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Research and Implementation of Tribology, Ultrasound and Thermographic Techniques to the Predictive Maintenance of Machinery.



TEAM MEMBERS

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ABSTRACT

This report was commissioned to research and implement three new analysis techniques (ultrasound, tribology and thermography) for a better prevention of imminent failures in Conducel Conducel. The research draws attention to the upkeep of machinery (TRB 1, Multiline Niehoff and Buncher Niehoff) and how the current analysis for failures is limited to only vibrational analysis. The numbers of premature failed bearings, belts and valves have caused concern for Conducel. Complimenting vibration analysis with ultrasound, tribology and thermography techniques will allow for a more precise and accurate diagnosis of each machine's current state of operation. Overall it is important to have a detailed predictive maintenance plan: to avoid losses in profits because of stalled production, a safer work environment and a more efficient manufacturing plant.

OBJECTIVES

- Research and Implement the predictive analysis techniques (Thermography, Tribology, Ultrasound)
- Implement the three analysis techniques specifically to the machines (Multiline Niehoff, Buncher Niehoff, TRB1)
- Propose a statistical method to help aid anticipating failures

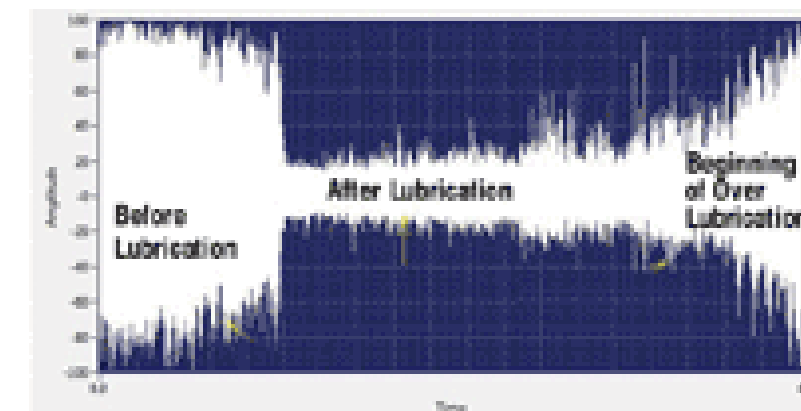
BACKGROUND

Maintenance is the upkeep of machines so that they perform to their expected capability for their designated predetermined life expectancy. The primary goal of maintenance is to avoid or mitigate the consequences of failures caused by machines. Our specific company Conducel is in the business of manufacturing cables for automotive industry. The cost of a downed machined due to unanticipated failures is very costly for example the TRB1 machine fails the company is put in a stand still because it is the first machine in the production line. For this reason predictive maintenance is a top priority for Conducel to anticipate and avoid complete failures to save time, money and resources.

