

The background features a collage of industrial scenes. On the left, there are blue electric motors and machinery. In the center, a worker wearing a white hard hat, safety glasses, and a high-visibility orange and yellow jacket is looking at a tablet. On the right, there is a large, complex piece of industrial machinery with a prominent gear or fan-like component. The entire image is overlaid with a white geometric grid pattern.

**FLUKE®**

Reliability

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# Reliable Assets in Resource Constraint Economy

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April 2024

# Meet the Speaker



## Michael DeMaria

*Director, Azima DLI Product Management  
Vibration Hardware, Software, Portal Systems*

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- **Background Naval Nuclear Power Engineering**
- Machinery Condition Analysis
  
- **Joined DLI Engineering in 1995**
- Engineering Lead / Analyst
- Program Manager, US Navy
- Director, Technical Support
- Director, Training
- Director, Product Management

## Who we are...



**FLUKE®**

**FLUKE®**

**Reliability**

# FLUKE®

Reliability

**db**® PRÜFTECHNIK

AZIMA | DLI

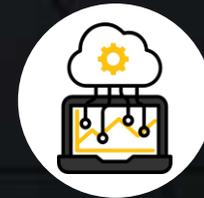
**emaint**™



World-class  
hardware



Remote condition  
monitoring services



Innovative  
Software

# About Us

# FLUKE RELIABILITY BY THE NUMBERS



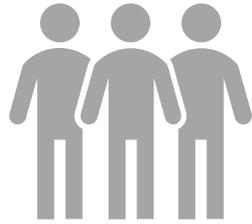
7,400+

CUSTOMER  
MAINTENANCE  
TEAMS

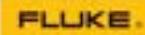


18  
OFFICES

AROUND  
THE  
WORLD



700+  
EMPLOYEES



Serving maintenance &  
reliability leaders

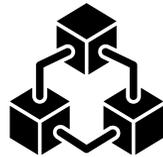
70,000  
CUSTOMERS



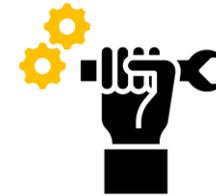
116  
COUNTRIES



150,000  
USERS



10  
ASSETS MANAGED  
MILLION



7,253  
EXPERT SERVICES  
DELIVERED

3,416,669+  
MACHINES FIXED



164,547,896  
WORK ORDERS MANAGED

# Fluke Reliability: One mission, one shared purpose

“

We simplify connected reliability solutions for the people who keep the world up and running.

”

# Your Partner in Reliability

We meet you wherever you are on your reliability journey



## Plan

We get to the root cause of your challenges and create a roadmap to success.



## Configure

Work the way you want to work. We tailor solutions to your industry and unique workflows.



## Implement

Our implementation team is there with you from day one until all your users are onboarded.



## Support

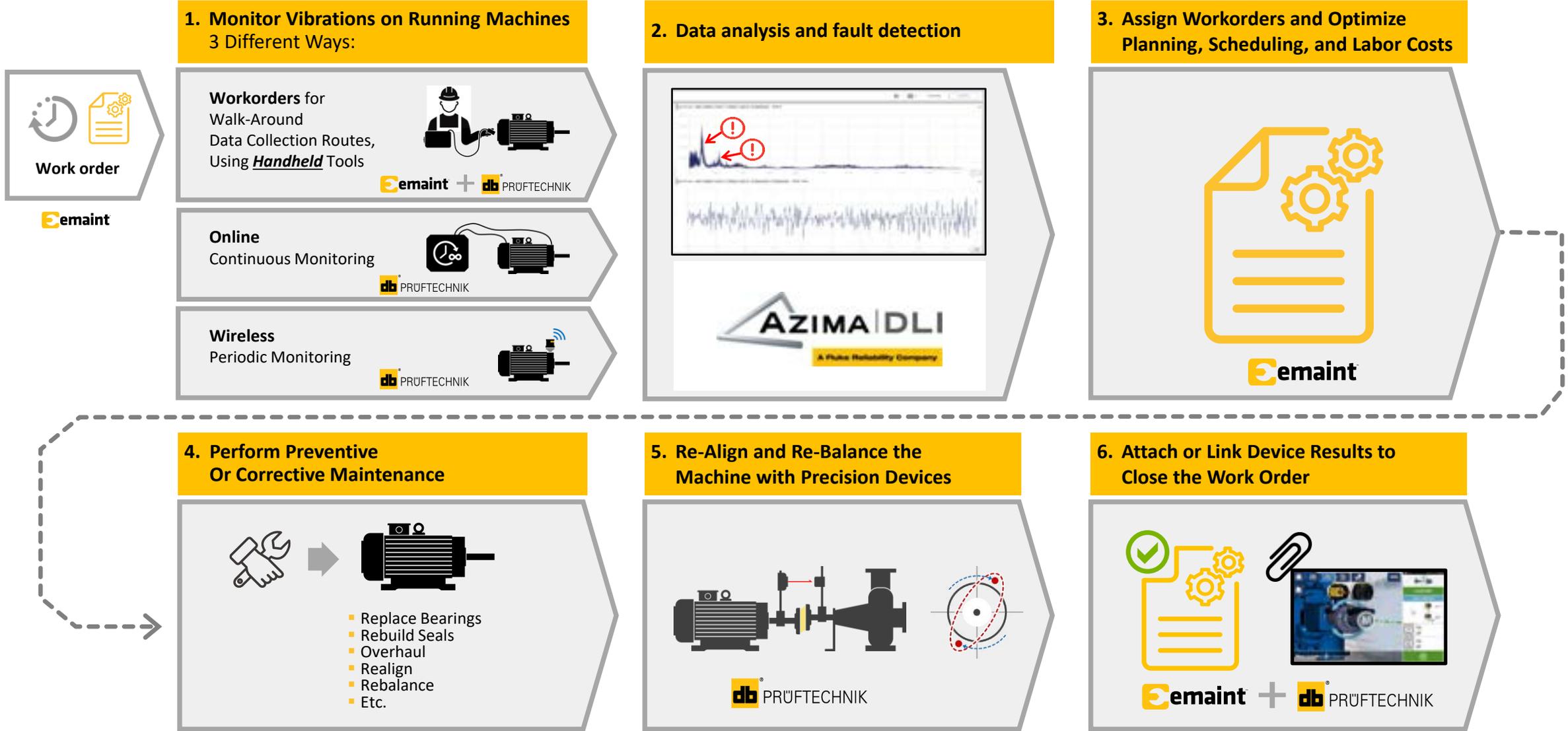
Our dial doesn't stop at 10. We push ourselves even further to provide **"Service on 11."**



