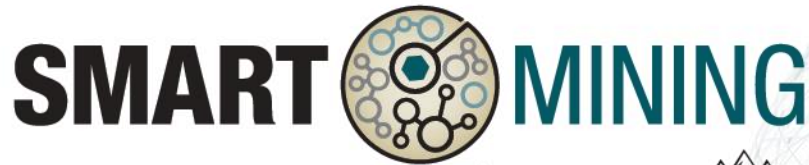


24/7 Condition Monitoring of Gearboxes in the Mining Industry



Resources for a Connected World

SME
2019 SME ANNUAL
CONFERENCE & EXPO

CMA
COLORADO MINING
ASSOCIATION
CMA 121st NATIONAL WESTERN
MINING CONFERENCE

Adam Soder
Sumitomo Drive Technologies

Many Critical Assets

- Belts
- Idlers
- Bearings
- Motors
- Gearboxes



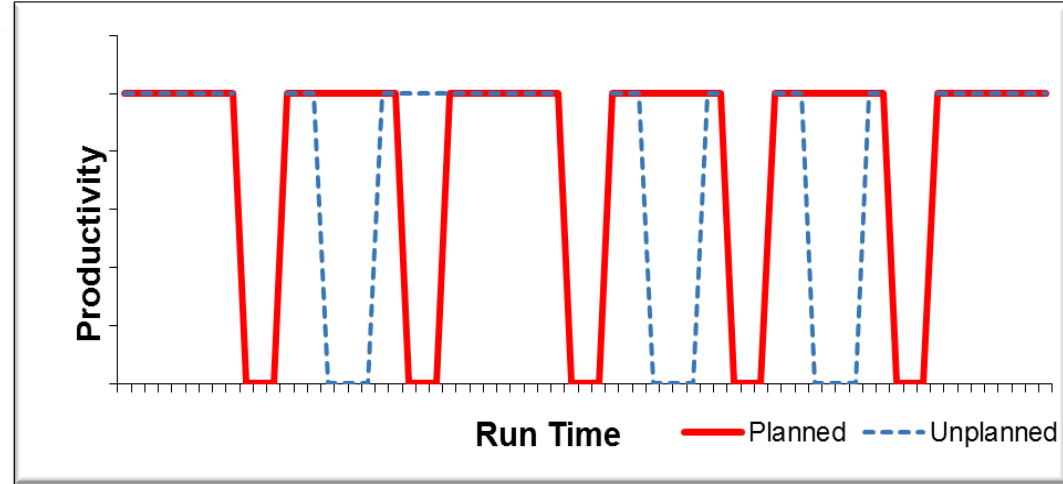
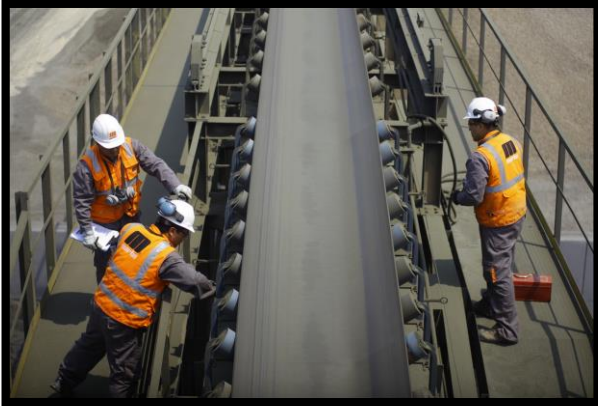
Routine Maintenance

