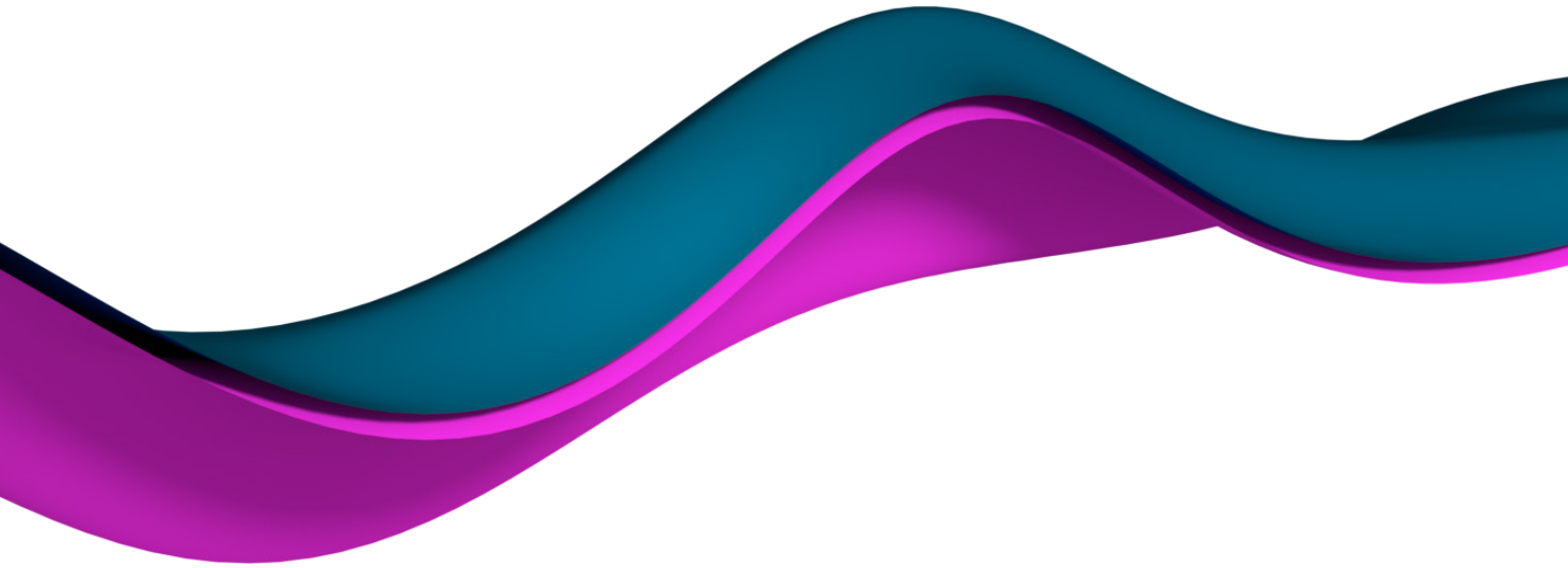


Catch the **next wave** in completions

PulseEight™

Dynamic Downhole Reservoir Management System

TAQA

It’s time to replace intelligent completions dictated by the constraints of downhole technology with a more agile completions approach, shaped by the dynamics of the reservoir

Introducing the world’s first re-deployable wireless completion

PulseEight gives you the opportunity to achieve greater recovery gains from any well.

Our PulseEight dynamic downhole reservoir management system is the world’s first re-deployable wireless completion with control, power, monitoring and communications already on board.

In contrast to a fixed intelligent completion, operators can deploy PulseEight systems on wireline in any well at any depth, programme it to dynamically manage drainage with infinite variability, then pull, re-programme and re-deploy elsewhere.

Putting the PulseEight systems’ suite of tools to work as intelligent assets represent a more agile completions approach, providing systems that respond to the changing dynamics of the reservoir during production.

To make this approach possible, we pioneered Fluid Harmonics production telemetry, the only downhole system designed for two-way cable-free communication by harnessing live production fluids.

Intelligent completions make way for the next wave: **intelligent assets**

In contrast to installing a fixed intelligent completion, operators can deploy a Dynamic Monitoring and Control insert anywhere on wireline, use it to dynamically manage drainage, then pull, re-programme and re-deploy.

Our PulseEight systems provide a versatile wireless alternative to existing data transfer and actuation methods within both production and injection wells.

Downhole, the flow regime is diverted through an infinitely variable choke system which permits the manipulation of the available flow area with which to create a pressure response that can be observed at surface. These communication waves can be received and decoded by surface software examining the amplitude, duration and interval of the waves to deliver meaningful data from the tool.

A similar effect can be achieved at surface using a production choke for the reversal of the communication route. As this communication wave is contained within the normal flow stream, it is possible to achieve this level of communication without the need for additional downhole 'jewellery', such as signal boosters or repeater systems.

