



FOUNDATION FOR REMOTE OPERATIONS MANAGEMENT

TRANSFORMING REMOTE APPLICATIONS

Remote Operations Management is one of the fastest growing segments of the process automation business. However, it is also caught up in the turbulence of business challenges, technological change, personnel issues, and the need for operational excellence. Here's how FOUNDATION technology addresses the needs of remote operations from oil and gas pipelines to tank farms and terminals with a single infrastructure built from the ground up for process automation.



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EXECUTIVE SUMMARY

Remote operations management – the management of automation assets and resources that are geographically dispersed – is one of the fastest growing segments of the process automation business today. Today, the ROM segment is plagued with a high degree of customization, solutions that are not easily configurable, and a break and fix mentality when it comes to asset management. Beginning in 2007, the Fieldbus Foundation began a new project that would extend the functionality and infrastructure of FOUNDATION fieldbus out to remote applications through remote I/O and wired HART. We then expanded that project to include leading industrial wireless networks such as ISA 100.11a and WirelessHART. Today, our overall FOUNDATION ROM specification is nearly complete, and ready to extend our capabilities to manage data from a limitless range of devices in some of the world's most unforgiving applications.

FOUNDATION for ROM allows users to implement a true predictive and proactive maintenance strategy for remote assets that could not previously support one. Data from devices on multiple networks, both wired and wireless, can be brought into the FOUNDATION fieldbus infrastructure, which provides a single environment for management of diagnostic data, alarms and alerts, data quality, control in the field capability, and object oriented block structure.

FOUNDATION for ROM has the potential to address numerous applications in upstream applications, such as oil fields, offshore platform automation, oil and gas pipelines, water treatment centers and

A UNIFIED APPROACH

FOUNDATION for Remote Operations Management provides a unified, digital infrastructure for asset management in remote applications, from tank farms and terminals to pipelines, offshore platforms, and even OEM skids. FOUNDATION for ROM provides connectivity to remote I/O and the leading wireless protocols in process automation, including *WirelessHART* and ISA 100.11a.



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distribution networks, mining operations, and even OEM skid mounted applications found in every industry from life sciences to brewing. Today, the upstream oil and gas and water and waste industries are the two fastest growing industries in process automation, and FOUNDATION for ROM is clearly targeted at these.

What is Remote Operations Management?

One of the fastest growing segments in the world of process automation is remote operations management. As the name implies, remote operations refers to the management of automation assets that are located in or are dispersed throughout remote geographic locations where it is difficult or impossible to send personnel. This is not limited to remote offshore oil platforms and oil and gas pipelines. It can also include tank farms and terminals, water and wastewater treatment facilities, and any industry or application that requires remote access to automation assets

Business Drivers and Challenges

There are several factors driving growth in remote operations, and the need for real intelligence distributed in remote automation assets. The most obvious of these is location. Resources are being found in increasingly hard to reach and hazardous areas. The drive to subsea production is good

- **Plant operations are becoming more geographically dispersed**
- **Resources are being found in increasingly hard to reach and hazardous areas**
- **Drive to subsea production**
- **Effort to get people out of harm's way and reduce personnel requirements : "Lights Out" operation**
- **Need to transport resources over greater distances**

evidence of this. We are digging deeper than ever and in more remote areas than ever for valuable resources like oil, gas, metals, minerals, and more. Once we discover those resources, we have to transport them over greater and greater distances. Record-breaking pipeline projects are either in progress or are being planned that will connect some of the most remote regions of the world with its most populated cities.

At the same time, end users are very concerned about deploying humans to

areas that are less than hospitable, whether that means reducing the number of personnel on an offshore platform or moving completely to fully automated "lights out operation". At the same time, the pool of skilled labor is decreasing, with an extreme shortfall in demand of qualified process operators and technicians.

End User Requirements Are Evolving

Many end users have found that the traditional approach to remote operations management no longer fits their requirements. Traditional RTU-based SCADA systems are prevalent in remote operations management applications. RTUs traditionally take historical data from instruments and perform functions such as custody transfer flow measurements. The old school RTUs and PLCs that are typically used to control these remote processes can do control, but they tend not to be highly configurable, and may even be only traditional standalone PLCs. In many cases, it is necessary to add

on a large amount of customization in a SCADA project in order to ensure that everything is connected together in the proper fashion.

