

Gaining an improved insight into subsea production

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One of the biggest challenges and most important drivers for operators in the offshore oil & gas sector today is generating an accurate picture of their subsea production systems. Reservoir monitoring technologies are facing many different challenges according to the regions they operate in.

In this context, Emerson's new Roxar wireless PT Sensor System is a significant step forward in reservoir monitoring, production optimisation, and offshore safety.

The new instrument, which includes a wireless reader, a wireless PT Transponder and antennae to monitor activity, attaches to the same cable as other reservoir monitoring gauges and provides real-time information on variations in pressure. For offshore operators planning subsea production or injection wells and for government regulatory agencies overseeing safety and environmental protection, the new solution will provide a significant step forward in well integrity and open up an important element of the subsea production system which was previously off-limits.

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One of the biggest challenges and most important drivers for operators in the offshore oil & gas sector today is generating an accurate picture of their subsea production systems. This is due to two key reasons.

Firstly, today's reservoir monitoring technologies are being tested like never before, operating in highly demanding environments from fields that are decades old to frontier, deepwater regions which are seeing production for the first time.

Secondly, these offshore challenges are also coming at a time when operators are under growing pressures to improve recovery rates and ensure the economic, productive and seamless flow of hydrocarbons from reservoir to refinery.

Challenges from Different Regions

Reservoir monitoring technologies are facing many different challenges according to the regions they operate

in.

Take the North Sea, for example - one of the more mature oil & gas regions of the world but an area that is seeing considerable exploration and production activity as smaller companies join the fray. Today, the Norwegian Petroleum Directorate (NPD) estimates that 50% of oil remains in the Norwegian North Sea. On the UK side, 150 different oil and gas companies now hold UK Continental Shelf (UKCS) licences.

This growth in new players and focus on older and smaller fields, however, can only be justified if reservoir monitoring technologies are used to the absolute limit, providing real-time data on well performance and ensuring that the dangers of older fields, such as increased water breakthrough, are headed off immediately.

At the other end of the spectrum are the newer fields - often in deepwater and fairly remote areas. Many are in wet gas fields where the

generation of water production profiles is crucial.

While offshore Brazil, Africa and the Gulf of Mexico remain key growth areas, there is also considerable development in less established regions. In India, for example, exploration has been initiated in 15 out of 26 sedimentary basins covering an area of three million square kilometres (*Source: Mantrana Maritime Advisory*).

What all these regions have in common is the need to have an accurate picture of how their reservoirs are operating during the production phase. Operators need to have information on pressures and temperatures, flow rates, corrosion and erosion, and other potential obstacles to production, such as water breakthrough and gas coning.

Going to Previously Inaccessible Parts of the Reservoir - The Annulus B

So are today's reservoir monitoring

technologies rising to the challenge?

From new fibre optic sensing technologies, to the latest in downhole pressure and temperature gauges and advanced SCADA data collection systems, there's no doubt that operators today have a clearer picture of their reservoirs than ever before.

Despite this, however, gaps remain – particularly in the ability to see downhole in subsea production wells and measure pressure, temperature and flow rates. One such example is between the well casing in an area known as the annulus.

The annulus of an oil well is the space between two concentric objects, such as between the wellbore and casing or between casing and tubing, where fluid can flow. In a completed well, there are normally at least two annuli - annulus A is the space between the production tubing and the

smallest casing string and the annulus B is located between different casing strings.

While in the past, the main focus has been on the annulus A which can perform a number of crucial tasks, such as gas lifts, the annulus B is also an important element of the well in that, if pressures build up in this area, there are significant implications for both production and safety. During production, it is the casing and the cement sealing behind the wellbore which provide an important barrier against high pressures in the well. As production flow increases, however, the casing will heat up and expand, leading to increased pressure in the annulus B.

While such increased pressures are to be expected, if they go above prescribed limits they can lead to scenarios, such as the deterioration of

the cement sealing or casing collapse, resulting in oil or gas migrating towards the surface. This can result in potentially hazardous situations with significant implications for both safety and production.

