Wireless telemetry can reduce high data costs

Francis Neill, Brian Champion, Expro Group

DISCUSSIONS ON RESERVOIR monitoring have traditionally tended towards offshore fields, since those are typically higher value investments and as such can justify greater resource allocation. Nearly all recent developments in monitoring or data acquisition technologies, such as permanent monitoring, fiber optic distributed temperature sensing or 4D seismic, have been driven by high value, high flow rate, offshore wells.

Despite downhole permanent monitoring having been accepted technology for over 10 years, the number of installations on land has been very limited. Land wells have historically had to make do with intermittent gauge surveys or production logs and then only in a small fraction of the total producing well population. Economic models have rarely been able to sustain a permanently installed monitoring system with total installation costs in the region of $250,000.

RESERVOIR MANAGEMENT

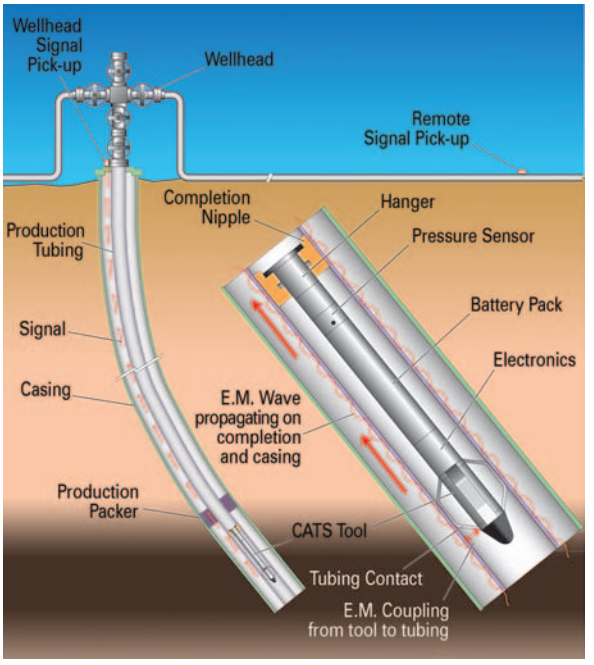
The fundamental principle of reservoir management remains the same whether the wells are offshore or on land. A key component of reservoir management is obtaining the data to make the correct decisions, in other words, reservoir monitoring. At a time of rising commodity prices and increasing concerns about long-term deliverability and accurate reserves determination, this raises the question whether there is an economic case for improved reservoir monitoring on land.

This is dependent on two issues:

• A reservoir monitoring system with sufficiently low 'total' cost to become economically justifiable

• Personnel and systems within operating companies to use the data and make decisions on the basis of it.

In some ways, the second issue is the most critical. Many fields have virtually no well reservoir data apart from occasional surface measurements. Wells and fields have been produced this way for a century. However, there is little point in acquiring reservoir data unless it is going to be used to make decisions to optimize the performance of the reservoir. Therefore the question arises: if a cost effective reservoir monitoring system is available, will operators have the resources to use the increased data and will they be able to justify the data acquisition by improving reservoir management? Until a more cost effective reservoir monitoring system is available, it is probably impossible to answer this question.



Expro Group's cableless telemetry system offers an option to high cost downhole data gathering by providing a cost effective alternative to surface read-out data for onshore wells.

DATA ACQUISITION

There are two options today for reservoir data acquisition. They include periodic wireline surveys with slickline or electric line that require an intervention in the well with the associated operational costs, issues and risks. These surveys either produce a snapshot of the reservoir at that moment in time or, in the case of long term memory surveys, produce data over time, but not until the gauges are recovered, which does not allow real-time decision making.

The second option is a permanently installed surface read-out system run with the completion. While the cost of these systems have been decreasing, the need for cabling, clamps, wellhead penetrators and surface equipment plus the increased rig time required to run the systems means that the cost will never decrease to the levels required to address the majority of the land market.

