

Using Ultrasound to Reduce Downtime in the Mining Industry

Created by: **ue**
SYSTEMS INC



Mining and associated services make up 6.9% of global GDP. With such a large economic contribution, it is crucial for mining operations to remain efficient and prosperous. However, the industry is faced with challenges that make it difficult to thrive, including limited accessibility, harsh work environments, and difficulty adopting predictive maintenance techniques. These challenges can perpetuate poor lubrication practices, which are often the root cause of machine failure. Thanks to new innovations in ultrasound, there is now a vast opportunity for mining facilities to improve their lubrication practices and overall success and profitability.

Challenges in Mining

Mining facilities not only face ongoing challenges with harsh working conditions, but they are notoriously behind the curve when it comes to optimizing their maintenance schedules and adopting new technology. This is partly because there is a lack of OEM technical support due to time zone issues, but also because there is a sense of complacency in work practices and ethics. In the rare case that condition monitoring has been implemented to improve reliability, there is a frequent change in suppliers, which makes it difficult to see progress over time.

The struggle to innovate can be linked to a lack of education. Training on condition monitoring and better maintenance practices is rarely a priority in the mining industry, causing high turnover and lack of progress.

4Ds of Automation and Mining

Improvement starts with innovation. Today, automation is leading change in facilities around the world, taking care of 4-D tasks: dirty, dull, dangerous, and dear. These tasks are especially common in the mining industry due to the contaminated work environment and tedious job duties.

1. Dirty

Exposure to high levels of dust, dirt, rain, and snow in mining facilities means regreasing practices can be a challenge. Particles can enter the lubricant upon regreasing if one is not careful when refilling the grease gun and dispensing grease into the bearing. Additionally, extended periods of time in a polluted environment can be hazardous to human health, making it an ideal opportunity for automation to take over.

2. Dull

There are many repetitive and tedious tasks automated systems are uniquely qualified for. When they're able to perform these, it frees up the human workforce to focus on more creative and interesting pursuits. From fulfillment centers to hotels and even hospitals, these devices are removing the monotony from many workplaces and often saving money in the process. In the case of the mining industry, regreasing tasks can be given to automated lubricators, giving maintenance staff the opportunity to focus on the bigger reliability picture.

3. Dangerous

The mining industry is known for being dangerous due to the range of equipment being used, the magnitude of particles in the air, and extreme temperatures. When opportunities for automation are identified, it lessens the need for human involvement. This, in turn, creates a safer workplace for employees because there is less risk associated with their day-to-day tasks.

4. Dear

Automated systems promote efficiency, meaning more can get done with less time and money. Although the initial investment can be quite large, these devices earn their keep by eliminating the need to pay wages (and potentially benefits) for a human to do the same job. That human can then contribute to higher level tasks such as solving unique problems and creating strategies to optimize the use of automated systems.

Ultrasound's Role

Considering the 4Ds of automation, a significant opportunity for the mining industry lies in ultrasound technology due to its remote monitoring capabilities. Ultrasonic sensors can be placed on bearings that are hard to reach, greatly reducing time that would be spent monitoring manually.

In one potash mine, maintenance staff invested in RAS (remote access sensors) on an overland conveyor, totaling 46 sensors on the asset. Before the sensors were installed, someone had to walk to each bearing with an infrared camera to measure bearing health, taking nearly 2 hours round trip. Now, the data is continuous and automated, providing early bearing failure detection and reduced time spent on condition monitoring tasks.

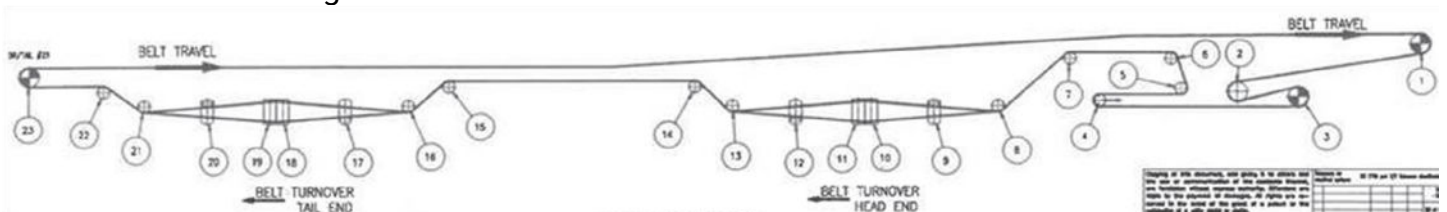


Figure 1. Illustration of the belt profile. Each number represents a pulley (2 bearings on each pulley). The head end is 7 miles away from the tail end.