Until now, however, the annulus B in subsea wells has remained inaccessible with no operator access following the sealing and cementing of the casing. Unlike land and platform-based wells where the annulus B can be accessed via valves, operators have simply been unable to generate pressure measurements in the annular space following completion.

Given the potential stakes of high pressures in the well, the resulting lack of information has unsurprisingly led to a cautious approach from operators with on occasion, an excessive and over dimensioning of the casing to compensate for worst



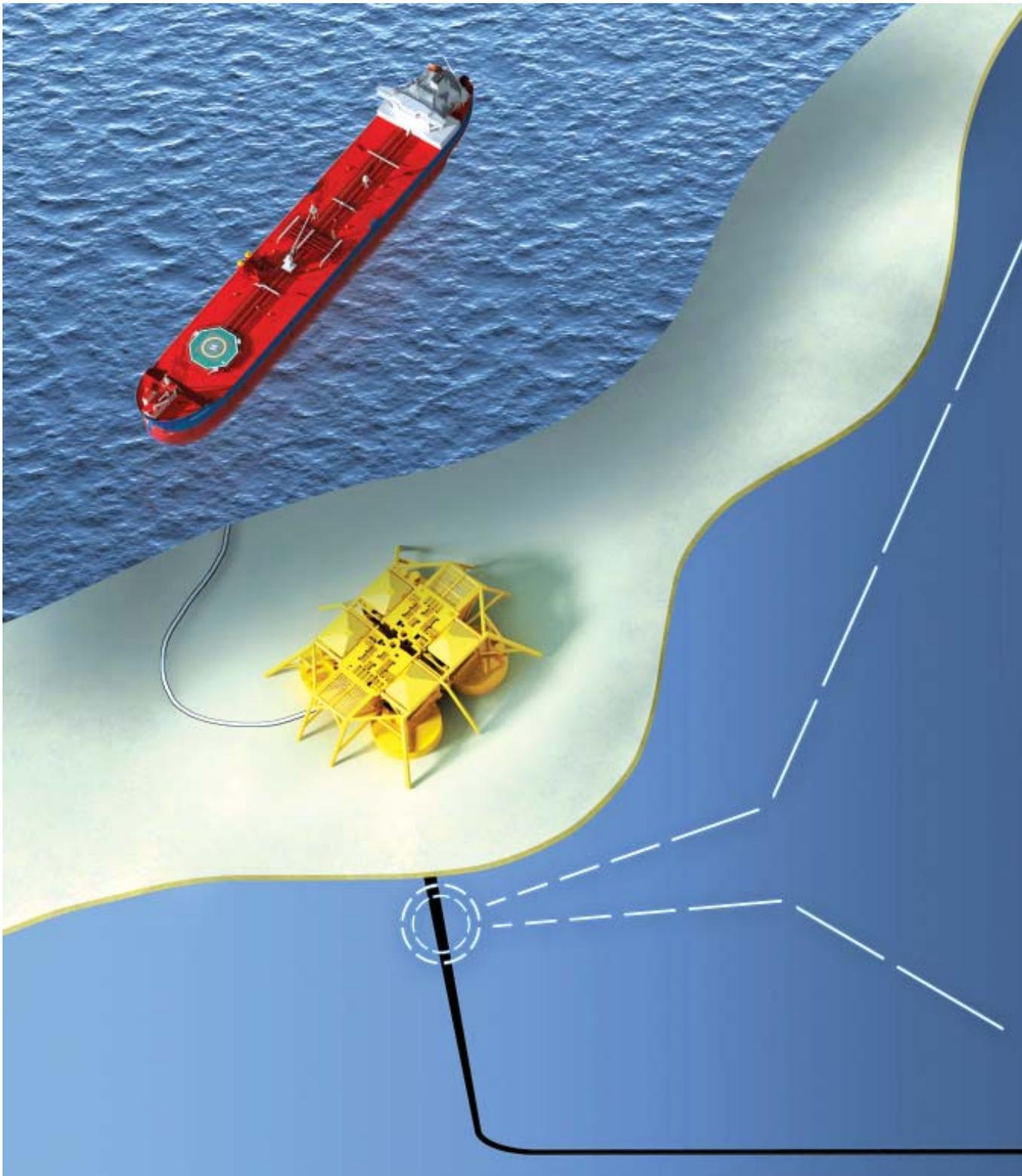
Gaining an Improved Insight into Subsea Production Can Only Take Place Through the Latest in Reservoir Monitoring Technologies

