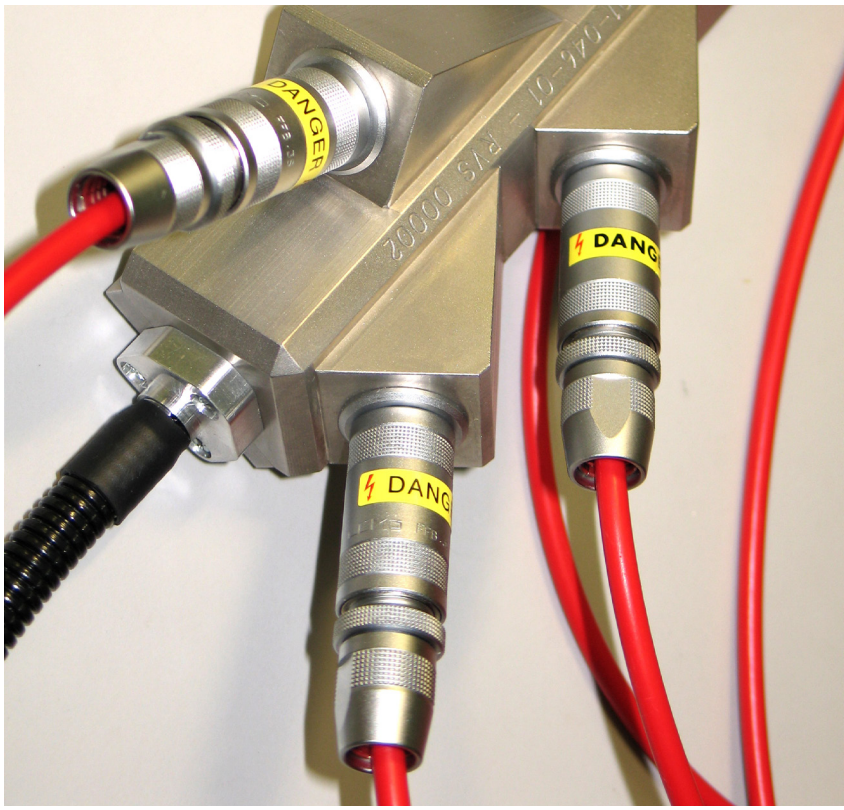
SECURITY & MONITORING

High in fibre: Synaptec's new approach to monitoring



Scottish university spin-out Synaptec has developed new monitoring technology, allowing operators to measure hundreds of data points miles apart, using a single fibre-optic cable

THE humble fibre-optic has transformed the way that systems capture and transmit information. Yet even with the dramatic advances of recent years, innovators are only really scratching the surface of what the medium can do. Distributed Acoustic Sensing (DAS) and its temperature-related sibling DTS are beginning to make waves in oil and gas. *InnovOil* has already explored some of the related technologies (such as Well-Sense's FLI system) as a means of delivery. On the whole, however, much of the industry's approach to asset monitoring and sensing applications remains rather analogue.

That may be about to change, thanks to a new innovation from a Scottish start-up. Technology from Synaptec allows operators to read and record multiple sensor measurements from up to 100 km of fibre-optic cable. Having already borne results in the power sector, it could potentially simplify the monitoring of oil platforms, subsea systems, offshore renewables, ships and much more.

Glasgow-based Synaptec was formed as a spin-out from research undertaken at the University of Strathclyde's Institute for Energy and Environment. Founded in 2014, the company is the result of University research and staff expertise in photonics, electronics, power and instrumentation, all of which has culminated in the development of some intriguing IP. *InnovOil* sat down with the company's co-founder and co-inventor of the technology, Philip Orr, to learn more.

Current affairs

The company's main offering lies in the ability to measure electrical current, voltage and other properties directly. Its IP uses optical interrogation systems that gather and characterise the measurements taken from fibre-optic networks to provide simultaneous readings along its length – even at distances up to 100 km. Orr outlines that "if you have a long fibre, we can install our sensors at discrete points or in machines and so on along the line, and then gather in multiple measurements from multiple locations on a range of parameters, including voltage, current, temperature and vibration, all in a single line."

"The core innovation here is the ability to use optical fibre to gather lots of measurements of electrical parameters over very long distances and in a very efficient manner. Nobody else can do distributed measurements of voltage and current in that way," he explains.

The sensors themselves are relatively small – about 2cm across for those measuring voltage, and about the size of a fist for those measuring current – neither of which should prove disruptive or unwieldy on a rig, or a piece of subsea equipment.

Because Synaptec's system is passive – and only requires a single cable – it does not require extra power supplies or communications links, reducing the cost of installation and ideally making monitoring simpler and more efficient.

That also means users can display multiple feeds on each of their measurements. "You've got one fibre and it snakes between different assets and areas on a platform. You've then got a string of measurements along that – some temperature, some voltage etc. – and you can gather that all at once," Orr adds. Moreover, the high data transfer rate of fibre-optic cable means that these results are returned in real-time. All that is required to process the data is a standard rack-mount unit, about the size of an average computer server.

Dark fibre

One of the main drivers behind the company's success in the power sector is that its monitoring can be done without additional infrastructure. All new power cables – or indeed subsea umbilicals – contain fibre-optic cores as standard, which are used for communications, and those which do not can be retrofitted via a winding machine. Most will also contain multiple lengths of unused or "dark" fibre, for redundancy, any of which can be used for monitoring – "If they have single-mode fibre in them, we can use them," assures Orr.