While the RAS are proficient in gathering data on bearing health, the OnTrak is an automated regreasing system that uses ultrasound to address all 4 Ds of automation.

Once installed, the system's sensor monitors bearing friction to determine the exact amount of grease needed. When a bearing is low on grease, the operator receives a notification via the cloud-based platform. He or she can then lubricate the bearing remotely and watch friction levels decrease as grease is dispensed through the single-point lubricator.

Mitigates Harmful Effects of the Mining Environment

Contamination control should be a focal point of every lubrication program as foreign particles are to blame for a significant percentage of lubrication-related failures. Though grease guns are common, they don't always do the best job of keeping the grease clean as it is being dispensed into the bearing, especially in mining environments where the air is filled with dust and debris.



Figure 2. OnTrak system installed

The OnTrak boasts a single-point lubricator, which keeps grease in sealed cartridges free from contaminants. Dispensing clean, dry grease from the start gives bearings a better chance at longevity. Since grease is piped into the component directly, there is a significantly lower risk of a maintenance-induced contamination occurring.

Cuts Time Spent on Lubrication Tasks

With the OnTrak, there's no need to physically tend to bearings, meaning mining facilities can drastically cut down on time spent monitoring and lubricating bearings. The digital platform simply alerts the lube tech when a bearing needs grease. From there, all the operators must do is push a button to give the system permission to lubricate. If a bearing faces a problem that requires inspection, users will be notified through the platform on their tablet, cell phone, or computer.

Creates a Safer Work Environment

Due to limited accessibility, extreme temperatures, and pollution, it is safest for operators to keep interaction with equipment to a realistic minimum. Because the OnTrak enables remote lubrication and condition monitoring, operators can enjoy peace of mind knowing the health of their bearings are in great shape anytime, anywhere, as long as they are connected to Wi-Fi, cellular, or ethernet. In this case, bearings would only need in-person monitoring periodically to replace the grease cartridge or check for misalignment.

Furthermore, devices are installed in areas that are either inaccessible or unsafe to get to during operation, eliminating the need to shut down machines to perform maintenance. If we can reduce the number of employees that need to enter potentially hazardous environments or environments that cannot be accessed during machine operation, then we are saving more than just time.

Reduces Unplanned Downtime

When bearings are greased with the right amount of the right grease at the right time, you actively prevent equipment failure from sneaking up on you. The OnTrak system addresses 4 primary lubrication failure modes on rolling element bearings:

Insufficient lube quantity – The single-point lubricator dispenses the right amount of grease every time and even boasts a “micro-dosing” capability. This keeps the bearing optimally lubricated by eliminating the chance of over greasing commonly associated with manual regreasing methods.

Over greasing can result in a seal failure and generate heat in the bearing housing. When too much grease is pumped into a bearing cavity, it eventually will become full, and if there is no relief port on the housing, the grease will blow through the seals. This can present several issues, since the grease remaining in the housing can leak out. It also provides a path for external contaminants to enter the housing.

Incorrect regrease intervals – The system allows you to regrease proactively to maintain bearing health. Traditionally, many plants have used time-based intervals, but this method has proven to be ineffective due to variance in operating conditions (operating hours, temperature, etc.). Condition-based regreasing accounts for any variance in grease requirements over time.

Wrong grease – Cartridges are shipped containing the right grease, eliminating problems of mixing greases or using the wrong grease. Mixing grease can be a disaster. As the various thickening agents interact, the result is usually grease hardening or oil dropout. In either case, your bearings, shafts, joints, or other moving parts could be left unprotected, open to corrosion, prone to wear or even complete failure.

Contamination – Grease stays in an enclosed container until it is dispensed, avoiding contamination potential that comes with manual regreasing methods. This is key to upholding the integrity of the equipment in mining environments.

