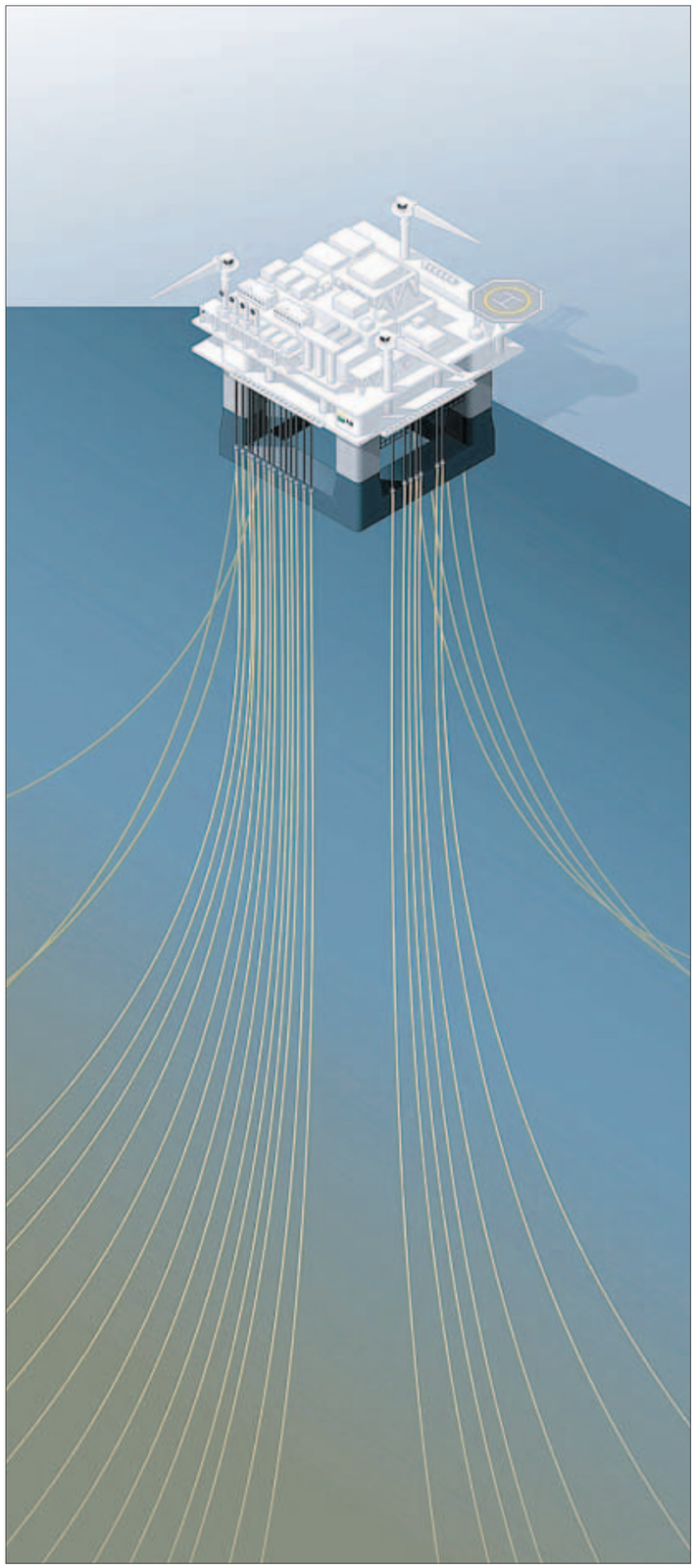
Well-to-platform risers receive top grade attention in high-pressure, high-temperature conditions of deep water field in Gulf of Mexico



Hanging risers: a watchful eye is needed to ensure long life for SCRs Graphic: 2H OFFSHORE

New kit aims to widen options in monitoring

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HARDWARE is currently being delivered to Chevron's Tahiti project for one of the most comprehensive and sophisticated deep-water riser monitoring systems yet to be ordered by the oil and gas industry.