- Lubrication
- Alignments
- Vibration
- Inspections



Unplanned Maintenance

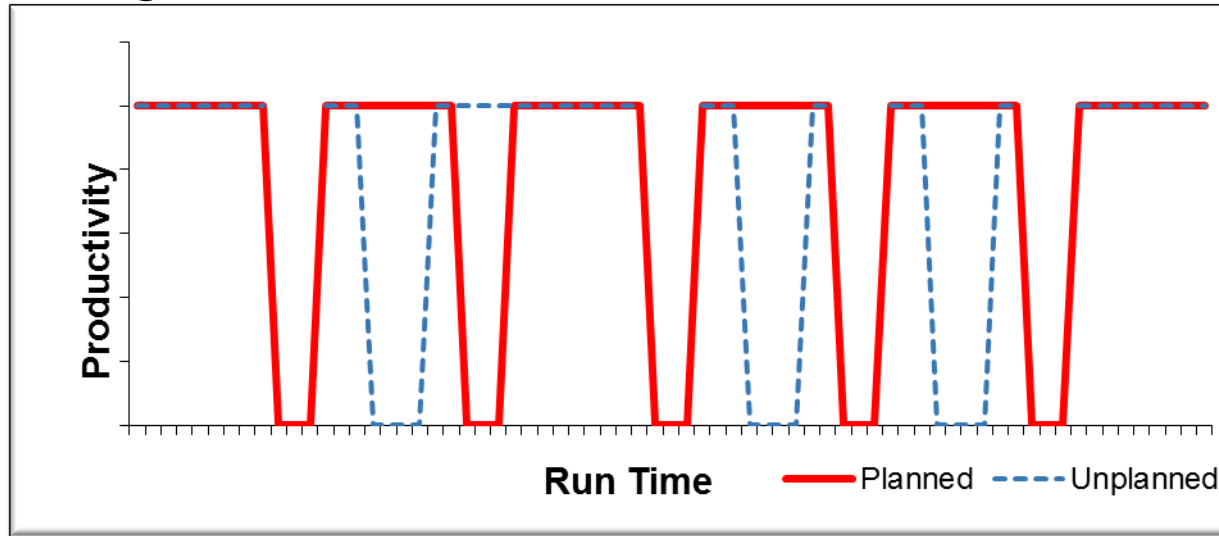
- Downtime
 - Costly, when not planned



- Cement Processing Plant
 - \$20,000/hr of Downtime
 - 5 Hours + to replace - \$100,000 of lost revenue

Preventative/Predictive Maintenance

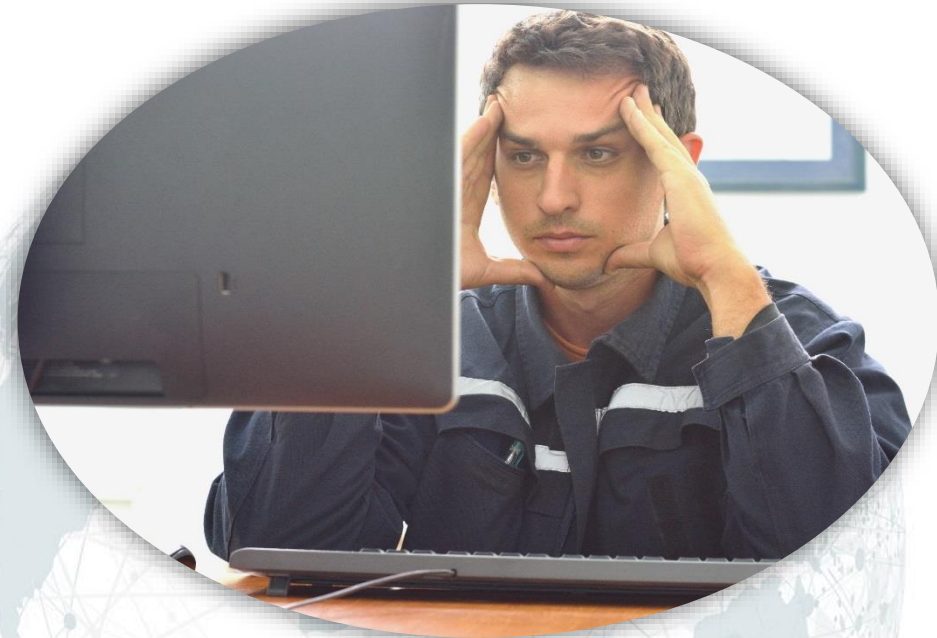
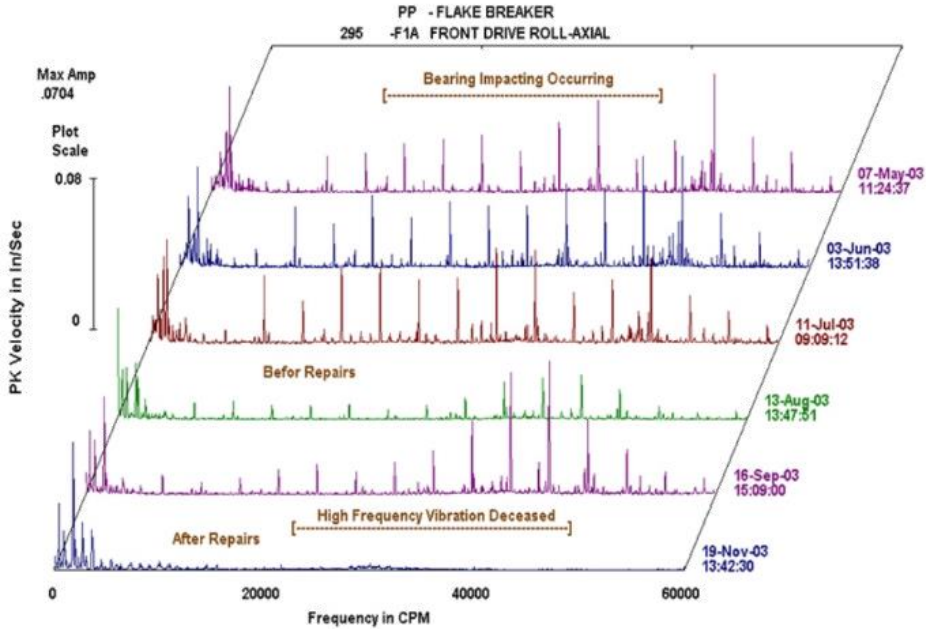
- Aim to align downtime, with scheduled shutdowns.