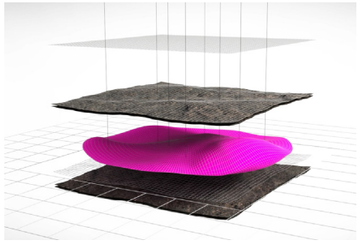
This provides the ability for the entire system to have an elegantly compact configuration with limited downhole footprint.

Additionally, surface equipment requirements can be reduced to almost zero by utilising existing pressure monitoring already in place which enables an easy to install solution.

PulseEight™ allows operators to be smart about how much they invest, how they manage pressure and outflow to keep a well economical, and when it's time to deploy elsewhere.

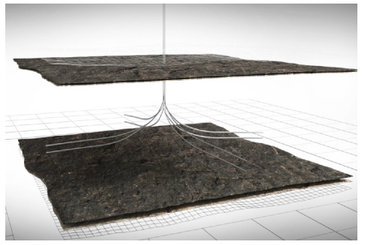
Adds value in **any** scenario

From marginal fields to multilateral wells, putting an intelligent asset to work provides the most direct way to reduce lifting costs, improve economic viability, extend productive life and increase overall recovery rates.



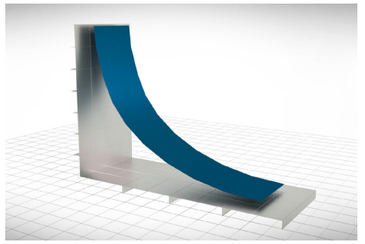
Reduce lifting costs in mature fields

With more oil and less water and gas breakthrough, PulseEight's intervention allows operators to design optimal wells, balance cash flow, achieve drive in reducing lifting costs, balance reservoir complexity with simplicity of completion, and it's your intelligent asset – use it again and again. Low risk solution with the target of reducing costs and extending production.



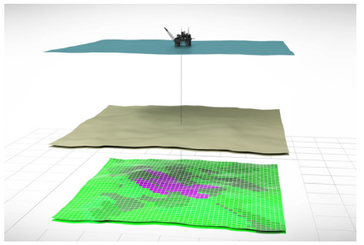
Simplify junction control in multilaterals

In multilateral completions, there is a tendency for one lateral to dominate. Cables and control junction lines struggle to overcome the complexity of multilateral completions. Multilaterals are easily within the capabilities of well design and drilling, but limited by completion technology today. PulseEight bridges this completion technology gap.



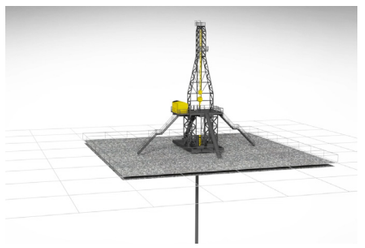
Improve marginal field economics

PulseEight systems allow changes to the economics of a marginal field. The well can be drilled and perforated as required allowing it to be simply and quickly brought on production – with PulseEight permitting future completion control later. This reduces exposure to market price volatility and overall completion costs. PulseEight improves NPV by allowing first oil sooner and can delay cessation of production by improving decline curves.



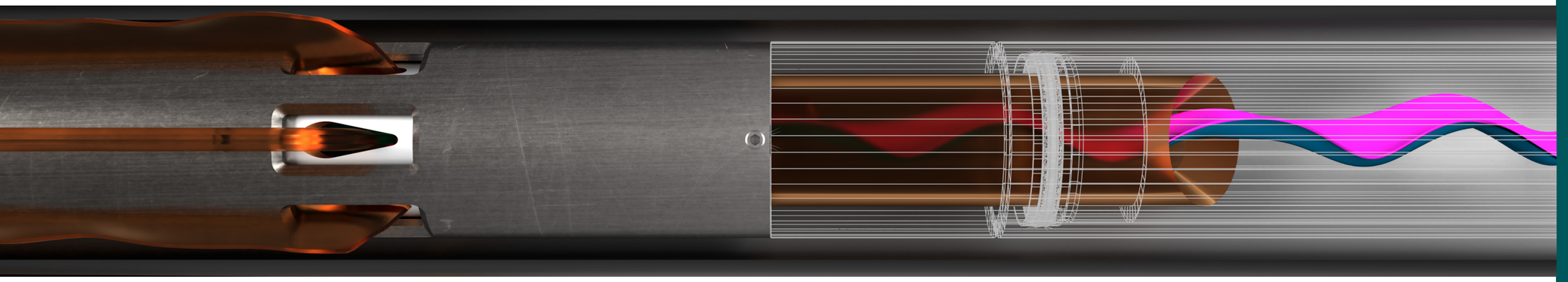
Maintain safety, address integrity issues and support compliance

The elimination of traditional hydraulic or electric control lines reduces overall system costs whilst delivering an improved design from a safety aspect. The truly intelligent capability of modern tooling sees the absolute need of surface data analysis for key trigger points in the well lifecycle to be mitigated, leaving engineering time to focus on more complex aspects of the reservoir's production potential.



