Wireless networks improve mines' efficiency and safety

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Customer success story

Nutrien Aurora Phosphate and Nutrien White Springs

Hitachi Energy

Customer highlights

Nutrien is the world's largest crop nutrient company, mining and processing key crop nutrients in locations around the world. Two of Nutrien's phosphate mines located in the United States are Nutrien Aurora Phosphate and Nutrien White Springs.

Challenges

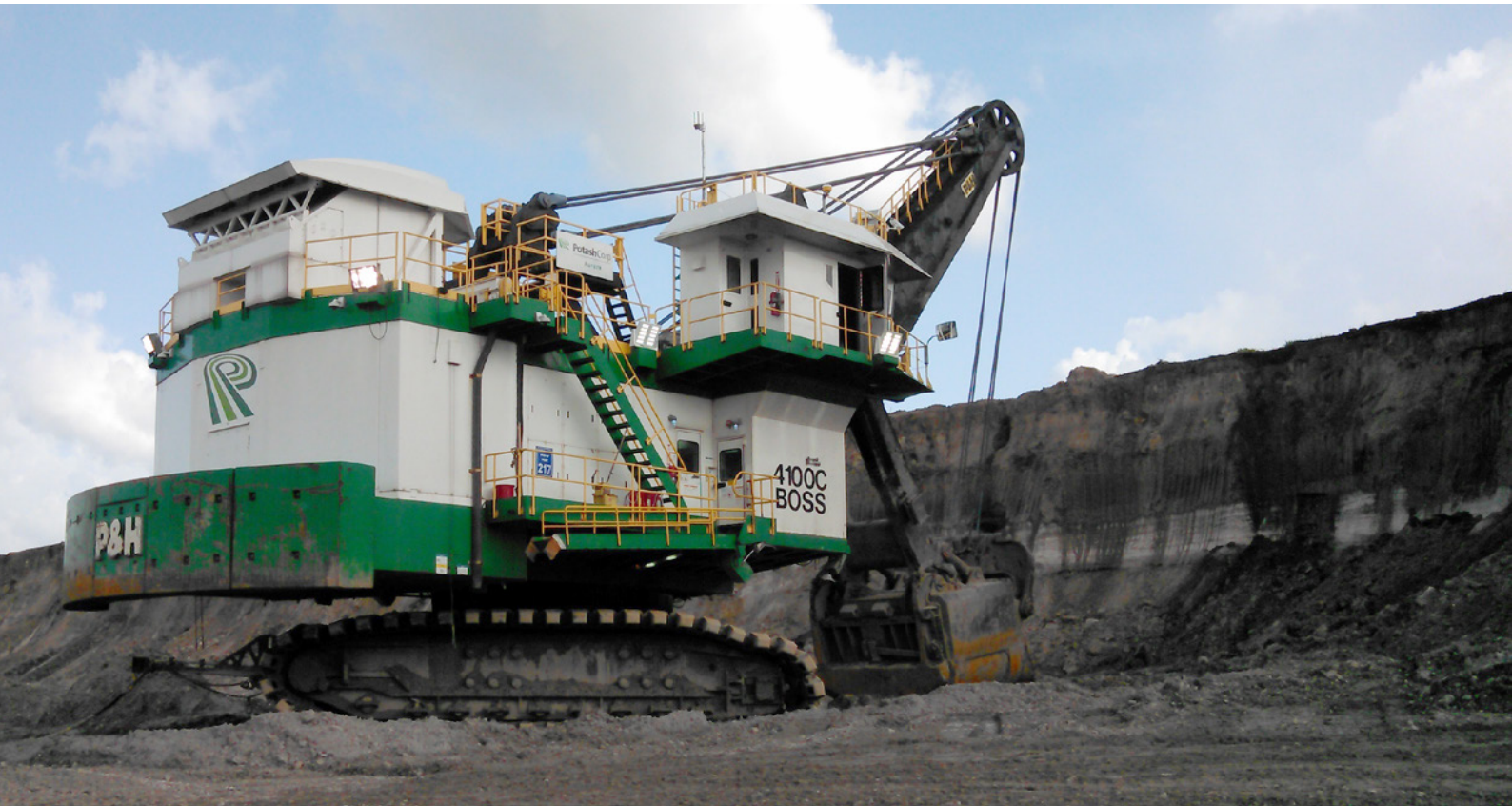
- Reliable communications between mining and processing equipment and the mines' operations center and chemical plant; extending enterprise applications into the field
- High bandwidth to support near real-time video (security and operations) plus additional applications that improve operational efficiency
- Flexibility to easily relocate nodes as mining operations dictates with minimal disruption to operation
- Resiliency to operate in a harsh environment (vibration, heat, dust)