case scenarios. Here, the completion engineer is faced with the choice of either increasing the pressure ratings of the casing or relying on shallow

zones in the well to absorb pressure rises. In some instances, wells have been shut-down in an effort to protect well integrity, costing potentially

millions of dollars and without any firm evidence that such an action is necessary.

In this context, Emerson's new



The Roxar Downhole Wireless PT Sensor System measures pressure and temperature behind the casing in subsea production wells .

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The new instrument, which includes a wireless reader, a wireless PT Transponder and antennae to monitor activity, attaches to the same

cable as other reservoir monitoring gauges and provides real-time information on variations in pressure.

The sensor is based around an Integrated Downhole Network (IDN) system to carry signals from the wellbore to the customer monitoring system with a Downhole Network Controller Card (DHNC) placed in the subsea structure and connected to a ¼" electrical cable and a series of up to 32 sensors distributed throughout the completion string.

These new and permanent monitoring capabilities provide added certainty to the well integrity monitoring process, ensuring that no gas leaks into the annulus because of poor well cementing integrity. It also provides valuable data input during trouble-shooting.

For offshore operators planning subsea production or injection wells and for government regulatory agencies overseeing safety and environmental protection, the new solution will provide a significant step forward in well integrity and open up an important element of the subsea production system which was previously off-limits.

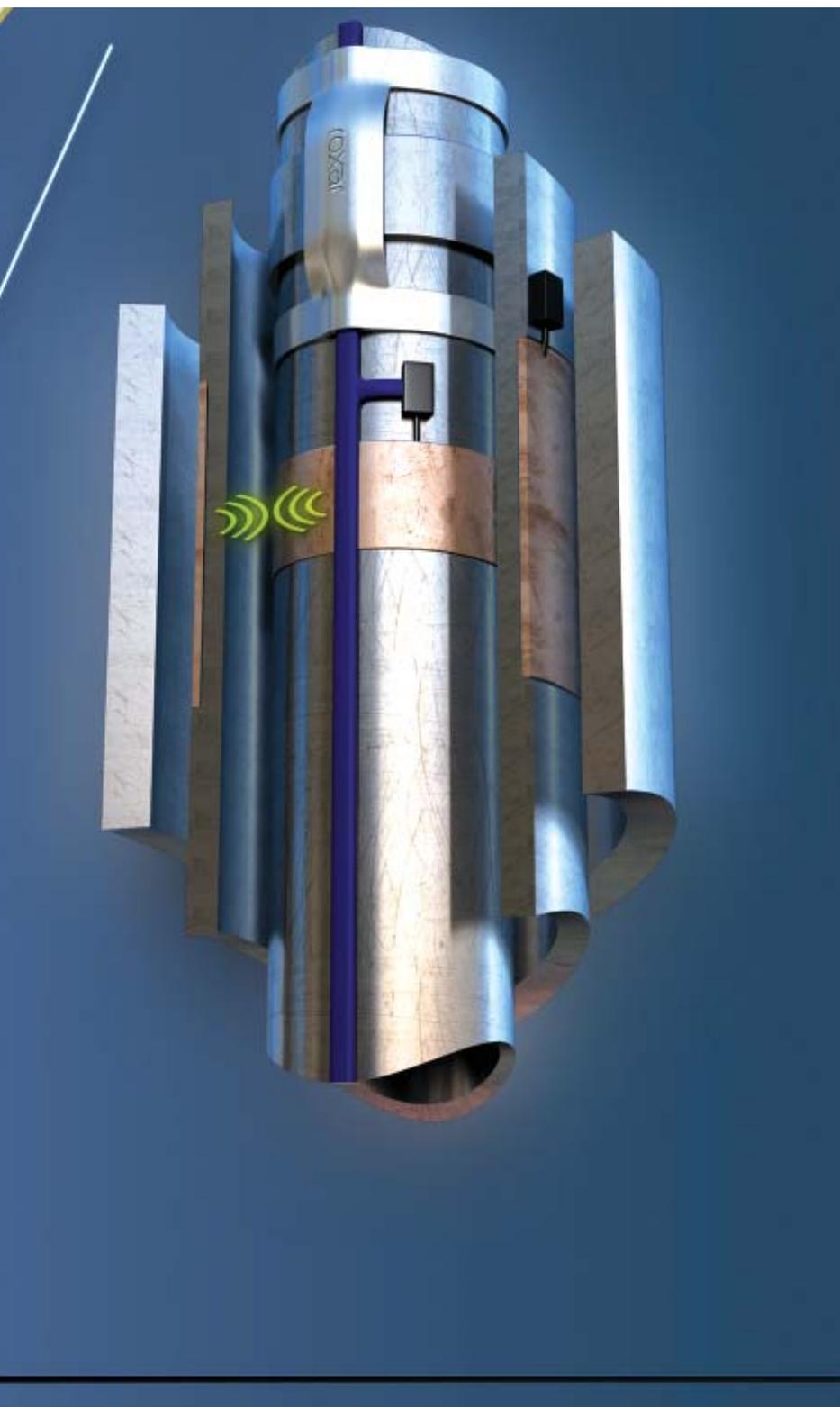
Confronting Sand and Corrosion with Wireless