## Train

With our workshops, trainings, and eMaint University, you can maximize your investment on an on-going basis.

# Fluke Reliability products integrate into a connected reliability workflow



# Fluke Reliability Solution Portfolio

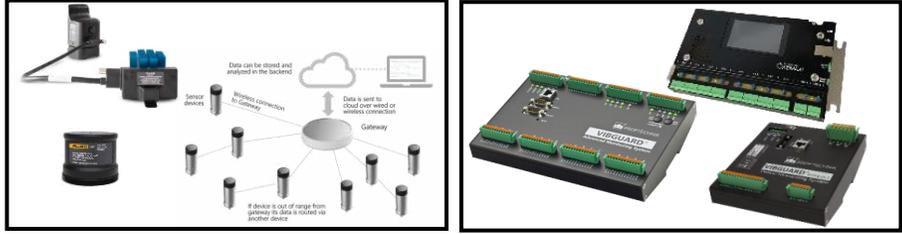

  
 Monitor critical assets and predict failures


  
 Improve asset uptime and OEE


  
 Optimize work and asset performance


  
 ~300 Patents  
 ISO27001

## Monitor



Wireless and online vibration monitoring devices and sensors

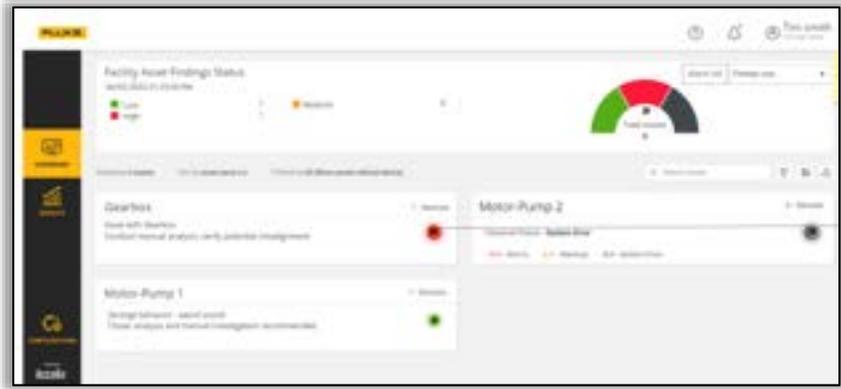
## Inspect & Maintain



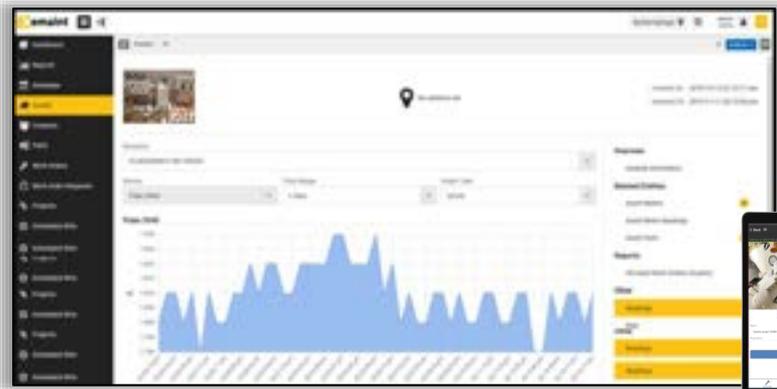
Handheld vibration data collectors and analyzers