Even in cases where there are single fibres, Synaptec's system can operate on a different signal wavelength, running both sensors and communications on a single fibre, without any disruption or interference.

The example use of such a system in subsea umbilicals offers a clue to the technology's pedigree. "The reason the

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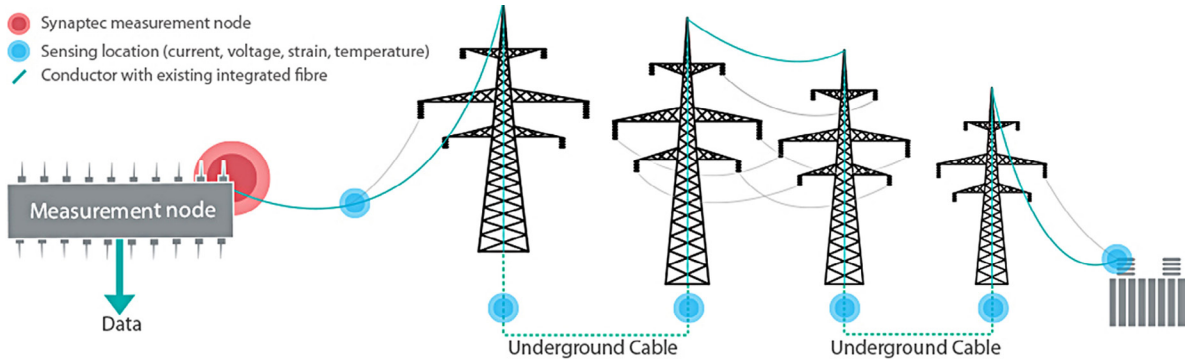

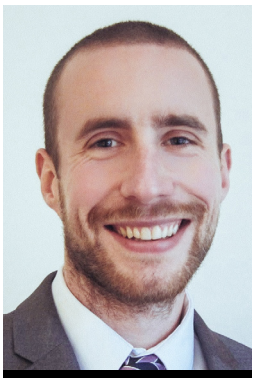

"If you look at it holistically, this is a cost-effective, unified, single measurement system for everything"

Philip Orr, Co-Founder, Synaptec

technology was originally developed was actually for subsea pumps," Orr explains, "largely because it's so difficult to get measurements of pump performance – voltage, current, power consumption etc. – over very long distances in that environment." Initial research at Strathclyde was backed by Wood Group's Electric Submersible Pumps (ESP) division, but was shelved when GE bought the unit in 2011. Synaptec's technology has clearly taken the long way round to reach its original audience.

The company has so far been involved in innovation projects with network operators SSE and Scottish Power, and as part of the Ofgem-backed FITNESS project working with ABB and GE. Here, as with many oil and gas operators, there is a move away from set instrumentation architecture towards a more centralised, "smart" approach.

Previous monitoring systems used systems placed at disparate locations, each of which required a sensor, power supply and a computer, placed in buildings and connected with point-to-point communications links. These systems are costly to use and maintain. "What we offer," Orr says, "is an architecture whereby you have a central substation and you have transmission lines with fibres fanning out from it, so you have a centralised gathering of new data on the system." Such an approach is increasingly popular as remote monitoring becomes the norm, and as the oil industry moves towards more unmanned operations.

Aside from the promise of better and faster measurement, cost-effectiveness is Synaptec's greatest business driver. Using existing fibre cuts down spending and interruption, but the system's main benefit is to eliminate duplication of results and media for gathering data, Orr says. By deploying low-cost sensors and centralising the monitoring platform into one system, he adds: "You're eliminating a whole lot of capex from what you'd normally spend for the equivalent number of data points… If you look at it holistically, at instrumenting a ship or platform as a whole, this is [a] much more cost-effective, unified, single measurement system for everything."

Cable ties

Other ongoing research projects could lead to further efficiencies, he adds. Recent work with the UK's Fraunhofer Centre for Applied Photonics has yielded some exciting results for applications in subsea cabling. "What we've been looking at is putting our technology into the same fibre as DAS, so one cable could provide you with vibration and temperature response along the cable, but also at discrete points it could tell you voltage and current," he says. It is certainly a game-changing proposition for the field of subsea electronics, and with the feasibility studies concluded, the next steps of the project should prove exciting. Watch this space.

Although Synaptec is confident in the enormous potential of its IP, it is only taking its first, tentative steps into oil and gas. The company is most interested in understanding more about how its technology could assist, or be included within new cable development. "We're interested in where we have room in the cable or in the splices to put in our small sensors that pick up the voltage or current," he continues. "We've been looking at termination points and splice joints between cables to see how spacious they are, and how many sensors we can fit in that location."

Orr's intention is that Synaptec sensors could be included in these splice points, providing a measurement of all 3 phase-to-phase voltages and all 3 currents at each joint. That requires extra know-how and expertise, leading the company to look for new partners and potential collaborators. "We're really keen to speak to anyone involved in subsea technologies, cable manufacturing and contractors that deal with specifications of electrical systems design on platforms," he says.

Beyond cabling, Synaptec's potential snakes out into multiple disciplines and sectors, from well monitoring and telemetry in oil and gas, to maritime systems and offshore renewables – and plenty to keep Orr and his team busy. But wherever these potential applications take the company, *InnovOil* is sure there are a lot of bright lights at the end of this fibre. ■

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