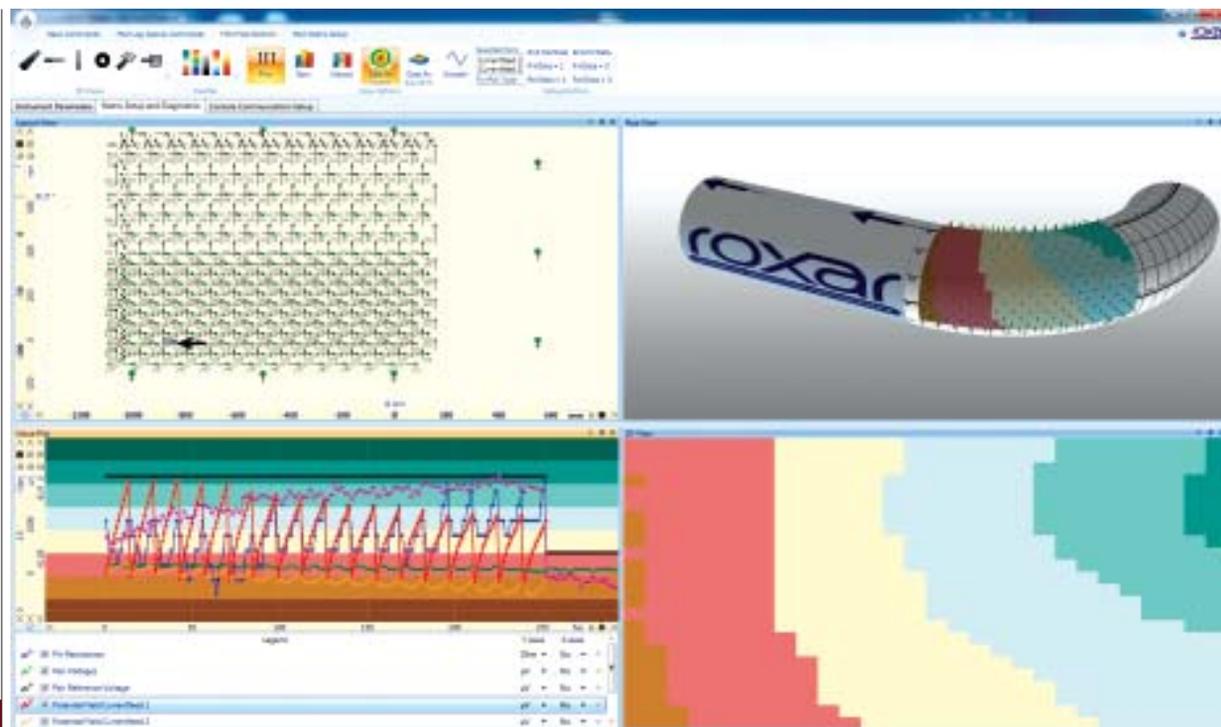
This growth in wireless solutions is also having a major impact on other inaccessible areas of the reservoir.

