

Putting wireless to work in process operations

Wireless technologies offer process operations new opportunities for improvement. With a wireless strategy and architecture that align with your business needs, you can begin gaining the benefits today while facilitating additional applications in the future.

Technology that makes a difference

New technology has historically brought disruptive change in the process automation field -- not because of the technology itself, but because of the functionality it enabled that brought new value to the fore.

This happened as the introduction of microprocessors and digital communications led to Distributed Control Systems (DCSs) and the migration of intelligence into field devices. These technology changes enabled users to gain more insight into their plants -- not only about process variables, but also about the current and future health of the devices and the process. The additional information enabled them to make a step change in the performance of their business through more flexible operations, increased safety, decreased operations cost, and decreased cost of change.

However, even with these innovations and the benefits of a digital plant, there are still untapped opportunities to reach new levels of process and business performance. Valuable information that can enhance productivity may still be out of reach because accessing it would be cost-prohibitive or technologically impractical.

For example, what if you could immediately detect leaks and releases before they lead to environmental problems and potentially millions in fines? Pinpoint corrosion inside piping, and vibration or temperature excursions that are attacking equipment life? How much more productive could your workers be if they had access to process and control information even when they're not in the control room or maintenance shop?

Wireless can make this happen. It is the next disruptive technology that will cause a major shift in process automation and deliver new

opportunities for performance breakthroughs. It will do this by further extending your information reach for better process control and asset management, by enabling your human "assets" to work more safely and productively, and by offering more cost-effective ways to manage business functions from security to personnel and asset tracking.

This white paper outlines potential benefits of wireless technology in process plants, key aspects of a wireless architecture to support the applications that deliver those benefits, and tips on how to get started putting wireless to work in your own operation.

The benefits: What can wireless do for you?

In past technology shifts, it wasn't the technology itself (such as microprocessors or digital communications) that drove the shift; it was applications that took advantage of the technology to deliver value. Similarly, the adoption of wireless technology will be driven by the ability to more easily and cost-effectively extend and manage the flow of information around the plant.

Wireless technology is not a complete replacement for wires, at least not for a while. But it is already enabling new tools that give you the freedom to solve problems you could not cost-effectively address in the purely wired world. The possibilities are limitless. Imagine a plant where...

- Safety relief valve emissions are monitored for more effective regulatory compliance
- Safety showers are monitored 24/7 so help can be dispatched immediately
- Wireless vibration sensors give you a real-time indication of equipment reliability every day, not just once a month/quarter/turnaround
- The status of previously unmonitored plant equipment such as on-off valves is known and historized in real time, providing a safer, more productive operating environment
- Operators don't have to make "clipboard rounds" to collect data
- Diagnostics in all HART devices – including those that couldn't be accessed before -- are available for asset management
- Workers can access desktop applications and perform tasks wherever they are – including viewing and responding to alarms from the field
- The locations of personnel and physical assets in the plant are tracked at all times

**Real, measurable,
easy-to-access benefits**

Here are just a few examples of how customers are using Emerson's Smart Wireless field network solutions today to access information that was previously out of physical or economic reach:

- Enhancing safety by monitoring for exothermic reactions in moving railcars
- Monitoring filter plugging to avoid damage to pumps
- Improving control of plant steam supply by detecting "cool spots" in cross-plant steam lines
- Reducing risk of overfilling tanks by adding redundant level measurements
- Optimizing lime-kiln flame profile with mid-zone temperature measurements
- Ensuring portable waste tanks are full before being taken to disposal areas
- Improving quality of steel coils by measuring flow to individual cooling-spray nozzles
- Eliminating need to reconfigure control system whenever portable process skids are moved

- You can broadcast messages to specific groups of workers wherever they are
- Security systems track and ensure authorized plant access
- Video systems not only patrol the fence line, but keep a cost-effective eye on the process
- Corrosion in equipment and piping is monitored by wireless sensors

Many of these applications are possible today without wireless technologies, but wiring costs or technical limitations make them impractical. Cost-effective and easy-to-integrate wireless technology can overcome these barriers, enabling you to gain better insight into your plant – and ultimately make your workforce more productive.

Maximizing the benefits of wireless technology will come from putting it to work in multiple applications. These opportunities typically fall into three categories:

1. **Plant and process information**, including extended plant and asset information, stranded diagnostics, and extending the "walls" of the plant
2. **Workforce productivity**, including remote and mobile operations and maintenance, automated work flow management, and mobile worker communications
3. **Business and plant management**, including physical plant security, video monitoring and surveillance, and people and asset tracking

Let's take a closer look at each category.

