

Luminant Tests First Nuclear Industry Large-Scale Wireless Monitoring System

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Comanche Peak Nuclear Power Plant is the site of a pilot program using a wireless, automated, remote diagnostic system to monitor generation-critical equipment. The early fault detection provided by such systems could save nuclear plants staff time, trouble, and expensive repairs.

In June of this year, the global remote monitoring company Azima DLI and Luminant, the Dallas-based power generation division of Energy Future Holdings, announced the launch of a pilot program to evaluate a wireless, automated, remote diagnostic system to monitor generation-critical machinery at Luminant's Comanche Peak Nuclear Power Plant (Figure 1). This program represents a number of nuclear industry milestones, including:

- The first large-scale deployment of a wireless sensing network meeting nuclear power industry guidelines.
- The first outsourced cloud-based machine diagnostic service that utilizes automated diagnostic software.
- The first integration of a vibration diagnostic solution with an enterprise OSI PI process data historian and alarm management system.



1. Luminant on the leading edge. A pilot program at Comanche Peak Nuclear Power Plant to evaluate wireless, automated, remote monitoring of generation-critical assets could help the plant identify potential equipment problems more quickly. *Courtesy: Luminant*

Clint Carter, Luminant's director of operations services explained, "We selected Azima DLI's WATCHMAN Service program because it offers a highly sophisticated solution for frequent, automated machine data collection, analysis and diagnostics. The Azima DLI system is also completely integrated into our remote monitoring and diagnostic center, the Power Optimization Center (POC), enabling around-the-clock monitoring

and alarming. Azima DLI is bringing us a unique approach to predictive maintenance. We have machine condition visibility like we've never seen before.”

The Azima DLI diagnostic software incorporates decades of mechanical fault detection signatures gathered from many thousands of machine types and models. Azima DLI is also staffed with a deep bench of predictive technologies experts who are available to consult with Luminant's in-house engineers and specialists when the need arises.

The WATCHMAN pilot program should further enhance Comanche Peak's own world-class predictive maintenance program through automated data collection, analysis, and prognostic determinations of emerging equipment issues. The automated collection capability over the plant's wireless infrastructure enables collection and analysis of generation-critical equipment several times daily. This is a significant leap forward when compared to the traditional industry-accepted practice of monthly data collection.

“Consequently, we are able to identify emergent equipment issues much sooner,” said Carter. “We also expect that we will be able to lighten the work load on our own maintenance and engineering teams in favor of automated monitoring. We think the value of this information only rises as we seek to improve operational efficiencies in a competitive environment.”

The Comanche Peak pilot program was several years in the making as Azima DLI and Luminant collaborated in the development of features considered vital and specific to the nuclear industry, such as network security, data transfer protocols, and reliability. The challenge was to develop a robust, cost-competitive network capable of both automated and on-demand data collection, the results of which would be readily accessible to a number of critical user groups. These include Comanche Peak plant personnel, Luminant's POC in Dallas (which monitors performance across the entire Luminant power generation fleet), and analysts at Azima DLI. The main objective is fault detection sufficiently early to eliminate incipient equipment issues and unplanned downtime.

How It Works

Vibration data is collected by wirelessly enabled sensors installed on 42 generation-critical plant assets. The data is then transferred over a secure network to the WATCHMAN machine database hosted by Azima DLI. Personnel at Comanche Peak, the Luminant POC, and Azima DLI are alerted to the receipt of new data, to which they have immediate, fingertip access over a simple, secure web browser via Azima DLI's WATCHMAN Reliability Portal. The data is processed by Azima DLI's proprietary ExpertALERT software, which compares the vibration data set to thousands of fault detection signatures archived within the system. These signatures are the compilation of more than 30 years of monitoring and diagnostic experience covering thousands of machine types and models across multiple industries, including the military.

Fault detections identified by ExpertALERT are automatically posted on the WATCHMAN Reliability Portal to bring them to the attention of Luminant and Azima DLI personnel. Alarms in the Luminant POC are also triggered at predetermined conditions, 24/7, to enable immediate response by on-duty personnel. Luminant also has the ability to set user-defined parameters to trigger automated alerts that can be distributed by email and/or text messaging.

An Azima DLI analyst will promptly review the potential faults for accuracy and note comments, corrections, and recommendations. These will appear instantaneously on the WATCHMAN Reliability Portal for review by Comanche Peak and/or the Luminant POC.

In rapidly evolving situations, collaboration between all parties takes place that shapes a follow-up action plan. This may involve a visual inspection and/or manual data collection by Comanche Peak personnel to confirm the

fault detection, or simply increasing the frequency of automated data collection to capture rapidly changing operating performance that will alert operators earlier to an emergent issue.

Azima DLI also rolls up the results of all analyses and issues in a weekly management report to Comanche Peak. That report provides complete visibility into machine condition health from a vibration-monitoring perspective and provides performance trending information, analytical results from a prognostic perspective, and recommendations to all stakeholders.