Route Based



Route Based



Data Points to Analyze

Vibration:

- A. Gear wear
- B. Machine imbalance
- C. Shaft misalignment
- D. Chain looseness
- E. Rolling element defect
- F. Bent shaft

Thermography:

- A. Bearing
- B. Barrier system failure
- C. Heat dissipation
- D. Lack of lubrication
- E. High electrical resistance
- F. Faulty fuse clips

Oil Analysis:

- A. Incorrect lubricant
- B. Overdue oil changes
- C. Component fatigue
- D. Sliding wear of materials
- E. Abrasive wear of bearings
- F. External contamination

Corrosion Monitoring:

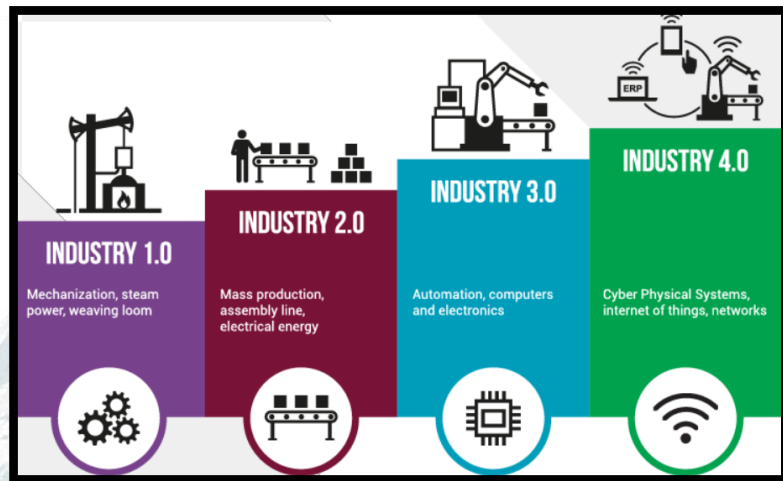
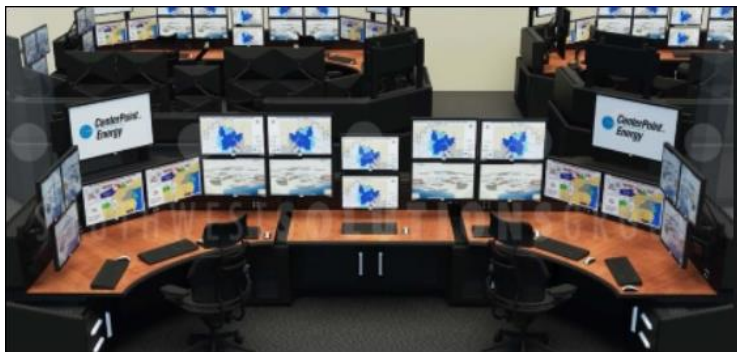
- A. Stress corrosion
- B. Corroded pressure vessels
- C. Leakage in pipelines
- D. Pressure failure
- E. Surface degradation