1. Applications for plant and process information

The more you know about the process, physical assets, and overall operations of your plant, the safer and more profitable your business can become. More (and better) measurements mean more opportunities for reducing operational costs and improving quality, throughput, and availability.

In addition, new environmental and safety requirements have been established after many of today's facilities were built, and plants have struggled to get access to measurement and diagnostic information that could ease compliance.

So, why aren't more plants "measuring up"? Too often, the cost or difficulty of adding new measurements has outweighed the perceived

Measurement, condition monitoring, and plant health

No one matches the breadth of Emerson's instrumentation offering, or the depth of our experience in applying these technologies to improve process operations.

Our wireless instruments for measuring pressure, temperature, level, and flow are already helping customers gain better insight into their plants, and we are extending our wireless capabilities to vibration, corrosion, discretetes, manual valve position, and mass flow.

Also on the way is a HART upgrade module for wirelessly accessing diagnostic information in the wired HART devices you already have.

We also work with third-party suppliers of specialty sensors to wirelessly enable them to meet application needs.

benefits. With traditional wired technologies, distance or complexity can make connecting the measurement point to a control system, asset management system, maintenance system, or data historian impractical or cost-prohibitive.

Wireless technology removes the barriers of traditional wired solutions and gives you unprecedented access to data that was previously out of economic or technical reach. Imagine, for example, the benefits of additional temperature measurements to detect "cool spots" in steam lines, or the advantages gained by cost-effectively instrumenting a remote tank farm.

This access to additional data includes not only process measurements, but instrument and equipment information as well.

For example, millions of smart HART-based devices in the field today have some level of diagnostics capability. Unfortunately, many plants don't have the infrastructure to receive HART data into the appropriate system. Since only a fraction of these devices are digitally monitored, the potential gain from accessing such "stranded" diagnostics is significant.

With wireless technology, the data doesn't have to be stranded anymore. Existing wired HART devices can be upgraded with a wireless adapter to transmit diagnostics information back to the control room or maintenance shop, where appropriate personnel can take corrective action as needed. Process control signals continue to be communicated over the wired connection.

Capabilities like these open the door to a broad range of applications – from monitoring pressure relief valves and stacks continuously to avoid environmental excursions and the ensuing fines, to monitoring corrosion in pipelines and vessels or vibration in mechanical equipment. And with safety always a top concern in plants, knowing the real time status of more plant equipment is critical.

The possibilities are almost limitless. All you have to do is think of all the things you've always wanted to measure but couldn't justify the investment. Chances are that now you can.

2. Applications for workforce productivity

In an era when an aging workforce and loss of experience are among the most pressing business problems process manufacturers face, wireless technology provides a means to empower next-generation plant workers just as cell phones and PDAs have empowered the mobile business person today.

Enhancing worker productivity

Emerson is the leading provider of handheld field maintenance tools and has been providing wireless remote operations and maintenance products since 2001. With the growing acceptance of wireless in the process industries, the use of these tools will increase.

Our products and technologies that can enhance the productivity of mobile workers include:

For mobile operators: DeltaV Remote Operate, PlantWeb Alerts, and Plant Messenger for PDAs.

For mobile maintenance workers: AMS Suite: Intelligent Device Manager remote client, CSI 2130 Machinery Health Analyzer, CSI 9800 Imager, CSI SonicScan, 375 Field Communicator.

Our portfolio also includes a number of Class I/Div 2 and intrinsically safe handhelds in various form factors that mobile workers can use to run these applications.

Even during normal operations, it's not uncommon for a large plant to have hundreds of people working throughout the plant, often far from their control rooms, maintenance shops, or offices. The new wave of wireless tools will dramatically improve the productivity of these people by providing instant access to information that they otherwise would have had to cover considerable distance to get to, or take valuable time from other plant personnel to find out.

For example, although technology has enabled operators to perform many of their control and monitoring duties from the comfort and safety of the control room, there are still times when they have to go out into the field. Some companies routinely have their operators make rounds to see firsthand how the plant is running. By providing remote access to control and asset-management systems, a ruggedized wireless PC can greatly enhance the efficiency of these people as they will be able to immediately relate what they see to what is happening to the process and take quick corrective action.

