

The background of the slide is a collage of industrial scenes. In the top left, there are blue electric motors. In the top right, a large metal gear is visible. In the center, a worker wearing a white hard hat, safety glasses, and an orange high-visibility jacket is looking at a tablet. In the bottom left, there is a large yellow industrial machine. The entire image is overlaid with a white geometric grid pattern.

**FLUKE®**

Reliability

## **Vibration Analysis in the evolving Condition Monitoring environment**

Best Practices Webinar Series

# Meet the Speaker



## Taylor Sheppard

*ISO Cat III Vibration Analyst*

- Field Application Specialist, Fluke Reliability Solutions
- Vibration Analyst, Toledo Paperboard Company, Toledo Oregon
- Senior Reliability Centered Maintenance Technician, Cripple Creek & Victor Gold Mine.
- Mill Diagnostic Mechanic, Senior Reliability Centered Maintenance Technician, Climax Molybdenum Mine.

\*Does not catch fish

## POLL QUESTION No. 1



Does your facility have a reliability program?

(Click only one answer)

- What's that?
- We may still have some tools in a cabinet... *somewhere*.
- Yes, but.
- Absolutely! Yes, a robust program!

## POLL QUESTION No. 2



Does your organization have a Root Cause Failure Analysis team?

(Click only one answer)

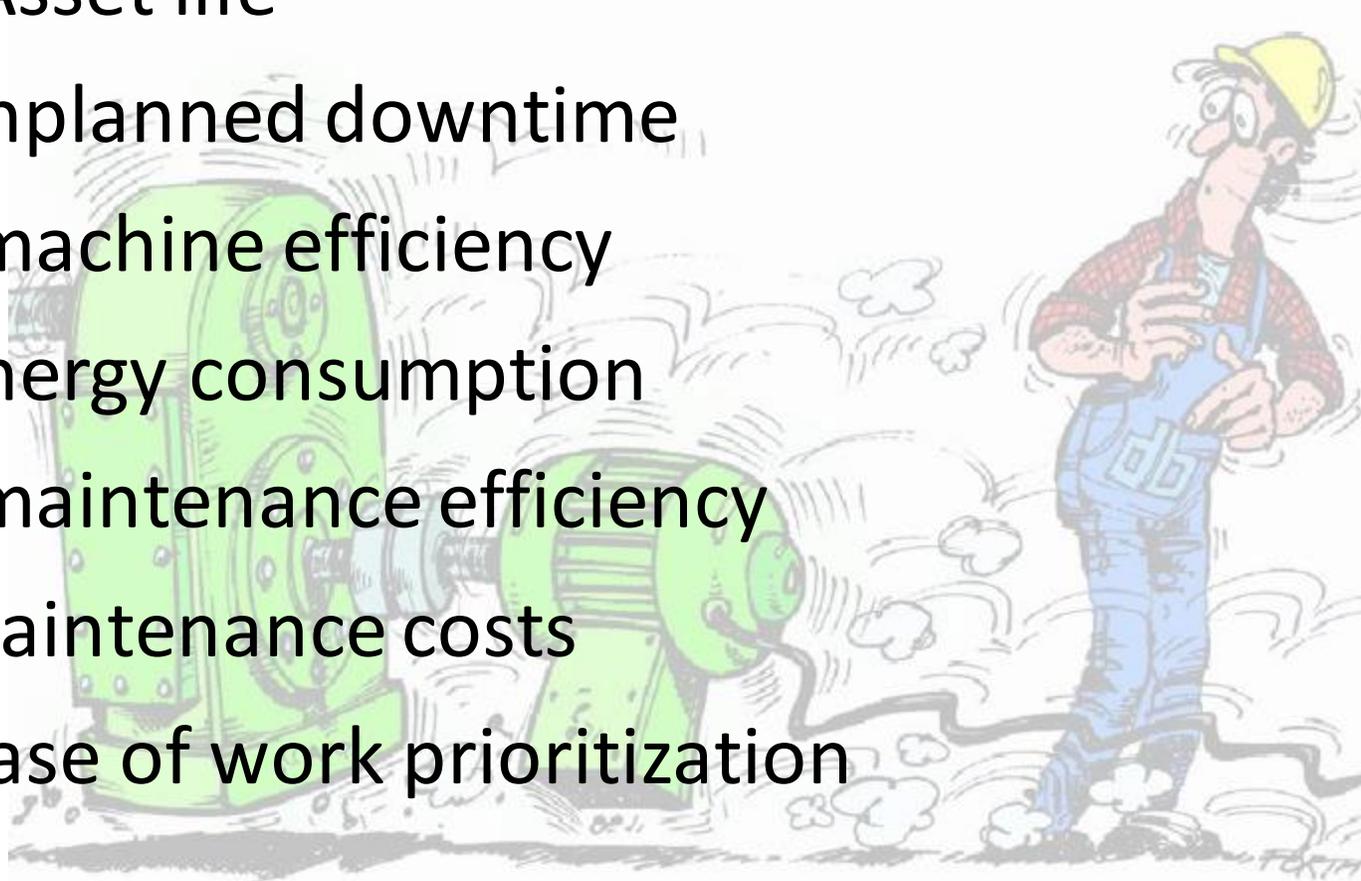
- Nothing ever fails in our organization.
- We just keep fixing the same stuff...over...and over
- Our organization has a RCFA team
- We use an outside service

## Know this feeling?



## Why Condition monitoring?

- Increase Asset life
- Reduce unplanned downtime
- Increase machine efficiency
- Reduce energy consumption
- Increase maintenance efficiency
- Reduce maintenance costs
- Greater ease of work prioritization