Drive down capex in new deals

Traditional systems incur significant CAPEX for initial deployment and increased risk due to possible damage of control lines. PulseEight eliminates that need.



A more **fluid** approach

PulseEight employs Fluid Harmonics, TAQA's proprietary wireless production telemetry that puts produced fluids to work as a two-way channel for data and tool commands.

The early development of PulseEight focused on the need to address the significant challenges associated with ensuring Fluid Harmonics telemetry could be achieved in not only liquid flow but also gas, and all three phases of flow.

Tool responses have been designed such that they can autonomously optimise the pressure response created downhole to illicit a robust surface signal. This has been demonstrated to be possible even within the changeable characteristics of 'steady state' flow regimes associated with any hydrocarbon production stream.

The **PulseEight Monitor** was first applied to a retrofit downhole pressure and temperature monitoring system. This significantly expanded upon the limited functionality of the traditional industry memory gauge by providing real-time data to surface. This has facilitated the capability of existing reservoir models to be simultaneously updated with the latest data in a timeframe that is unhindered by the need for well interventions to retrieve memory gauges to surface for download.

These benefits, coupled with the flexibility of the retrofit design, were exemplified over multiple deployments over the last few years. This permitted valuable pressure and temperature monitoring to be regained in wells which had experienced a failure of their permanent downhole gauge systems and in wells which were never designed for gauge inclusion in the first place.

In one example, declining reservoir pressure in a field had resulted in the requirement for more surface compression capability to drive production. It was therefore crucial that there was an accurate understanding of reservoir pressure and decline to meet contractual gas deliveries and achieve recovery targets. A long-term deployment of the PulseEight Monitor system secured the requisite information to facilitate these needs.

The communication system capability has been further expanded to offer true cable-free access to wellbore data. A recent deployment of a **PulseEight Control** in an onshore well demonstrated the ability of the system to send data wirelessly from the tool all the way to a smartphone app.

In what is believed to be a world first, this wireless 'reservoir to smartphone' communication enabled easy access in almost any global location with either cell phone or satellite link connectivity.

Despite the obvious benefit of ease of access, this opens up a new data route capability for challenging wells and/or remote locations that would otherwise be unattainable.

The system's additional ability to function autonomously in reaction to specific wellbore events, without the need of surface instruction, opens a new chapter in the digital oilfield delivery.

The **PulseEight Secure** is the first tool in the range which utilises this autonomy. It conducts downhole shut-ins in response to conditional flow changes associated with losses of surface containment or emergency shut-down events in producing wells. These first steps now brings aspects of data analysis downhole to elicit responses in a timeframe unachievable by traditional human analysis and action alone. Allowing for future more rapid production optimisation from the PulseEight suite.

As produced fluids travel through the tool, infinitely variable ports are used to briefly manipulate the flow regime with precision

Information is embedded within the amplitude, duration and interval of the resulting communication wave

Proprietary software running in the surface acquisition unit identifies and decodes the received signal

By manipulating surface chokes, tool commands can also be transmitted from the surface and decoded downhole by PulseEight™'s onboard software

Wireless communications like no other

Robust without repeater

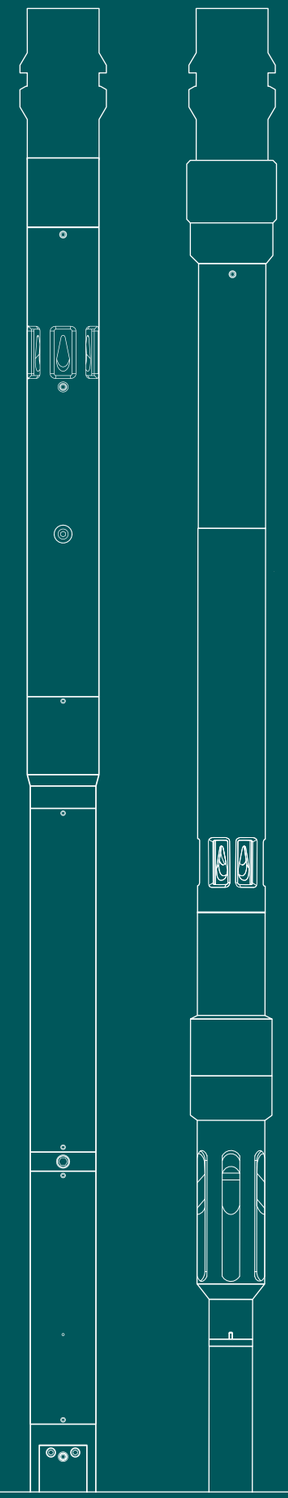
Proven in gas, liquids and multiphase fluids

Unconstrained by casing/tubing design

Subsea compatible

Simple surface integration

PulseEight™ Tools



Add monitoring where it matters

PulseEight Monitor

PulseEight Monitor adds a continuous monitoring capability to any well with an intervention rather than a costly workover. The tool uses Fluid Harmonics to transmit regular pressure and temperature data through live produced fluids, as well as recording high-rate data to memory. Two-way telemetry enables the gauge's data settings to be changed in-hole without the need to retrieve and re-programme.

