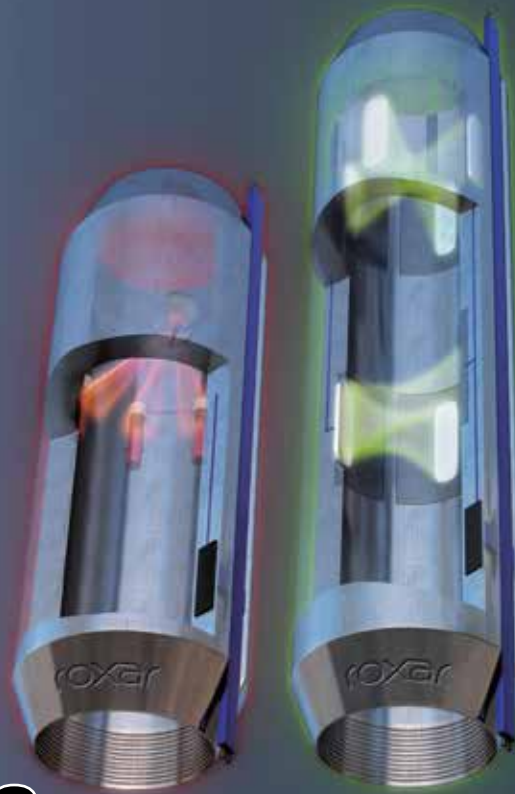


向下钻进， 以增加产量

Going downhole to support production



井下流体传感系统可从油井的井下和油藏深处生成多相流动测量数据
Downhole flow sensor system generates multiphase flow measurements from downhole in the well and deep in the reservoir

随着运营商的探明油藏和海底油田组合逐渐变得更为复杂，以及尽力提升产量并延长油田寿命的压力与日俱增，获取精确井下信息的需求变得空前重要起来

As operators' reservoirs and subsea portfolios become ever more complex and as pressure increases to both maximize production and extend the field's lifecycle, the need for accurate, downhole information has never been more important

例如，有关压力和温度的信息不仅可提醒运营商意识到开采作业和油气流所面临的威胁，而且可为现有开采系统提供至关重要的支持，如潜水电泵（ESP）和油井优化。因此，对于艾默生过程控制有限公司（Emerson Process Management）及其Roxar业务部今年即将举行的井下监测解决方案推出25周年庆典，其时机选择可谓充满了巧合。

Roxar品牌在井下监测领域的领先地位可追溯至1987年，当时斯梅德维格公司（Smedvig）与拉萨尔压力数据服务公司（Lasalle Pressure Data Services）携手合作，组建了IPR AS公司，从而为挪威国家石油公司（Statoil）的Gullfaks A油田部署了监测解决方案。1990年，Roxar（当时被称为Smedvig）成为PDMS业务的唯一所有者，2009年，Roxar被艾默生过程控制有限公司收购并成为了其中的一个业务部。

艾默生的Roxar井下监测系统及高压、高温测量仪已经广泛部署于当今世界各地的开采、注水、观测和高度复杂的多区域智能油井之中，

Information on pressure and temperature, for example, can not only warn the operator of threats to production and flow assurance but also provide crucial support to existing production systems, such as electrical submersible pumps (ESPs) and well optimisation,

It is therefore good timing that Emerson Process Management and its Roxar business unit are celebrating 25-years of downhole monitoring solutions this year.

The Roxar brand's leading position in downhole monitoring began in 1987 when Smedvig and Lasalle Pressure Data Services joined forces to form IPR AS, leading to the deployment of monitoring solutions on Statoil's Gullfaks A field. In 1990, Roxar (then known as Smedvig) became the sole owner of the permanent downhole monitoring system (PDMS) business and, in 2009, Roxar was acquired and became a business unit of Emerson Process Management.

自从于1987年在挪威国家石油公司的Gullfaks A油田安装第一个Roxar PDMS（永久性井下监测系统）以来，如今全球各地已经安装了近1400个Roxar井下测量仪——足以证明该产品可靠性、耐用性和创新性。例如，挪威国家石油公司位于北海的Gullfaks C开采平台一直在使用原有的Roxar井下测量仪，在近21年的时间内，从未中断，也未进行任何维护或更换。

除了Roxar PDMS及Roxar井下HS测量仪之外，其他的井下解决方案还包括智能型井下网络（IDN）和Roxar井下无线PT传感系统，前者可允许运营商在单根电缆上安装多达32个装置；后者可测量海底油井中的油井套管后部的压力。此外，还有最近推出的Roxar井下流体传感系统，该系统首次实现了对井下的多相流体测量。