# Why Condition monitoring?



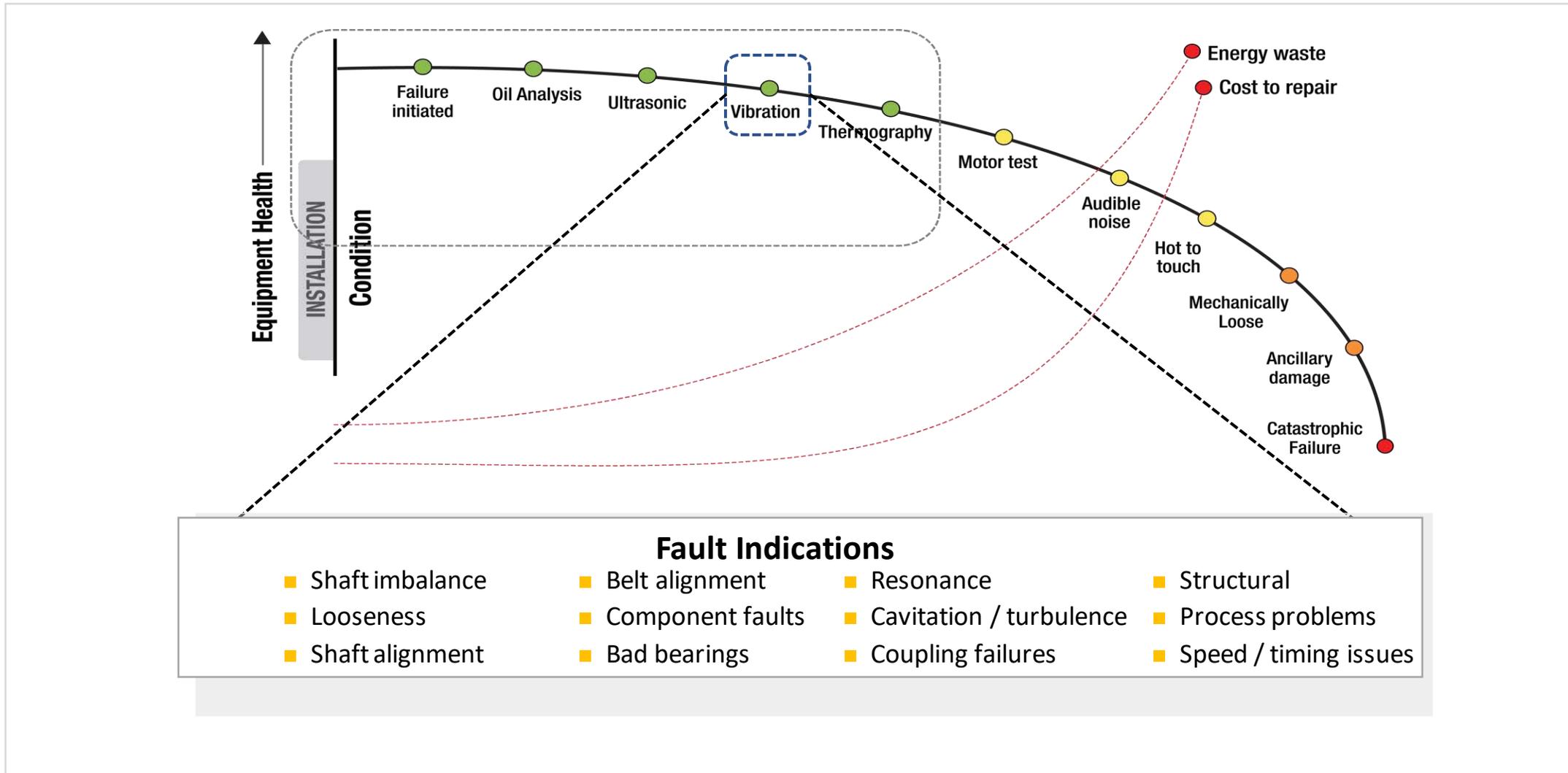
# Why Condition monitoring?



# Why Condition monitoring?



# Precision to Failure Curve



# Maintenance Practices

## Ideal world

*“All maintenance is done proactively, during planned downtime. With a minimum of waste and within the allotted personnel hours”*

## Real world



### Reactive (RM): Run to failure

- Increased cost due to last minute fixes
- **Unplanned downtime: longer lost production and time to get parts**
- **Stressful work environment**
- More severe failures resulting in “cascade failures”



### Preventive (PM): Interval based maintenance

- Equipment is repaired based on historic failure rates
- **Fault-free machines are overhauled unnecessarily because they’re “due”**



### Predictive (PdM): Condition Based Maintenance

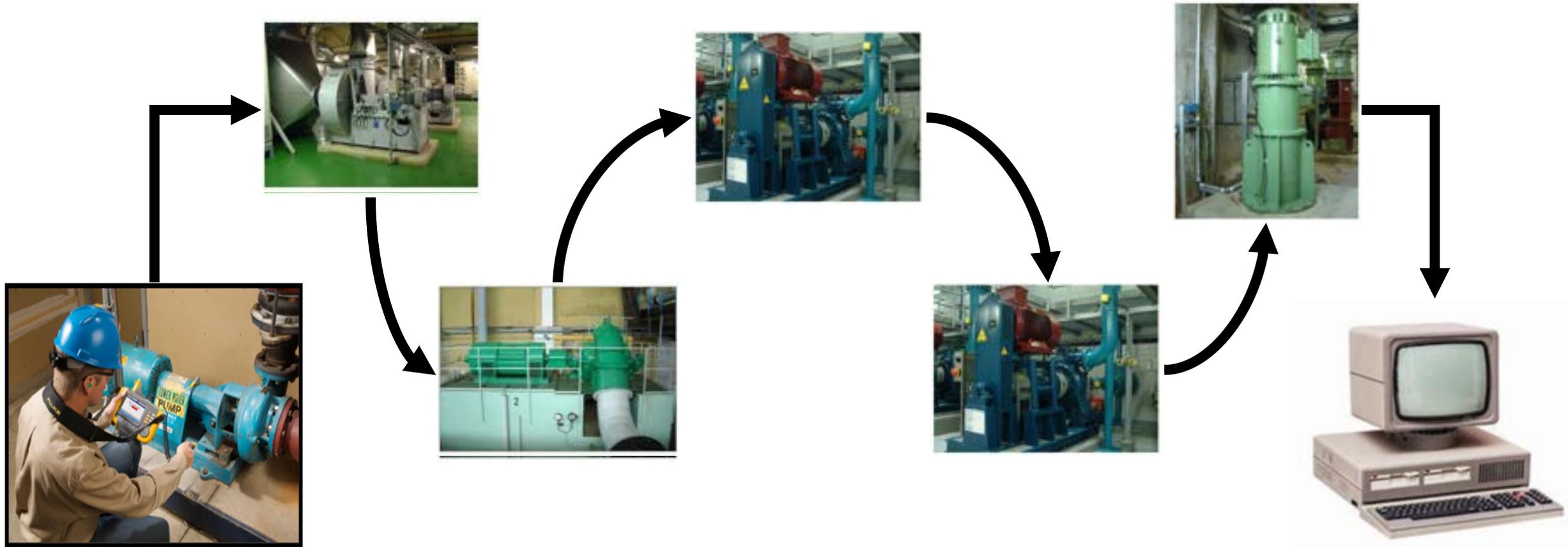
- Costly implementation
- **Difficult to sell – hard to change company culture**
- Data overload
- **Already busy with PMs/repairs**