Laser shaft alignment



Condition Monitoring, Analysis and Predictive Algorithms



CMMS/EAM and Mobility



## Reliability Consulting    Remote Condition Monitoring    Expert Reliability Services



# Watchman™ System

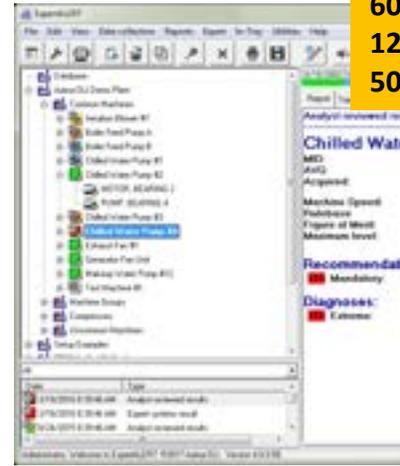
Remote Setup App



Vibration Data Sources



Expert Automated Diagnostic System

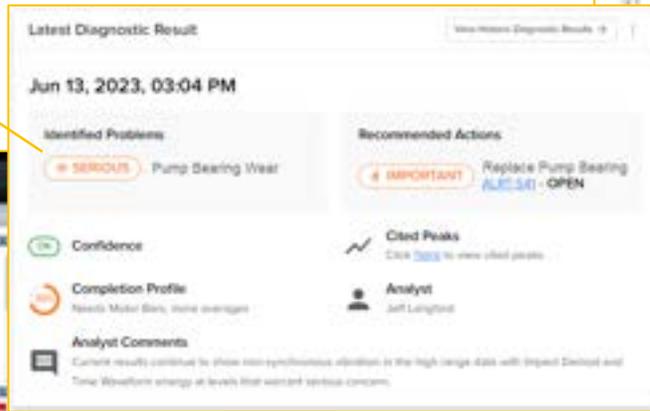


Vibration AI

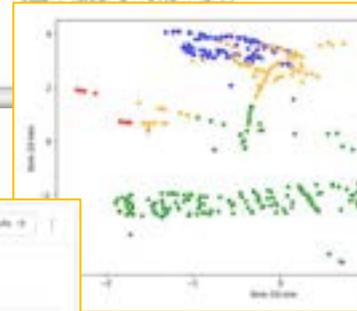
6000+ Trained Diagnostic Rules  
1200+ Identifiable Fault Conditions  
50+ Asset Component Library



Program Management



Watchman Portal™



Watchman Services

25+ Level 2, 3, 4 ISO Certified  
50k Assets Monitored  
540k Annual Machine Tests

Asset Data Lake



100,000  
Unique Assets



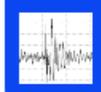
150,000  
Asset Components



3,000,000  
Machine Tests



150,000  
Component Specific Faults



100 Trillion  
Individual Vibration Test Points  
approximately



FLUKE

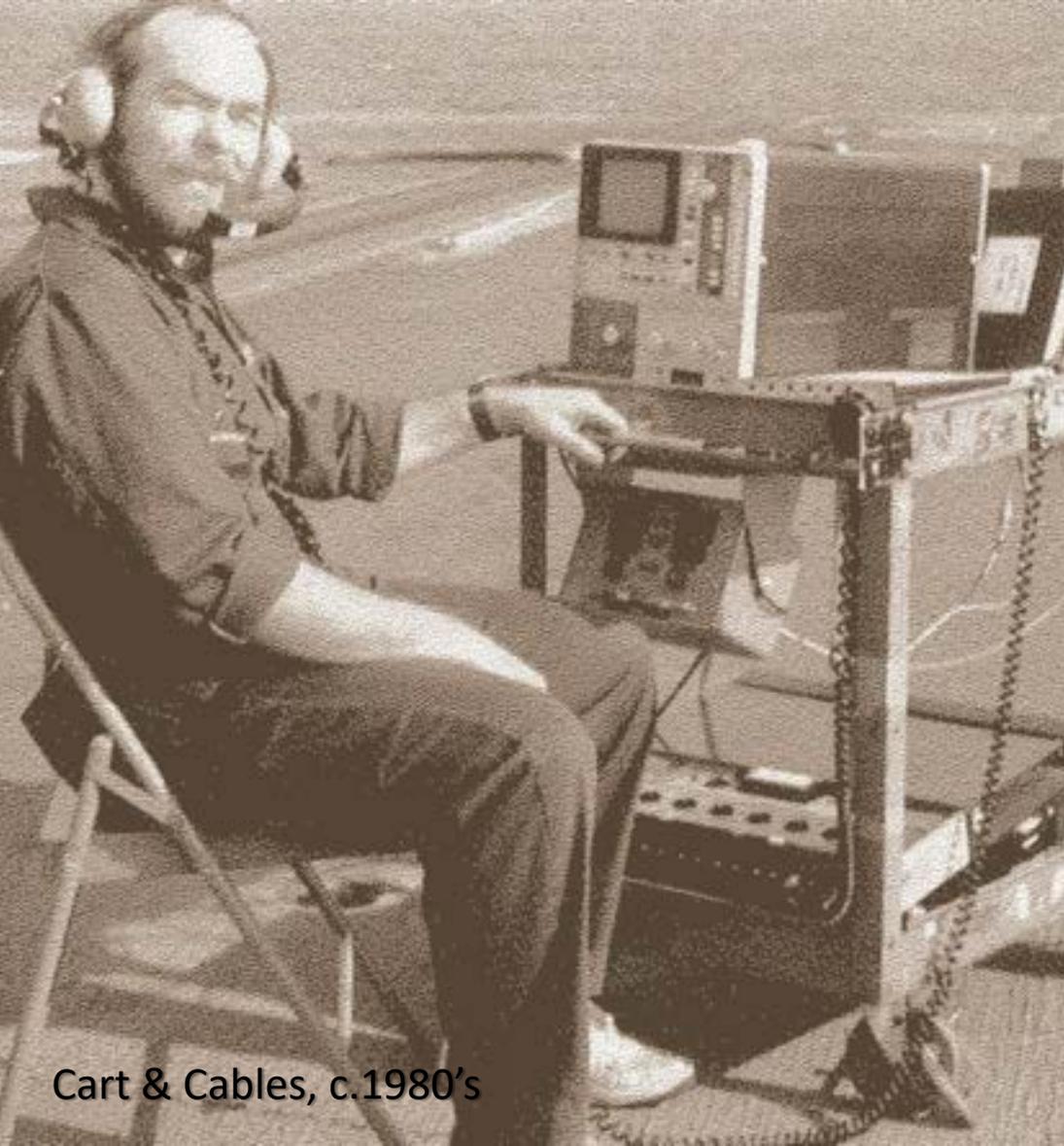
Reliability

A person in a blue suit is using a tablet in an industrial setting. The background is dark and blurred, showing what appears to be a large wheel or a piece of machinery. The person's hands are visible, holding the tablet and touching the screen. The overall scene is dimly lit, with some light reflecting off the tablet's surface.