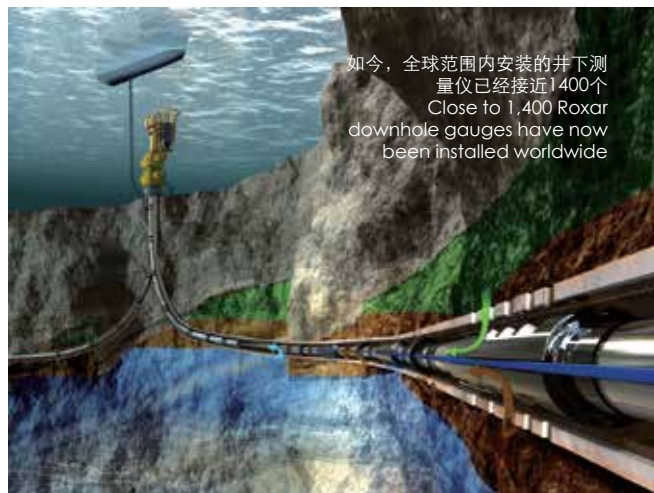
作为其油藏监测作业的一部分，运营商最希望了解的一个数据是各个油井的流动情况。然而，油井结构日益复杂，加之分支油井和分段油井的增多，使得运营商不得不选定总的开采流体数据而非单个油井区段的流体数据。正是基于这个原因，Roxar井下流体传感系统对油藏监测和流动保障实施了逐步的改进，提供了完整的多相测量——针对单眼井或多分支油井配置的流体组分和流动速度。

最后，艾默生还研制了开采管理软件Roxar Fieldwatch，这是一款专业化的基于视窗的油田监测系统，可确保勘探和开采运营商远程“密切关注”他们油田，通过图形用户界面，运营商可直接在桌面上获得实时的数据。

软件的快速获取数据和显示功能为用户提供了迅速直观显示数据并判定趋势、模式或供进一步分析的关注领域。藉此，它可满足运营商获得一个一体式、智能型油藏监测与资产管理系统的的需求，该系统可对经济冲击及油藏管理决策风险进行全面评估。

无论将其用于开采作业（如案例分析中的塔里斯曼能源公司）、测量井下多相流动速度，还是将其用于解决沙土和腐蚀的双重威胁，如今的井下监测正在为运营商针对其油藏作业提供更加深刻的洞察和控制并帮助其增加产量。

拥有25年骄人既往业绩记录的艾默生过程控制有限公司及其Roxar业务部以其创新性、精准性和牢靠性而享有盛誉，目前，正在引领该领域继续向前发展。



如今，全球范围内安装的井下测量仪已经接近1400个
Close to 1,400 Roxar downhole gauges have now been installed worldwide

Emerson's Roxar downhole monitoring systems and high pressure and temperature gauges are today deployed in production, injection, observation and highly complex multi-zone intelligent wells across the world, where they are generating reliable and real-time downhole information crucial to reservoir operations.

Having installed the first Roxar PDMS on Statoil's Gullfaks A field in 1987, close to 1,400 Roxar downhole gauges have now been installed worldwide - testament to the products' reliability, longevity and innovation. Statoil's Gullfaks C production platform in the North Sea, for example, has been using the same Roxar downhole gauge, uninterrupted and without maintenance or replacement for nearly 21 years.

In addition to Roxar PDMS and the Roxar downhole HS gauges, other downhole solutions include the Intelligent Downhole Network (IDN), which allows operators to install up to 32 instruments on a single cable; and the Roxar Downhole Wireless PT Sensor System, which measures pressure behind the well casing in subsea wells. There is also the recently launched Roxar Downhole Flow Sensor System which, for the first time, generates multiphase flow measurements from downhole in the well.

The single piece of data operators want to know most about, as part of their reservoir monitoring activities today, is the flow from individual wells. Yet, the growing complexity of well architecture, with an increase in multilateral and multi-zone wells, has led to operators having to settle on total production flow data rather than flow from specific well zones. That's why the Roxar Downhole Flow Sensor System represents such a step-change in reservoir monitoring and flow assurance, providing full multiphase measurements - fluid fractions and flow rates - from either single bore or multilateral well configurations.

Finally, there is Emerson's production management software, Roxar Fieldwatch, a specialised Windows-based field monitoring system which enables E&P operators to 'watch their fields' remotely and where real-time data can be accessed directly at the desktop via a graphical user interface.

The rapid retrieval and display capabilities of the software provides the user with the ability to quickly visualize data and identify trends, patterns or areas of interest for further analysis. In this way, it meets operator demand for an integrated and intelligent reservoir monitoring and asset management system, where the economic impact and risk of reservoir management decisions can be fully assessed.

