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Cell Phones Boost Remote Monitoring

By Randy Krall

ALBUQUERQUE, N.M.–Remote monitoring increases oil field profitability. Operators again are experiencing high volatility in commodity prices, and remote monitoring uniquely addresses both reducing costs and improving production.

Numerous case studies demonstrate that timely and accurate well status information reduces both field maintenance and spill remediation costs, and also increase production. Despite these benefits, however, widespread adoption of the technology is still in its early stages, although it is growing rapidly. Improvements are likely to accelerate this trend.

Until recently, remote monitoring of oil and gas assets has had two traditional flavors. Rare or infrequent reporting systems provide information on daily up to hourly bases from equipment used for alarm call-outs, while in some cases also providing limited production data. The assets monitored include tanks, pumps and flow meters.

Systems that report more frequently, with scan times on the order of minutes or even seconds, traditionally are employed on supervisory control and data acquisition architectures, and monitor programmable logic controllers that control complex plants or other processes that require much higher data rates and resolution.

Advances in digital cell phone technology and coverage of the oil fields permit a blurring of this traditional distinction with systems that deliver near real-time data at a price point far below that of SCADA systems. The benefit to the operator is an enhanced ability to spot problems with equipment quickly and without polling, and also to see short-term events in wellhead pressures or flow meters, which leads to improved management of the field assets and increased production.

Cost And Presentation

The major drivers of the traditional variations in remote production data gathering are cost and presentation. On the cost side are the two extremes of a SCADA system versus a simple call-out system. The SCADA system typically employs a dedicated or private network, which provides high volumes of information on a near-continuous basis at a cost of up to several hundred thousand dollars for spread-spectrum radios, radio tower infrastructure, satellite uplinks, and complex software to control it all.

Such a system is generally feasible only for an enterprise with a full information technology staff, field instrumentation technicians and several thousand barrels of oil or Mcfs of gas production to justify its cost and complexity.

The major oil companies and large independents have been building and maintaining such systems for decades, and their business value lies in the quality of the field information created and their ability to permit "pumping by exception" and other technology-dependent strategies for managing oil fields.

On the other extreme, the basic call-out system utilizing a land line–or more recently a cell phone connection–often is installed to monitor and report changes on a simple digital input regarding the presence of fluids above a static preset level. This system works well to provide a simple alarm, but after it is triggered, the only recourse usually is a trip to the site to investigate the reason for the call.

Any information regarding production values also will require a trip to the site to collect the data in person. The simple call-out system makes rare calls to report an unusual event, and its simplicity and low data capabilities are the basis for its reduced monthly cost. The business value of this system is as a tool to extend the visibility of field personnel in a limited manner by reporting problems after they have occurred.

When it comes to data presentation, a SCADA system generally features a rich set of custom-designed screens that show flow rates, tank levels, and pressure values both in graphical and tabular formats, which are updated several times an hour or even by minute. The volume of data requires sophisticated software to avoid overwhelming the user with detail. The presentation usually is customized for the specific needs of the enterprise user, and traditionally has required an IT staff in order to install, customize and maintain the application on one or more corporate servers dedicated to that purpose.