Shape inflow to improve recovery

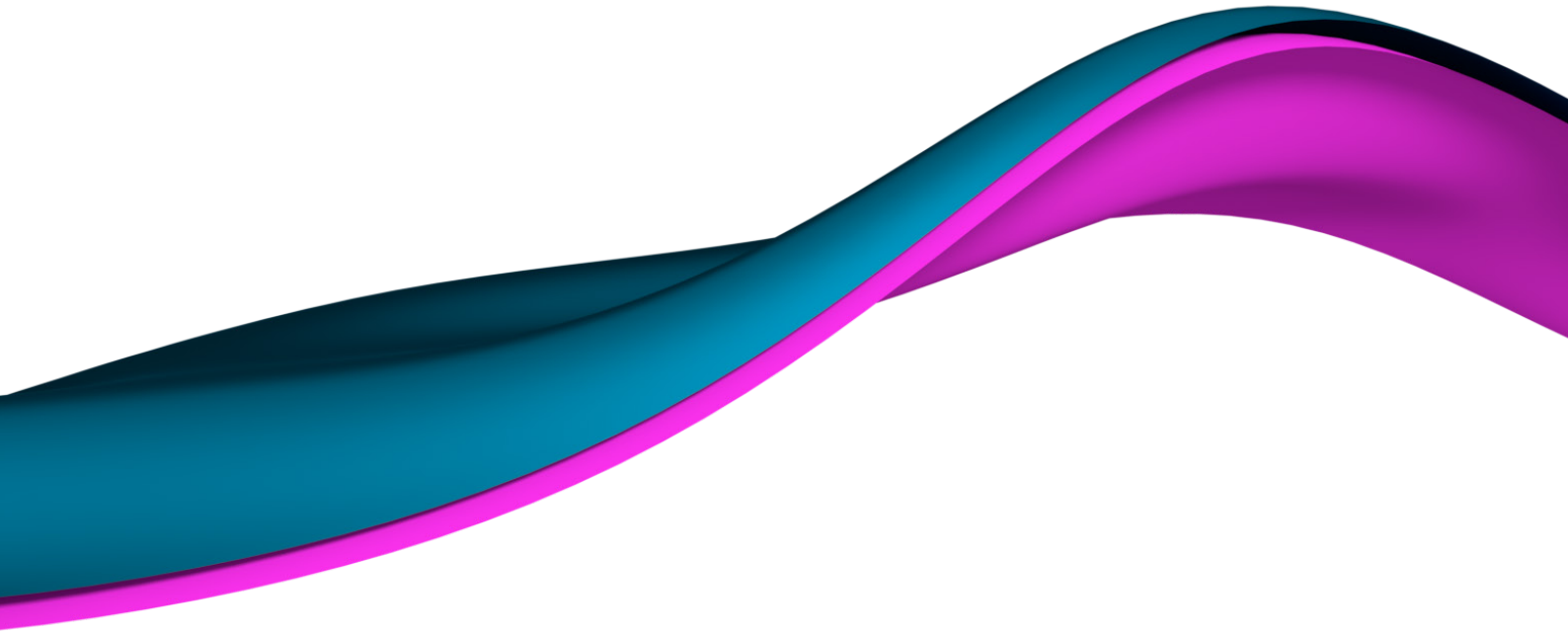
PulseEight Control

The PulseEight Control provides cable-free control of fluids flowing into the wellbore and, in the case of injection wells, into the reservoir. Fluid Harmonics wireless production telemetry allows multiple control valves to be freely positioned and work together to isolate a single section, or to seamlessly control multiple zones.
A target pressure drop is maintained by the system responding autonomously as downhole parameters change, eliminating the delays of manual decision-making.

Maintain safety and support compliance

PulseEight Secure

The API qualified PulseEight Secure offers a smart way to re-establish lost well control with fewer of the constraints of insert valves and storm chokes – even when due to control line failure. Simple to install, the tool senses the tell-tale changes in flow that signal fluid losses or emergency shut down, and can take immediate remedial action. The self monitoring device also uses Fluid Harmonics to send a daily health-check wirelessly back to surface to confirm its operational and battery life status, removing uncertainty of traditional tooling.



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