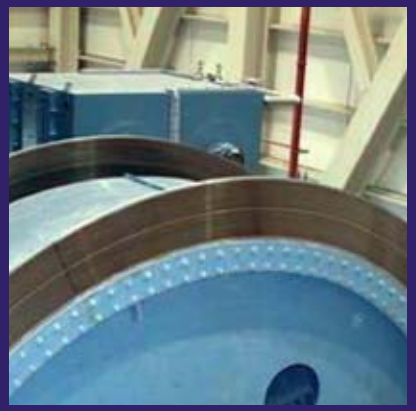
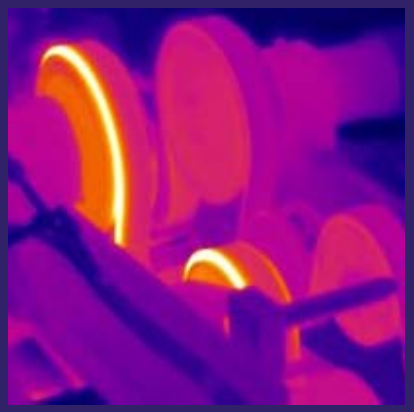
10 WAYS PDM IMPROVES ROI

Examples of Cost-Benefit Analysis for Condition Monitoring







Plant Services Special Report

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Proving the cost-effectiveness of vibration monitoring, lubrication oil analysis and thermography is an important step toward gaining the support of C-level executives for condition-monitoring applications.




Engineers see the value of predictive maintenance (PdM), but unfortunately there's no line on the spreadsheet for it. The difficulty of demonstrating return on investment (ROI) is one of the top barriers to success identified by plant engineers and middle management who understand a PdM program's effect on the bottom line.

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"The trick is finding the numbers that the C-Suite is following, such as production revenue, and then building a case with those numbers in mind", says Terrence Cullen, director of field services for Azima DLI (www.AzimaDLI.com). "If the C-suite isn't following MTBF or reduced parts inventory or repair cost, don't waste your time trying to justify your program based on those numbers."

Here's our list of the top 10 ways PdM can have a positive effect on your spreadsheet and some examples of companies that already have felt the benefits.

1. Avoid late shipments/lost opportunity
2. Be safer – planned work is safer than emergency or breakdown stops and restarts
3. Prevent environmental damage/regulatory violations - risk mitigation
4. Mitigate the experienced worker shortage - you don't need as many of those guys around all the time in case of a breakdown
5. Avoid downtime/lost production
6. Catch degradation in output level or quality before it drops too far
7. Reduce repair time – have skills, parts, tools and information planned and ready, avoid overtime
8. Reduce consequential damages to other things that get wrecked when you run to failure
9. Avoid utility penalty charges
10. Eliminate distractions to production workers – unplanned breakdowns result in confusion, tension, loss of morale, lost productivity

Avoid Downtime & Catch Degradation

Mill technicians at Orchids Paper suspected two roll bearings were deteriorating on the most critical paper machine. The mill technicians collected vibration data from the suction pressure roll and top press roll bearings. The data was then posted to Azima DLI's WATCHMAN Reliability Portal for an analyst to review. The Azima DLI vibration analyst reviewing the data confirmed the mill's suspicions and determined the top press roll had developed a new bearing defect from the drive side roll bearing. Data collected one month later revealed

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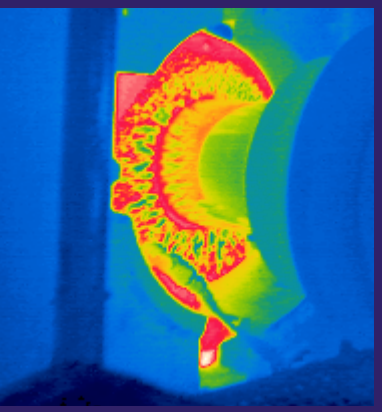
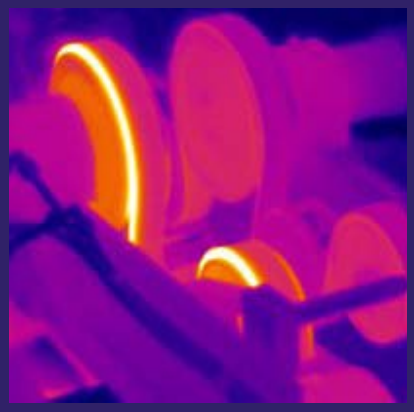