## Agenda

- Evolution of the Industry
- The Challenges
- Solutions

# Evolution



Cart & Cables, c.1980's



## Evolution of Asset Reliability

Fewer Robust / Heavy-duty Machines → More Precision Machines

One- or Two-Speed → On-demand / Variable Speed

Redundant Assets → Lean Operation

Short Work cycles → 24x7 Operation

Troubleshooting → Go / No-Go → Trending

When problematic → Annual → Quarterly → Monthly → Daily or More



# Evolution of Vibration Analyst



## Evolution Reliability $\neq$ Evolution Analysis

- More machines and more data with less analyst capacity
- More frequent data does not mean better analysis
- New machines are harder to diagnose
- Simplification at detriment of risk
- Harder to retain trained staff

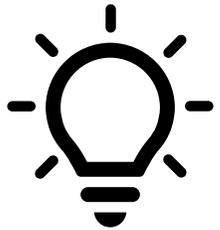
## What's changed?



The cost to produce your product has increased. Due to both material and labor requiring higher investment. “The total cost per product increased from approximately 11% to 15% year-over-year”  
- Food Manufacturing, 2022

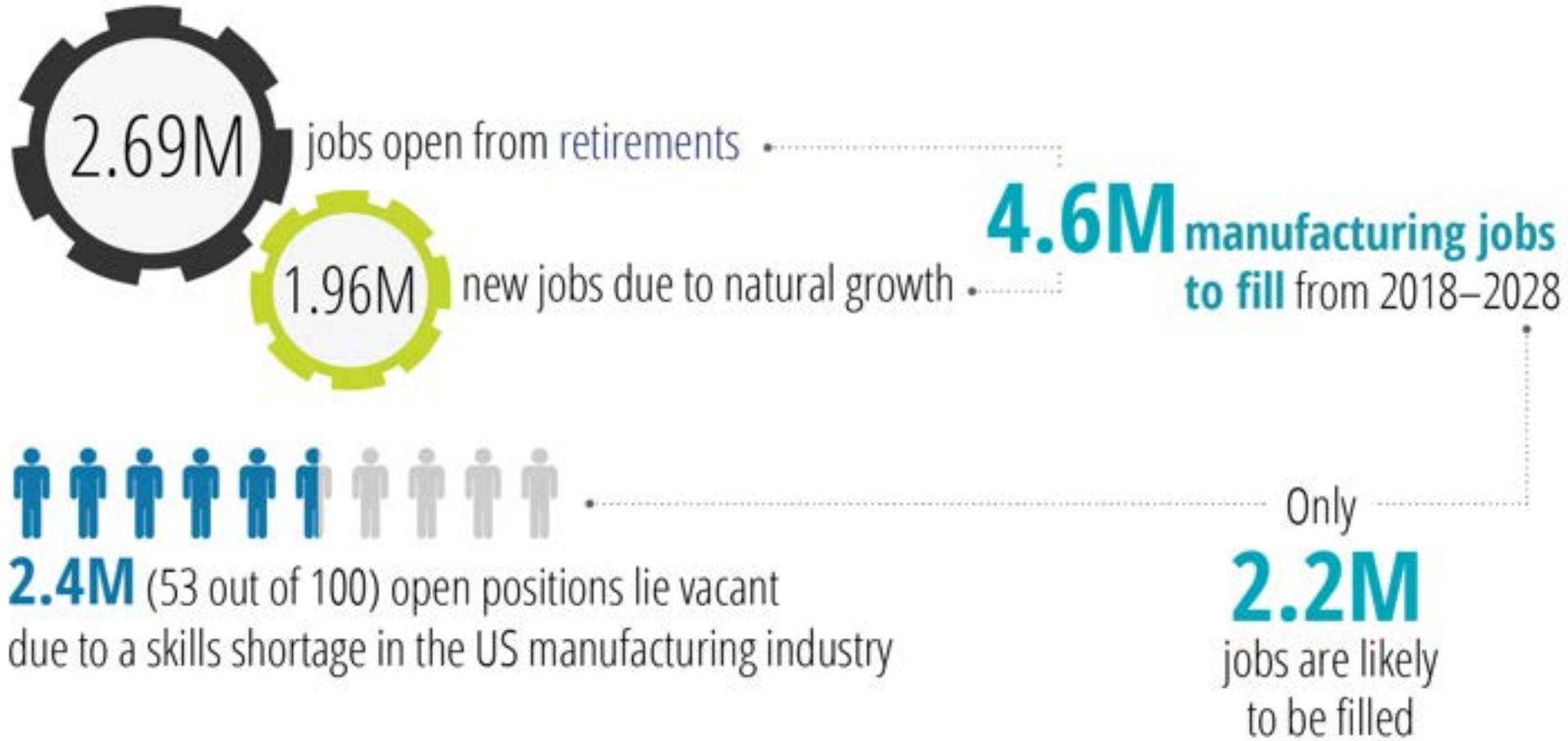


Diminishing pool of skilled labor. “Brain Drain”, making it harder to keep up with demand.  
- Modern Diplomacy



It is expected that [3.5 million jobs in the US manufacturing industry](#) needed by **2025** and 2 million positions will go unfilled due to a lack of skilled manufacturing workers.  
- Deloitte and the Manufacturing Institute

# The skills gap may leave an estimated 2.4 million positions unfilled between 2018 and 2028



\*Calculated on the basis of 52.7% of the skilled manufacturing positions that are unfilled (per the 2018 survey)

\*\*Retirement age of 66

Source: BLS Data, OEM (Oxford Economics Model), Deloitte and Manufacturing Institute skills research initiative.