The large amount of customization in remote operations and in the overall process industries costs end users billions of dollars a year. Users can spend more than half of their project costs on activities that can be directly traced to customization. At the field device level, analog technology creates unnecessary work processes because of the lack of direct, bidirectional digital access to devices for commissioning and diagnostics. Instrument engineering alone can account for 20 percent of overall automation project costs. Even if you are using digital devices, customization and proprietary technology at the application and network level meant that much of the data from intelligent devices may not even be accessible, and certainly not easily so, by the people that need it when they need it.

From Steady State to Dynamic Environment

The traditional environment of most remote operations applications has been a steady state one. Systems collect historical data and the end users analyze it using whatever tools they have at their disposal and their own intellectual resources. Coordination of the data from multiple RTUs is done with



Sending Workers to Check Remote Assets in Forbidding Territory Can be a Costly Proposition

supervisory control systems and is reflective of the rigid and hierarchical control philosophy of first generation distributed control systems.

The dynamics of remote operations applications, however, are rapidly changing from static to dynamic. Variables that may have previously changed daily or weekly are now approaching real time. Take the example of energy costs. Electricity rates, for example, can change by as much as 40 percent in the course of a day. Natural gas prices are among the most volatile of all commodities traded. Users are also faced

with tighter production specifications and increased regulatory pressures, whether it is the amount of methane allowed in natural gas, addressing losses in water distribution networks, or more advanced corrosion detection methods in oil pipelines.

The Human Resources Challenge

Users are faced with more people related challenges every day. Chances are your maintenance department is a lot smaller than it used to be. Most major end users are trying to reduce or eliminate the number of personnel in remote areas, and it is becoming increasingly challenging to send technicians to check remote service areas, both in terms of cost and safety.

The Technology Challenge

An increasing array of new technologies has found its way into remote operations. In many ways, remote operations have adopted more new technologies than other process industry applications. Wireless technology, for example, is being heavily adopted in tank farm applications and rail yards. The

rapidly changing market dynamics of natural gas transmission applications requires tighter coordination of automation assets and production management and enterprise management applications. Of course, there is the ever-present creep of IT standards such as Ethernet into the world of automation.

The Security Challenge

Remote operations by definition pose a great security challenge, not only for physical security such as access control and surveillance, but also for cyber security. Users are increasingly integrating technologies such as video surveillance, and many of the recent cyber security mandates for the process automation industries are targeted at remote applications. The US Department of Energy, for example, has published a guide containing 21 steps that must be taken to secure SCADA networks that control American infrastructure. Among the recommendations is to avoid relying on proprietary protocols to protect your system. According to the DOE document, “Some SCADA systems use unique, proprietary protocols for communications between field devices and servers. Often the security of SCADA systems is based solely on the secrecy of these protocols. Unfortunately, obscure protocols provide very little “real” security. Do not rely on proprietary protocols or factory default configuration settings to protect your system.”

The Cost Challenge

Projects in the remote applications space get bigger and bigger. Record-breaking pipelines, gas processing facilities, and offshore deep-water drilling platforms are popping up all over the world. These



The \$13 Billion Keystone Pipeline Project Will Connect Canadian Oil Sources to US Refining Centers

bigger projects are naturally more complex and difficult to manage. The Keystone Pipeline project, for example, is expected to cost \$13 billion and will connect the Canadian Oil Sands with major refining centers in the US. At the same time, project engineering costs for industries like upstream oil and gas are increasing by as much as 6 percent according to sources such as IHS/CERA. Users are looking for new ways to speed time to production, operational readiness, and reduce engineering costs.

FOUNDATION for ROM Brings it all Together

FOUNDATION for Remote Operations Management (ROM) is a suite of technologies and additions to the FOUNDATION fieldbus specification that provide for both a wireless and wired infrastructure for remote assets and applications. FOUNDATION for ROM provides for direct access to information and diagnostics in wireless and remote I/O devices. Conversely, FOUNDATION for ROM can take the data from those devices and place into the FOUNDATION fieldbus environment for data management and quality. FOUNDATION fieldbus is much more than just a

communications protocol. The user layer allows for all kinds of flexibility and standardization of data management, and it is all built around the requirements of process automation.