Solution

- A wireless broadband network deployed around mine perimeter and on key mining equipment to monitor equipment telemetry and analyze production trends and issues
- Single network supports multiple applications concurrently: equipment telemetry data, manufacturing process data, IP phones, video cameras, e-mail, etc.

Results

- Centralized tracking and analysis of mining equipment telemetry data helps reduce unscheduled maintenance and downtime thereby increasing productivity and safety
- Fast access to phosphate analysis data provides visibility into trends related to production issues enabling proactive problem resolution
- Video improves perimeter security with ability to centrally monitor multiple locations at the same time
- Video provides plant operations with visibility into near real-time activity in mining pits, improving operational efficiencies and safety
- Video provides dragline operators with a 360° view around dragline, increasing effectiveness and safety
- Support for IP phones used throughout the mine fields for communicating with operations
- Network that is easy to deploy, operate, and relocate without disruption to operations



Background

Nutrien is the world's largest crop nutrient company; they mine and process key crop nutrients such as potash, phosphates and nitrogen in locations around the world. Two of Nutrien's phosphate mines in the United States are located in Aurora, North Carolina, and White Springs, Florida.

Phosphate is mined from ancient marine fossils and used in crop fertilizer, to enhance feed nutrition, and in industrial products (soft drinks, food additives, and metal treatment).

- **Nutrien Aurora Phosphate** operates a phosphate ore mine and processing facility producing phosphoric acid, di-ammonium phosphate (DAP), ammonium poloyphosphate solution, superphosphoric acid (SPA), and merchant-grade phosphoric acids (MGA). The plant site sits adjacent to the Pamlico River and it employs approximately 900 permanent and up to 300 contract workers.

- **Nutrien White Springs** produces phosphate products for agricultural and industrial uses, and operates a phosphate mine and two chemical plants where they produce Black Super Phosphoric Acid (Black SPA), Low-Mag Super Phosphoric Acid (Green SPA), Mono-Ammonium Phosphate (MAP), Blended Merchant Grade Acid (BDMGA) and Phosphogypsum. Nutrien White Springs employs more than 700 people.

Challenges

Aurora and White Springs facilities both operate open pit phosphate mines around the clock, seven days per week. At each location the plant manager wanted to achieve near real-time access to data and video from the mining pit both from the mine control center and at the processing plant. Access to more information in near real-time was targeted at improving operational efficiency and safety. In addition, a communications network would enhance worker effectiveness by extending accessibility to IT resources (including email, training and reference data, IP phone) around the mine.