	Particle Induced			Non-particle-induced			
Sector	Abrasion	Erosion	Fatigue	Adhesion	Fretting	Other	Total
Pulp and Paper	S	U	S	N	S	U	U
Forestry	U	U	S	N	S	U	S
Mining	S	U	S	N	S	U	U
Agriculture	R	U	U	N	U	U	U
Transportation	R	S	S	N	S	S	S
Power Generation	N	N	R	S	S	S	S
Total	N	N	N	N	N	N	N
Percentage by Category	82%			18%			

Table 1: Mining equipment faces significant risk for contamination-related failure.



Lubrication Staff's Role

If you're considering the implementation of ultrasound technology to manage regreasing tasks, you might be wondering how day-to-day tasks of lubrication staff will change. Will there be enough work for employees? Will they have to be trained to manage other areas of the plant? Will their learned lubrication skills still be applicable to their new role?

While staff will no longer have to regrease bearings manually, there is still plenty for them to do including managing and growing the lubrication program as a whole, focusing on the bigger reliability picture, and using data to drive strategic decisions.

Growing the Lube Program

Now that much of the grunt work is being performed by automatic regreasing systems, the lube tech can now shift focus to the other components of the lubrication program. The lube tech must ensure storage and handling practices are up to standard, schedule regular oil analysis, establish KPIs to measure success, and more. A comprehensive lubrication program is important because it makes up the foundation of reliability. Without a lubrication program that gets results, other efforts to strengthen reliability are shadowed.

The best way to grow a lube program quickly is to designate a "lubrication champion", which is someone who takes ownership of the program's direction.

Champion Responsibilities

Champions optimize the likelihood of program success. They are always on the front lines and in direct communication with the entire team. In essence, they are the guardians of the project.

Identify Strategic Objectives

Champions must fully understand all the intricacies of the project so they can easily convey the "why" to others. They should also be able to answer the "what's in it for me?" question for every team member involved.

Champions work with the team to ensure the project's vision is successfully conveyed. Conveying what success looks like and making sure the team members all share the same vision will help increase the project's efficiency. The champion needs to know exactly what the best practices entail and should always be pushing toward those practices. If incorrect practices are implemented, it becomes nearly impossible to initiate change again in a short timeframe.

Monitor Automated Systems

Although automated systems can perform simple jobs accurately and efficiently, no system is 100% problem-free. The lubrication champion should proactively monitor all devices and check for any malfunctioning parts and signs of imminent failure. The OnTrak assists with that by showing the operator the decrease in friction as the bearing is lubricated. If there is an issue and bearing friction doesn't budge, the user will be notified.

Use Data to Drive Decisions

A documented lubrication program consumes time, money, and energy. Being able to prioritize improvements and knowing where the low-hanging fruit lie are important qualities of a champion. The champion should monitor key performance indicators to determine where an investment should be made, what's working and what isn't. The OnTrak calculates key lubrication insights that help improve your lubrication program. Insights like quantity of grease used, time between lubrication cycles and resulting change in friction are all useful metrics to consider when assessing the success of the program.

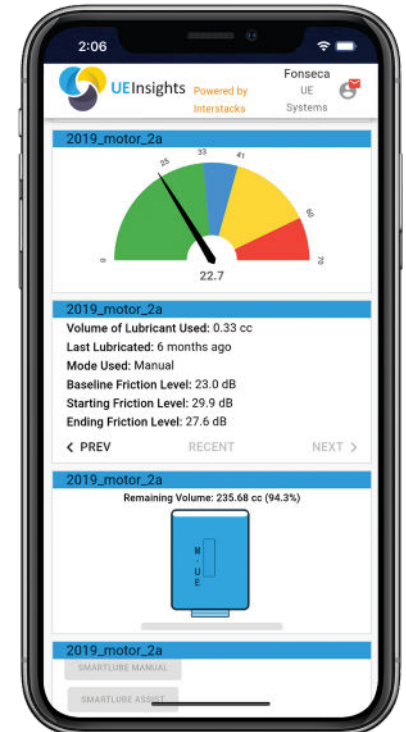
For example, the OnTrak's system calculates grease savings over time. If you're able to cut down on grease usage by 30%, the cost savings can be used to justify other investments in the plant like new filters, site glasses, and more. In this sense, one quick win can lead to another, accumulating reliability-boosting improvements over time.