Monitoring remote locations and devices is essential for efficiency, safety and security. An effective remote operations capability enables personnel to minimize field travel time and operational costs, and drastically improves personnel safety and overall efficiency. FOUNDATION for Remote Operations Management provides an open path for integration of multiple wireless and wired networks, from conventional remote I/O to ISA 100.11a and WirelessHART™, and enables direct access to device information and diagnostics. It extends the range and capabilities of Foundation fieldbus to encompass many more devices throughout the plant — regardless of their communications technology.

With Foundation for Remote Operations Management, industrial organizations will realize improved data management, quality and consistency. They will be able to monitor and manage operational activities across multiple facilities from anywhere within a network of sites, helping them better leverage their expertise between locations and mitigate staffing issues associated with remote locations, as well as maximize production and optimize operations.

Fieldbus and Wireless Technology Integration

One of the benefits of FOUNDATION technology is its open and sustainable development path, which allows it to adapt to new technologies as they become available in the marketplace. Wireless networks for process sensors are one such technology. Wireless can further reduce user installation costs, while facilitating connection to points physically or economically difficult to access. Wireless solutions allow easy access to additional measuring and actuation points for process supervision and control, process optimization, plant and personnel safety, and maintenance. Providing significant installed cost benefits for field installations, wireless devices can be installed in existing plants or in new projects. Power and bandwidth may limit wireless functionality and update rate for some applications, but the Fieldbus Foundation realizes that wireless technology will coexist and complement existing bus technologies for the near future.

Development Teams

FOUNDATION for ROM and the corresponding Wireless and Remote I/O (WIO) technical specification development effort encompasses three project teams – the Conventional Remote I/O team, the Wireless sensor team to integration ISA 100.11a and *WirelessHART*, and the Backhaul Team (also the ISA 100 cooperation team). Our development teams include some of the leading engineers in the field of wireless networks for process automation.

Remote I/O Integration

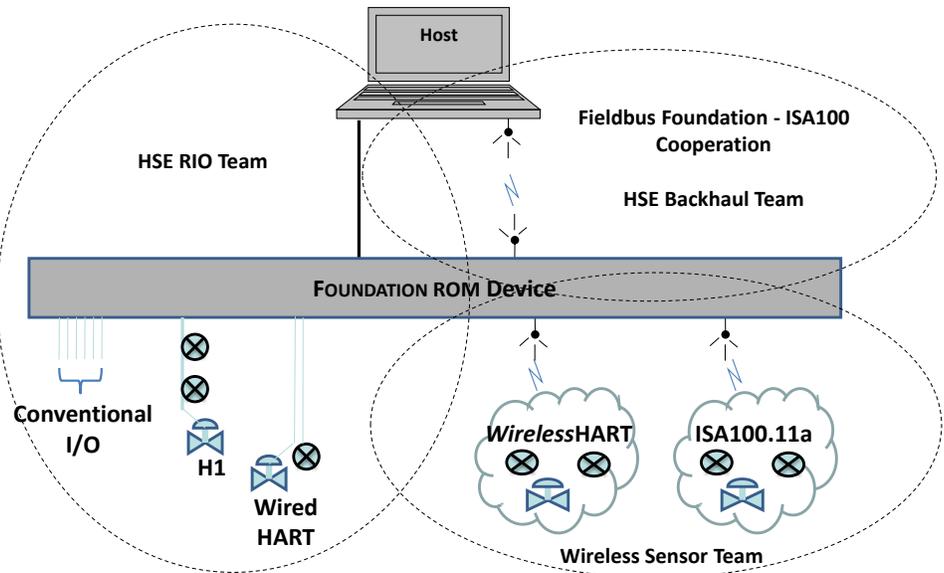
The interface for conventional wired remote I/O and wired HART, dubbed RIO, was launched back in 2007. The HSE remote I/O (HSE RIO) specification allows end users to access high data requirement devices directly in the fieldbus host system via HSE high-speed fieldbus. The remote I/O specification allows all forms of conventional I/O to be brought into the native fieldbus environment easily. This solution makes discrete-in, discrete-out, analog-in, analog-out and FOUNDATION H1 available over a common Ethernet network. The Fieldbus Foundation released the Remote I/O portion of the specification in April of 2011.

