■ The Hanover Company operates more than 600 high-value compressors for Williams Field Service near Farmington, New Mexico, U.S.A.

HANOVER ROM PANELS GO BEYOND SCADA

Big Benefits from a New Breed of Remote, Real-time Monitoring and Control System

By Steve Hammond

To keep more than 600 high-value compressors running in the Four Corners Region at Farmington, New Mexico, U.S.A., Hanover Compressor has a lot of ground to cover. In addition to the terrain, that means collecting and reviewing a large amount of real-time operating data. At Hanover, we do this with our Hanover Remote Operations Management (ROM) panels and the communications services of M2M Data Corporation.

To meet the operating needs and goals for our customers, Hanover began developing solutions that would enable us to get enough data and knowledge out of the ROM network to serve high-value remote assets. In developing the ROM network, we identified the need to gather a high volume of raw data that could be quickly acted upon and used to direct day-to-day operations.

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Hanover also identified the need for trends and alarms integrated into current workflow priorities and displayed on maps of the region.

The ROM network and M2M have delivered for us. The high level of data integration is carried out with software distributed through the M2M network in intelligent remote gateways, in network communications links, and in their presentation and analysis of the raw data. M2M enables Hanover personnel to take direction and decisive action within two clicks on their website.

In Farmington, The Hanover Company serves the extensive Williams Pipeline operations. The Hanover Company provides natural gas compression services with a rental fleet of 3.7 million hp (2760 MW).

I came to Farmington in 1992. Operations then required a close physical and personal relationship with the machines. Control meant traveling to the site. We relied on operator experience to keep compressors running in the harsh and varying environment of New Mexico. This in-depth, on-site knowledge would become an important element and the basis for Hanover's development of successful remote operations management systems.

Throughout the '90s, Hanover saw the value in deploying new technology to improve our response to changing operating conditions. From early investigation, our team predicted that collecting operational data and controlling machines remotely over a communications network could increase revenue, reduce maintenance costs and improve customer service.

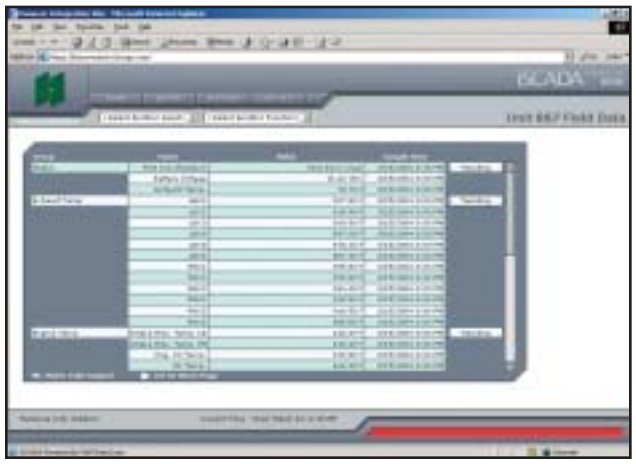
But there were challenges. Data important to efficient operation and maintenance was not readily available. We needed information such as suction and discharge pressure, engine and compressor operating pressures and temperatures, and much more.

To communicate with the compressors, our early PLCs (programmable logic controllers) were adapted from HVAC (heating, ventilating and air conditioning) controllers. PLCs were initially installed on several units. The results were less than spectacular. The range of information was severely restricted by the network link and control was limited to on/off functions. The system relied on pneumatic and manual actuation rather than electronic actuation. When variability was introduced, the adjustments were limited to large steps. In addition, PLC controllers were not suited for the rugged environmental conditions of temperature and compressor vibration.

Although knowledgeable programmers provided the PLCs, most did not fully understand and appreciate the operating requirements involved in compressor technology. Their "one way fits all" approach did not account for variability from compressor to compressor. Several breakthroughs came from listening to the mechanics in the field who knew the machines very well and who provided valuable suggestions on the kinds of changes needed to improve compressor operations. Over time, control advanced from on/off to load/unload functionality. Compressors could then be slowed down or moved to a recycle mode rather than being shut down. This greatly facilitated keeping

■ Steve Hammond

■ **Graphical locators on system map screens tie to machine operational data and analysis screens for rapid and concise fleet management.**



a compressor online.

Programming of PLCs was done on-site and field personnel learned to adjust the programming of the PLC to accommodate the characteristics of each machine. We found that most PLCs came preprogrammed with set options. This limited functionality and variability. At Hanover, the Allen-Bradley PLC we eventually adopted was not preprogrammed. Instead, it served as a blank slate on which we wrote our own functionality. They were customized by our I&E staff for each individual compressor unit.