Relay Updates

Communication plays a vital role in a program's success. Keeping the stakeholders well-informed of KPIs will allow the program implementation to progress smoothly. KPIs must be relevant and specific to the program aspect they are designed to measure and preferably prepared from data that is available from existing systems like the OnTrak. KPIs should also have an associated target figure or finite goal. This could be dollars, a percentage, cleanliness level, etc., but it must be measurable in some way. Finally, the KPI must be presented in a clear, summarized format that shows present and historical performance, targets, benchmarks, etc.

Allocate Resources

There is nothing more detrimental to a project than having good intentions to improve with no resources. These resources are typically related to time, money, or energy. If they are not carefully planned, scoped, and allocated, the program will fall through. Human capital is another valuable resource that must be well-considered. The lube champion should have the support of individuals who believe in the program and are willing to learn and comply with best practices.





Traits of a Successful Champion

The champion should be somebody who is not only skilled and knowledgeable in lubrication, but someone who is capable of leading others. This person must be prepared to take ownership of the program and oversee a variety of tasks.

Understanding of Lubrication and Reliability

The sheer volume of this subject matter requires a champion to be passionate enough to want to continually learn. A good starting point is achieving MLT1 or MLA1 certifications, which cover the basics of building a successful lubrication program.

Excellent Communication

Gaining buy-in is a major contributor to program success and being able to bridge the gap in communication between upper management and plant-floor operations is an invaluable skill. A champion should understand each group's needs and wants and can speak to both in terms of what's important to them. Knowing how to motivate team members most effectively on both sides of the operation (management and skilled labor) is a critical role of a champion.

Organized

A champion must be able to juggle multiple projects within the program, making sure that efficiency is high and waste is minimized. The OnTrak assists in organization with its bearing and lubrication database, which keeps track of specific details including bearing type, size, grease type, and calculated lubrication interval and quantity. The system also integrates with your existing CMMS or ERP system to automatically document that lubrication has been performed and the key insights.

Frequently Asked Questions for Mining Applications

Because mining facilities present a unique set of challenges, it's beneficial to get the full details on an automated regreasing system before purchasing. The most frequently asked questions on this application are as follows.

Can the system operate without Wi-Fi/cell signal?

Yes! The OnTrak also has an ethernet option, so you can simply wire into your facilities an existing ethernet connection. Keep in mind the cell option is not carrier specific – it will connect to the strongest signal it can find, so even in a remote location, if there is a signal present, the OnTrak cell version will detect it.

How are new cartridges delivered to potentially remote mine sites?

The good news is the settings in the UE Insights dashboards can be adjusted to notify the customer (and UE Systems) to indicate that a cartridge will soon need to be replaced. For example, the system can be set to alert when the cartridge is half full and get the ordering and shipping process in place sooner than later to maintain system continuity.

How well does the lubricator seal out contaminants in a mining environment?

The single-point lubricator was designed for just that – to maintain a clean and contaminant free lubricant. UE Systems also provides an extra layer of protection with the dust cover that comes with each new service pack.

Conclusion

As mining evolves, the application of automated systems will be encouraged to promote efficiency and workplace safety. While adopting new technology presents a unique set of challenges in the mining world, facilities can prepare for integration by keeping staff informed on reliability best practices and tying metrics to business goals.

If your site is seeking a way to optimize regreasing frequency, quantity or procedures, installing ultrasonic tools provides a quick return on investment if implemented properly. The OnTrak presents an easy way to get started with automation because there is minimal training needed and the user-friendly platform provides an easy way to keep track of bearing data.

About UE Systems & the OnTrak

UE Systems is the world leader in ultrasonic instruments & training solutions for predictive maintenance, reliability, condition monitoring and energy saving program. The OnTrak by UE Systems uses the power of remote prescriptive monitoring to give lubrication experts a powerful, accurate and easy-to-use software application to monitor bearing friction and remotely lubricate from anywhere, anytime or any supported device. To learn more about UE Systems and OnTrak, please visit UESystems.com/ontrak or UESystems.com.