Wired and WirelessHART Integration

In September of 2011, the Fieldbus Foundation announced the preliminary specification addressing fieldbus transducer blocks for wired HART and *WirelessHART* devices, together with updates to the WIO System Architecture and WIO Data Structures related to the transducer block specification.

The wired and *WirelessHART* technical specification defines a fieldbus transducer block used to represent HART devices within Foundation for ROM devices. Both wired HART and *WirelessHART* devices may be represented in this block. In addition, the specification describes the expected method for HART configuration tools and

asset-managing hosts to access HART devices using the native HART command protocol transported through the Foundation High Speed Ethernet (HSE) network. The specification also defines structures to identify and maintain HART device status in wired multi-drop networks as well as in *WirelessHART* mesh networks connected to Foundation for Remote Operations Management devices.



FOUNDATION for ROM Has Three Primary Project Teams

ISA 100.11a Integration

The ISA 100.11a phase of the project has also made considerable progress in the integration of the ISA 100.11a wireless sensor network into the FOUNDATION fieldbus infrastructure. The draft preliminary specification has been completed, with preliminary specification, testing, and final specification to be completed within a year. Similar to *WirelessHART* devices, ISA 100.11a devices will be represented as transducer blocks in FOUNDATION ROM devices.

HSE Backhaul team

In late 2008, the Fieldbus Foundation and ISA entered into a cross-licensing agreement allowing the two organizations to collaborate on wireless networks. This agreement will assist the ISA100.15 working group in developing a wireless backhaul standard. Backhaul networks integrated remote locations and applications with central control facilities. The FOUNDATION for ROM specification provides for HSE as the backhaul network for remote applications, available in both wired and wireless configurations.

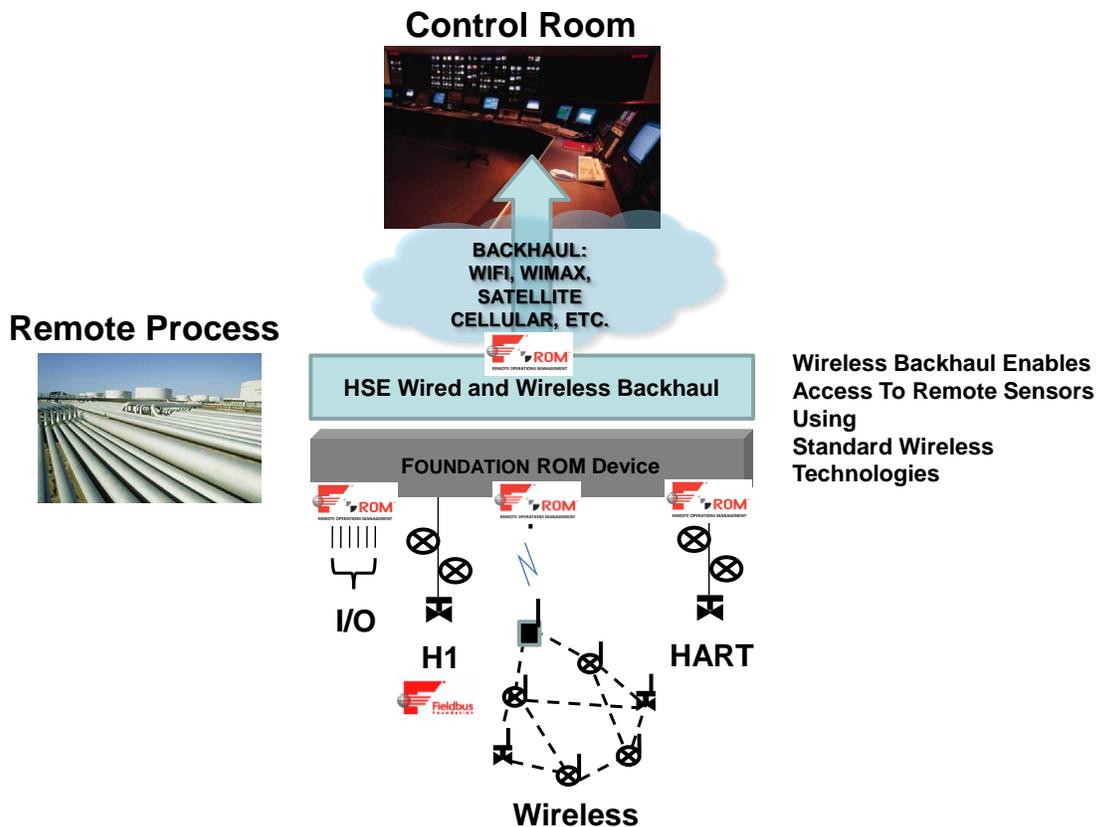
Future Integration of Additional Networks