# Segue

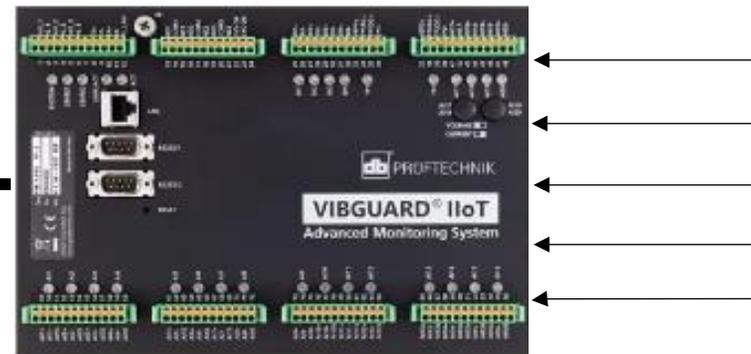
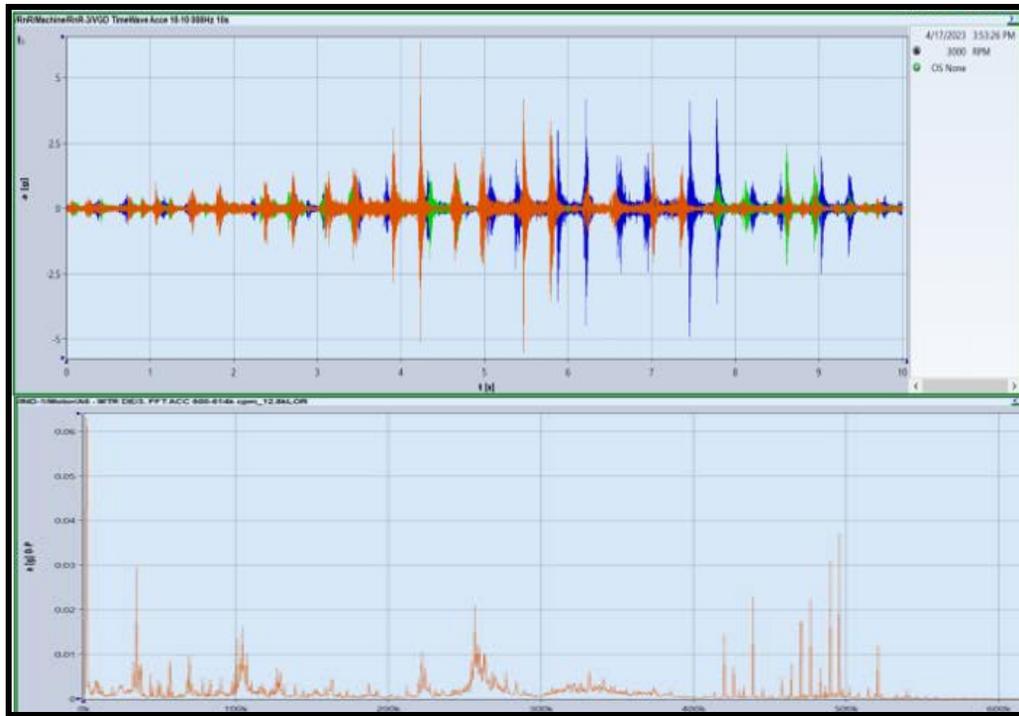


