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A new maintenance support vessel for Shell’s smaller gas fields in the southern North Sea boasts a number of technological innovations, as Russell McCulley reports.

The Kroonberg vessel went to work this spring in the UK and Dutch sectors of the southern North Sea, where Shell’s ONEgas business unit and the Shell-ExxonMobil joint venture NAM operate 56 gas producing platforms, 44 of them unmanned. The bespoke support vessel is a key piece of the company’s operational strategy in the region, where production is shifting from mature, declining reservoirs to smaller gas deposits.

That strategy, put in place over the past several years, includes a significant reduction in the use of helicopters to transport maintenance crews, says ONEgas project leader Haije Stigter. The Kroonberg serves as both a “walk-to-work” vessel and an efficient way to transport the equipment and chemicals needed to maintain gas production.

“The big reservoirs have been discovered and developed,” says Stigter of the mature Southern North Sea basin. “But there are smaller accumulations waiting to be developed. So there are two drivers. With mature assets and declining reservoirs, we continuously need to look at managing our operating costs and field life. And with smaller, newer accumulations, we need to look at optimising our development costs.”

About 35 years ago, Shell began moving to marine access-only facilities to cut both operating expenses at mature fields and the cost of exploring new, smaller discoveries. The shift to “minimal facilities” had the “knock-on effect of not having to put a helideck and all the associated equipment on the platform,” Stigter says.

The first platforms introduced under the walk-to-work scheme were designed to be visited by “small, fast rescue-type craft, where we could put six people on the platform in quite moderate sea states. And since 2006, we’ve used motion compensated gangways, initially fitted onto the backs of standard DP-2 platform supply vessels.”

The new approach worked well enough, but operations were hampered by inclement weather and sea states. Cranes on the small vessels could not operate when waves exceeded about 1.5 metres, which meant work was mostly limited to the warmer months. Restricted space also made it difficult to transport the significant amount of chemicals needed to maintain production, such as corrosion and hydrate inhibitors.

In 2012, Shell engineers started to toss around ideas for a new service and supply vessel to meet multiple needs. Those early meetings started with a fundamental question, Stigter recalls.

“If we had a blank piece of paper, what would a total solution for our ONEgas operations look like? We not only want to be able to put people on the platform, we also want to put materials on the platform. And wouldn’t it be nice to be able to transport the chemicals we need to produce and evacuate wet gas?”

Riding the waves

The Kroonberg vessel ticked the right boxes on Shell’s wish-list. Measuring 80 metres in length and almost 16 metres in width, the ship has accommodations for up to 66 people, including a crew of 20. Built by Royal Niestern Sander shipyard for owner and operator Royal Wagenborg, the vessel is configured for the southern North Sea gas fields.

In 2013, we requested a motion compensated crane on the vessel, but that didn’t exist then,” Stigter says. As it happens, another Dutch company, Barge Master, was conducting field trials at the time on a motion compensation system that could be configured to work with a large crane. The equipment was much larger than what Shell needed, or what the Kroonberg’s limited deck space could accommodate.

“It’s interesting — you put a demand out into the market, and there will be a company out there to pick up the challenge and start developing a solution,” Stigter says. “We found a partner in that respect with Barge Master, which already worked with motion compensation but put all of its technology and knowledge into this motion compensated crane.”

The Barge Master crane, as configured for the Kroonberg, can lift up to five tonnes 32 metres above sea level at a reach of up to 20 metres or 15 tonnes at a reach of 10 metres. “It’s been working quite happily in three-metre seas,” Stigter notes — all the more remarkable, he adds, “considering the fact that the crane didn’t exist when we signed the contract in June, 2013, but was installed on the vessel late last year. And we’ve now had a few months working with the vessel, putting it through its paces, and everything works like a dream, within the boundary conditions that we set.”

The motion compensation technology increases the weather window for offshore operations from about half of a typical year — the “workability” rate Shell was getting with the smaller vessels — to between 85% and 90%, based on historic metocean data, Stigter says.