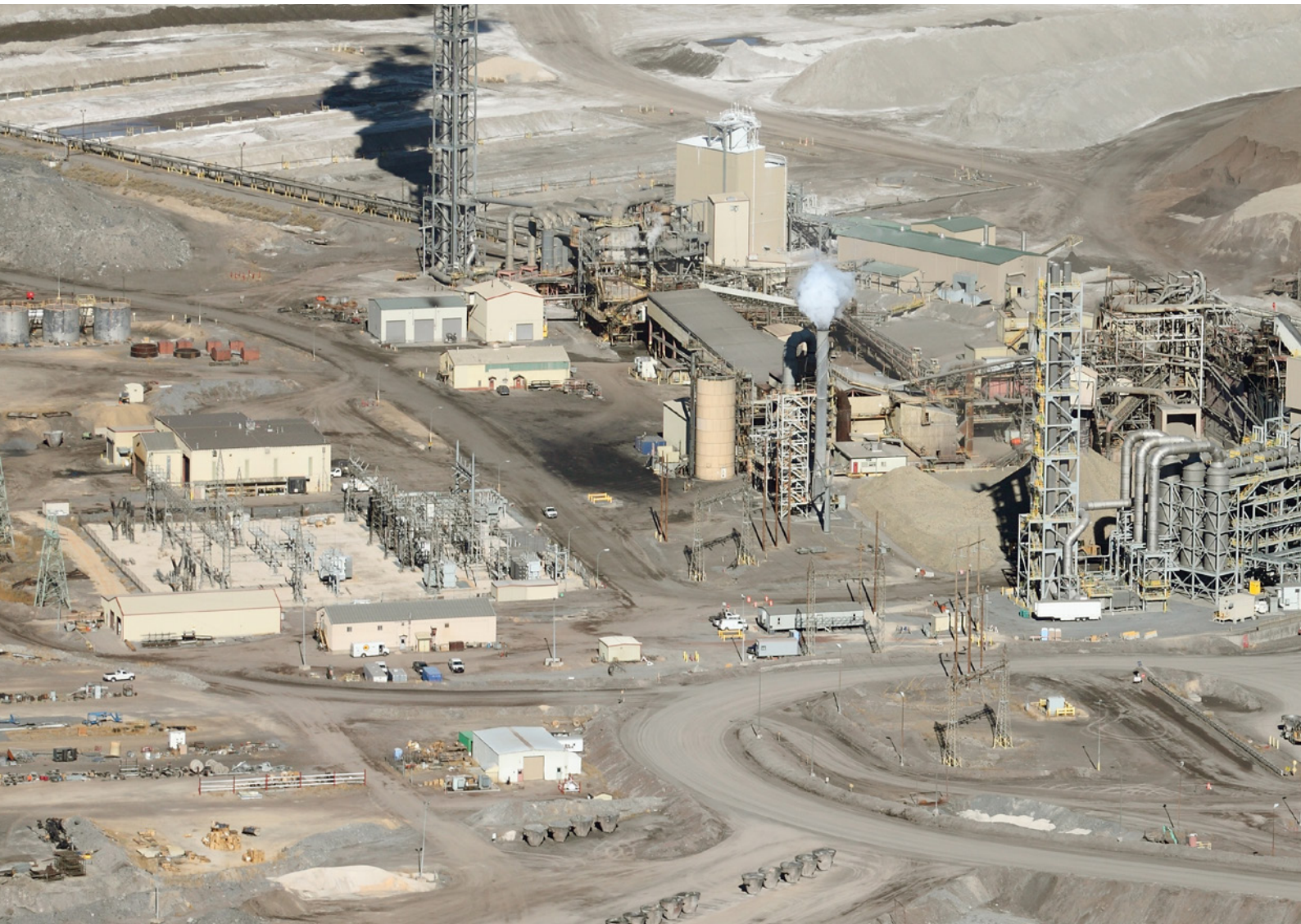
The Aurora plant has a trailer located near the mine pit that is used as the mine control center; White Springs plant has four mine areas with a future mine control center residing centrally.

A key part of the mine control room activities include collecting and analyzing pit operational data; this process data is also utilized at the chemical processing facilities. In addition to providing reliable communications, a network needs to be able to adapt to the dynamic nature of mining operations. It would require self-configuration, allowing it to automatically reconfigure and adapt as the dig site location and distance between network nodes change over time.

Draglines are critical pieces of heavy-duty excavation equipment in the mines, each carrying a capital cost in the millions of dollars. It is critical that these machines remain fully functional as much of the time as possible and regular maintenance is essential for safe and optimal operation. Some of the draglines had the ability to collect telemetry data. However, the data was stored locally and downloaded periodically, which limited the ability of operations to detect dragline problems early and therefore possibly prevent them.