Ultrasound Monitoring:

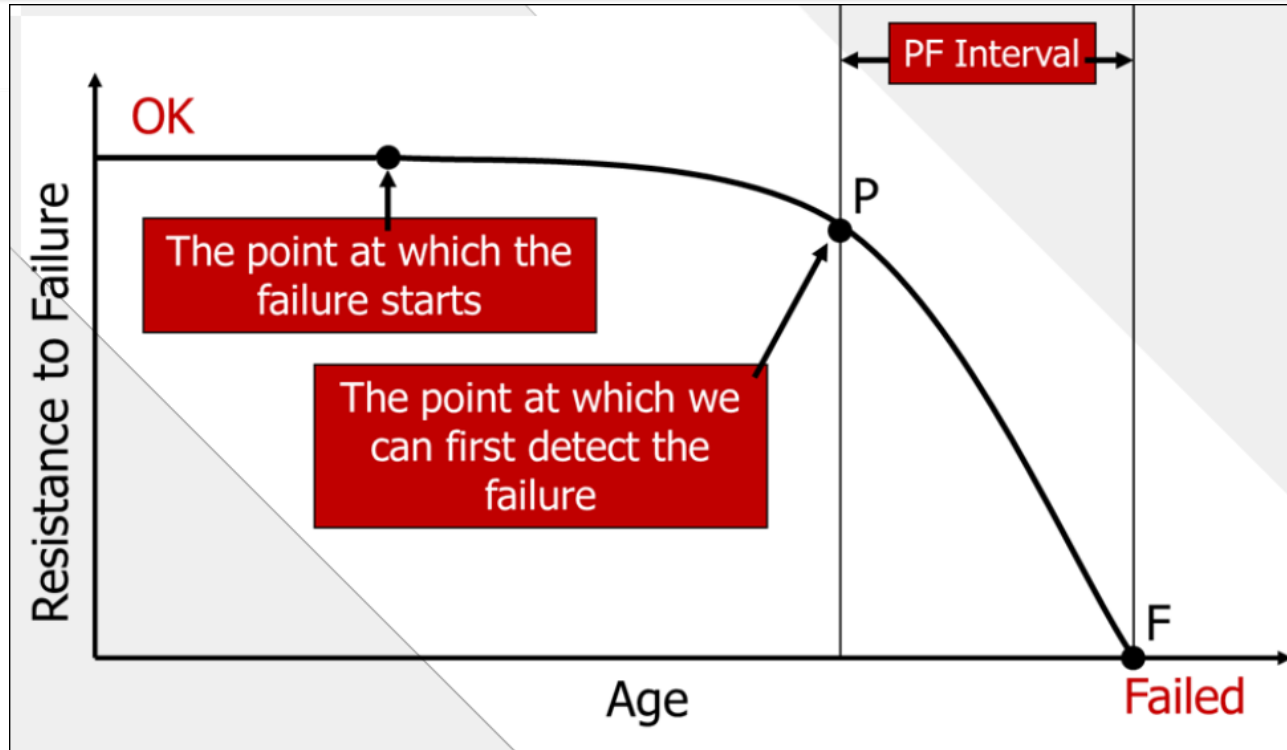
- A. Bearing faults
- B. Faulty gears
- C. Electrical inspection
- D. Circuit breakers

