, Torger T. Kyvik knows what the key to success is in drillship design – close connections with leading equipment manufacturers.

Kyvik is the Offshore and Systems Manager at LMG Marin, the design house based in Bergen, Norway that is one of the world's leading independent designers of drillships. Having good connections with major drillship equipment manufacturers around the world is critical for a company involved early on in design. "Our most valuable resource is our network," says Kyvik.

Any engineer can solve detailed engineering, but to solve problems at the concept stage you need to focus on the important things with support from various technology specialists, Kyvik says.

### Introducing bold ideas early

Novel ideas need to be introduced before basic design starts; that is during a conceptual or initial study when there is time to consider solutions that might entail class societies adapting rules to address new technologies.

For a drillship, the main design concerns revolve around position, power and control systems. As an example of recent technological advancement Kyvik points to the so-called "closed bus" in dynamic positioning systems (see page 93).

Petrobras specified these requirements before they were covered by class rules, and designers and equipment manufacturers are now making this a reality to reduce fuel costs. The DP3 system has traditionally been split in a way that could require several engines to run at low loads, while the closed bus system promises more optimal operation with the same level of safety.

## LMG Marin – innovative design and engineering

LMG Marin – one of Europe's leading independent naval architect and maritime engineering companies – has been serving the maritime and offshore industries for more than half a century.

The Bergen, Norway-based company has references from more than 1,000 ships built at yards around the world, including Arctic vessels, offshore vessels, naval vessels, LNG-powered ferries, bulk carriers, tankers and cargo vessels. Some of the company's projects include:

- Navis Explorer (now Belford Dolphin), deepwater drillship built at Samsung
- KNM Svalbard ice-class coast guard vessel
- E39 212 PBE Gas Ferries (21 knots LNG powered ferries)
- Ramform Sovereign, the world's largest seismic vessel built at Aker Yards
- LNG Gas Ferries for Vestfjord built at Remontowa Yard
- FPSO Conversions
- Espadon class drillships

LMG Marin was founded in 1943 by three naval architects – John Lund, Johan Mohr and Karl Giæver-Enger – whose initials formed the basis for the name of the company. From the first decades when the company founded its legacy on reliability, experience and innovation, LMG Marin has since contributed to the development of the modern maritime and offshore industries in Norway.

Espadon class drillship

The closer to the yard a project gets, the less a technology provider can influence its design. While new technology can influence design at an early stage, the makers list at the yard needs to make room for competing suppliers.

## Multi-discipline coordination

Designing drillships is especially challenging because of the various operational modes as well as the wide range of equipment that must be aligned. That means ensuring that interfaces are in place and various control systems are integrated.
"We don't have detailed knowledge about every system, but we know enough to bring the right people to the table for discussions that need to be taken between the various disciplines," Kyvik says.

His background is in electro and control systems engineering. Before joining LMG Marin in 1998, he worked with condition monitoring systems for ships. The years when he spent 100 travel days installing systems in cooperation with yards all over the world were invaluable experience, Kyvik says. Learning how people on board ships work and how yards differ in their approaches prepared him for the coordinator role he has now.

Kyvik describes his colleagues in the offshore group of LMG Marin as a very dedicated team with a keen interest in technology. The company's Managing Director Geir Lasse Kjersem, who came from Oddfjell, initiated their venture into the offshore segment and brought in new ideas based on his experience with drillships with production capabilities used in the North Sea.

## Secrecy versus shared knowledge

While Kyvik points to the company's open dialogue with multiple stakeholders as crucial to staying up-to-date, he acknowledges that exclusive partnerships and formal agreements on IP (intellectual property) rights are also needed in some cases.

Partners often offer engineering support and detailed drawings that are not shared widely. However, before a design reaches the yard, a level playing field should be created for the competitors on the makers list. "As a designer, we need to make sure that the design is open for competing suppliers," Kyvik says.

If an early stage design is based on technology from a specific equipment manufacturer, the decision to go in this direction must be made by the owner the vessel is being designed for. The only way a manufacturer with a unique solution can make it to market ahead of the competition is to influence the ship owner directly.