Deloitte Insights | [deloitte.com/insights](https://deloitte.com/insights)

**FLUKE**

Reliability

**By 2030**

**85.2 Million**

Global Talent Shortage

**\$8.5 Trillion**

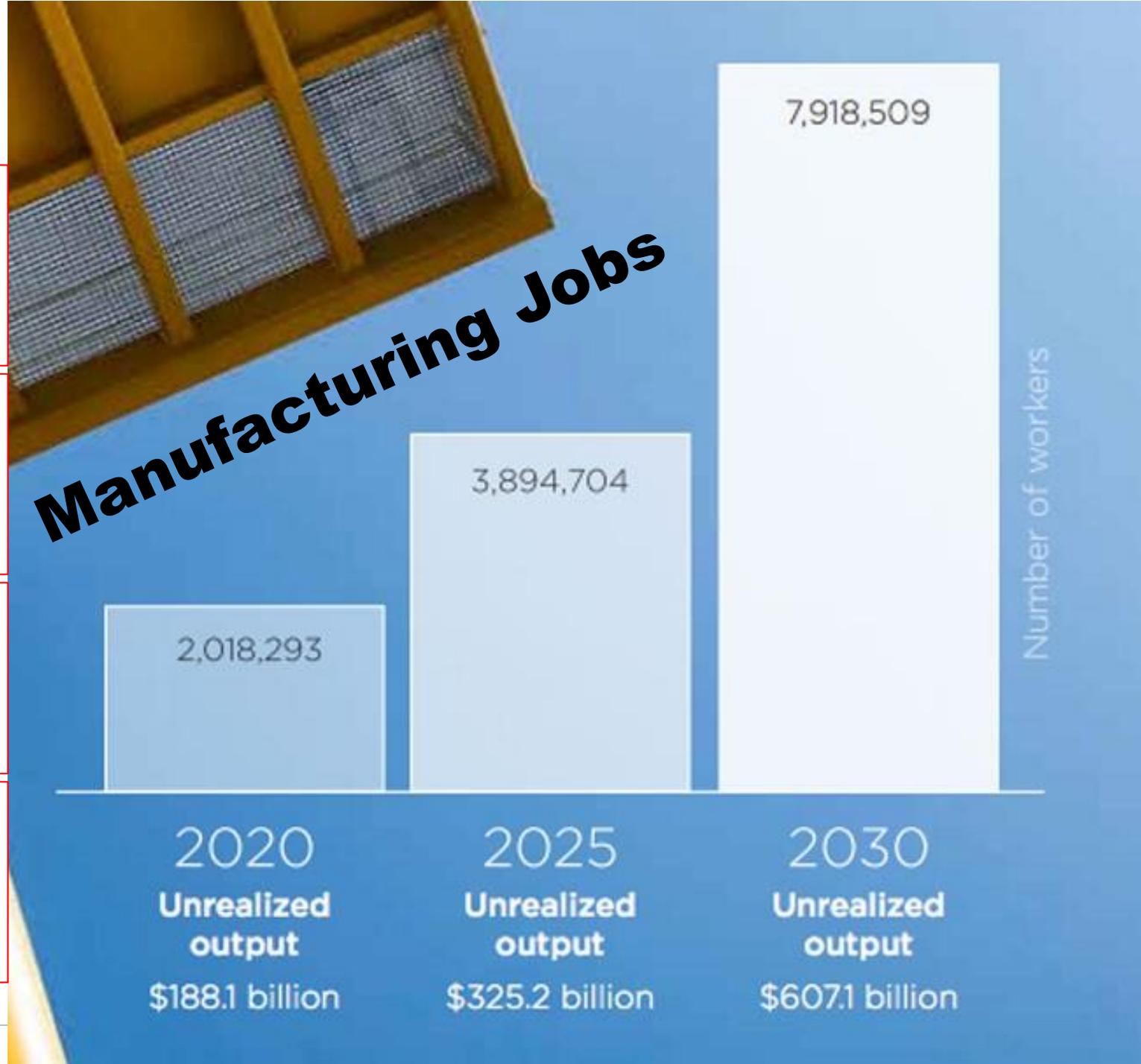
Unrealized Revenue

**54% Companies**

Can't Achieve Digital Transformation

**10,000** Baby Boomers

Retire Daily, Next 19 Years



“ Experts say firms might want to step back and assess what skills they are actually missing, instead of how many people they need to hire. ”