# Traditional Role of the Vibration Analyst

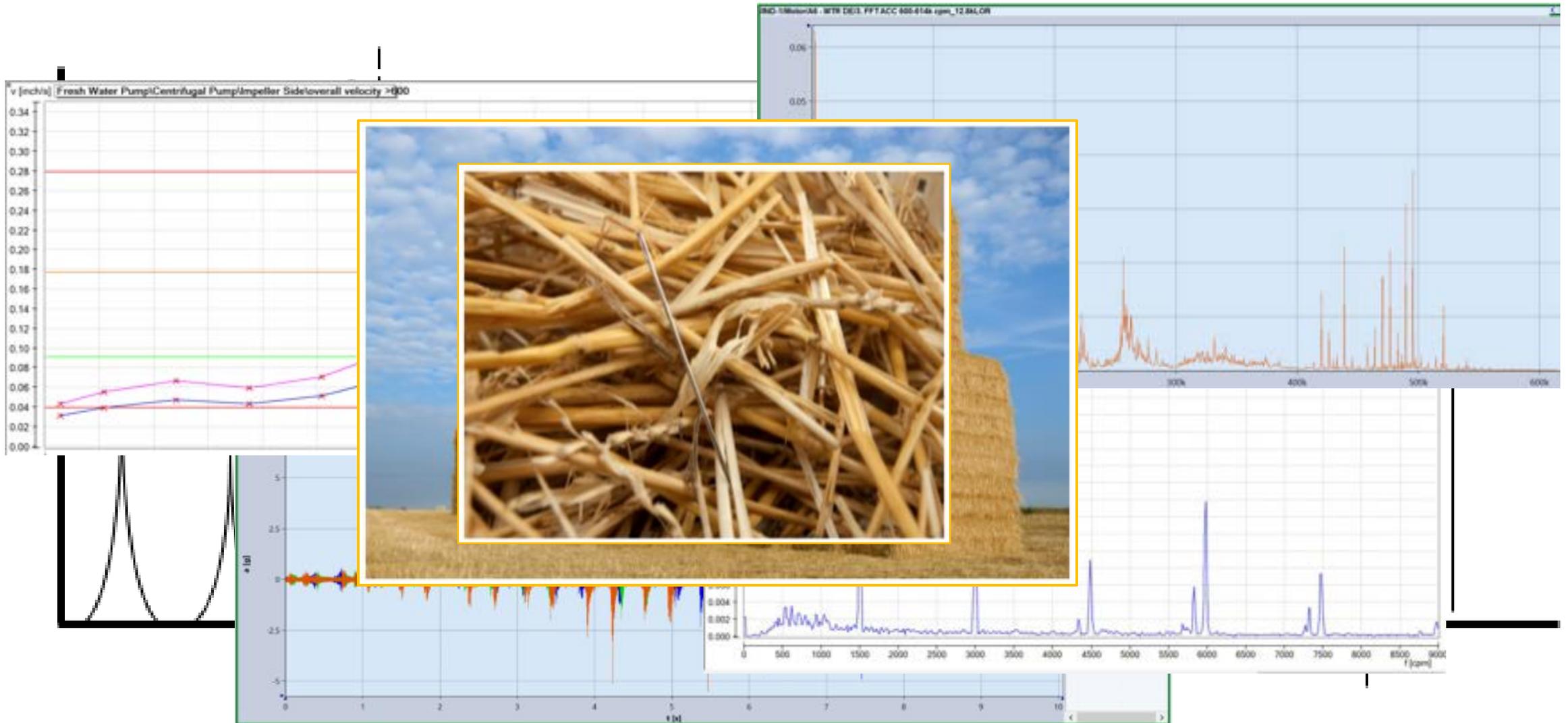
# Route Based Data Collection



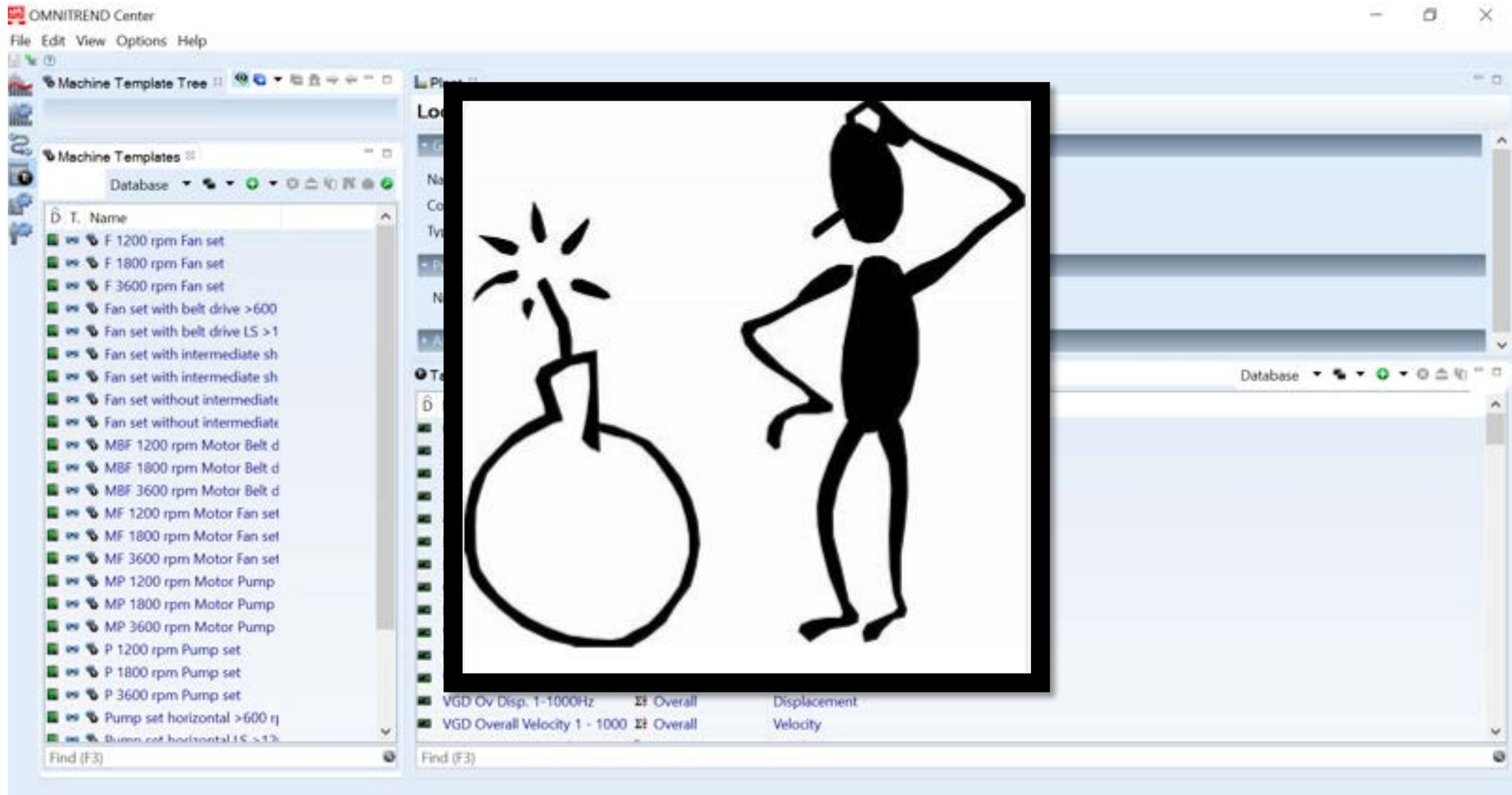
# Online Vibration Data Collection



# Data review



# Database management



# The Goal



# The price of Failure

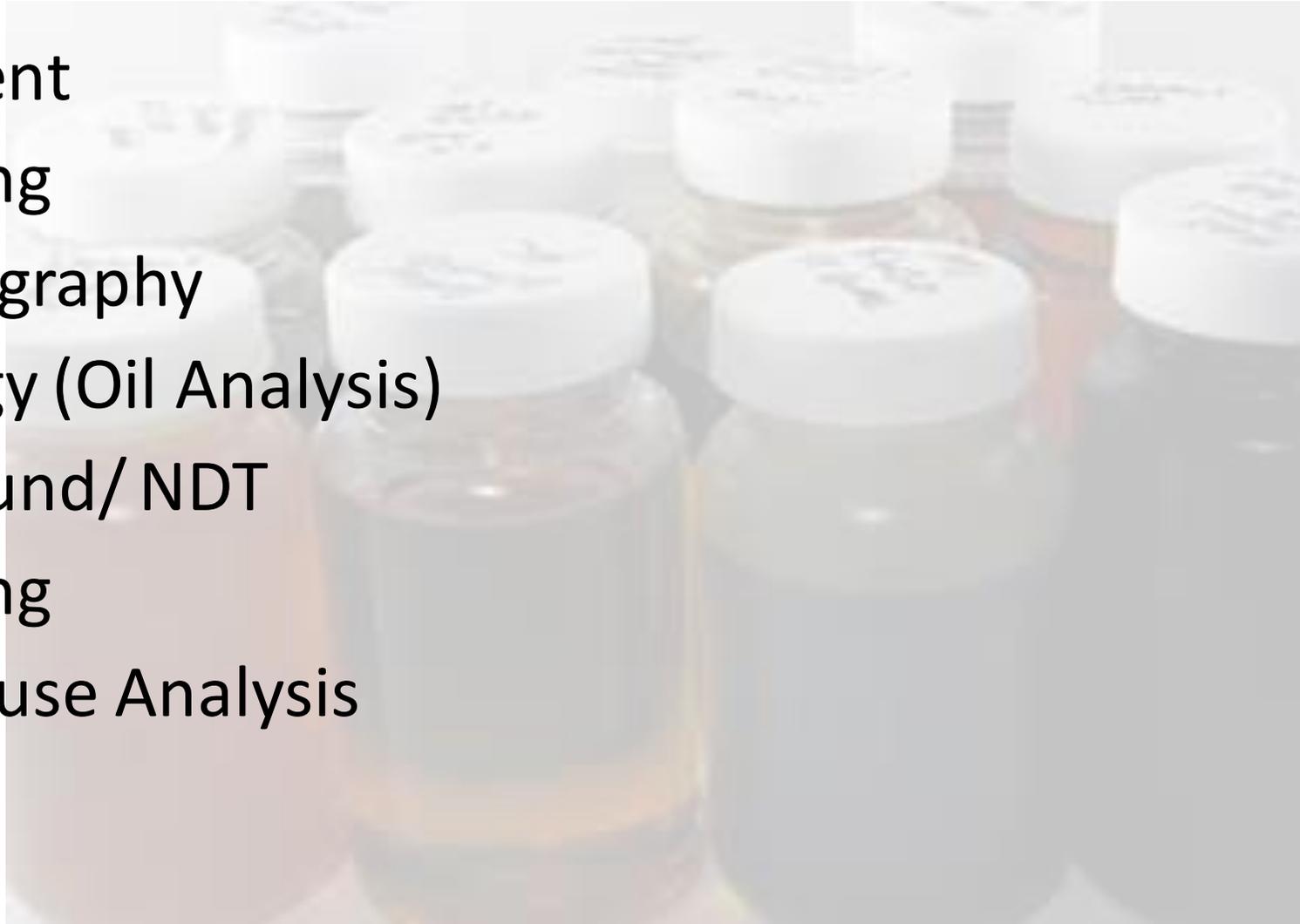


Failure of a 1.7 MW (2280 hp) motor

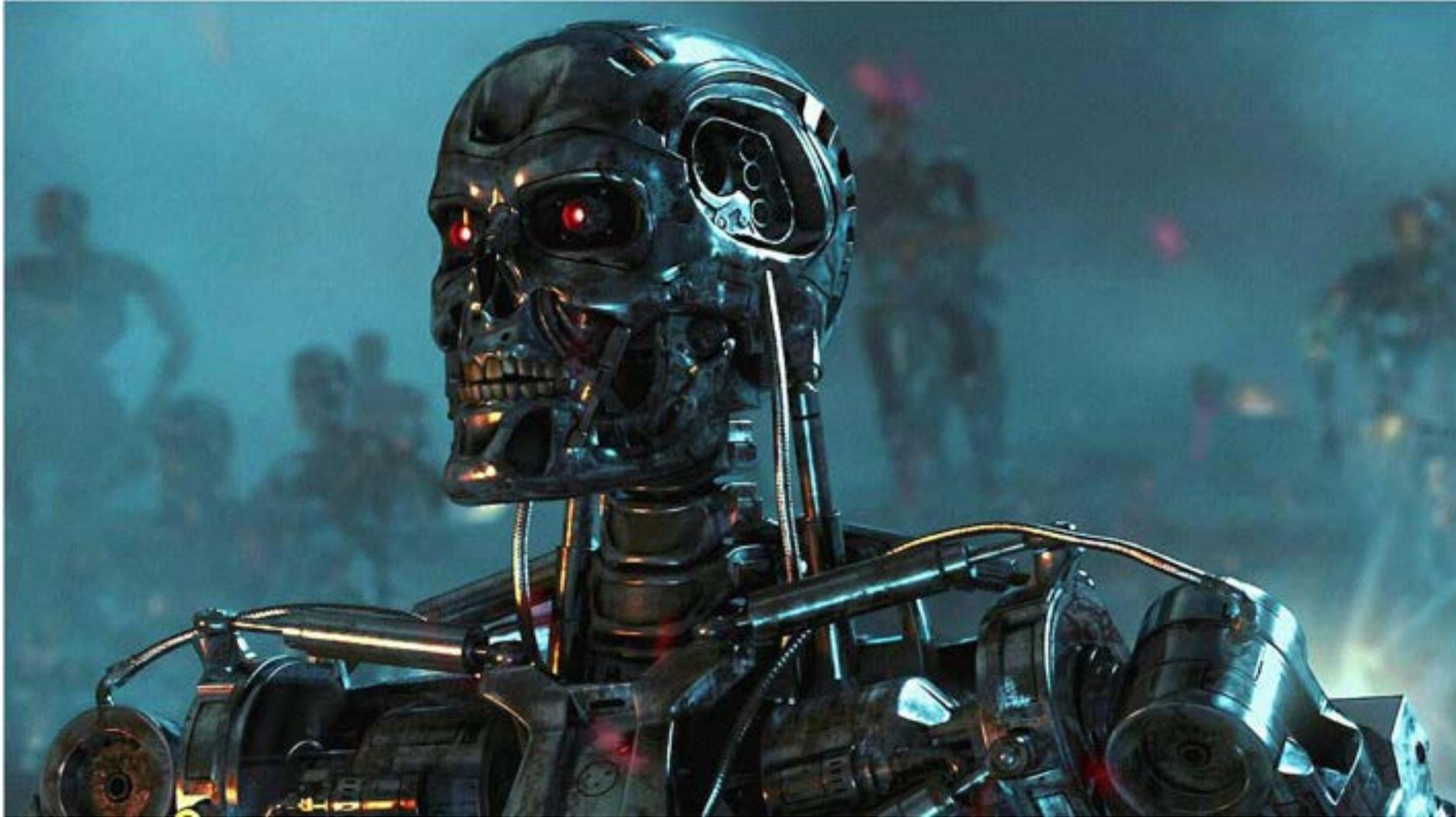