When operators are in the field, there may be no one in the control room watching for alarms. But with wireless access points throughout the plant, operators can use these PCs or similar tools to access critical process information, historical data, graphics, and other key functions that normally reside in the control room or elsewhere in the plant. That includes viewing and acknowledging alarms from wherever operators are.

New wireless technologies can also improve worker communications. While many plant workers already use an older wireless technology – walkie-talkies – for short-range communications in the field, combining a plant-wide wireless broadband network with Voice over Internet Protocol (VoIP) technology can extend communication reach as well as enabling "smart" communications. For example, you could broadcast messages to specific teams based on the IP address of each worker's radio. Often when customers evaluate traditional hardwired PA systems they realize that such systems cost a lot more than putting in a wireless infrastructure that allows VoIP communications. The other advantage of this wireless approach is that you now have a platform that allows you to implement other applications that require a Wi-Fi coverage.

Maintenance workers can also benefit from these applications. Wireless tools such as handheld communicators allow these workers to access maintenance work orders, instructions, and other information on the spot, and to immediately track or report inspections, tests, and repairs.

To be deployed in the process industry, however, applications like these must address issues such as harsh, industrial environments, high RF interference, bandwidth allocation, and sharing the airspace with higher-priority control information from wireless field networks.

To offer wireless solutions that meet these requirements, Emerson has teamed with Cisco Systems, Inc. Cisco is a leader in designing and installing open wireless networks and applications to meet users' business needs. Emerson and Cisco work with you to define requirements and identify appropriate technologies. We will then design the wireless network and any infrastructure required to deliver the results you're looking for.

3. Applications for business and plant management

Wireless applications such as personnel and asset tracking, as well as wireless video surveillance for security and safety, have changed the way offices, hospitals, warehouses and retail stores operate. These applications can also solve business needs inside process environments, such as improving safety and security.

Open, best-in-class applications

Emerson has teamed with Cisco to allow us to design, specify, and install the best wireless technology to meet your business and plant-management needs. Cisco is the industry leader in mobility solutions, and we offer a portfolio of best-in-class solutions for wireless security systems, video surveillance, and people and asset tracking. Our standards-based architecture and vendor-neutral approach enable you to receive the best available solution for your application.

Wireless allows affordable access to information for better insight into what's happening, especially for safety and security. For example, it's easy and cost-effective to add wireless cameras where it would be too difficult, costly, or risky to trench or wire.

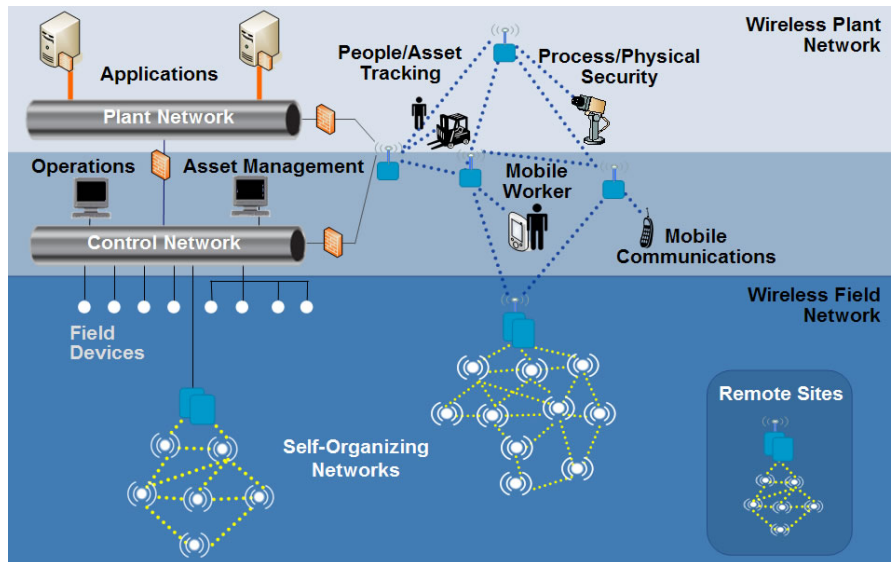
Many plants are already using wireless technologies to improve security. Wireless closed-circuit television cameras and RFID-equipped access badges enable intelligent security monitoring and control – from restricting access to specific areas based on levels of security, to tracking attempts to violate security protocols and helping security managers identify potential vulnerabilities and improve systems. Wireless applications can also enable you to monitor hazardous applications in order to reduce risk to plant personnel.