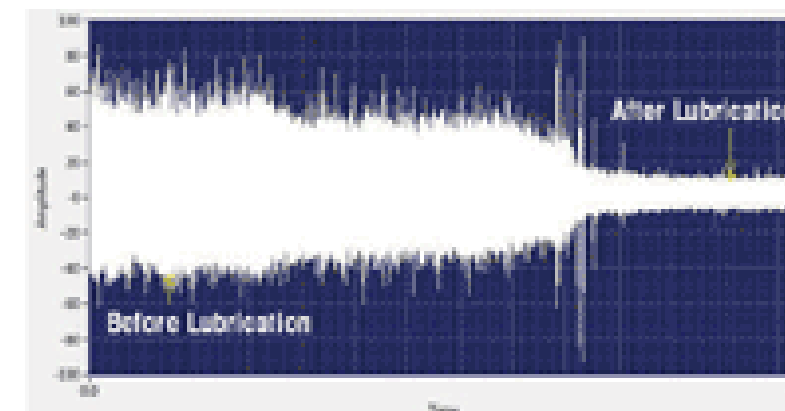
METHODS AND MATERIALS

Three analysis techniques researched: Tribology, Thermography and Ultrasound

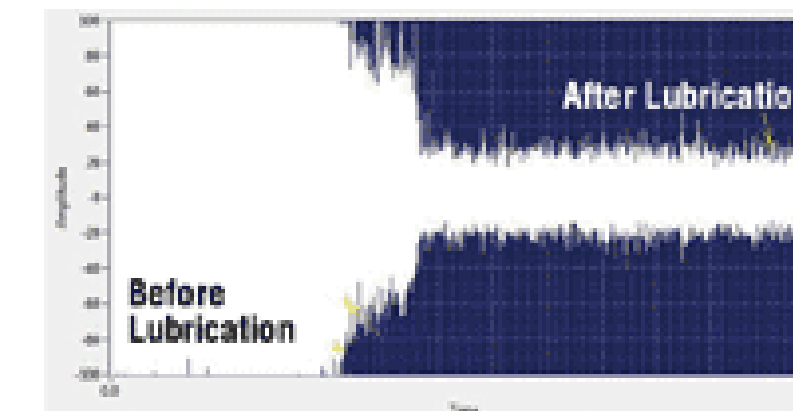
- Ultrasound uses high frequency sound energy to conduct examinations of materials internally. The use of Contact Ultrasound picks up sounds of a precise location and presents the decibel levels graphically. Audio Ultrasound is a trained technicians ear being able to notice differences in sounds being produced by moving parts.
- Thermography converts infrared radiation to temperature allowing us to see max and min temperature peaks. This technique is mainly used in: Electric and mechanic systems, buildings and medical processes.
- Tribology studies the wear and the interaction between lubricants and surfaces. Oil Analysis is a cheap and powerful technique that can help to anticipate failures, identify critical components and eliminate the root causes of problems by measuring specific characteristics of oil samples.



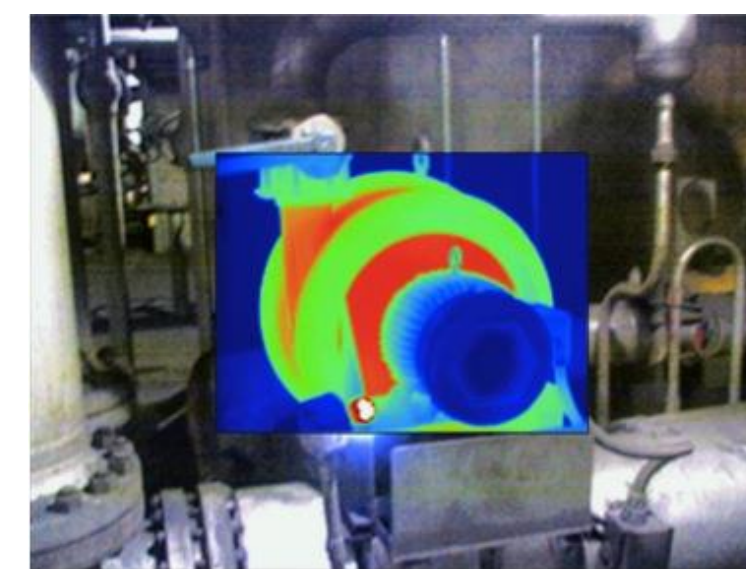
This image shows what happens when too much lubricant is applied. Notice the increase in amplitude or the noise level when lubricant continues to be applied.



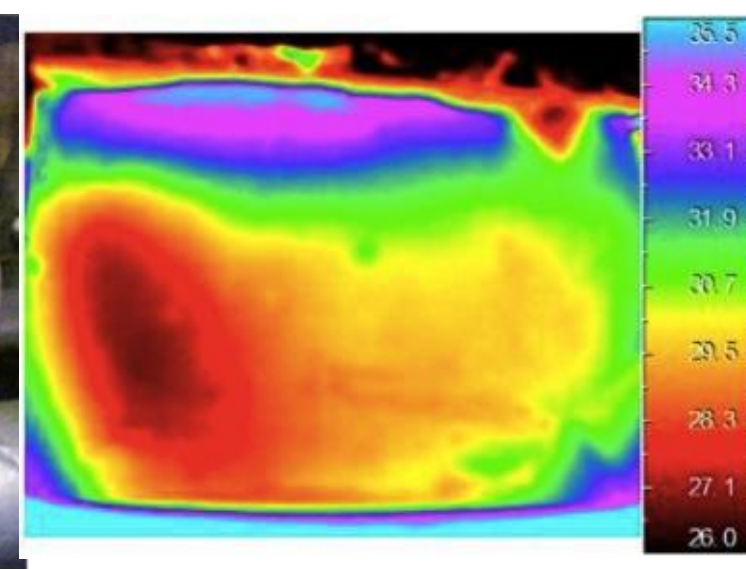
This is another time series view of a recorded ultrasound from a bearing in the process of being lubricated.