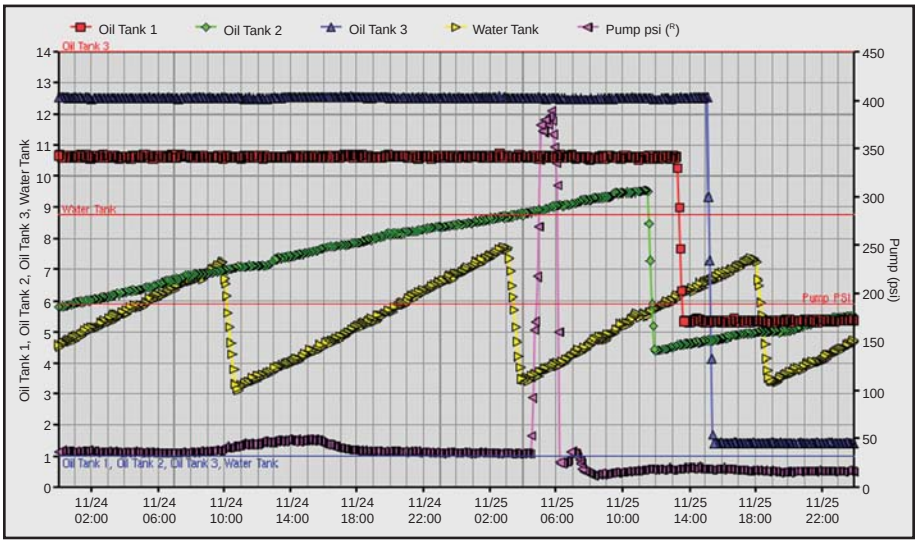
The call-out system, on the other hand, may have no data presentation at all beyond a simple voice telephone call to report the rare event it is designed to monitor. The simplicity of this system is both its strength and its greatest limitation.

The New Alternative

Advances in digital cell networks and associated infrastructure permit an interesting alternative to these extremes. Modern digital cellular modems cost a few hundred dollars with price plans in the low tens of dollars a month for several megabytes of data. When these are coupled with increasingly inexpensive embedded computers and Web-based software, a system with capabilities approaching the SCADA

FIGURE 1

Tank Levels and Pump Pressure with Alarm Event



alternative can be constructed without the large initial price tag or maintenance requirements normally associated with that alternative.

The cost savings come through both initial installation and ongoing maintenance that utilizes the power of Internet-based information delivery and third party resources to provide it.

The benefits are equally impressive and fulfill a need from the operator community. The technology permits a new level of communication among engineering, management and the field team. Discussions such as, "It looks like you had the well off line for 45 minutes today. What caused that?" may be somewhat shocking initially, but once they are accepted, they result in much better coordination of activity.

Operators have been demanding more timely and accurate data from their field teams for years. This demand has been partially met with field data capture systems that employ laptop computers or personal digital assistants (PDAs). This approach is limited in that it can be collected only manually through a trip to the well site.

More recent systems employ digital cellular modems and site computers, and permit automated data capture. Software and communication advances allow the data to be presented in near real time.

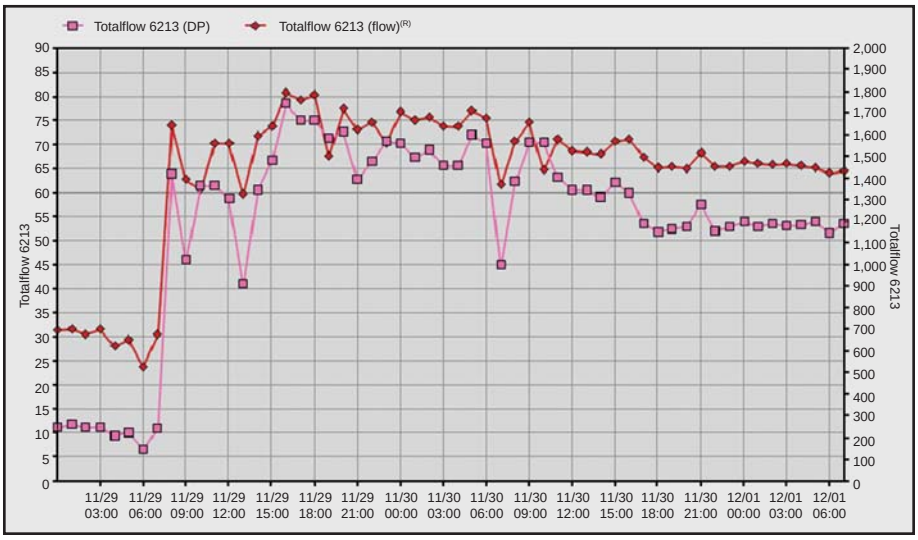
The newest addition to the cellular network is the availability within oil and gas fields of reliable, inexpensive packet-switched data that uses standard protocols such as TCP/IP (transmission control protocol/Internet protocol) or UDP/IP (user data-gram protocol/Internet protocol). This infrastructure now can be leveraged to allow near real-time reporting of production data from the operator's fleet of field assets at a fraction of the cost of a SCADA system.

