

Capturing downhole data

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According to PetroWiki, the advent of the digital oilfield has many aims, but all seek to address three key points: 'maximising productivity, eliminating non-productive time and increasing profitability through the design and deployment of integrated work flows'. Crucial to this adoption is to address one of the many current industry challenges in the gathering of enormous amounts of data from the well and reservoir. The end aim of which is to be integrated into advanced software tools for analysis and subsequent action.

It has been clear that the 'in well' aspect of improving data gathering has lagged behind those of counterparts used to monitor on surface. This in part is due to the overlap with other industries. It is also testament to the versatility and robustness of traditional techniques, which have continued to deliver an established value in the difficult trading conditions of the last few years.

Despite the uptake of technology in drilling and well testing operations, technology providers, and the industry itself, must focus on the development and use of systems which can integrate more permanently into the digital oilfield philosophy. This will help to close the widening gap between downhole and surface gathered information.

The adoption of technology for downhole monitoring and control in a permanent completion has traditionally been slow. The industry focus must turn to new advancements in these areas, without which the goal of achieving maximised productivity and improving profitability will be difficult, if not impossible, in the years to come.

An evolving oilfield

The early digital oilfield allowed companies to capture more data and have it analysed in real-time, or near real-time, to optimise production and improve well performance. One of the key attributes to this was improving efficiency in decision-making by delivering the data directly to the right people and into the right models.

Now, that vision is advancing towards full automation for production optimisation by using truly intelligent systems and thereby, closing the feedback loop.

However, in order to provide power and communication capability, most downhole monitoring and control equipment used today is operated via hydraulic and/or electric control lines, which run between the downhole device and the surface control system. The use of these control conduits can significantly affect project costs as a result of the additional hardware, manpower and rig-time necessary for installation and use.

However, the alternative of a conventional completion system can often see the savings on equipment nullified over the life of the well due to increases in operational expenditure and deferred production through increased intervention and poor reservoir performance.

For low complexity wells wishing to adopt downhole monitoring and control systems, there are a number of challenges. These can include compatibility with common well architectures, potential well integrity issues due to feedthrough connections, and the significant amount of hardware required, all of which can make it uneconomical for marginal fields.

Wireless intelligent well technology can extend the operating envelope for the advanced completion by enabling data monitoring and control, which is currently unachievable in conventional systems. The use of these independent, intelligent valve assemblies which could operate without the need of control lines allowing them to be functioned without physical connection to the surface offers significant benefits. Other advantages would include inflow control of selected intervals or in the laterals of multi-lateral wells.

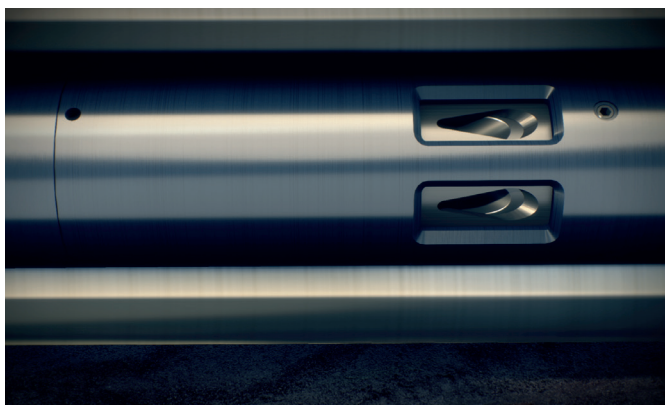


Figure 1: Tendeka's PulseEight device

Intelligent well technology

To combat the limitations associated with the use of conventional control lines, the development and deployment of wireless completions equipment is now becoming more prevalent.

From drill stem testing to multi-node intelligent completions, the shift from downhole equipment with no communication and/or actuation mechanisms to wireless technology represents potentially huge efficiency and performance savings, as well as improved safety. However, these solutions tend to be targeted towards new field developments where there are currently limited options for replacement of failed equipment, or applications for existing wells, other than to conduct a complete workover.

For instance, there are a variety of digital oilfield solutions on the market today for topside applications, which can be integrated into existing fields to manage data and automate processes. Unfortunately, the same cannot be said for downhole solutions. The limited scope of intelligent equipment available does not address the needs of existing assets and can therefore demonstrate limited value. Without these retrofittable, intelligent downhole systems, the full benefit of the digital oilfield is beyond the reach economically for many mature fields.

Global completions service company, Tendeka has developed a unique pressure pulse telemetry system which can be applied to downhole devices for communication in a flowing well. The system provides a versatile wireless alternative to existing data transfer and actuation methods within both production and injection wells.

The telemetry was first applied to a retrofit downhole pressure and temperature monitoring system, creating the PulseEight Wireless Gauge, which expanded upon the limited functionality of the traditional industry memory gauge. This provided a means of adding real-time downhole data from an existing well into reservoir models, rather than waiting for the memory gauge to be retrieved to surface for download before analysis could begin.

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. It now brings aspects of data analysis downhole to illicit responses in a timeframe unachievable by traditional human analysis and action alone.

The digital oilfield vision

Despite oil price increases, it is prudent for the industry not to abandon strategies employed through the low oil price era for optimising existing assets and extending production life. Efficiently and accurately delivering data on the status of well or reservoir, in addition to removing the middleman from some decision-making processes, can provide great financial and technical value to operators in multiple situations.

Intelligent, wireless technology, as a minimum, has the ability to simplify and confidently advance digital oilfield operations by removing the need for traditional hydraulic or electric control lines. The elimination of these items can positively impact overall system costs whilst delivering an improved design from a safety aspect. Moreover, 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.

The future for this and other technologies should be to extend the operating envelope for intelligent completions and address its various applications. With advances in surface data analysis, autonomous completion tools which can link both inter-tool, but also inter-well, should be considered as the next step for production optimisation over multiple wells and have demonstrable value to both existing and new field developments.

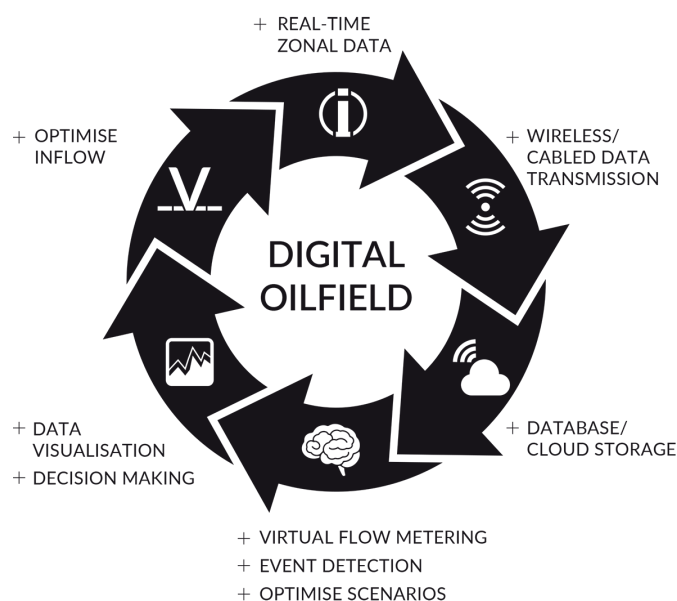


Figure 2: Tendeka's digital oilfield offering covers multiple aspects