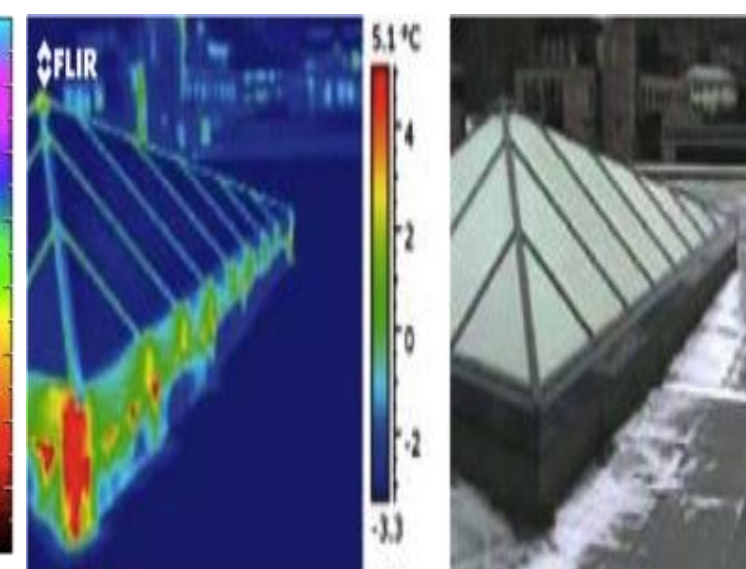
The image above is a time series view of a recorded ultrasound from a bearing in the process of being lubricated. Notice the before noise or amplitude at the beginning and then once the bearing was properly lubricated at the end.



Overheat on bearing. (Snell Infrared Canada)



Dam with cracks. (Universitat Politècnica de Catalunya)



Glass roof with air leaks. (Infrared guidebook for building applications)



