FOUNDATION for ROM: Petrobras Live Field Demonstration

Remote operations management (ROM) is the management of automation assets and resources that are geographically dispersed – is one of the fastest growing segments of the process automation business. 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. As the leading digital field network for the process industries, FOUNDATION™ fieldbus has now expanded into the rapidly growing world of ROM, from the digital oil field to pipelines, tank farms, and FPSOs.

Several years ago, the Fieldbus Foundation began a new project that would extend the functionality and infrastructure of FOUNDATION fieldbus out to remote applications through the integration of remote I/O and wired HART® communications. We then expanded that project to include leading industrial wireless networks such as ISA 100.11a and WirelessHART®. Working cooperatively with ISA, the International Society for Automation, the Fieldbus Foundation has also specified a long distance backhaul network technology based on Standard High Speed Ethernet (HSE) that connects remote assets with their command centers. Today, our overall FOUNDATION for ROM specification is nearly complete, and ready to extend our capabilities to manage data from a limitless range of networks and devices in some of the world’s most unforgiving applications. FOUNDATION for ROM is ready to address the rapidly changing business challenges of end users in remote operations.

As one of the leading global users of FOUNDATION technology, and as one of the leading global oil companies with a heavy focus on remote operations, Petrobras has been an active member of the FOUNDATION for ROM project team. The Fieldbus Foundation is pleased to announce that Petrobras, through its industry leading Cenpes research and development center, is the first site for a live demonstration of FOUNDATION for ROM technology.

FOUNDATION for ROM: Leveraging the Managed Infrastructure for Remote Applications

FOUNDATION fieldbus is much more than just a communications network. 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 in industrial 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 it into the FOUNDATION fieldbus environment for data management and quality. FOUNDATION fieldbus is much more than just a communications network. The user layer allows for all kinds of flexibility and standardization of data management, 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 and extends the range and capabilities of FOUNDATION fieldbus to encompass many more devices throughout the plant — regardless of their communications technology.

One of the benefits of FOUNDATION technology is its open and sustainable development path, which allows us 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.

FOUNDATION for ROM was designed to enable fieldbus connectivity to remote I/O and the leading industrial wireless protocols, and is the first successful integration of ISA100.11a, WirelessHART, wired HART, and wired H1 protocols into a single standard environment without sacrificing the diagnostic capabilities of existing wireless devices. Instead, these capabilities are mapped into the FOUNDATION block structure to provide a standard environment for data management and quality, eliminating techniques that are highly customized and much more costly to maintain throughout the plant lifecycle.
As part of this solution, FOUNDATION for ROM provides a way to bring large concentrations of discrete and analog field I/O back to the control room using HSE communication. It also employs Electronic Device Description Language (EDDL) and function blocks to ensure interoperability with FOUNDATION for ROM devices. This is essential to improve integration of critical functional areas, including machinery health monitoring, safety interlocks, fire & gas detection systems, and video surveillance.

**Object Oriented Integration**

In the world of software, objects are building blocks of code that can be replicated and reused throughout the system. Objects can be used to represent a variety of things. In the world of FOUNDATION fieldbus, we use objects called blocks to represent certain devices, control algorithms, and more. The FOUNDATION fieldbus transducer block specification is used to represent wired HART devices, WirelessHART Devices, and ISA 100.11a devices so they can be managed within the FOUNDATION fieldbus infrastructure.

**HSE Backhaul Provides Truly Open Remote Communications**

The Fieldbus Foundation has announced approval of a backhaul architecture model, developed in collaboration with International Society of Automation standards committee ISA100 that provides a common framework enabling multiple industrial communication protocols to run over a shared wireless backhaul network in process automation systems.

Completion of this work is a key milestone supporting implementation of the Fieldbus Foundation’s wireless HSE backhaul included in FOUNDATION for ROM technology.
In June 2008, ISA100 leaders established a new working group, ISA100.15—Wireless Backhaul Networks Working Group—to develop standards and technical reports to address one or more dedicated or shared wireless backhaul(s) to support technologies running multiple applications. At the same time, Fieldbus Foundation end user members identified the wireless backhaul as critical for FOUNDATION for ROM development.