Industry 4.0 and The IIoT

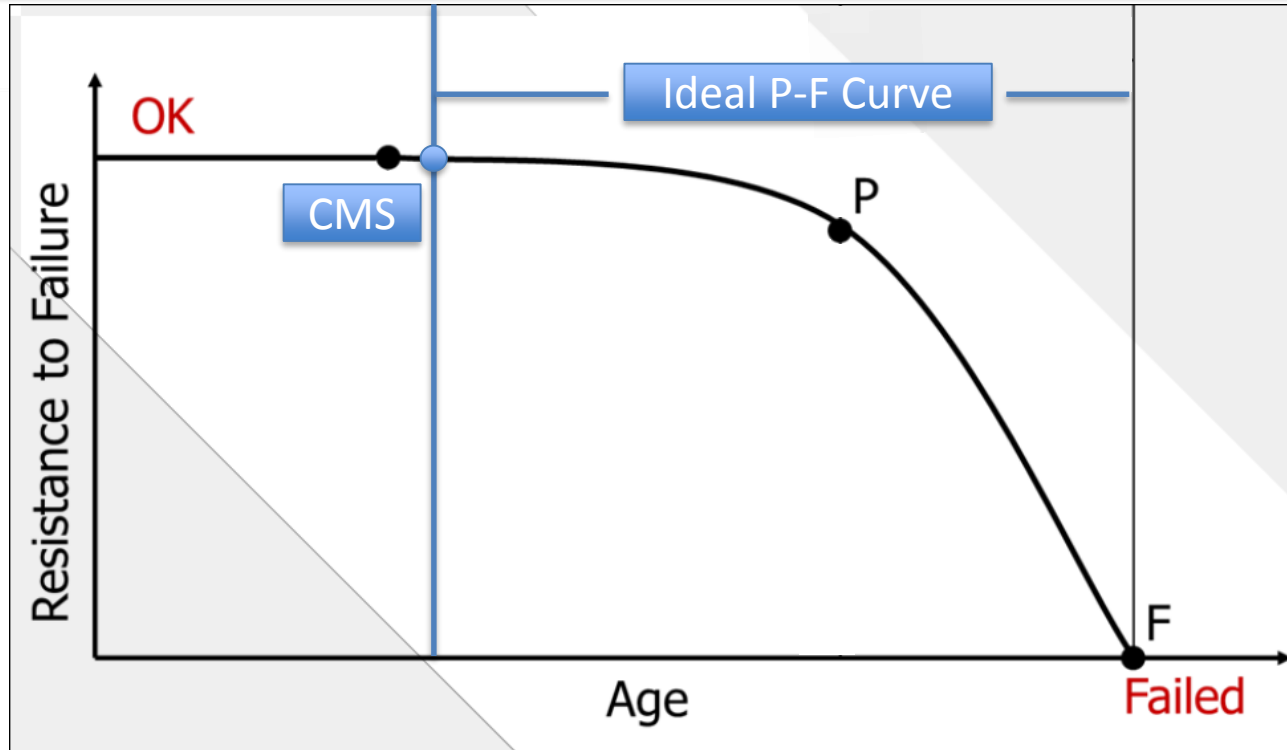
- Changes in Industry
 - Faster data delivery
 - More complex systems
 - Reduction of system costs