## Other Condition Monitoring roles

- Alignment
- Balancing
- Thermography
- Tribology (Oil Analysis)
- Ultrasound/ NDT
- Balancing
- Root Cause Analysis



## What is changing?



# THE FUTURE

## 3 challenges confronting today's predictive maintenance leaders



1

**How do we grow a reliability program**  
... when we are 100% busy?

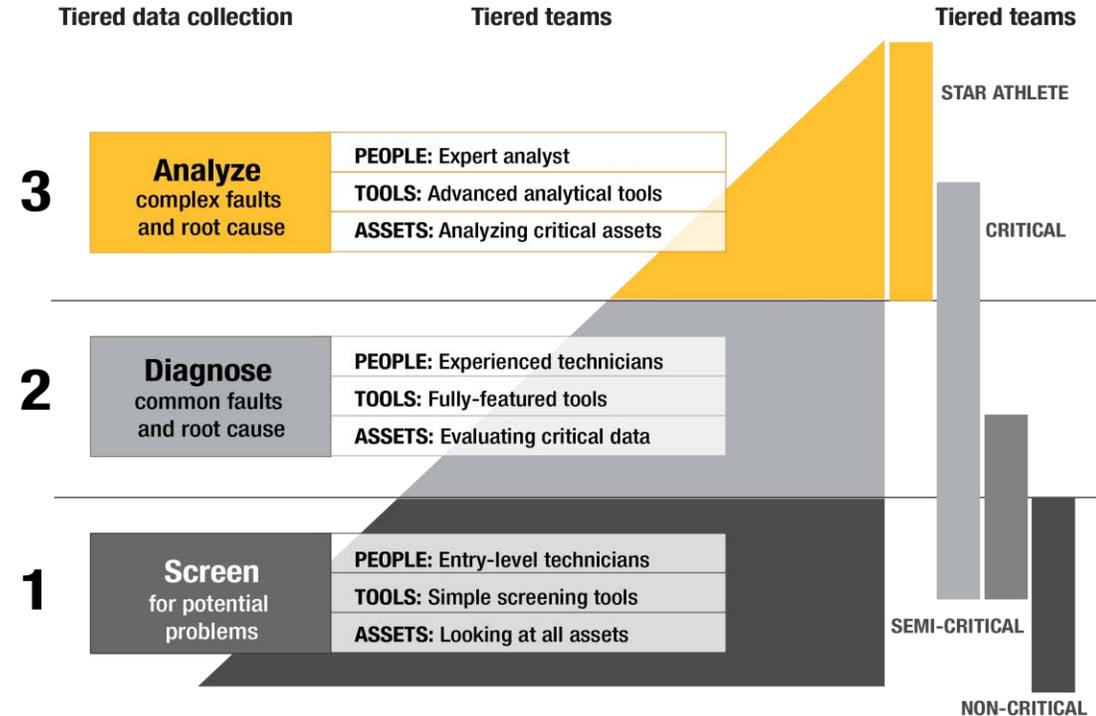
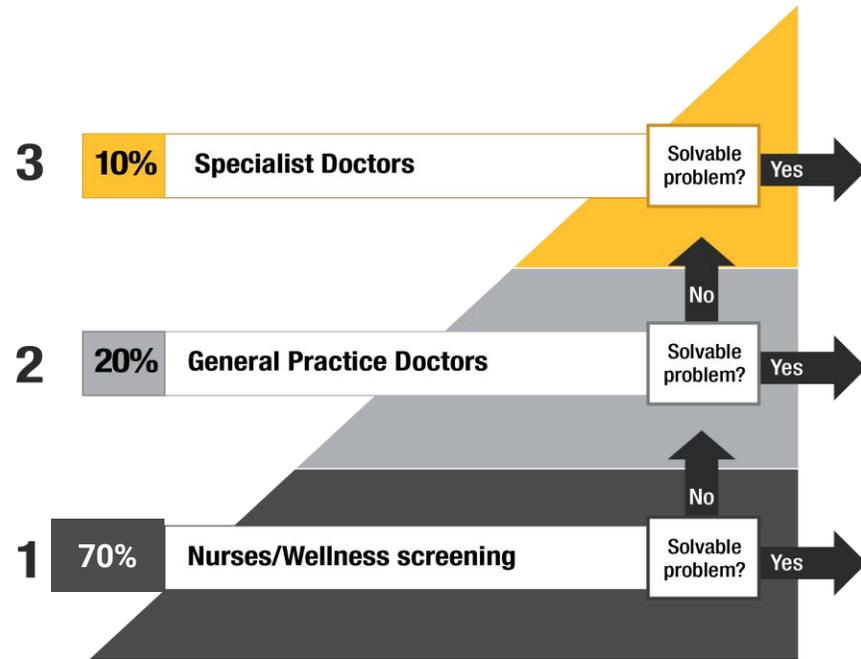
2