The equipment is complemented by a propulsion system comprising two Voith Schneider Propellers and two Voith Inline Thrusters. The system provides the station keeping necessary to transfer personnel and materials safely, Stigter says, and to make use of the vessel’s chemical supply and cold start-up capabilities. PG Marine Group, now known as PG Flow Solutions, provided the Kroonberg’s cold start and inspection, repair and maintenance (IRM) package, a below-deck arrangement of pumps, injection and control systems, a nitrogen generator, umbilicals and hose reels.

The below-deck tank installation, said to be the first of its type,
The vessel has been working quite happily in three-metre seas.

Haije Stigter, ONEgas

“Lowering the swing load”

utch technology company Barge Master was still testing its innovative BM-T700 modular motion compensating platform when Shell proposed the idea of a similar, but much smaller, piece of kit for the Kroonborg crane.

The BM-T700 consists of three hydraulic cylinders, arranged in a triangle, that work together to compensate heave, roll and pitch – the three of the six degrees of freedom that most affect lifting operations dynamic positioning or anchoring systems compensate for the horizontal motions surge, sway and yaw. The platform has a payload capacity of 700 tonnes or can accommodate a crane with an average capacity of 160 tonnes at a radius of 12 metres.

The set-up requires considerable space – the platform and foundation together weigh 270 tonnes and the foundation has a footprint of 16 metres x 11 metres. Shell used the BM-T700 system earlier this year to install a permanent bridge between a new depletion compression platform and the existing gas production platform at the Malampaya field in the Philippines (see page 45). But putting a motion compensated crane on the Kroonborg required significant reengineering, says Barge Master chief executive Martijn Koppert.

“They said, ‘we only need to lift five tonnes at a 20-metre radius, but we don’t have a lot of deck space’,” Koppert recalls of the initial talks with Shell in late 2012. The company wanted the set-up scaled down to a footprint that would not exceed four metres by five metres. “We said, ‘we can make the T700, this triangular platform, a bit smaller. But we will never get to the footprint that you have in mind’. So we had to go back to the drawing board.”

Barge Master redesigned the platform “to a more sequential set-up”, Koppert says, with two cylinders compensating for roll and pitch to keep the pedestal upright, then one cylinder compensating for heave. “The T700 has many applications, but we had to incorporate that technology into a design specific to a crane, and drastically reduce the footprint. The bigger the area, the better – it was very difficult to concentrate in a small footprint.”

Nevertheless, the company was able to design, test and deliver the BM-T740 system for the Kroonborg in about 18 months. “This is the first fully motion compensated crane on the market,” Koppert says. “The concept enables the Kroonborg to work in close proximity to platforms, in wave heights up to three metres. “I worked a lot offshore, and often experienced the problem of swaying load,” he says. “A heave compensated crane does not eliminate swaying. That’s why we came up with the concept of the motion compensated crane.”

The technology creates a much wider operating window and increases safety, “and by doing that, you reduce cost tremendously”, he says. “The one thing crane operators have to get used to is, when they’re sitting in the crane, they’re sitting still but the vessel is moving. That’s a bit of a strange experience, but they get used to it. Even the guys who normally get seasick can operate this crane.”

“Cleaner fuel”

Stigter points out, which can make the steel brittle, gas at start-up of production, to the Joule-Thomson effect –the allows start-up of high-favour of GTL in the world”.

Kroonborg is another first, in what Shell says is another first, as a cleaner burning (GTL) fuel, which has made some emissions,” he says. “It’s a much diesel onshore. Inroads as a cleaner burning (GTL) fuel, which has made some emissions,” he says. “It’s a much cleaner fuel.”
A new depletion compression platform at the Malampaya gas field will keep lights burning in Manila for years to come. Russell McCulley talks to Shell about the landmark project’s latest development phase and the technical and logistical challenges involved.

It is difficult to overstate how important the Malampaya Deep Water Gas-to-Power project is to the Philippines. Since production began in 2001, the joint venture of operator Shell Philippines Exploration and partners Chevron Malampaya and Philippine National Oil Company Exploration Corporation has generated billions of dollars in revenue for the national government, reduced the country’s energy imports by an estimated 35%, and provided a powerful symbol of co-operation between the public and private sectors in a nation eager to promote a business-friendly environment to international investors.