Korn Ferry: The Job Market Still Rocks as the Great Resignation Still Rolls

How to Capture Data

How to Analyze Data

How to Deliver Results

## Challenges - Data Collection

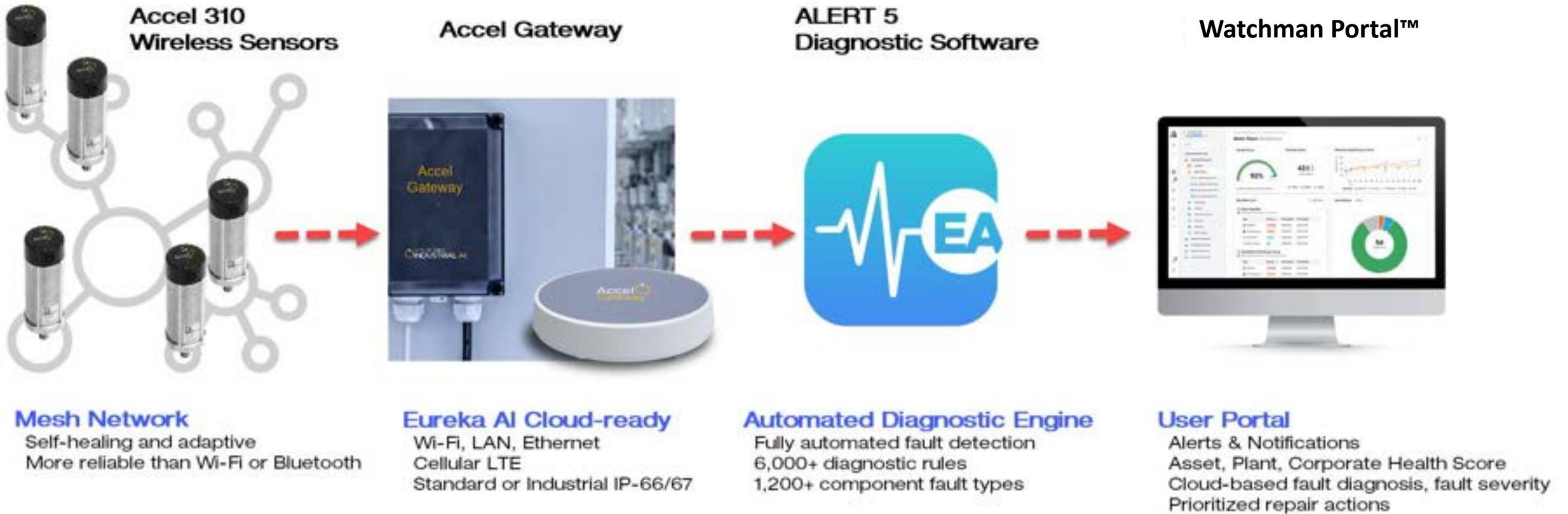


## Requirements:

1. Must be simple to setup and use
2. Must support majority of plant assets
3. Must provide clear indication of faults
4. Cannot add burden to existing staff

# Solutions - Wireless Vibration

## Watchman AIR™



# Solution – Simplified Portable Vibration

## Watchman TRIO System

TRIO®



Desktop or Embedded



Database Sync



ExpertALERT™



Watchman™ Portal



### Portable Data Collection

4-channel + tach inputs  
Up to 102.4kHz sample rate  
Route + Advanced Data Acquisition

### Communication Layer

Local database management  
Route/Survey File Exchange  
Cloud-hosted Synchronization

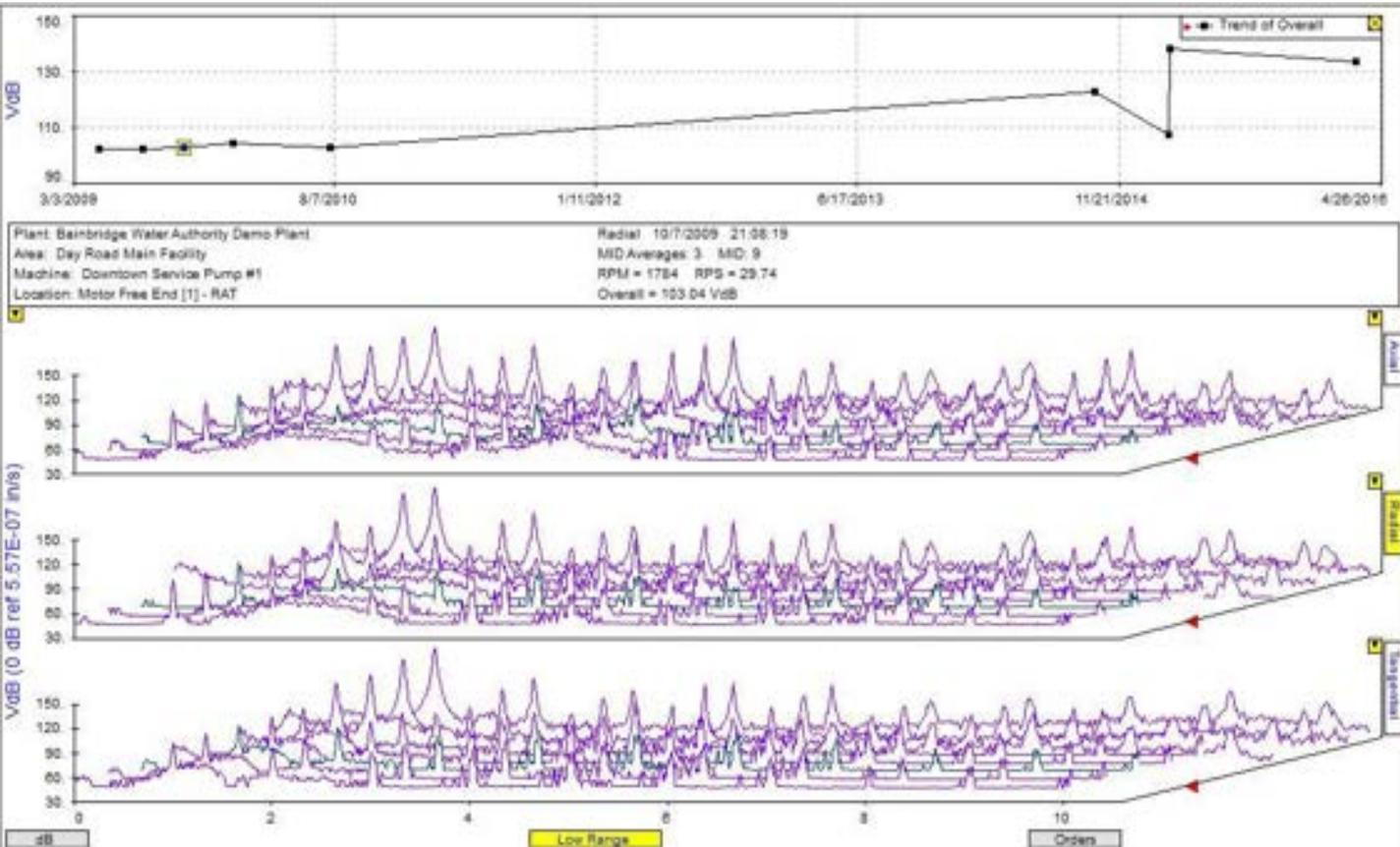
### Automated Diagnostic Engine

Fully automated fault detection  
6,000+ diagnostic rules  
1,200+ component fault types