**How do we make the best decisions**  
... when we have incomplete information?

3

**How do we monitor all critical assets**  
... with limited resources?

# The resource dilemma – a healthcare parallel



- Tiered levels of education and certification
- Tiered volume of visits / inspections
- Tiered number of resources spent on each patient

**Condition-based screening helps relieve workload at each level of criticality**

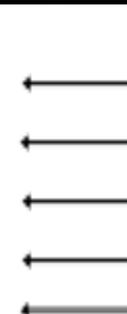
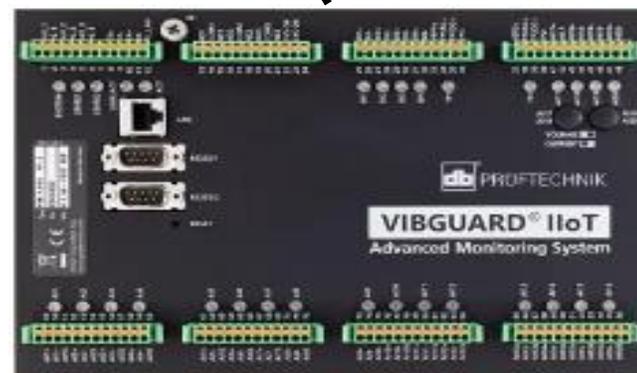
# Wireless Sensors