Through the years, the range of operational functions progressed beyond rudimentary on/off states. While we were able to control loading and unloading to keep the unit online and keep gas flowing, however, we still had to go to the site to operate the unit. We knew that we could talk to the compressor through the PLC. We recognized that if we had a stable and reliable communication link from the remote site we could remotely control monitor and diagnose the machine. Our success with the telemetry, however, gave us misplaced optimism. Cellular telephone service was not available; radio and fixed wireless were impractical; and landlines and satellite were not feasible.

As the search for a communications link continued, Hanover continued to expand the capability of the PLC to add data monitoring. The name of the improved PLC reflected our vision for a breakthrough to a comprehensive remote controlled compressor management system. We called our new PLC a ROM (Remote Operations Management) panel.

The ROM panel provided big potential for revenue enhancement, costs savings and improved customer service. Hanover's ROM panels are able to read hundreds of data points for detailed data collection and include extensive set points for finite control functions. Some of the more important data collected and analyzed include cylinder, manifold and coolant temperatures; suction and discharge pressure; rpm; tank level; coolant level; valve position; voltages; shutdown alarms; cause of shutdown, and data and set points.

When satellite communications became feasible, we tested and evaluated several packages but none met the standards that Hanover had set. At the same time, Hanover's ROM panels produced larger data loads and more frequent transmissions than most networks could handle reliably or economically. As a result of the network limitations, we experienced very high error rates that made the data unusable and we were only successful 60 to 70% of the time in unit start-ups. In addition, support from the current network providers was not forthcoming.

As a result, the communications problems began to degrade the great gains we had made in automation with the ROM panels by relegating us to troubleshooting the network. Our new core skill in compressor automation was taking a back seat.

Without a reliable network connection, real progress in remote operations management was limited. At that time, a company specializing in remote monitoring was gaining a strong reputation in the energy industry with several new approaches to device networks and machine-to-machine communication. Hanover management learned of these advances by M2M Data Corporation and referred them to me to help with our problems at Farmington.

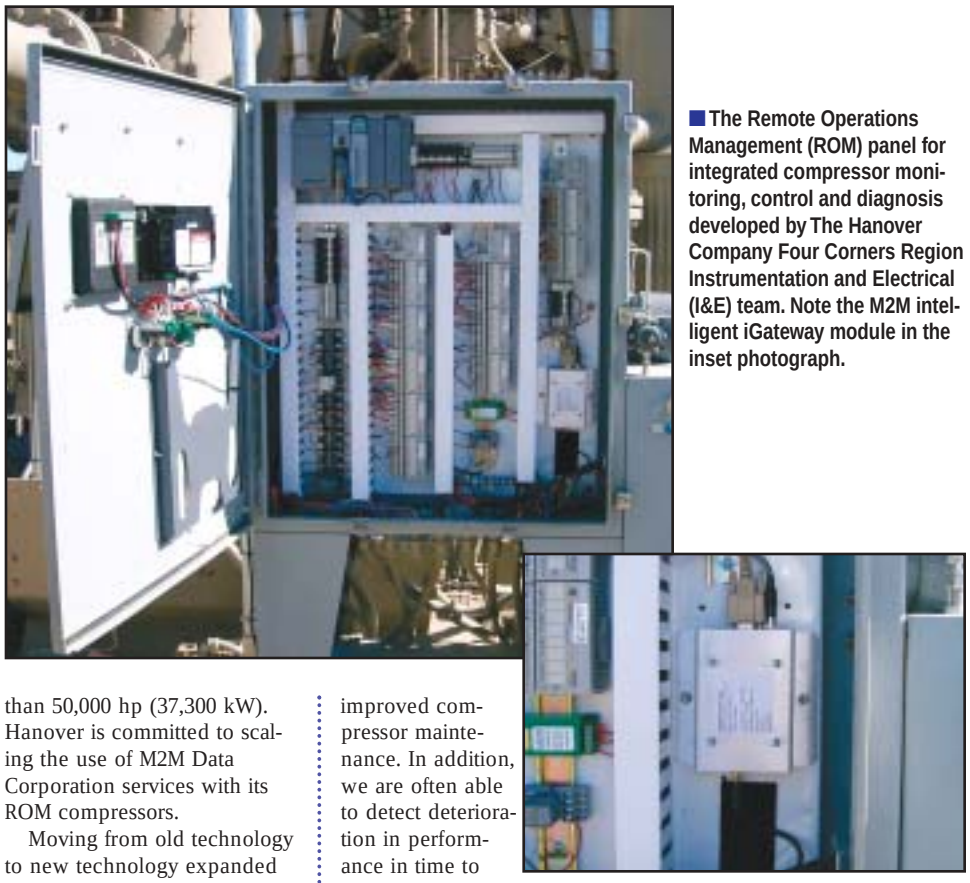
M2M had made several breakthroughs that were recognized immediately. M2M had an intelligent gateway to aggregate data from many different sensors and formats at the compressor. It would work with the data available at our ROM panel. Their transport techniques reduced the amount of data actually moved over the satellite network for increased speed and reduced cost. Their presentation on the user interface made the data much easier to understand. And it was accessible over the Internet with a Web browser.