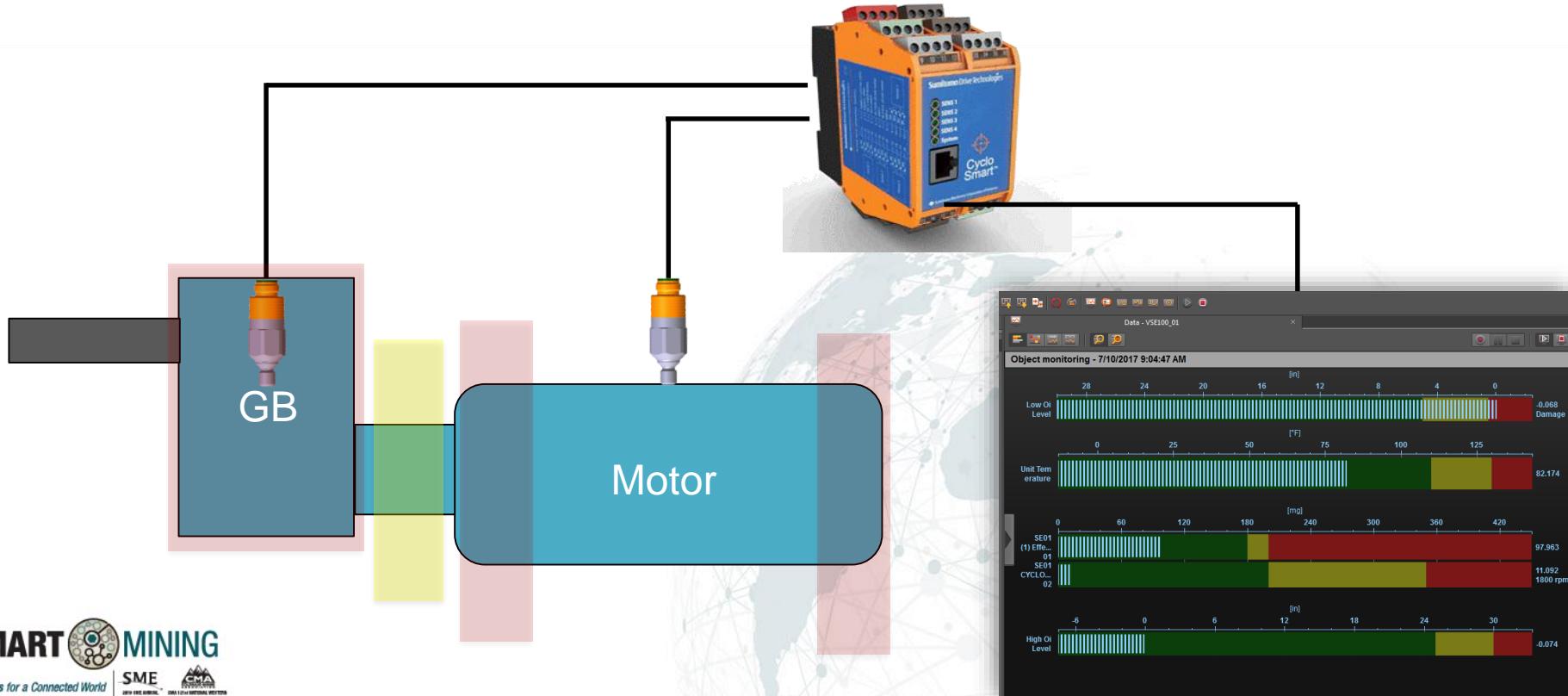
Typical P-F Curve



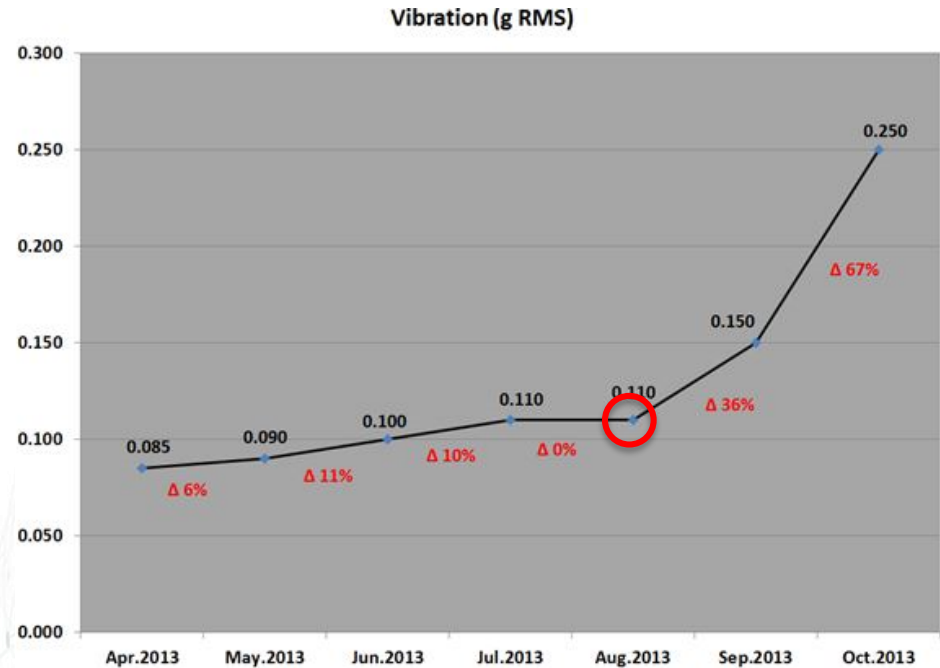
CMS and a P-F Curve



Condition Monitoring System (CMS)



Case Study



Case Study



- Replaced During Weekend Shut down
 - Saved user \$5,000/hr in lost production
 - Install not rushed, allows for proper install

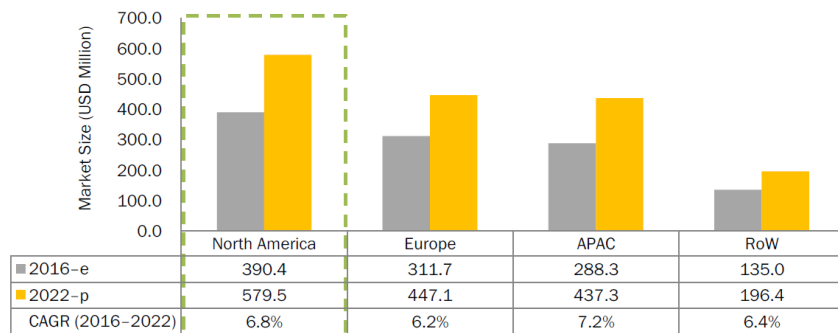


Alert and Alarm Methods



CMS Growth

FIGURE 30 NORTH AMERICA EXPECTED TO ACCOUNT FOR THE LARGEST SHARE OF THE VIBRATION MONITORING MARKET BETWEEN 2016 AND 2022



Source: The Association for Asset Management Professional (U.S.), Experts' Interview, Whitepapers, and MarketsandMarkets Analysis

TABLE 3 MARKET FOR VIBRATION MONITORING , BY INDUSTRY, 2013-2022 (USD MILLION)

Industry	2013	2014	2015	2016-e	2018-p	2020-p	2022-p	CAGR (2016-2022)
Oil & Gas	200.2	215.3	231.1	247.6	283.4	323.4	368.1	6.8%