To expedite the work, the Fieldbus Foundation and ISA began joint collaboration on wireless networks combining Fieldbus Foundation application protocol expertise with ISA100 communication networking resources to complete the architecture model. ISA will publish the work as technical report ISA-TR100.15.01, Backhaul Architecture Model: Secured Connectivity over Untrusted or Trusted Networks, within the ISA100 family of standards. 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 for 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.

**ROM Team Members**

About Petrobras and Cenpes

Petrobras is the seventh largest oil company in the world and the biggest company in Latin America. As the leading oil company in Brazil, Petrobras produces close to 2.7 million barrels of oil and liquefied natural gas per day, with over 16.4 billion barrels of oil and gas equivalent reserves.

Petrobras made headlines when it approved a record shattering $224 billion capital spending plan through 2015, and most of this money will be spent in the upstream sector on the highly publicized Pre-Salt area of the Santos Basin. Evidence of the spending and development is all around, with Rio's harbor filled with offshore oil rigs and a large Floating Production and Storage Operation (FPSO) and other equipment.

Short for Centro de Pesquisas Leopoldo Américo Miguez de Mello, Cenpes serves as the heart of research and development for Petrobras. It is the largest oil and gas related research center in the southern hemisphere. Cenpes also houses several pilot plants for Petrobras, and it is on one of these pilot plants that we will be installing the first FOUNDATION for ROM field demo.

Miguel Borges, one of the automation leaders at the Cenpes facility, believes FOUNDATION for ROM can be an enabling technology for remote applications on Petrobras' offshore platforms. “The Fieldbus Foundation’s ROM solution is attractive to us, since we want to gain access to diagnostic information from devices installed at our remote sites,” Borges said. “Petrobras is committed to investing in this type of technology, and is seeking the most effective solutions available in the marketplace.”

The Cenpes Installation

The Petrobras field demonstration offers a look at the full functionality of FOUNDATION for ROM, including wireless device integration, remote I/O integration, and wireless backhaul capabilities. This demonstration is the first step to show the capabilities of FOUNDATION for ROM before it is specified for commercial projects. The ROM solution
enables end users to diagnose, either locally or remotely, the condition of their automation assets and then optimize predictive and preventive maintenance strategies.

FOUNDATION for ROM equipment is installed on an existing distillation column unit in the Cenpes pilot plant area. The project was completed through a cooperative effort between Petrobras and local Brazilian automation suppliers. The Cenpes installation is an excellent example of the value of installing FOUNDATION for ROM and FOUNDATION fieldbus in an existing plant. The existing distillation column already has many analog and HART field devices installed. Petrobras was able to install a number of additional measuring points with a very small hardware footprint through a combination of H1 FOUNDATION fieldbus and wireless devices. The installation includes three types of FOUNDATION for ROM devices – wireless gateways, process controllers connected to H1 FOUNDATION fieldbus devices, and conventional remote I/O.

H1 fieldbus devices are connected to a Smar FOUNDATION for ROM controller. H1 FOUNDATION fieldbus device suppliers include Emerson, Pepperl+Fuchs, Smar, StoneL, Westlock, and Yokogawa, as well as a fieldbus indicator from Beka. Discrete I/O from R. STAHL is also installed. H1 devices are connected to fieldbus device couplers and integrated power supplies from Pepperl+Fuchs, MTL, and R. STAHL.

A number of wireless devices on both the WirelessHART and ISA 100.11a networks are also installed, and their diagnostic data is integrated into the host system and plant asset management system. WirelessHART devices from Emerson and Smar are connected to a FOUNDATION for ROM wireless

Petrobras FOUNDATION for ROM Demo Installation Includes H1 FOUNDATION Fieldbus, WirelessHART, ISA100.11a, and Conventional Remote I/O
gateway from Smar. Yokogawa and Honeywell have supplied ISA 100.11a devices that are connected to a Yokogawa ISA 100.11a gateway.