M2M offered to demonstrate their remote control and data collection service on a unit of our selection. I chose a 1000 hp (746 kW) compressor at our 30-5 site.

M2M connected their intelligent iGateway to our ROM panel for the machine and a satellite link was established to its servers and operations center in Denver. Using a new Web browser and Internet connection at my office in Farmington, I was able to complete the link to a ROM panel at the 30-5 site. After pushing, or rather "selecting," the start button on the M2M screen, the compressor started and the system began to display the full list of operational data, including machine rpm, loaded/unloaded state, suction pressures, temperature and more in real time. The link was complete and we were truly in control…remote control.

Hanover's customer, Williams Field Service, immediately noticed the benefits of remote monitoring and control. Our dispatch office, which is located next door to the Williams dispatch office, monitors our operations 24/7. Our dispatchers, who are qualified compressor mechanics, do analysis from machine data and change flow according to requests from Williams. They are also able to control machines and dispatch on-site service at the click of a mouse. Their skills take full advantage of the range of options provided by the ROM panel network and M2M data integration.

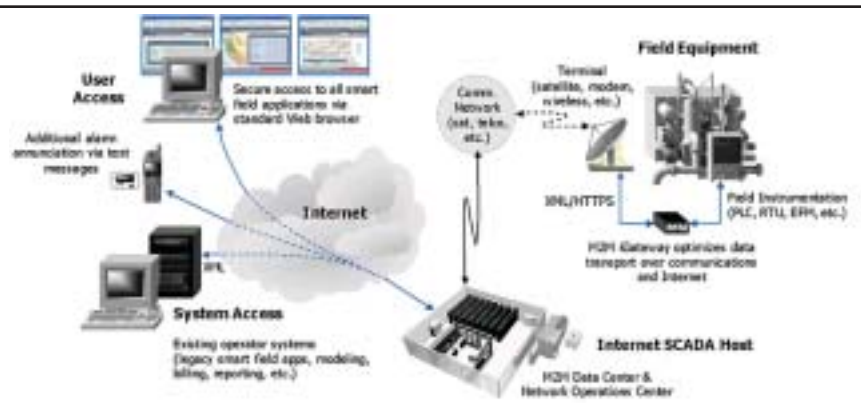
Hanover ROM-enabled units have been continually added to the M2M service. Our staff now is able to focus full time on their responsibilities to install ROM panels on more units. Today we monitor and control 16 sites with 47 compressor units totaling more



■ The Remote Operations Management (ROM) panel for integrated compressor monitoring, control and diagnosis developed by The Hanover Company Four Corners Region Instrumentation and Electrical (I&E) team. Note the M2M intelligent iGateway module in the inset photograph.

than 50,000 hp (37,300 kW). Hanover is committed to scaling the use of M2M Data Corporation services with its ROM compressors.

Moving from old technology to new technology expanded my I&E staff skills, created a new resource for Hanover and shifted non-core communications activities to a service provider with a focus on new services. Having real-time data improved compressor maintenance. In addition, we are often able to detect deterioration in performance in time to prevent catastrophic failures that take compressors off-line and usually mean higher repair costs. Our customers are also happier knowing that Hanover is better equipped and prepared to keep their product flowing by avoiding failures. ■



■ The basic architecture of the M2M system can be seen in this diagram.

ABOUT M2M

Founded in Denver, Colorado, U.S.A., in 1999, M2M Data Corporation provides electronic monitoring and control of remote and mobile assets to increase revenues, reduce downtime and minimize maintenance costs. The M2M Service Platform applications combine wireless, Internet, security and device networking technologies with value-added turnkey services. M2M said its applications are fast, reliable, cost-effective, easy to implement and guaranteed, and that they help transform high volumes of raw data into knowledge for immediate action in the daily workflow and for strategic planning. M2M serves top energy companies, utilities and government contractors developing and operating critical infrastructure throughout the United States.