More critically, the development provides between 35% and 40% of the energy supply to Luzon province, which includes Metro Manila and its roughly 12 million inhabitants. “It is really the only significant upstream resource in the Philippines,” says Antoine Bliek, Shell’s project manager for Malampaya Phase 2 and 3. “We always say that one lamp in every three in Manila is kept on by gas from Malampaya.”

For that reason, when planning began several years ago for Malampaya’s second and third development phases, Shell and its partners were under considerable pressure to see that any service interruptions were kept to a minimum. Malampaya Phase 2, which added two infill wells to maintain pressure and production, was completed last year. Phase 3, to be completed by the end of 2015, includes a new depletion compression platform (DCP), which Shell claims is the first gas platform to be built entirely in the Philippines. Local capacity to build something on that scale is a relatively new source of pride for the South-East Asian nation. But Malampaya has provided a number of occasions for celebration since...
The final investment decision was announced, with much fanfare, in 1998, nearly a decade after the Camago gas discovery some 80 kilometres north-west of Palawan Island. The adjacent Malampaya discovery in 1992 brought resource estimates in service contract area 38 to 2.7 trillion cubic feet of natural gas and 85 million barrels of condensate. The platform was installed three kilometres from the area 38 to 2.7 trillion cubic feet of natural gas and 85 million barrels of condensate.

In 2001, the project’s initial phase included five subsea wells — eight at Malampaya and two at Camago — in 80-metre water depths. The wells tie into a 10-slot subsea manifold, gas flows through two 38-inch, 32-kilometre flowlines to a shallow-water concrete platform. Processed gas is driven by Rolls-Royce RB211 turbines, a utility module, equipment room, pipe rack and a deck crane. The new platform is linked by 43-metre bridge, also designed by Arup, to the original Malampaya platform.

Calcareous sands were not the region’s only challenge, says Martyn Turner, Shell’s design team leader for the depletion compression project: “I think it’s worth remembering that, as you come farther north in the Philippines Islands, you’re in a seismic region and also in a typhoon region. So one of our challenges was designing for both.” To mitigate risk, the DCP had to be designed with an air gap of 23 metres, which meant installation options were limited, he says. “That was one of the challenges around the installation. The lift barge capacity in the region is not geared up for lifts that big. So that was another reason for the selection of a self-installing platform.”

Minimal downtime
Shell chose a design that would minimise downtime for the production platform, and timed installation to coincide with a scheduled maintenance shutdown. Turner says, “We took various decisions, such as going with air coolers, so that we minimised the number of tie-ins. We added our own local equipment to make sure that we could maximise our pre-commissioning prior to leaving the Keppel yard,” he explains. “Interuption would be a huge issue. If you look at more traditional approaches, where you have a number of fields producing into the grid — say, in areas like the North Sea, where you can afford to have a couple of months shutdown to do a tie-in — here, we don’t have that luxury. So everything was geared up to make sure we were as complete as we could be before we left the yard.”

The platform was installed in February, followed by a planned 16-day maintenance shutdown, during which the major tie-in work was completed. Some 150 workers were offshore at the peak of activity, with Poseal’s accommodations semi-permanentised safe Astoria on call. During a 48-hour procedure, the platform was lowered into place and temporary bridge access installed. Gas production remained online during the operation. The 150-tonne permanent bridge was lifted into place using strand jacks temporarily installed on the DCP and existing platform. In order to minimise the risk of snatch loading — the sudden tensioning of a slack cable — Bonsai’s BH200 cable was turned to Dutch company Barge Master, and its new BM-T700 motion compensated lifting system (see page 21) mounted on the deck of Bonsai’s construction vessel Ndeavor. The operation marked the first commercial use of the system, says Barge Master chief executive Martijn Koppert.

More than 1200 workers were involved in the two-year construction of the DCP. “We were quite keen to maximise local content and do what we could in country,” says Turner. “Capability is growing fast in the Philippines. We supplied our own expertise to the contractors, but I think the fact that the project was delivered as scheduled is good proof that, yes, this can now be done. It’s quite an achievement.”

“Gas supply interruption would be a huge issue.”

Martyn Turner, Shell