substantially increased vibration from the bearing. The overall rise was from 0.25 ips to 0.61 ips. The abrupt increase generated a Priority #1 status alert that called for the bearing to be replaced immediately. Even though the mill had a prescheduled outage in less than 18 hours, the precipitous increase in vibration demanded a prompt determination of machine health. An Azima DLI analyst received the data, analyzed it, and reported the results within one hour. Despite the rapid deterioration in the bearing, Azima DLI was able to confirm that the mill could continue operating safely through the balance of planned production, avoiding a potentially costly unplanned shutdown. Both bearings were replaced during the prescheduled outage. Azima DLI's WATCHMAN Insight program is also in place on additional equipment throughout the mill, providing regular machine health data on critical assets producing 33,000 tons of paper per year representing 61% of total production capacity or approximately $59 million of revenue.

Catch Degradation & Avoid Late Shipments

A major steel producer in Arkansas undertook a major upgrade to its gearboxes driving its F1 and F2 mill stands. The upgrade represented a capital investment of nearly $24 million. Due to the low speeds of these very large machines, traditional vibration monitoring was of questionable value. However, monitoring of the bearing temperatures in these massive gearboxes was recommended by the gearbox OEM. The company also applied Azima DLI's thermal imaging technology to the gearboxes in order to confirm the data from the temperature monitoring systems. The thermal imaging results revealed that the lubrication feed oil piping temperatures were much higher than anticipated, suggesting a malfunction in the lubricating system. Further thermal imaging tests discovered a fault in a large water-cooled heat exchanger used to regulate lubricant temperatures. The findings revealed a leaking bypass valve that was allowing hot oil to cross over into the cooled lubricant stream to the gearboxes, with the effect of overheating the bearing. A simple correction to this valve promptly lowered lubricant temperatures. The application of multiple condition-monitoring technologies provided a quick and simple solution.

Avoid Penalties, Be Safer & Catch Degradation

A potentially catastrophic electrical fault was discovered at Total Petrochemicals in March 2010 during a routine annual infrared thermography survey performed by Azima DLI. The reactor appeared to be operating normally, but the infrared inspection revealed a faulty wire connection and critical heat damage to the aluminum bus bar that would otherwise have gone undetected until failure. Total Petrochemicals made the decision to take the capacitor bank out of service immediately to avoid devastating damage to the equipment and to

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eliminate the danger posed to personnel working in the area. Had the capacitor failed, Total Petrochemicals could have incurred a significant penalty usage charge of $30,000/month from the utility company; and even though catastrophic failure was avoided, the capacitor was still out of service approximately one week waiting on new parts and components. This doesn't even include the avoided cost of potential collateral damage to costly nearby equipment, possible harm and injury to personnel, and extended repair time had the electrical fault gone undetected until failure.

Eliminate Distractions & Reduce Repair Time

At a large potash mine in Esterhazy, Saskatchewan, Canada, a 19.5 ft diameter drum hoist, rotating at 60 rpm, is used to bring freshly mined material to the surface by raising and lowering two loading sleds. This is the only drum hoist at this mine location, and its performance is absolutely vital to the mine's operation. To ensure the highest level of monitoring of the drum hoist's condition, Azima DLI applied an online condition monitoring system using its SpriteMAX platform to continuously capture and diagnose potential faults from the machine's vibration spectral data. Prior to commissioning the SpriteMAX system, the hoist engineers would perform a battery of specialized tests using their handheld instruments on a monthly basis. With SpriteMAX as the early warning system tracking the health of the hoist bearings, the hoist engineers can focus their attention on other tasks. When the system alerts them to a change in bearing health, the engineers will observe the data and/or perform other specialized tests to determine the rate of degradation. With the help of SpriteMAX online monitoring, they are able to apply timely and planned corrective action, such as additional lubrication or schedule repairs to coincide with planned hoist/cable maintenance.