The truss spar platform at the centre of this Gulf of Mexico development is due to be installed in close to 1300 metres of water this summer, above a first-phase array of three subsea wells.

By September, the Heerema heavy-lift Thialf should be hanging eight steel catenary riser pipes (SCRs) off the hull in diameters from six inches to 20 inches to connect those wells to the surface and to export processed crude and gas.

The all-important riser pipe link between seabed and floating platform is widely acknowledged as a defining challenge of any deep-water development.

In Tahiti's case, that challenge is all the greater because of the high pressure and temperature of the wellstream that will be handled and the effects this can have on the high-performance thick-wall steel used for the pipes.

On top of this, although the Gulf of Mexico is not defined as a particularly harsh environment, it is subject to an ever-present risk of strong currents — often varying in direction according to depth — and the occasional risk of extreme movements in a hurricane.

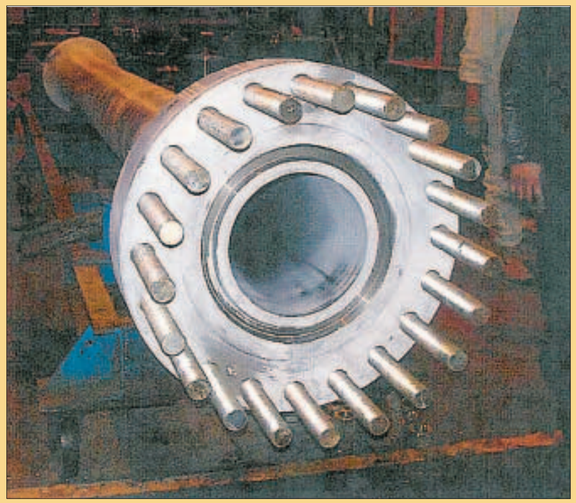
As a consequence, operator Chevron has taken the step of ordering a $3 million state-of-the-art system from specialist riser engineering company 2H Offshore to monitor the motions and stresses in the Tahiti risers.

The aim is to gain the best possible picture of how pipe fatigue life is standing up under the potentially debilitating effects of vortex induced vibration (VIV) and the like.

VIV is a major design driver for deep-water risers. Regular vortex shedding can cause structures to resonate, giving greatly accelerated fatigue damage.

Steve Hatton, one of the founders of 2H, could hardly be happier about the Tahiti commission from Chevron.

On the hardware front it gives his company a high-profile showcase for its newly-developed gauge named IntegriStick, "a strain measuring device in a stick that lowers the cost of such equipment by some way", as Hatton puts it.



Top: IntegriStick can be strapped to a riser without removing coating Above and right: all riser types must guard against VIV Photos: 2H OFFSHORE

In addition, on a wider front, it gives him welcome justification, backed by a highly-respected operator, for his conviction that deep-water risers are far from as well understood as many believe, and that monitoring them in service should be the norm rather than the exception.

"There needs to be much more emphasis on monitoring, and Tahiti is an ideal example," says Hatton. Otherwise, he reckons, there is nothing like as much monitoring going on as there should be, with the honourable exception of BP.

Certainly, 2H ought to know what it is talking about. The company claims to have monitored more steel risers than anyone else, top-tensioned systems as well as leading-edge SCR schemes. Part of the Acteon group, 2H bills its core skill as "the structural design of fatigue dominated riser systems".

On the back of this, it has built up a trio of linked business lines — design, hardware supply, and integrity monitoring and management. It has also expanded geographically from its 1993 origins in London to set up further offices in Houston, Rio de Janeiro and Kuala Lumpur.

Chevron has chosen an array of 10 IntegriPod motion loggers to measure riser global response at Tahiti.

These are divided in two groups — below the riser hang-off points, and above the seabed touch-down zone, at points chosen to capture the best data possible.