FOUNDATION for ROM conventional remote I/O is provided by R. STAHL. The conventional remote I/O, process controller, and wireless gateways are all connected to the HSE wireless backhaul network through managed switches from Belden and Phoenix Contact. We also wanted to show the integration of cyber security for automation with the installation of automation firewalls also from Belden and Phoenix Contact.

The HSE wireless backhaul network uses backhaul WiFi radios from Belden and MTL. All the wireless backhaul network hardware is standard hardware with no modifications. OPC and video data is also transmitted over the wireless backhaul network. The wireless backhaul network connects to a remote control room location to a Smar FOUNDATION fieldbus host system and plant asset management system.

The FOUNDATION Fieldbus Diagnostics Difference

One of the primary benefits of integrating wireless devices and devices from other wired networks such as HART and Modbus is the ability to manage the diagnostic information that comes from these devices in the FOUNDATION fieldbus managed infrastructure. Lots of networks and many smart devices have the capability to relay diagnostic information, but FOUNDATION fieldbus is different, providing the user with a greater scope and depth of diagnostic data.

FOUNDATION fieldbus has a unique approach to management of device diagnostics. The publish/subscribe structure of FOUNDATION fieldbus means that diagnostic information is available immediately to a wide range of workers in the plant. The challenge is to organize that data in a way that turns it into useful information for the right people at the right time. That is why the Fieldbus Foundation created the Fieldbus Diagnostic Profile addition to our specification. The Field Diagnostic Profile incorporates the NAMUR NE 107 recommendations, which state the diagnostic data should be presented in a standard manner, with standard coloring and symbols, so it is easily understandable by the different worker roles that must have access to the information.

As with all our technology specifications, Fieldbus Foundation provides a standard framework on how data should be handled and provided to those that need it. The suppliers in turn have the ability to add their own competitive advantage by providing ways to manage an even wider range of diagnostic information within our standard structure.

The FOUNDATION fieldbus Field Diagnostics Profile Specification was defined to make it easier for end users to access and configure the diagnostics in devices, regardless of which manufacturer’s device or
system is used. The Diagnostic Profile includes a standard and open interface for reporting all device alarm conditions and provides a means of categorizing alert conditions by severity. The technology facilitates routing of alerts to appropriate consoles based on severity categories selected by the end user.

**Freedom to Choose the Right Wireless Network**

In the right applications, wireless devices can offer significant benefits both in terms of installed cost and operational costs. In a world where we still have competing wireless standards, however, it can be difficult to choose which network to adopt. With FOUNDATION for ROM, users have the freedom to choose from both ISA100.11a and WirelessHART networks, and the information from those wireless devices can all be managed in a common environment. Today, FOUNDATION for ROM is the only open solution that can provide this level of choice and open integration. Our philosophy is to continue to provide integration of other networks into the FOUNDATION fieldbus infrastructure as our end user advisory council demands it. Future candidates include networks such as Modbus. The future potential to integrate a huge variety of networks is unlimited.

**Future Demonstrations**

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. Over the next couple of years, the Fieldbus Foundation will continue its executions of global live demonstrations showcasing the strong value FOUNDATION for ROM delivers to end users demanding non-proprietary and interoperable system architecture. Here is the current projected schedule for 2014-2015:

- Live Demonstration at Reliance Jamnagar, India - February 2014
- Field Trial - Japan - Mid 2014
- Live Demonstration at Shell Amsterdam - 2014
- Live Demonstration at Saudi Aramco - Dhahran, Saudi Arabia - Mid 2015

You can find out more about FOUNDATION for ROM at the Fieldbus Foundation web site at [http://www.fieldbus.org](http://www.fieldbus.org).