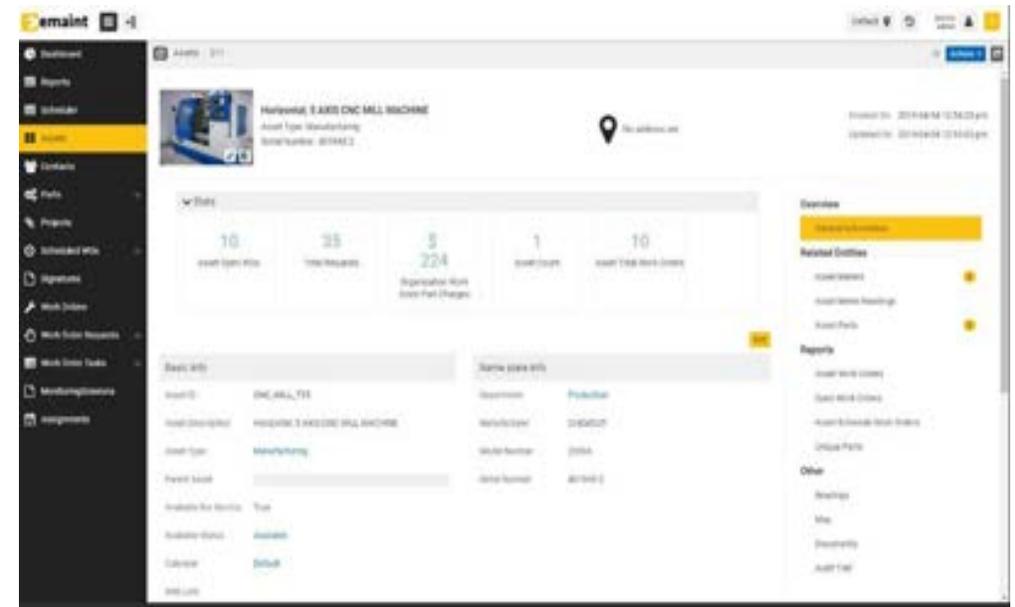
# Online Monitoring



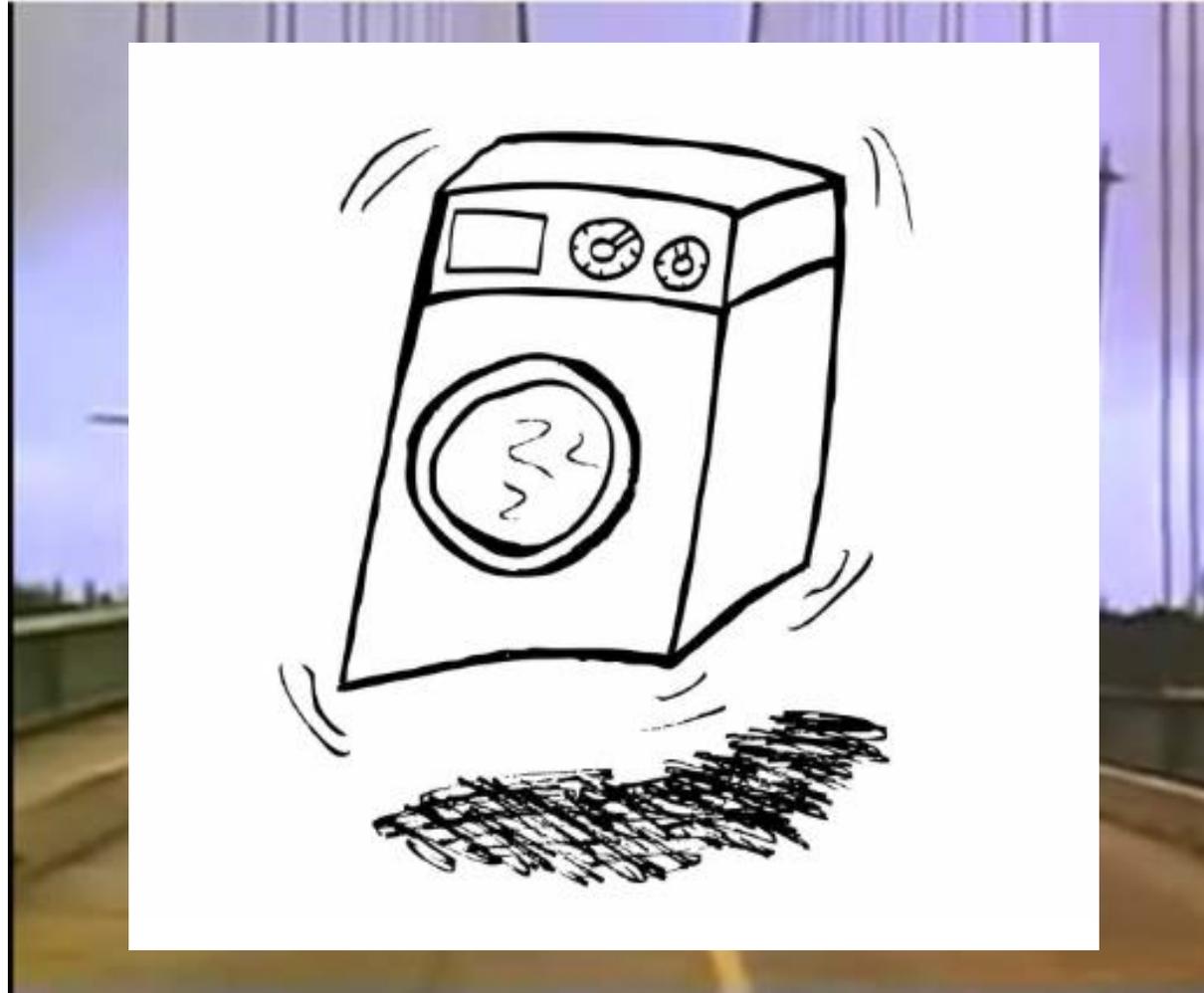
# Remote Condition Monitoring



# Diagnosis and Troubleshooting



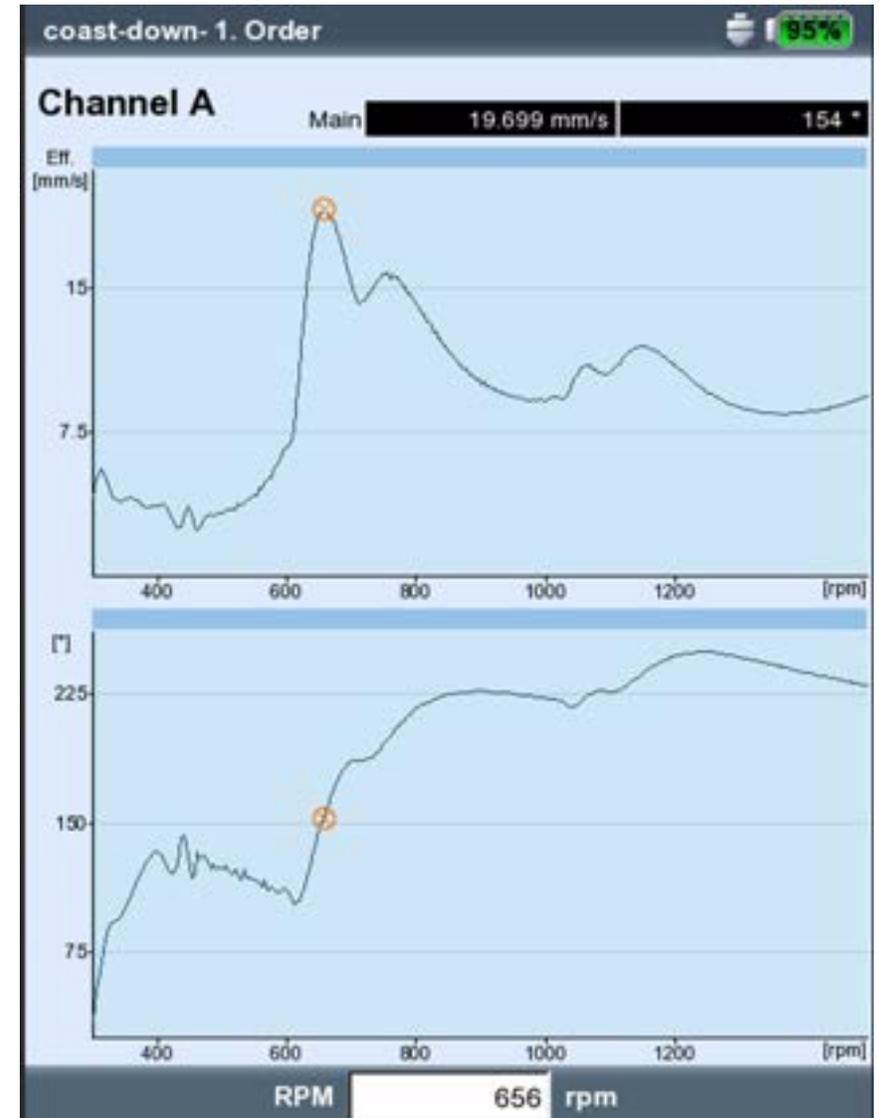
# Mechanical Resonance



## Resonance inspections

In physics, **resonance is the tendency of a system to oscillate with greater amplitude at some frequencies than at others.** Frequencies at which the response amplitude is a relative maximum are known as the system's resonant frequencies, or resonance frequencies. **At these frequencies, even small periodic driving forces can produce large amplitude oscillations,** because the system stores vibrational energy.

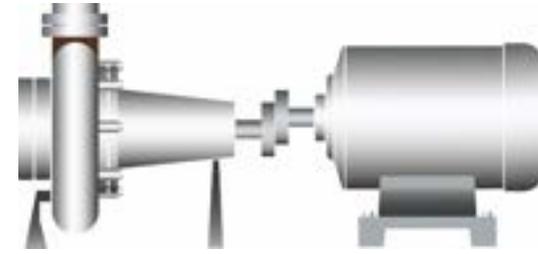
\* <http://en.wikipedia.org/wiki/Resonance> version from March 07th 2014