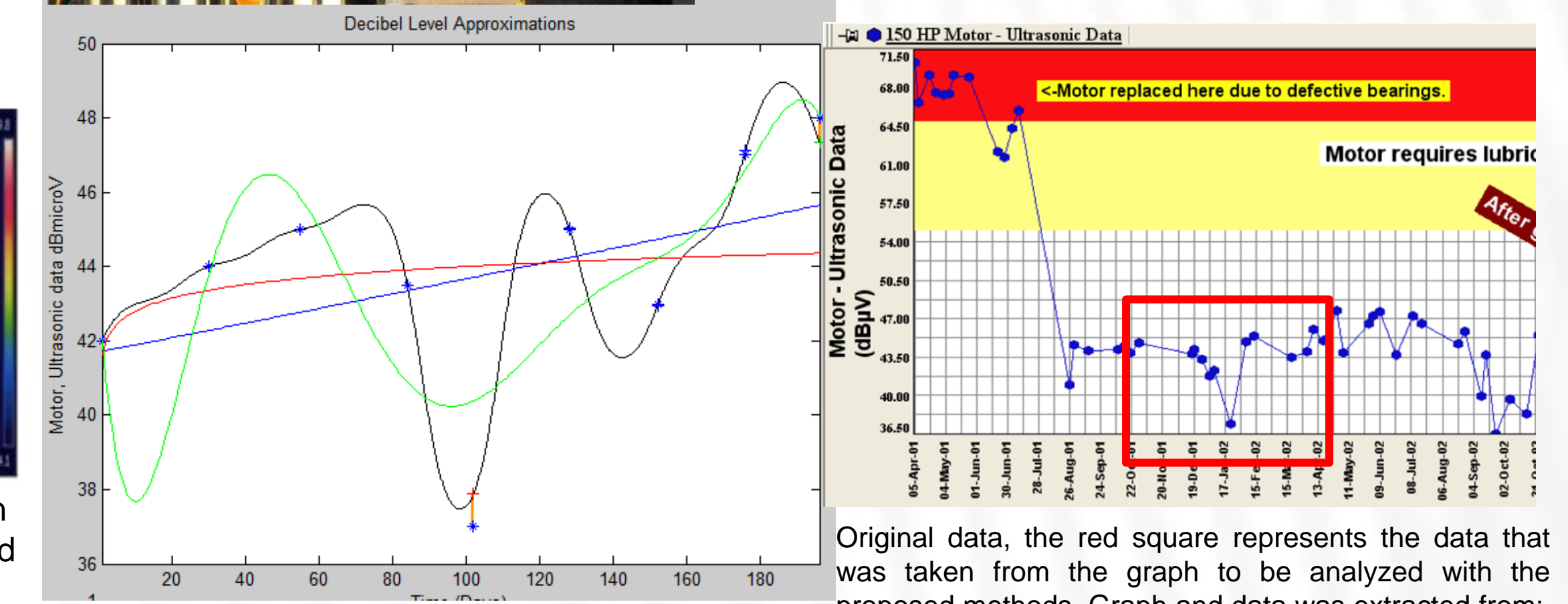
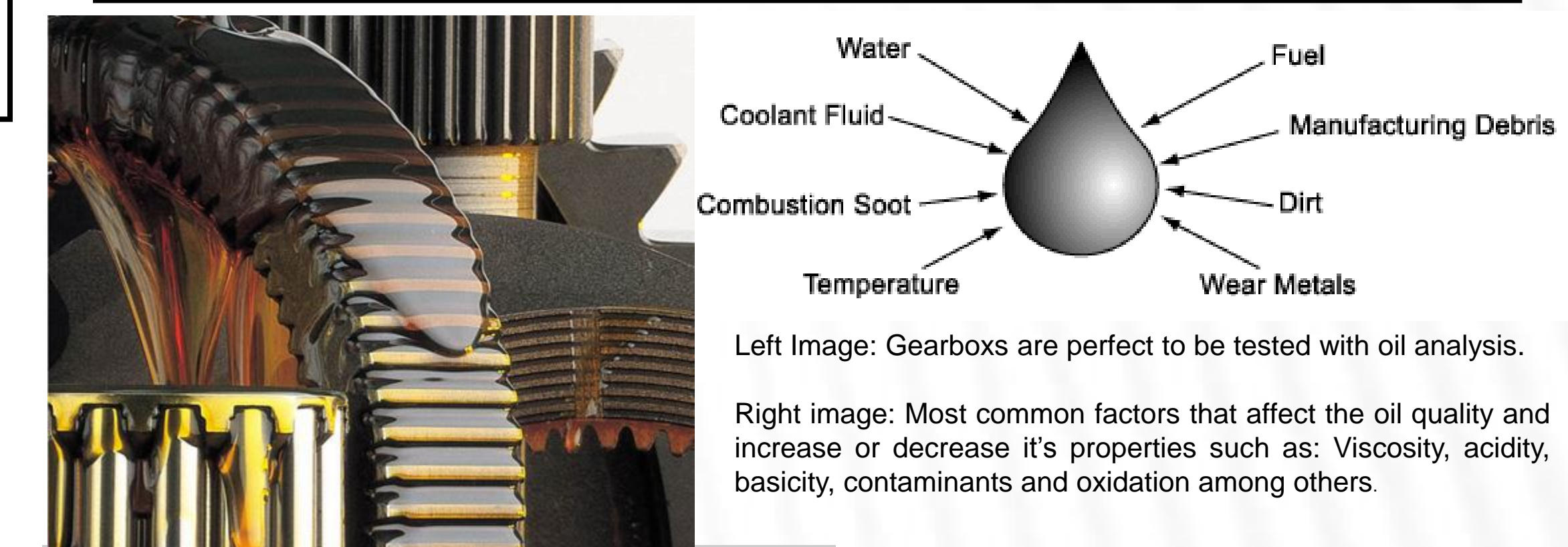
Loose connection on the top wire. (Infrared imaging services)

CONCLUSIONS

Predictive Maintenance is an ever growing field of interest for companies because its capability of detecting a wide array of failures before they occur. This allows for companies to repair machines on their time rather than on the machines time.

Our project serves to benefit Conducel's overall performance in manufacturing of cables by assisting in the detection of impending failures.

The research conducted of the three analysis techniques will compliment Conducel's vibration analysis technique for predicting impending failures.



RESULTS/RECOMMENDATIONS

Conducel-Conducel will see an increase in machine reliability, decrease in labor hours needed for repairs, increase in overall plant safety, an increase in detection of impending failures and a decrease in time delays for locating spare parts needed for machines repairs.

Recommendations:

- Conducel begins collecting a detailed log for when and why bearings, belts, valves etc. have been replaced. Collect base readings for each bearings noise level produced.
- Conducel starts a fresh PdM with detailed notes on each machine specifically points of interest
- Acquire a baseline reading for each working part while properly functioning to be used for future comparisons to detect when changes are occurring.

REFERENCES

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