Appropriate uses of wireless instruments delineated

As OPEX and CAPEX come under increasing pressure, cost-effective wireless installations become more appealing for E&P companies.

By David Newman, *Emerson Process Management*

For the past two years, petroleum industry innovators have experimented with and proved the value of wireless monitoring instruments in remote, hard-to-reach areas where high construction costs made wired devices unacceptable. Now, wireless' cost and operational advantages — along with its security and reliability — are making it a good choice for a broad range of traditionally wired upstream operations.

Traditional cabling will continue to be used in contiguous areas such as on offshore platforms and in oil sands upgrader facilities, as well as in safety systems. But wireless is now commonly employed in existing facilities, and use on new construction projects is already occurring.

Today's advanced wireless technology weighs less and has a smaller footprint than a wired installation, an important consideration on platforms. It delivers significant installed cost savings over traditional 4-20 mA instrumentation of up to 30% per point when compared to wired analog points on individual installations in existing facilities where cabling and cable trays are used. Moreover, savings of up to 75% can be realized on applications where conduit is used. This is predominantly in North America.

As anyone familiar with industrial automation knows, a search for a digital replacement to the 4-20 mA analog standard began in the mid-1990s. FOUNDATION fieldbus was developed by ISA as SP50 and, along with competing technologies, has been widely adapted across industries.

New studies show that installed cost savings with wireless exceed those of FOUNDATION fieldbus where cable runs are less than 250 m and there are less than 500 points for connection. Above those numbers, fieldbus savings are somewhat larger than wireless. These studies show that optimal design of an offshore installation could well be a combination of traditional 4-20 mA for safety, fieldbus for control, and wireless for monitoring and slow-changing control applications. Other advantages of wireless include simpler engineering and construction, more flexible start-up, faster deployment, and the ability to accommodate late design changes, since wireless devices are easier to install.

Safety is a consideration as well. Process and operational information is delivered where it's needed, wirelessly. Personnel no longer need to make manual readings where process pressures and temperatures are high.

Emerson's Smart Wireless solution employs self-organizing mesh technology that overcomes many of the drawbacks of older, line-of-sight systems. For example, wireless instruments can be widely distributed across onshore oil fields, where traditional data collection from wired instruments isn't feasible or practical. Self-organizing mesh networks continuously monitor transmissions from pressure, temperature, flow, and vibration measurement devices, automatically finding the optimum communication route to the network gateway (receiver). If a temporary obstruction blocks a connection, signals are rerouted via adjacent wireless devices, which act as transceivers. In this way, connectivity is maintained while achieving greater than 99% data transmission reliability.

This technology is the basis for the *Wireless*HART standard, approved by the more than 200-member HART Communication Foundation, representing both instrument users and manufacturers. A substantial number of field devices, valve and equipment position monitors, vibration data transmitters, and smart gateways meeting this standard are already in use in the petroleum industry.

Successful projects

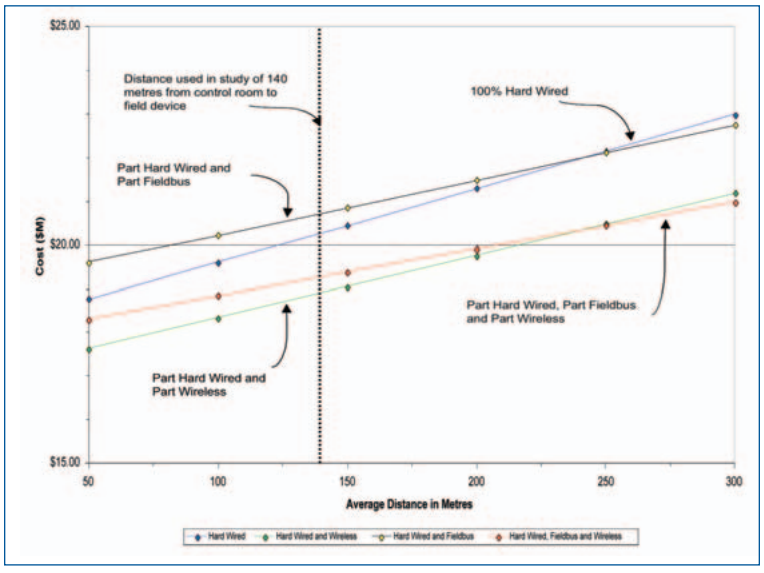
An early application of a Smart Wireless network was made in August 2007 at the BP Wytch Farm installation in the UK, one of the largest onshore operated oil fields in Europe. To increase worker efficiency and eliminate daily operator rounds to read wellhead instruments, BP installed 40 Rosemount wireless pressure transmitters, two per wellhead. A single Smart Wireless gateway mounted outside the process area connects transmitters to control system. All new transmitters were online within 30 minutes, monitoring wells continuously and identifying out-of-the-norm pressures.