Wireless location technologies allow you to quickly find and track inventory and valuable assets – even workers -- moving inside and outside the plant. Time spent looking for assets can be dramatically reduced, which can have significant benefits during major turnarounds, emergencies, and new construction projects. Being able to quickly locate each worker also offers safety and productivity benefits.

Our alliance with Cisco enables us to assist customers in wide-scale deployment of wireless networks for business and plant management. While our open, standards-based approach allows you to choose from a broad range of suppliers for applications such as video surveillance, security systems, and personnel and asset tracking, we also offer a portfolio of solutions from best-in-class suppliers. Cisco and Emerson have done extensive testing to verify integration of these solutions with our wireless architecture.

An architecture that works for you

Gaining the benefits of the applications outlined above requires a solid foundation of wireless networks and infrastructure. To meet this need, Emerson has developed an architecture that can extend your plant wirelessly at both the wireless field network and wireless plant network levels.



This architecture integrates the wired and wireless worlds to provide a single, scalable infrastructure that helps you optimize applications across your operation. In effect, we are simply "unplugging" the benefits of our PlantWeb digital plant architecture, extending its predictive intelligence and human guidance to assets that were previously out of physical and economic reach.

Our approach is based wholly on open standards so you can choose standards-based solutions without being tied to a specific technology or vendor.

- **For plant and process information applications.** At the field network level, we are working closely with customers and other suppliers to achieve a wireless standard that effectively solves customer problems in process applications. Our wireless field products are based on WirelessHART and are committed to be compliant with this standard. We also actively participate on both the WirelessHART and the ISA SP-100 committees and are working with these groups to include WirelessHART technology in the SP-100 standard.
- **For workforce productivity and plant and business management applications.** At the wireless plant network level, the architecture uses commercial standards such as IEEE 802.11 Wi-Fi, the emerging 802.11s Wi-Fi mesh standard, and 802.16 WiMAX to leverage the advantages of these readily available, widely supported technologies.

Wireless technologies for field networks

Our smart wireless solutions in the field use self-organizing mesh technology that is tried and tested in the field – and the basis for the recently approved WirelessHART standard. Each wireless device in a self-organizing network can act as a router for other nearby devices, passing messages along until they reach their destination.

This capability provides redundant communication paths and better reliability than solutions that require direct, line-of-sight communication between each device and its gateway. Whenever there's a change in the network or in conditions that affect communications, the devices and gateways in a self-organizing network work together to find and use the most efficient path for each message – a path that optimizes data reliability while minimizing power consumption.

Self-organizing network technology also reduces the effort and infrastructure to set up a successful wireless network. One of the difficulties of setting up the traditional point-to-point wireless network is the requirement to do a site survey to be certain that every node in the system has a line-of-sight path. This survey work is expensive and also tends to require up to three times as many infrastructure nodes as a self-organizing network.

Another advantage of self-organizing networks is that they are dynamic. As new obstacles are encountered in a plant -- such as scaffolding, new equipment, or moving vehicles -- the networks can reorganize around them. All of this happens automatically, without any intervention by the user.

Our self-organizing networks use IEEE 802.15.4 radios with channel hopping as the physical layer. They are designed and tested to be tolerant to almost all interference and can co-exist with other wireless networks in your plant. The networks are also highly scalable and capable of one-second scanning with low latency.

Emerson's wireless devices based on this technology have been proven in use to demonstrate greater than 99.9% data reliability.

Wireless technologies for plant networks

Emerson has been delivering wireless products and solutions at the plant network level since 2001, when IEEE 802.11 became an accepted standard in our industry. Our experience has demonstrated the importance and benefits of using WLAN technology in manufacturing and processing plants for enabling applications such as video monitoring and data access.

Our Smart Wireless architecture uses rugged wireless access points from Cisco to provide Wi-Fi coverage. The Cisco® Aironet 1520 Series Outdoor Wireless Mesh Access Points are Class I, Div 2 certified and support dual band radios compliant with IEEE 802.11a and 802.11b/g standards. Because these access points are based on open standards and protocols, they provide a universal standard network infrastructure for easy integration of all the wireless applications in your plant, including security, personnel and asset tracking, and mobile worker productivity solutions.

A combination of pre-tested and validated backhaul technologies, including Wi-Fi bridging, WiMAX, and satellite connectivity, are also available.