In another improvement, many cellular providers now offer similar services, so the solution does not have to be customized or dependent on the capabilities available within a local geography. As usual, the consumer market is demanding the bulk of these services, and the competition to supply them is driving down prices and increasing coverage.

A typical use in the consumer market would be data services to enable connecting a cell phone, PDA or laptop to a digital network for Web browsing, e-mail or other application. It is valid to ask whether an infrastructure designed for that use is suitable for the demands of a system that a producer likely will come to utilize on a daily basis. Experience shows that service quality and reliability are very high and are improving constantly.

FIGURE 2A

Differential Pressure Readings (Hourly Data)



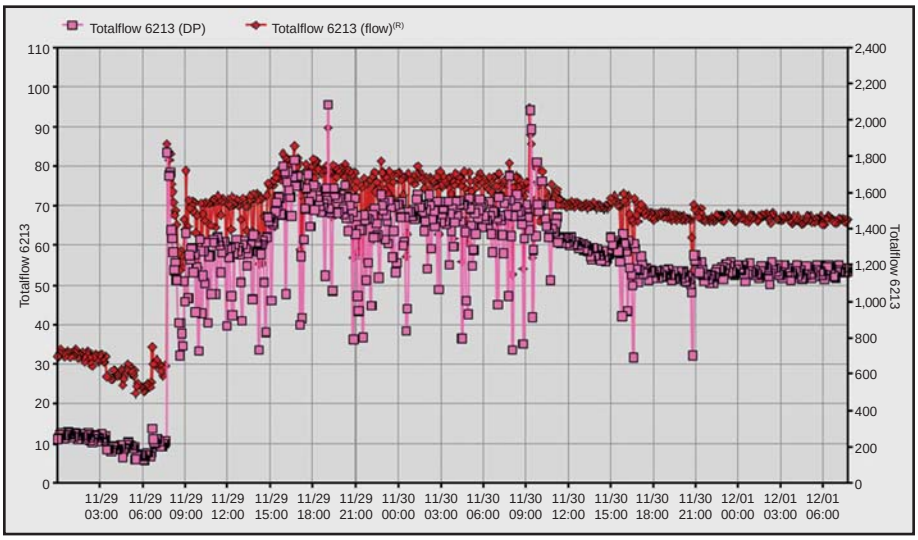
Benefits And Impact

In many cases, the benefits of this type system occur after an alarm has been triggered. The user can see trend information at high resolution for several hours prior to the event and determine whether the alarm was caused by a transient spike in pressure or something more serious.

Figure 1 displays tank levels and pump pressures for 24 hours. The alarm event is clearly visible along with the pump pressure change that caused it. Since there was no corresponding change in tank level, the sensor's temporary variation outside of normal values is easily attributed to a momentary equipment failure, and likely warrants additional online scrutiny, but not a much more expensive site visit.

Real-time data also have benefits outside of alarm reporting and analysis. The high resolution permits detailed examination of a well's initial downhole production characteristics. Pressure and flow variations that are invisible with daily or even hourly reporting show up with stark clarity at the higher resolution.

FIGURE 2B
Differential Pressure Readings (Real-Time Data)



Note the differential pressure readings in violet on Figures 2A and 2B, which show normal hourly (Figure 2A) and high-resolution (Figure 2B) modes compared with the flow rates shown in red. The transients in the earlier 24-hour period are easily detectable in high resolution and nearly invisible in hourly mode.

In summary, by combining a modern digital cellular modem with sensors and a high-quality user interface, operators now can experience many of the benefits of a much more expensive SCADA system. The early adopters of this technology are enjoying substantial improvements to their bottom lines in the form of increased production, improved operating efficiencies, and reduced exposure to environmental liability. ❐

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