### User Portal

Automated Alerts & Notifications  
Asset, Plant, Corporate Metrics  
Fault event Tracking

# Challenges - Data Analysis



## Requirements:

1. Must be able to handle volumes of data
2. Must provide prioritized work list
3. Must provide diagnostic screening
4. Must be intelligent and automated
5. Must deliver high utilization rate

# Analysis - Automated Diagnostics

## Setup / Input

Asset Details

Install Sensors

Automated Learning



## Diagnostics / Output

Automated Review & Workflow

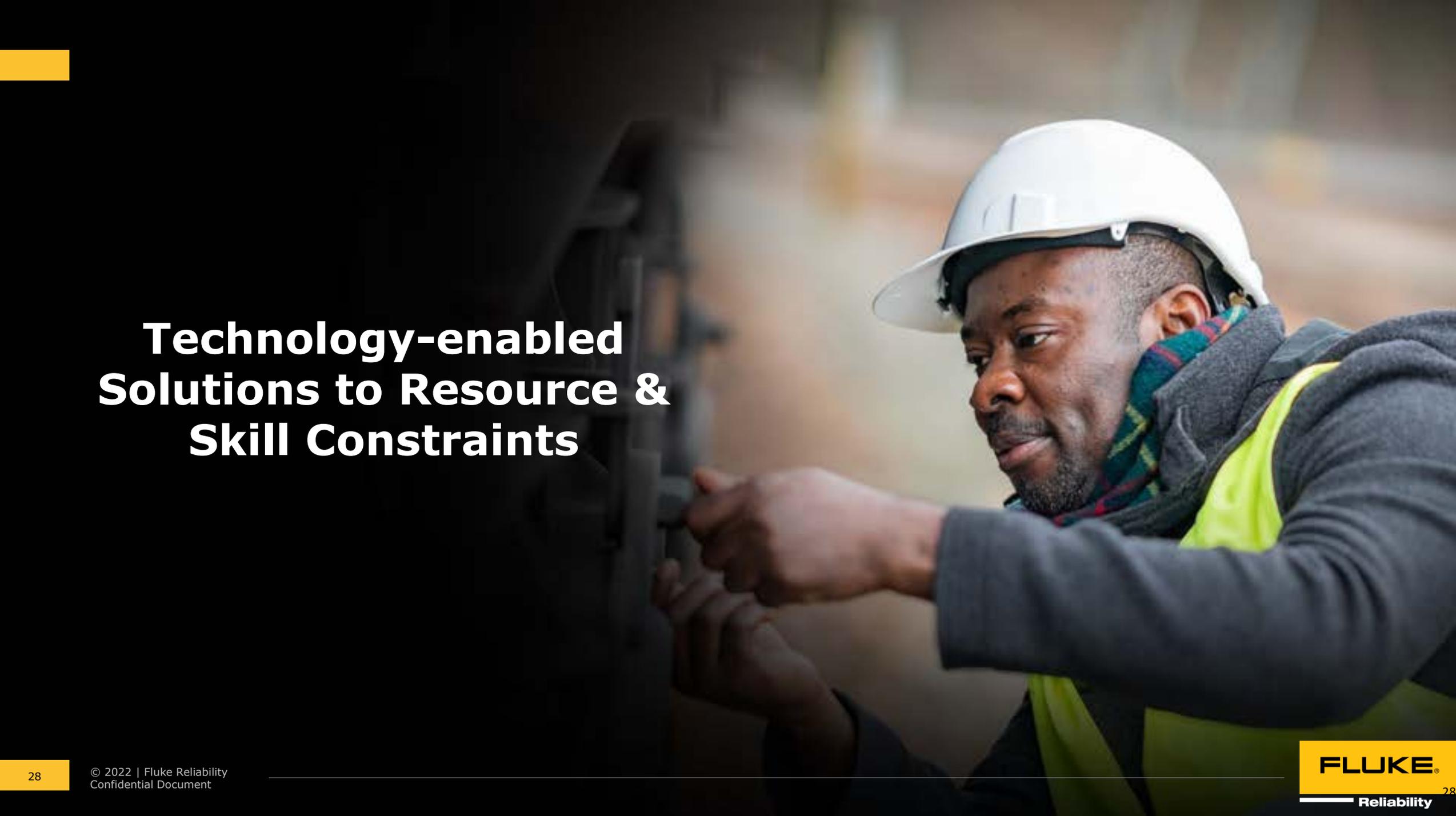
Analyst Assignment per SLA

Prioritized Actions & Alerting

Asset Configuration for Expert Automation

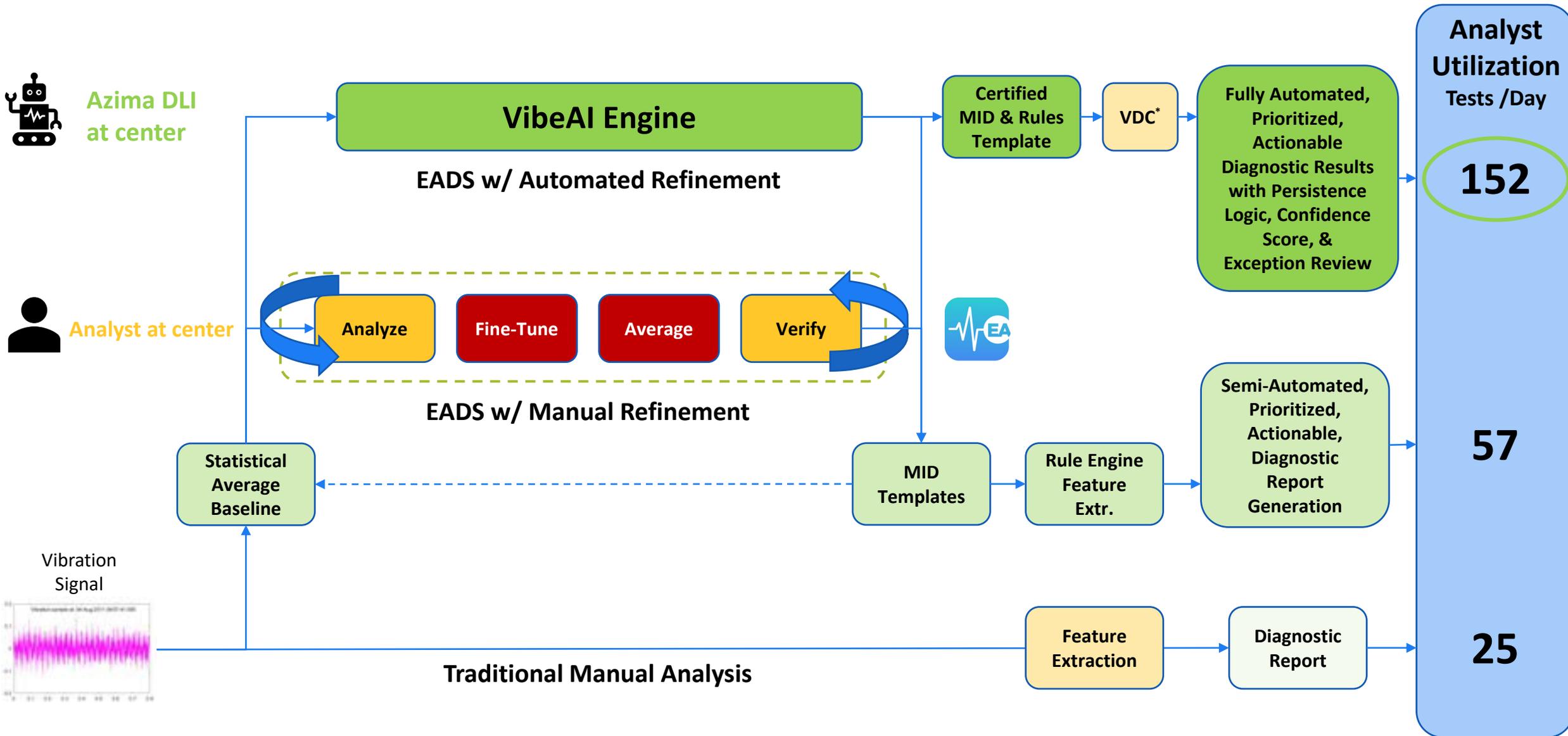
- 6000+ Trained Diagnostic Rules
- 1200+ Fault Conditions
- Automated Baseline Averaging
- Automated Fault Code Finder
- Result Confidence Scoring
- Result Persistence Logic

Workflow Automation for Volumetric Analysis

A close-up photograph of a Black male worker in a white hard hat and a grey hoodie with a high-visibility yellow vest. He is focused on his work, adjusting a component of a dark-colored machine. The background is blurred, suggesting an industrial or construction setting. A solid yellow horizontal bar is located in the top-left corner of the page.

# Technology-enabled Solutions to Resource & Skill Constraints

# AI-enabled Vibration Analysis



# Solutions – AI-enabled Automated Diagnostics

- 6000+ Diagnostic Rules
- 1200+ Fault Conditions
- 50+ Component Library
  
- Trained Diagnostics