The system also includes 12 IntegriSticks measuring riser strain. Two of these are placed below the riser hang-off to measure local spike in strain.

The other 10 are in the touch-down zone to measure strains that will yield an understanding of the interaction between riser and seabed.

The design of this type of system is particularly challenging to integrate with riser installation to ensure it is not damaged, says Hatton.

This system can feed information back to the vessel and shore immediately the SCRs are installed, allowing specialists to receive real-time information about the patterns of stress that the risers are experiencing.

All this is directed towards watching over the rate at which the fatigue life of these vital arteries is consumed, and confirming that "the riser we've got is the one we thought we'd get," says Hatton.

"Fatigue is a complex problem," says Hatton. "There are usually significant local spikes that we need to understand well. We feel we can measure fatigue damage accumulation to within 10%, which is pretty good.

"Monitoring has enabled us to find all sorts of things we were blissfully ignorant of before, and to catch events that might otherwise have been missed and led to failure."

Stick beats strain out of watching over fatigue rates

TWO broad approaches are available in the riser monitoring business — measurement of motion or of strain.

At arguably the more sophisticated level, the riser response can be determined by measuring motions, using sensors that provide information about the pipe's configuration and dynamics in the water at any given time using accelerometers. This data can be used to calculate the stresses the riser is experiencing.

The alternative is to measure the stresses much more directly by means of strain gauges fixed to the pipe, in effect measuring curvature.

"Generally we are happy with motion alone since we are confident with the mathematical techniques required to get from motion to stress," says 2H Offshore boss Steve Hatton.

"But most companies like direct strain, and anyway it is always good to have that data to allow detailed investigation into local issues such as soil suction effects. So as a company we felt it was necessary to offer both approaches."

As the latest result of 2H Offshore's drive to develop reliable, cost-effective methods of measuring strain, the new IntegriStick combines an impressive claimed accuracy with an agreeably low cost.

"For example, Chevron has now got 12 stations for the same budget as two fibre-optic stations would have cost," says Hatton. Not everyone in the offshore world is totally committed to the cause of monitoring. Probably the most muted enthusiasm is to be found among the installation contractors, because it can get in the way, and also throw up complex contractual issues.

However, companies like 2H, and enlightened operators like Chevron and BP, are increasingly convinced that monitoring offers value for money and must become ever-more widespread, particularly as hardware improves in performance, reliability and cost.

"For example, all recent major deep-water West African projects have elements of riser monitoring in them, which they wouldn't have had five years ago," says Hatton. "It is no longer acceptable to be running blind," he adds. "I've got more instrumentation in my car than there is in many very expensive offshore riser assets."

Giving it some stick: 2H co-founder Steve Hatton

2H raising the bar to catch offshore curves

IT MAY look like a simple metal bar, about a metre long, but the IntegriStick curvature sensor developed by 2H Offshore and now being delivered for the Tahiti monitoring project has taken 18 months to develop and get into full production.

"It has been a challenging time," says marketing manager Karim Jan. "You are aiming to produce something intrinsically simple, but with complex technology, and it needs to be absolutely repeatable and most importantly, reliable long-term subsea."

The stick is a corrosion resistant tube, adopting titanium and super duplex steel, containing a gauge able to measure to an accuracy of one micro-strain.

When attached to a riser it can measure any change in curvature of that pipe in two planes, and "from this it is possible to determine bending stresses and hence the fatigue damage rate", says Jan.

Instrumentation specialist Pei An and the 2H team have developed a sealed oil-filled device, pressure-balanced for service down to at least 3000 metres water depth. It is simply attached to the outside of the pipe and can even be fixed on the outside of three inches of polyurethane coating.

"You don't even need to remove coating and get down to bare pipe," says 2H co-founder Steve Hatton. "This non-intrusive aspect is a huge advantage. The system can be strapped on to any structure and will do everything that bonded strain gauge and fibre-optic mat technology does, but with improved reliability and an order of magnitude cheaper."