Avoid Downtime

A U.S. Navy ship's main propulsion reduction gear unit is a complex arrangement involving multiple gears and multiple shafts typically driven by twin turbines and powering a large diameter propeller shaft. Many U.S. Navy ship classes and commercial vessels utilize up to four pieces of this type of equipment. In September 2002, a routine pre-yard-availability machine condition analysis (MCA) survey on 400 machines was conducted on one of these ships by Azima DLI with assistance from the ship's crew. One of the high-speed driven gears, associated with an intermediate shaft, was found to have a severe crack in the web. This gear was replaced at the shipyard, and a post-repair vibration test indicated good machine condition and no faults. It is speculated that if the inspection and repair hadn't occurred, then there likely would have been a catastrophic gearbox failure during subsequent ship operation. The total cost of removing one unit and installing a new unit is estimated at upward of $8 million, which is close to the entire cost of

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the MCA program for the whole fleet of a dozen ships for a decade. Consider that the program is used to monitor more than 4,000 machines regularly, in most cases at least four times per year. Over time, hundreds of machines are given repair recommendations prior to machine failure. Equally important, most machines are proclaimed healthy and avoid the cost and risk associated with planned repairs using a predetermined schedule (time-based maintenance).

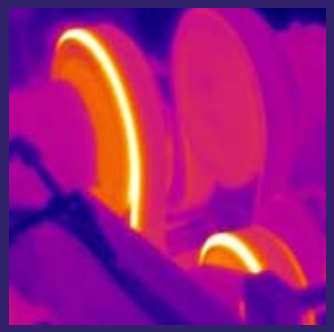
Reduce Repair Time & Reduce Consequential Damages

Over the past 16 years, unplanned machine failures at the Conoco Phillips Ferndale plant have diminished to near zero. The plant's pump mean time between failure (MTBF) rate increased from 22 months to 52 months in a 10-year period after implementing the Azima DLI condition monitoring system. The annual maintenance costs for all pump repairs have dropped from $1.3 million/year in 1994 to $600,000/year in 2004. Virtually every maintenance task at the plant is planned. Equipment failures are few and far between. Machinist overtime has been nearly eliminated. Since 1991, the Conoco Phillips Ferndale plant has come a very long way. What was once a run-to-failure plant where machine breakdowns were common and machinist overtime was inevitable, is now a plant with a 91% on-stream availability with a staff of just five machinists. Implementing Azima DLI's vibration data collector with ExpertALERT software was the crucial turning point for the Ferndale plant. Using Azima DLI, the staff is now able to perform preventive maintenance and predict machine failures well before they happen.

Catch Degradation & Mitigate the Experienced Worker Shortage

A European wind farm is monitored remotely by a team from Azima DLI in Seattle. Data is collected on each of the turbines automatically using 16-channel, Web-enabled SpriteMAX systems. The client has local access to diagnostic reports via a mimic display. Azima DLI engineers access the system via a Web portal where data is manually reviewed, and the client is notified of any changes in machine condition. A local engineering company had recently overhauled the gearbox of one turbine, which was still under warranty. An early warning of generator bearing noise and gear mesh wear escalated quickly but was caught before catastrophic failure, thanks to persistent remote monitoring. More consistent symptoms of first gear mesh problems became present in both the high- and low-frequency tests and prominent sidebands were spaced at the second intermediate shaft rotation rate in the low-frequency tests. Even when the symptoms appeared to have stabilized, the team understood how quickly a situation could turn for the worst. Ultimately, perseverance paid off, and the gearbox rebuild company arrived and found the bearing on the intermediate shaft was severely damaged, similar to what was discovered when the gearbox was rebuilt in July 2008. The bearing was replaced, and the unit went back online.







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