Whether it be supporting production activities (as in the case study with Talisman), measuring multiphase flow rates downhole or tackling the twin threats of sand and corrosion, downhole monitoring today is providing operators with increased insight and control over their reservoir operations and improved production.



Roxar Fieldwatch——一种综合性的油田监测系统
Roxar Fieldwatch – a comprehensive field monitoring system

客户：挪威塔里斯曼能源公司

油田：北海Gyda油田，距斯塔万格270公里。2011年初，在潜水电泵公司（ESP）的支持下，挪威塔里斯曼能源公司在Gyda油田中完成了两眼新油井。

挑战：部署井下监测系统，使其生成至关重要的温度和压力信息，以支持开采系统并确保最优的ESP作业。该监测系统必须能够在高温（HT）应用环境作业，而且必须能与ESP有效地协同工作。

解决方案：塔里斯曼选择了艾默生过程控制有限公司的Roxar井下HS测量仪，因为该测量仪能够在严酷和高温应用环境中运行且能满足高标准的交付时间。

Roxar井下HS系统有最新一代的HS测量仪组成，该仪器专门设计用于极端恶劣条件，是Roxar一体式井下网络（IDN）的有机组成部分。该系统的电子器件具有现代技术水平，而且其采用的技术均为业界领先水平，系统的设计初衷是尽量减少井下电缆感应所导致的噪音影响。此外，该系统还包含Roxar井下网络控制器（DHNC）卡，该卡在连接电源之后，可在油田运营商和第三方通信系统之间实现信息交换。

效果：在岸上进行综合测试之后，结果证明，Roxar井下HS测量仪可与ESP高效协同运行。该测量仪随后于2011年初完成部署。快速通道式的制造和交付确保了在创纪录的短时间内顺利完成岸上测试、运输设计和输送。

油田实际运行效果显示，测量仪的运行完全满足了塔里斯曼的要求，且没有受到由ESP装置运行所导致的任何明显干扰。在第一口井中，HS测量仪在高达153摄氏度（°C）的条件下运行，且被用于维持ESP装置的最佳运行状态。在第二口井中，运行环境温度为131摄氏度，Roxar HS系统自始至终顺利完成运行，尽管在多次尝试启动ESP之后系统出现了极为严重的振动和冲击。

执行概要是有艾默生过程控制有限公司与塔里斯曼合作关系的大型报告/案例分析的组成部分。

本文由艾默生过程控制有限公司Roxar流动测量部副总裁
Vincent Vieugue撰写

With a track record of 25 years and counting and a reputation for innovation, accuracy and robustness, Emerson Process Management and its Roxar business unit are leading the way.

THE CUSTOMER: TALISMAN NORWAY

The Field: The Gyda Field, North Sea, 270 kilometres from Stavanger. In early 2011, Talisman Norway completed two new wells on the Gyda field supported by Electrical Submersible Pumps (ESPs).

The Challenge: To deploy a downhole monitoring system which generates crucial temperature and pressure information to support production systems as well as ensure optimal ESP operation. The monitoring system must be able to operate in high temperature (HT) applications and work effectively alongside the ESPs.

The Solution: Talisman selected Emerson Process Management's Roxar downhole HS gauges, due to their ability to operate in robust and high temperature applications and meet highly demanding delivery times.

The Roxar downhole HS system consists of the latest generation HS gauge designed for the most extreme conditions and is part of the Roxar Integrated Downhole Network (IDN). The systems state of the art electronics and market leading technology has been designed to minimize the influence of noise induced onto the downhole cable. The system also includes the Roxar Downhole Network Controller (DHNC) card which receives electrical power and exchanges information through field operator and third party communication systems.

The Results: Following comprehensive onshore testing to demonstrate that the Roxar downhole HS gauges could operate effectively alongside ESPs, the gauges were deployed in early 2011. The fast track manufacturing and delivery ensured that the onshore testing, carrier design and delivery were achieved within record time.

The field results showed that the gauges operated according to Talisman's requirements without any discernable interference from the operational ESP. In the first well, the HS gauges have been functioning at temperatures of up to 153 degree Celsius (°C) and have been used to maintain the ESPs operating under optimal conditions. In the second well at temperatures of 131°C, the Roxar HS system functioned successfully throughout whilst experiencing extreme vibrations and shock after a number of start-up attempts of the ESPs.

The executive summary is part of a larger report/case study on the partnership between Emerson Process Management and Talisman. ■

This article was written by Vincent Vieugue, vice president, Roxar Flow Measurement, Emerson Process Management