WIRELESS OPTION

However, there is now a solution to the current cost barrier. Wireless gauges available from the **Expro Group** present an alternative that has the potential to provide cost effective surface read-out data for land wells. A wireless gauge can transmit pressure and temperature data from downhole without the need for cables, either permanent or temporary. No wellhead feedthroughs are necessary and by using the flowline as a signal transmission medium, the signals can even be picked up at a location several kilometers away from the wellhead.

Gauges can either be run as part of the completion or retro-fitted on wireline. Due to the technology constraints and the fact that the gauges are battery powered, wireless gauges do not transmit at high data rates. More typically the gauges are set up to transmit a couple of data measurements per day for several years. However, in most situations, getting a single bottom hole pressure a day for three years is a significant improvement over no data at all. In addition, where more regular pressure measurements are required, such as during a well shut-in for pressure build-up, the tool can, on request, record the data and transmit it over time to surface.

FIELD PROVEN TECHNOLOGY

Wireless technology is now field proven to depths in excess of 12,000 ft. In addition to standard installations for monitoring reservoir pressure and temperature, the technology is finding new, non-standard applications in reservoir monitoring. In the Far East, a client wanted to monitor reservoir performance beneath a beam pump. By monitoring the reservoir pressure, they could optimize the operating envelope of the pump and thus maximize system efficiency and reduce the lifting cost. Other technologies had been tried but were either too costly or suffered from the noise effects of the pump. During a workover, a wireless gauge was installed below the pump close to the producing zone. The wireless gauge successfully transmitted during

pump operations enabling optimization of the pumps.

In West Africa, the flowline transmission capabilities of the system were used to overcome security challenges associated with wellsite equipment and operations. Incidents of vandalism and sabotage were common and the removal of wellhead instrumentation was a real possibility. A retro-fit wireless system was installed in the well using standard wireline equipment. The gauge was programmed to send readings every six hours initially and then weekly for a period of up to three years. The signal from the gauge was transmitted up the well completion to the wellhead and then along the flowline to a secure gathering station located 5 km away from the wellhead, where the data was recorded and stored for the client.

A client used wireless gauges in the Rocky Mountains to carry out long term interference testing between wells, allowing the client to optimize well spacing in a tight gas environment. Initial installations were in an abandoned well with gauges hung below bridge plugs in each zone. The impact of nearby producing wells could be monitored. Installations are now planned on a newly drilled well with the gauges installed on the outside of the casing to record the reservoir pressure in unperforated zones.

Multiple systems can be installed in the same well, meaning that applications can include installations in multilaterals to measure the pressure in each leg. Similarly, wireless gauges can be installed at points along a screen in a horizontal well.

SYSTEM COST

What system cost will the market sustain? Obviously, this depends on the production from the wells and the benefit of improved reservoir management. At the lower end of the spectrum, being able to optimize beam pump wells using pressure below the pump would be nice, but how many wells will justify any additional expense at all? Discussions with operators have indicated system costs of between $10,000 to $50,000 will be necessary to address the land market. If the cost is nearer to $50,000, the market will be smaller; if it is closer to $10,000, it is potentially very large. These costs equate to increasing overall production of the well over its life by between 200 bbl and 1,000 bbl to recover the investment at today's prices.

Today, a total system cost including installation of $10,000 is not achievable with wireless gauges, however, with sufficient volume and suitable supply chain initiatives it may be possible to get close to this cost in the future. By eliminating the fixed and installation costs of a traditional permanently installed system, the wireless system is inherently less costly. Innovative commercial models such as rental of gauges or "pay for data" may also help to increase operator acceptance in years to come.

The majority of the world's onshore oil and gas production is now "mature" and has passed its production peak. As new opportunities to replace this production become more difficult to find, the question becomes how can overall recovery factors from these mature fields be increased? The Middle East, North America, Russia, North Africa and South America all have large numbers of wells and fields that would benefit from improved reservoir data. In these mature producing areas, wireless reservoir monitoring technologies may provide a means of cost effectively acquiring the critical data that will allow operators to more effectively manage and optimize their production.