According to Chris Geen, BP manager, "Wytch Farm has been a critical pilot project for BP to determine if self-organizing wireless mesh technology would be suitable for other similar projects. Following the success of this installation, BP is planning to install Smart Wireless transmitters in similar applications on offshore platforms."

A Smart Wireless network is already employed on the Grane Platform operated by StatoilHydro, remotely monitoring wellheads and heat exchangers in the harsh, difficult-to-reach North Sea. Obstructions that might have blocked line-of-sight transmissions proved no obstacle for the self-organizing wireless technology.

In this case, 22 wireless pressure transmitters are mounted on the wellhead to measure annular pressure, and 12 similar devices monitor the inlet pressure and pressure drop over the heat exchanger. Each transmitter relays data via the network gateway to operator consoles in the control room.

Signal strength and consistency are excellent, and the system has a 100% rating for reliability and stability. Here again, daily visits to manually record gauge readings have been significantly reduced. Operator exposure to hazardous areas also has been reduced.



Studies indicate that wireless technology, by itself or in combination with analogous wired technologies, can provide substantial cost savings without increasing risk. (Image courtesy of Emerson Process Management)

"We are delighted with the performance of the Smart Wireless network," said Geir Leon Vadheim, instrument lead on the platform. "Following a short training program, our instrument engineers are very confident about adding more wireless devices to our installation as required."

The Venezuelan state-owned oil company, PDVSA, has issued multimillion dollar orders for automation upgrades in the Morichal District, including wireless monitoring of more than 180 wells. This self-organizing wireless network will use more than 600 wireless transmitters. In addition to cost reduction, the wireless solution is expected to deliver reliable pressure and temperature data where grounding problems and harmonics generated by electric drive equipment in the well pads rendered wired instrumentation unreliable.

Wireless studies of new projects

Recent studies show Smart Wireless technology results in measurable benefits when used for 25% to 45% of total I/O on both small and large capital projects. In addition, wireless increases design flexibility and shortens schedules due to application and installation ease. The study results indicate best practice for new greenfield construction projects combines wired HART, fieldbus, and wireless communications technology.

Wireless on a greenfield offshore manned platform. An Emerson study of an actual offshore platform with about 4,000 I/O proves wireless technology can be broadly used in process applications. It is unnecessary to restrict wireless to those applications where deploying wired instruments would be too expensive or impossible.

Examination of various combinations of wired HART, fieldbus, and wireless devices, and the projected installed costs, show wireless to be cost-effective in comparison with the other communication means. For the platform studied, approximately 17% of signals were economically and reliably transmitted via wireless devices. In this case, installing wireless along with other technologies in the process control system can realize savings of up to 7%, or more than US $1million. Further, eliminating some 800 wired points results in a weight saving of up to 35 tons and reduces required deck space of up to 129 cu m in cabling, cable trays, junction boxes, and cabinets.

Extrapolating cost savings as a function of average wired distance show that wireless instrumentation saves money at any distance, with savings greater at longer distances. The study established a repeatable methodology for calculating project savings through use of wireless.

Wireless on greenfield process plants. An additional study of a chemical process plant, by independent consultants, had consistent findings: When used in small or large capital projects, today's Smart Wireless technology currently results in significant capex installed cost benefits. When used for up to 45% of total project points, engineering, construction and startup savings are shown to be up to 35% compared with wired analog points.

Roger Hoyum, principal engineer at JDI Contracts and author of the Chemical Industry Capital Cost Study, said, "Our recommendations regarding best practices are firmly centered around procedures and technology required to meet owner objectives and deliver expected project outcomes, including scope, schedule, budget, and less tangible factors such as maintainability and ease of use. With wireless technology, we can deliver a better plant." ■