For example, sand and corrosion remain a constant reservoir integrity challenge. With many current solutions being wireline-based, however, there are inevitable restrictions as to areas that can be monitored with a need for cables, other subsea infrastructure, and access to power.

This need to gain an improved insight into subsea production will see Emerson bring its new corrosion and sand wireless transmitters to market this autumn.

The transmitters, based on





Roxar Fieldwatch

With a new flow sensor system which, for the first time, will generate full multiphase measurements of fractions and flow rates from either single bore or multilateral well configurations downhole in the reservoir. What will be known as the Roxar Downhole Flow Sensor System will play a crucial role in understanding reservoir flow and zonal contributions from specific wells and will open a new window into subsea production operations. The new solution will remain fully compatible with Emerson's downhole product portfolio, such as its high pressure and high temperature gauges, and will also be incorporated into the production management system, Fieldwatch

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intrusive sensors that are installed into pipes or vessels through an access fittings system, will result in a significant reduction in installation costs and improved flexibility as to areas of the reservoir that can be monitored.

The highly sensitive and accurate sensors will have direct integration to Emerson's smart wireless network and, together with the Roxar wireless PT Sensor System, are an example of how Emerson's automation, wireless and digital expertise are combining with Roxar instrumentation to provide an integrity management system.

Characterising Flow Downhole

For all the importance of pressure and temperature, sand and corrosion, probably the single piece of data operators want to know most about as part of their reservoir monitoring activities is the flow from individual wells.

While the developments of multiphase meters over the last few years have resulted in ever more sophisticated characterisations of flow, gaps in information have remained - particularly in regard to flow rates downhole.

This information has become even more difficult to obtain due to the growing complexity of well architecture. Multilateral wells, for

example, have revolutionised reservoir access with multiple wells drilled from a single main wellbore. With operators looking to reduce the risks in deepwater fields, the idea of reducing the number of wells drilled and completion work is particularly attractive.

The ability to access flow rates from different zones and branches off a single wellbore has to date remained elusive with operators having to settle on data on total production flow rather than flow from specific well zones. This is about to change, however, with a new flow sensor system which, for the first time, will generate full multiphase measurements of fractions

and flow rates from either single bore or multilateral well configurations downhole in the reservoir. What will be known as the Roxar Downhole Flow Sensor System will play a crucial role in understanding reservoir flow and zonal contributions from specific wells and will open a new window into subsea production operations.

The new solution will remain fully compatible with Emerson's downhole product portfolio, such as its high pressure and high temperature gauges, and will also be incorporated into our production management system, Fieldwatch.

Going Off-Limits

As these examples illustrate, companies such as Emerson are making significant inroads into tackling areas of the reservoir which were previously considered off-limits.

Whether it is the Annulus B and

pressure, sand and corrosion, or individual flow rates in different well zones, reservoir monitoring technologies are working hard to meeting operator needs, ensuring improved control over operations and the ultimate goal – increased production. dewjournal.com

about the author



Terje Baustad is Product Manager, Downhole at Roxar Flow Measurement, a division of Emerson Process Management. He recently presented a paper at the Offshore Technology Conference 2011 in Houston with the title: 'The Development of an Instrument Measuring Pressure Behind The Casing in Subsea Production or Injection Wells.'