FOUNDATION for ROM allows for future integration of other networks aside from ISA 100.11a, *WirelessHART*, and others. Future candidates include networks such as Modbus. The future potential to integrate a huge variety of networks is unlimited.

What are FOUNDATION ROM Devices?

The FOUNDATION for ROM specification can be embedded into a range of products, including RTUs, controllers, remote I/O modules, and more. Once the FOUNDATION ROM specification is embedded in a device, however, its functionality expands to reflect a combination of the traditional functions found in wireless gateways, process controllers, and RTUs. FOUNDATION for ROM devices provide the protocol translation functions of a gateway, but they go beyond the traditional functions of a gateway because they have the ability to represent these devices as transducer blocks in the FOUNDATION fieldbus infrastructure and all of the capabilities that it holds, including data management, alarms and events, data quality, function block structure, and more.

The Fieldbus Foundation is one of the only automation industry organizations with a registration program requiring mandatory testing of critical elements of its technology. All products incorporation the FOUNDATION for ROM specification will also be tested and registered with the Fieldbus Foundation, just as all other devices and host systems are. Within the Fieldbus Foundation's automation infrastructure, interoperability is possible because devices and software must all conform to the same standard and they are tested and registered to that standard. Products bearing the FOUNDATION Product Registration



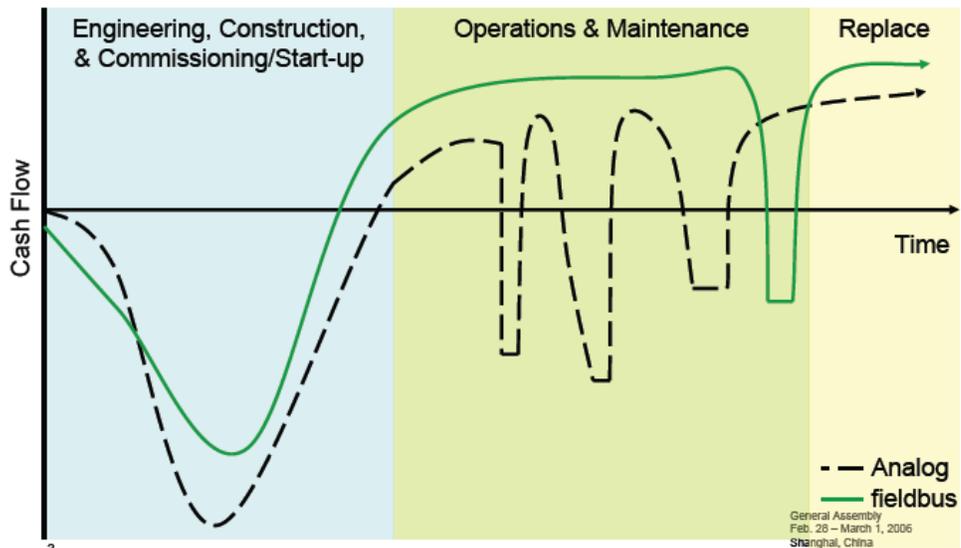
FOUNDATION for ROM Devices Can Integrate a Diverse Range of Remote I.O, Wired, and Wireless Networks into the FOUNDATION Fieldbus Infrastructure

symbol have undergone a series of common tests administered by the Fieldbus Foundation. End users can select the best device for a specific measurement or control task, regardless of the manufacturer.

Business Benefits of FOUNDATION for ROM

Technology is only useful insofar as it provides business value to the end user. FOUNDATION for ROM is no exception, and there are several key business benefits that can be achieved through implementation of this technology. FOUNDATION for ROM enables real time remote operations management, which means more effective use of your remote experts that need to diagnose the condition of your automation assets, often from thousands of miles away. Many end users are dealing with fewer personnel, and it costs more and more to send maintenance people out to these remote assets to check them in person.