Energy & Power	187.0	201.5	216.7	232.7	267.5	306.4	350.2	7.0%
Metals & Mining	123.3	131.0	139.0	147.3	164.7	183.5	204.0	5.6%
Chemicals	98.6	105.7	113.0	120.6	137.0	155.0	175.0	6.4%
Automotive	83.6	91.2	99.4	108.1	127.3	149.5	175.1	8.4%
Aerospace & Defense	72.4	78.7	85.4	92.6	108.4	126.5	147.3	8.1%
Food & Beverages	55.5	59.2	63.0	67.0	75.4	84.7	94.9	6.0%
Marine	49.1	51.6	54.1	56.6	61.9	67.5	73.4	4.4%
Others	44.7	47.4	50.1	52.9	58.9	65.3	72.2	5.3%
Total	914.3	981.6	1,051.8	1,125.3	1,284.6	1,461.8	1,660.2	6.7%

Source: The Association for Asset Management Professional (U.S.), Experts' Interview, Whitepapers, and MarketsandMarkets Analysis

Industry	2013	2014	2015	2016-e	2018-p	2020-p	2022-p	CAGR (2016-2022)
Metals & Mining	123.3	131.0	139.0	147.3	164.7	183.5	204.0	5.6%

Thank you!

Are there Any Questions?