The challenge, however, is that the engineering and equipment packages that go into a drillship have to a large extent already been formed, making them much harder to alter.

## Clear responsibilities

Three packages have evolved with their own distinct responsibilities: the drilling package, electro and finally DP with automation. In the Brazilian project, a new combination was introduced as the so-called marine package: thrusters, generators, electro and DP. However, Kyvik sees this more as a one-off consortium than a new type of standard package.

These distinctions have their roots in the actual operations of a vessel. Here responsibilities are divided between drilling operations, the well itself, and work that is distributed between the different third parties involved in the various phases of a drilling operation. This distinct set of responsibilities is deeply engrained in the industry; each party specializes and takes a clearly defined role that is well known to the entire market. Earning a position in this market takes long, tough, global efforts.

## Step by step

Given the deeply rooted division of responsibilities and the fierce competition to deliver well-defined equipment packages, it comes as no surprise that improvements usually come incrementally.

The drillship itself is a small part of a much bigger picture, starting with the exploration for oil and gas itself. Whenever a new challenge comes along – like taking on the pre-salt oil reservoirs in Brazil – the specification changes, giving rise to opportunities for new ideas.

## Dynamic positioning – vital to safety

Dynamic positioning (DP) systems are becoming increasingly important to operational safety as offshore activities move into deeper waters and environmentally sensitive areas, and the number of vessels outfitted with such systems is rising as new technologies bring down costs.

These computer-controlled systems minimize fuel consumption and keep a vessel at a defined location or on a pre-determined track against the forces of wind, wave, tide and current by using its own propellers and thrusters. Position reference sensors, wind sensors, motion sensors and gyro compasses provide information on the vessel's position and the magnitude and direction of environmental forces. This information allows the computer to calculate the required steering angle and thruster output for each thruster.

This technology has allowed vessels to operate where mooring or anchoring is not possible because of, for example, deep water or congestion on the sea bottom from pipelines, templates, etc. DP is not limited to offshore vessels and mobile drilling units. Cruise ships and oceanographic research vessels, for example, also use DP, which locks a vessel's position either to a fixed point or relative to a moving object like another ship.

Under guidelines issued by the International Maritime Organization (IMO) in 1994 to provide an international standard for DP systems on all types of new vessels, the IMO grouped requirements into three equipment classes – the greater the consequences, the more reliable a DP system should be:

- Equipment class 1 – Loss of position may occur in the event of a single fault.
- Equipment class 2 – Loss of position should not occur from a single fault of any active component or system (such as generators, thrusters, switchboards, remote-controlled valves, etc.). Normally static components (such as cables, pipes, manual valves, etc.) will not be considered to fail where adequate protection from damage is demonstrated, and reliability is satisfactory.
- Equipment class 3 – Loss of position should not occur from any single failure, including for items listed for class 2 as well as all for components in any one watertight compartment, or in any one fire sub-division, from fire or flooding.

The classification societies have their own notations based on IMO guidelines.

A joint venture with Statoil to design a drillship suitable for the harsh Arctic environment is also such an example. The initiative started five years ago, now Statoil is broadening the effort and bringing in more partners to meet the challenge.

This is typical for early stage studies, according to Kyvik. One design study builds upon the other until someone is ready to order a drillship and build the first vessel. As a design and consultancy firm, LMG Marin generally relies on fees for the work itself, and design fees per unit.

When asked to name the most noticeable changes in drillships in recent years, Kyvik points to the remote control work of the drilling operation itself. The manual drill deck of the 70s and 80s was a dangerous place to work, and doing the job from an operations chair in a drilling cabin revolutionized the working environment.

At present Petrobras has spurred innovative development with its closed bus DP specifications. Another area in which Kyvik expects to see innovation in the future is in mud.

Last year he participated in an interview session with Aker Solutions where cross-discipline knowledge sharing was a main objective. Developing a network of close partners who share ideas will remain crucial to bringing about innovation. While new technology will always be a driver of change, the main drivers will still be costs and meeting requirements for local content in the emerging offshore markets, says Kyvik.

**Text:** Johs Ensby

---

For technical insight into DP see *Analysing DP incidents* on page 150; see also pages 27 and 154.