Early problem detection and alerts for preventative maintenance timing is critical for some mining equipment and can significantly affect production. For example a bad bearing on a dragline can cost thousands of dollars in downtime; scheduling a preventative maintenance could avert such an incident and take significantly less time to make the repair, in part because field crews would be on hand to take action immediately with the right parts and tools.

Plant managers wanted virtual eyes into pit operations and for enhanced gate security and access control. Operations desired the ability to use video to monitor and record remotely how much material the draglines pick up, logging this information and using it for analysis. With video cameras at the gates, security could easily view and log who was coming or going, and when, without having to disperse guards to each location.



Additional challenges specific to each location:

Aurora
The mining operation in Aurora covers more than 70,000 acres; the mine plant is located less than 1 mile from the current dig. In a few years it is expected that the distance between the mine plant and the nearest dragline will increase to several miles. To reach phosphate rock, located 50 to 80 feet down, requires draglines, spreaders, feeders, and shovels. Careful ongoing monitoring of the mining equipment telemetry data is necessary for scheduling maintenance and reducing unscheduled downtime. Since the mine site moves frequently, fiber connectivity between the plant site and the mine is not feasible, making wireless communications the best solution.

White Springs
The mining operation in White Springs covers over 100,000 acres and there are four draglines operating in different locations. The furthest dragline is 14 miles from the mine plant, which supports all the draglines. There are two chemical plants located six miles apart which process the phosphate into product.

Solution

Hitachi Energy's wireless mesh routers are deployed in several areas in and around each mine pit with nodes providing a broadband communication pipe to each mine control center and each of the chemical processing plant(s). In addition, Hitachi Energy nodes are directly on draglines where they collect information from multiple sensors that monitor the equipment; with additional nodes mounted on utility poles in the mining pit.

Aurora
Currently, over 18 Hitachi Energy mesh routers are deployed in Aurora both in the mining pit and to the processing plant. Plans are to add an additional 11 nodes in the near future to expand coverage. The network provides communication for video cameras used for perimeter security and for monitoring of mining processes, providing operations with visibility into what is taking place in the mine at any time. In addition, the network supports IP phones in and around the mine area.

White Springs
Currently, there are over 20 Hitachi Energy mesh routers deployed in White Springs with two to three nodes around draglines and additional fixed nodes in between the mining pit and the processing plants where fiber backhaul is available. Some of the more remote nodes utilize solar for power.

Results

Hitachi Energy wireless mesh networks have improved operational efficiencies and provided new visibility into key mining equipment for predictive maintenance planning. The network connects to sensors on the draglines, shovels, feeders, and sleds, providing telemetry data that is collected and analyzed to recommend scheduled maintenance and ensure the equipment it is operating within set parameters. Preventative maintenance and monitoring has been demonstrated to reduce equipment downtime while improving productivity and safety.

Video in the mining pit enables operations to have more information about what is going on in near real-time which can help in planning trucks for transporting material from the pit to the processing plant; analysis of the amount of material being mined; and a tool to increase worker and equipment safety.

Additional applications planned

- Additional Hitachi Energy mesh routers are planned for placement on more mobile mining equipment and in vehicles around the mines to support asset location tracking, monitoring of equipment telemetry, and production analysis.
- More video cameras will enable additional visual monitoring of processes and equipment in the pit

Hitachi Energy offers:

- Wireless communication solutions
- Network management
- Maintenance, services and training

"After a thorough review during which we evaluated wireless technologies already deployed at our site as well as alternatives that we had not previously examined, we chose Hitachi Energy to provide the wireless broadband network in our mine. Hitachi Energy equipment and software provides the cost-effectiveness, mobility support and ease of deployment that we require."

GARY PETERSON
Superintendent IT
Nutrien White Springs,
Nutrien Aurora Phosphate

Hitachi Energy
marketing-update@hitachienergy.com
hitachienergy.com

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