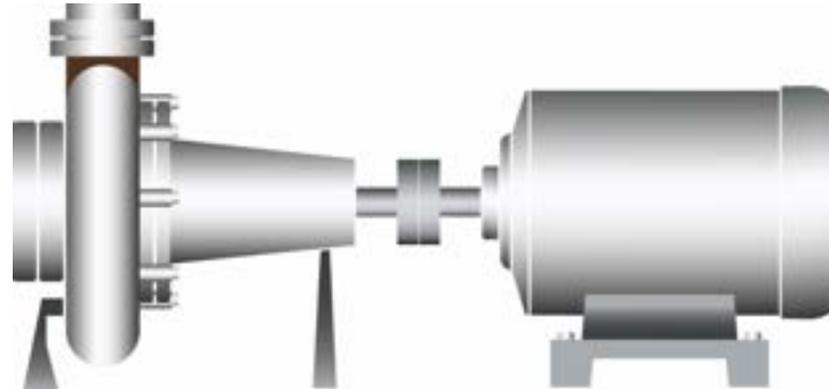
# Shaft Alignment



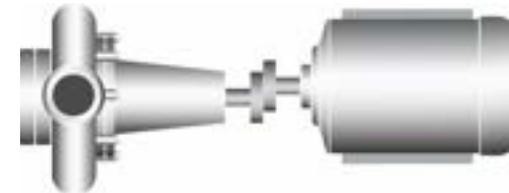
Vertical angularity



Vertical offset



Horizontal angularity



Horizontal offset

# Balancing



# Precision Maintenance

# Precision workflow

Screen all machines

- Wireless
- Online
- Daily checks

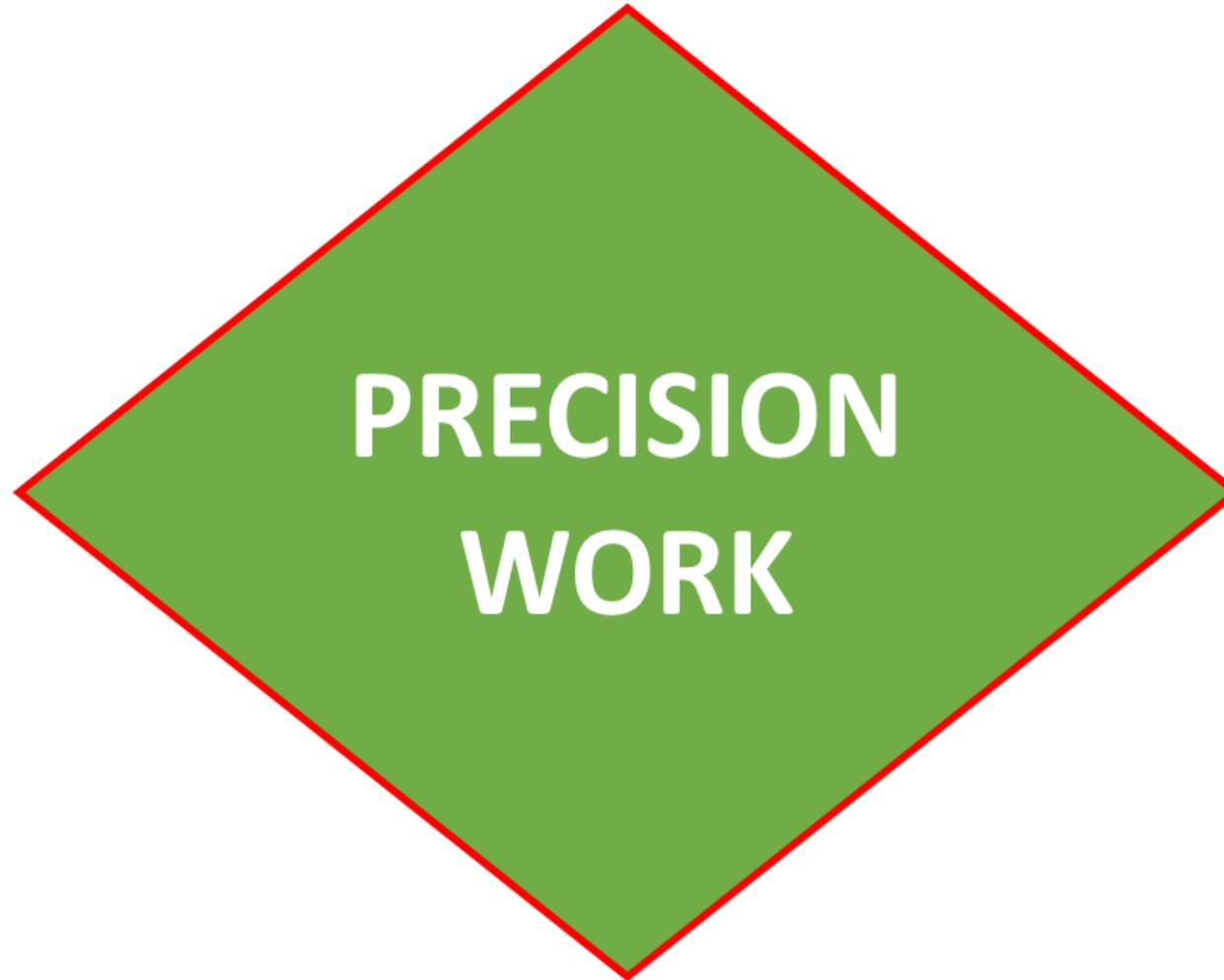
Collect "local" data on potential faults, Diagnose faults make recommendations

Plan the work

PRECISION WORK

*Verify repairs*

Conduct Root Cause Analysis



# Precision hand tools



# Precision tools



## Precision maintenance verification



# Precision Maintenance Verification?!



# Root Cause Failure Analysis



Conduct  
Root  
Cause  
Analysis

**WHY?**

**WHY?**

**WHY?**

**WHY?**

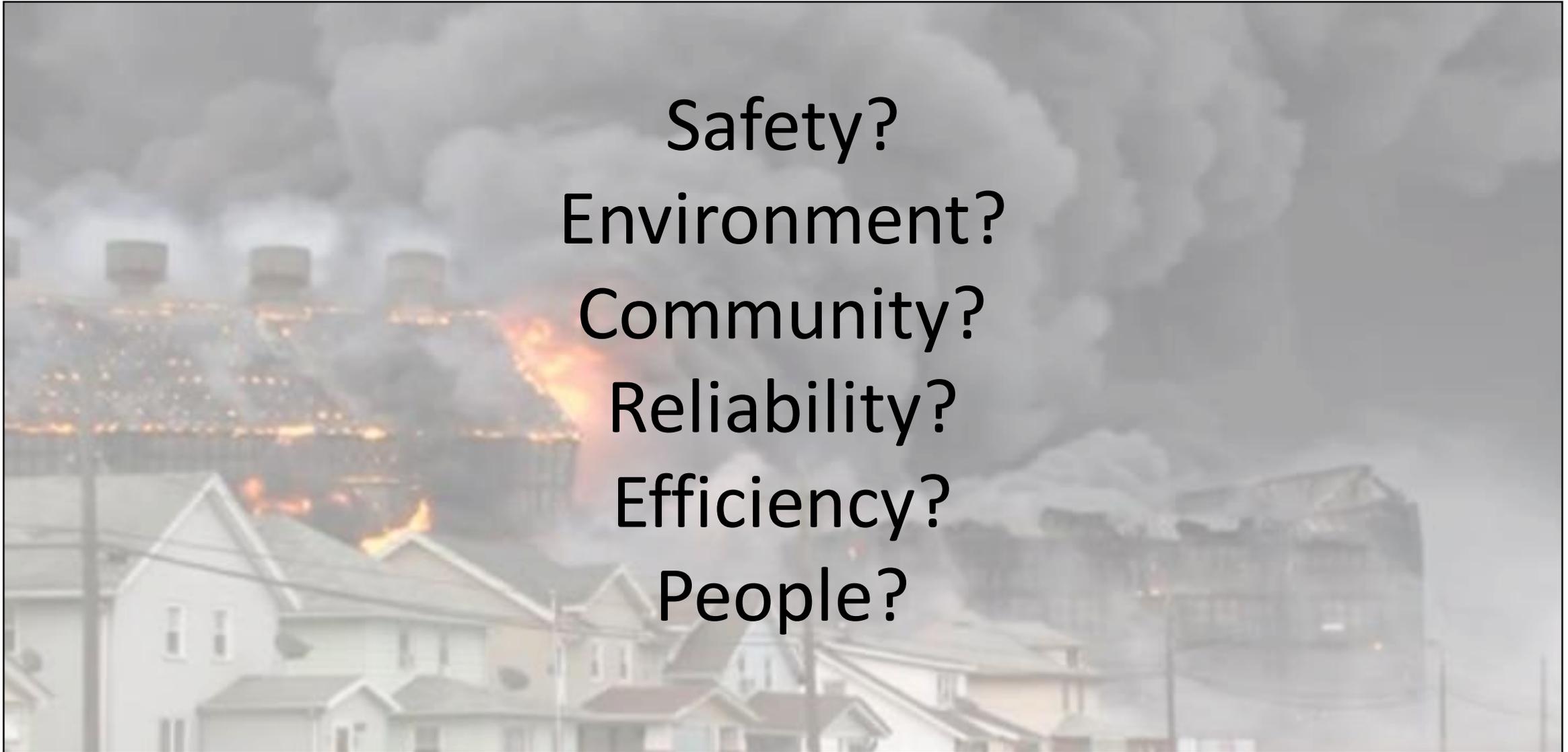
**WHY?**

# What does this mean for the ~~Vibration Analyst?~~



RELIABILITY PROFESSIONAL

## What's the Point?



Safety?  
Environment?  
Community?  
Reliability?  
Efficiency?  
People?



Safe Operational and Maintenance Practices  
Environmental Stewardship  
Community Advocacy  
Reliable Production  
Efficient Operations  
Personnel retention



**FLUKE®**

Reliability

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**THANK YOU!**

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# QUESTIONS?



Thank you!

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[PRUFTECHNIK | Laser Alignment](#)  
[| Condition Monitoring | NDT](#)