Impact on the Luminant Power Optimization Center

The Luminant POC relies on a number of performance monitoring and optimization software packages to maintain peak performance across the power generation fleet. These depend largely on correlations between high volumes of streaming process data to detect deviations from normal performance envelopes. When the data depart from normal operating patterns, Luminant POC personnel go to work diagnosing the problem and trying to bring process parameters back into normal alignment.

Alerts triggered by process-based systems are frequently inconclusive and may call for vibration analysis to establish a more precise diagnosis of mechanical faults. With the WATCHMAN program running continuously in the background, current vibration data is already available to supplement process-triggered alerts, saving POC personnel critical time in developing a response (Figure 2).



2. A watchful eye. The WATCHMAN program provides current vibration data to supplement process-triggered alerts, saving Luminant’s Power Optimization Center personnel critical time in developing a response.

Courtesy: Luminant

One important distinction between process-based performance optimization software packages and the Azima DLI WATCHMAN program is that most software programs are not supported by a team of diagnostic experts assigned to supporting customers and their plant operations. Azima’s programs are built on the premise of delivering a technology-enabled service, with more than 40 on-staff vibration analysts solely dedicated to delivering timely, actionable machine diagnostics, with expertise concentrated both by industry and machine type. “Azima DLI’s deliverable has more in common with mission-critical information services than it does

with hardware or software vendors. Our technology is vital to creating transparency around timely actionable information,” said Burt Hurlock, CEO of Azima DLI, “but it’s the quality of the conclusions drawn by the plant maintenance teams, operators, and our own analysts that really counts.”

Potential Impact on the Nuclear Industry

As an opinion leader in the nuclear industry, Rafael Flores, Comanche Peak’s chief nuclear officer, has long championed a culture of continuous improvement through the application of leading technologies and services with a focus on nuclear safety and plant reliability.

“We view the WATCHMAN pilot at Comanche Peak as an industry-level demonstration of how we can apply advanced telecommunications technologies and analytics to improve operational efficiencies and plant performance,” said Flores. “Anything that we can do to improve our monitoring capabilities contributes to our focus on nuclear safety and our goal of providing a safe, reliable, clean source of electricity for Texans.”

While safety, reliability, cost efficiency, and transparency are compelling aspects of Luminant’s work with Azima DLI, the untapped potential of the WATCHMAN solution is its scalability. Nuclear power plants present special challenges to consistent, whole-plant machine health monitoring and reporting. The additional challenge to developing best practices for the nuclear industry is the absence of an accessible, broad-based critical mass of information about mechanical faults in the nuclear setting.

“Nuclear power generation is a very special industry comprised of professionals dedicated to continuous improvement with distinct requirements,” said Ben Mays, Comanche Peak’s vice-president of nuclear engineering and support and a 33-year veteran of the plant. “The way the WATCHMAN program centralizes data and makes it broadly available to all our users may have powerful implications for developing and sharing best practices, which is a time-honored tradition in the nuclear industry,” said Mays. “If we can inspire other nuclear power generators to participate, the potential exists to make a material contribution to advancing monitoring and maintenance practices.”

Disruption in the New World of Big Data

As remote monitoring capabilities become more widespread, and the era of big data creates expectations of universal transparency and awareness, most large industrial production operations will find themselves in cultural transition. The traditional formula for manual data collection, review, and problem identification will become obsolete in favor of highly efficient automated systems. The result will be improved economies of scale and less human investment to derive value from the process. Technology and automation also can assist in offsetting the forecasted impact of workforce attrition and the associated loss of vital knowledge and experience as personnel retire.

“The automated data collection and diagnostic elements of the WATCHMAN program will never displace the onsite teams,” Carter observed, “but the information can make them a lot more powerful, save them hours of legwork in route-based data collection, and give them the visibility to get ahead of their preventive maintenance, so they can manage the work and not the other way around.”

“There’s no question that this will be a change from our traditional way of managing predictive maintenance programs.” Flores added, “but it’s the next evolutionary leap made possible by the Technology Age. Why wouldn’t we take full advantage of it if it makes us better at what we do?”

Combining Approaches

The Comanche Peak wireless monitoring pilot project will run for six months before Luminant decides whether to make it a permanent, integrated feature of its predictive maintenance program and determines how far it makes sense to expand the automated service throughout the facility. The plant's preexisting predictive maintenance program covers approximately 800 pieces of machinery on route-based manual data collection programs. While periodic manual data collection makes sense for a good portion of these machines, there may be benefit to expanding the automation capabilities where it makes good business sense.

“Current best practice is almost always some combination of higher frequency, automated reporting with less-frequent, manual route-based reporting—a combination we support at many other customers,” Hurlock observed.

Comanche Peak, and Flores in particular, pride themselves on being innovative leaders in the nuclear power industry. “This pilot program is just another step in a long-standing commitment by Comanche Peak to continuous improvement,” said Flores. “With information and diagnostic technologies advancing as rapidly as they are, we simply can't afford to stand still if these capabilities can make us and our competitors more efficient.” ■