The architecture uses Cisco Wireless Control System (WCS) software for wireless network management, supported by Cisco Secure Services for network security. WCS is the industry's leading platform for wireless LAN planning, configuration, management and mobility services. It enables you to manage routing, segregation and prioritization of wireless data, as well as the security infrastructure for data transmission and access. This provides a cohesive wireless communications platform across the physical as well as the functional areas of plant operations so that the shared network can support diverse applications with the necessary security, policy, and performance management.

Security

Because we also understand your concerns about protecting process performance and data, security is designed into our wireless offerings right from the start.

At the wireless field network level, robust security is provided through advanced, standards-based encryption as well as authentication, verification, key management, and anti-jamming techniques.

For example, Emerson's Smart Wireless solutions employ end-to-end 128-bit encryption using the Advanced Encryption Standard (NIST standard FIPS-197). For authentication purposes, each gateway maintains a "whitelist" of devices allowed to communicate with it, and individual devices accept messages only from a previously identified gateway or from other gateway-validated devices.

Separate Join and Network keys can be set to automatically rotate or be changed on demand. Implementation of the WirelessHART standard will add Session keys for communication between two network devices so that other devices can't "listen in." These can be rotated as well.

Message Integrity Codes are used to verify messages, both per-hop and end to end. Anti-jamming techniques such as DSSS with channel hopping plus multi-path routing help sidestep noise sources, whether malicious or not. And gateway-to-host security leverages well-known standards such as SSL as well as complete encryption/authentication.

At the wireless plant network level, security is fundamental to the Cisco Unified Wireless Network. The standards-based Cisco Self-Defending Network solution provides confidence your plant and business data will remain private and secure. Threat-control capabilities actively and collaboratively control and contain known and unknown threats, and network admission control helps you enforce organizational security policies to allow only trusted end-point devices to access your network.

The Cisco Aironet 1520 Series fully integrates into the Cisco secure wireless solution and is compliant with 802.11i and Wi-Fi Protected Access 2 (WPA2), which employs hardware-based Advanced Encryption Standard encryption for wireless communication.

Services

While our wireless architecture and applications are designed for ease of engineering, installation, and use, we also offer a broad range of services to help you get up and running quickly – and make the most of wireless technology. Our wireless experts ensure that your business needs are met and help you decide and implement the best combination of wired and wireless technologies and products to meet your goals.

For example, we can help you plan and implement your wireless infrastructure and applications – from evaluating opportunities to conducting network and application design, specification, installation, configuration, and verification. With our wireless self-organizing field networks, an onsite technician can install the wireless devices and AMS Device Manager, complete a full network health assessment to ensure optimal connectivity, and verify device and gateway functionality. Our service professionals can also help you bring all your wireless data into your control system.

For users who have limited resources available to manage their wireless networks, Cisco lifecycle services can also play an integral role in wireless solution deployment, establishing highly secure and scalable infrastructure with optimized, reliable messaging for coexisting communications.

Start anywhere

This is not a top-down or bottom-up model. You can begin anywhere based on what your highest priority needs are.

Our Smart Wireless solution does not require you to invest in an expensive wireless infrastructure throughout your facility to try out a simple monitoring application. All our gateways, devices, access points and software use wireless communication standards and have gone through rigorous coexistence testing. This ensures that wherever you start in the architecture, you can seamlessly and easily expand later as your budget and your confidence in the technology evolve.



For example, would additional process measurements help you improve product quality or reduce energy usage? Build a self-organizing sensor network at the field level. Need to leverage the skills of your best operators? Set up plant-level wireless access points so workers can get the information they need wherever they are. Are both types of applications important? No problem; you can do both at once.

In short, you can start wherever it makes sense for you – without investing in more infrastructure than you need for that application.

Put wireless to work for you today

Although wireless technology isn't new, concerns about reliability, security, and battery life have kept it from being widely adopted for applications in process environments-- until now. Those barriers have now been overcome by advances in device and network technology.

That means there's no longer a reason to delay using wireless in your own operation. In fact, there are probably a host of reasons to start immediately: just think of all the ways that easy, affordable access to additional information could help you improve business and plant management, workforce productivity, or plant and process operations.

Then pick an application – even a small one -- and get started. The insights you gain from that first application will help you make even more of the technology in the future.

For more information, visit www.EmersonProcess.com/SmartWireless.

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