FOUNDATION for ROM is also a highly configurable solution, allowing for less customization. Many automation solutions for remote operations today are highly customized. In fact, customization for automation projects costs the process automation industry billions of dollars every year. Users can spend more than half of their project costs on activities that can be directly



FOUNDATION for ROM Provides Reduced Engineering Costs, Faster Time to Startup, and Reduced Operations and Maintenance Costs

traced to customization. At the field device level, analog technology creates unnecessary work processes because of the lack of direct, bidirectional digital access to devices for commissioning and diagnostics. Instrument engineering alone can account for 20 percent of overall automation project costs. Even if you are using digital devices, customization and proprietary technology at the application and network level meant that much of the data from intelligent devices may not even be accessible, and certainly not easily so, by the people that need it when they need it.

Numerous end users have avoided unplanned shutdown due to the diagnostics and function block capabilities of FOUNDATION fieldbus. FOUNDATION technology with its predictive diagnostics can help users develop a proactive maintenance strategy that avoids unnecessary trips to the field for routine scheduled maintenance. Many end users view maintenance as one of their key costs that can be significantly cut. End users have estimated that more than half of maintenance activities result in no action.

Integration of Functional Areas for Remote Operations

FOUNDATION for ROM has the capability to integrate many of the functional areas that are typically encountered in remote operations. Remote operations have many complex assets, such as pipeline

compressor stations. The ability of FOUNDATION for ROM devices to take in up to 2,000 points or process values (PVs), allowing for integration of machinery health monitoring sensors to diagnose the health of compressors and other process equipment. FOUNDATION for ROM can also support safety interlocks, fire and gas detection, and video surveillance applications that play a significant role in remote operations management.

Application Examples

Numerous applications can take advantage of FOUNDATION for ROM technology. Many of these applications are in the upstream oil and gas industry, including pipeline SCADA applications, intelligent oil fields, offshore platform automation, and tank farms. Other applications include water and wastewater SCADA, terminal automation, mining applications, and even OEM skid mounted equipment used in the process industries. Many of these applications also happen to be the fastest growing industries in process automation. End users are investing much more in the upstream oil and gas sector compared to downstream, for example.

End User Driven

Our technology continues to evolve based on the requirements of end users, and this is the case with FOUNDATION for ROM. Our decision to incorporate a variety of wired and wireless networks into the FOUNDATION infrastructure allows users to connect all their process automation assets seamlessly into a single framework for control, diagnostics, and data management. The secure and standard Ethernet-based HSE wired and wireless backhaul allows users to extend this capability to remote assets that could be thousands of miles away in potentially hazardous places. This has the potential to save end users billions in ongoing maintenance, operational, and installed costs. What's more exciting about FOUNDATION for ROM is that we have yet to realize the scope of potential applications. In the initial stages of our project, our team identified 21 applications in a wide range of industries from offshore oil production to life sciences. FOUNDATION for ROM has a promising future.

Application	Geometry (WxLxH)	Environment	Field Devices	Typical application and FF Considerations:	Wired Power Availability*
Oil or Gas Well / Production	R=30-100m	Isolated Location / Unmanned	< 10/per well	Flow, Pressure, Temperature, Emergency shutdown	Small
Pipeline Monitoring (Oil, Gas, CO₂, etc.)	> 1000m, linear	Remote locations; Power, wiring, & installation cost considerations; Unmanned	</= 5 terminal; several terminals over hundreds of km	Flow, Pressure, density/API monitoring; flow control, cut detection; emergency shutdown	Not available
Oil Distribution / Shipping	50-200 X 100-500 X 10m	Rural or Urban Site / Roaming	100 to 500 <i>Nomadic Devices and Wireless Workers < 100</i>	Flow, Pressure, density/API monitoring; flow control, ESD	Available for fixed devices
Oil Marketing / Retail	30 X 30 X 10m	Rural or Urban Site	< 30	Flow, Pressure, Temperature, Emergency shutdown	Available
Offshore Platform	50-100 X 50-100 X 50-100 m	Remote Location / Mostly unmanned	5000 to 25000	Flow, Level, Pressure, Temperature, PH, Density, Analyzers, heavy control, batching ESDs	Mostly available

A Sample of Target FOUNDATION for ROM Applications