- Prioritized Actions
- Statistical Averages
  
- Azima Utilization ~152 tests / day / analyst

**Analyst Reviewed Results**

### Main Service Pump #1

MID: 6  
Averages: 4  
Date Acquired: 11/5/2015 3:36:59 PM (UTC)

Machine Speed: 1781 RPM  
Rulebase: 20130322  
Figure of merit: 201  
Maximum Level: 111 (+14) VdB at 1.00xM on Motor Drive End Axial

**RECOMMENDATIONS:**  
⚠ IMPORTANT: INSPECT COUPLING AND CHECK SHAFT ALIGNMENT

**DIAGNOSTICS:**  
⚠ SERIOUS: **ANGULAR MISALIGNMENT**  
111 (+14) VdB Motor Drive End Axial at 1.00xM  
107 (+11) VdB Motor Drive End Tangential at 1.00xM  
107 (+12) VdB Pump Drive End Axial at 1.00xM  
105 (+12) VdB Pump Drive End Tangential at 1.00xM  
103 (+11) VdB Pump Drive End Radial at 1.00xM  
103 (+ 8) VdB Motor Drive End Radial at 1.00xM  
96 (+ 8) VdB Pump Drive End Axial at 2.00xM

**DISCUSSION BY ANALYST:**  
The vibration has increased over the previous tests.

Analyzed by: Jeremy Smith 11/5/2015 10:27:49 PM (UTC)

Repair Priority

Repair Recommendation

Fault Severity

Fault Diagnostic

Cited Peaks



# Confidence Level & Completion Score

## Latest Diagnostic Result

Feb 02, 2023, 06:55 AM

### Identified Problems

 **SERIOUS**

Motor Shaft Looseness

### Recommended Actions

 **IMPORTANT**

Check Motor Bearings For Improper Fit  
[ALRT-22996](#) - **OPEN**

 OK

### Confidence

No warnings for this diagnostic result.

 65%

### Completion Profile

Needs Motor Bars, more averages



### Cited Peaks

Click [here](#) to view cited peaks



### Analyst

Manjunath

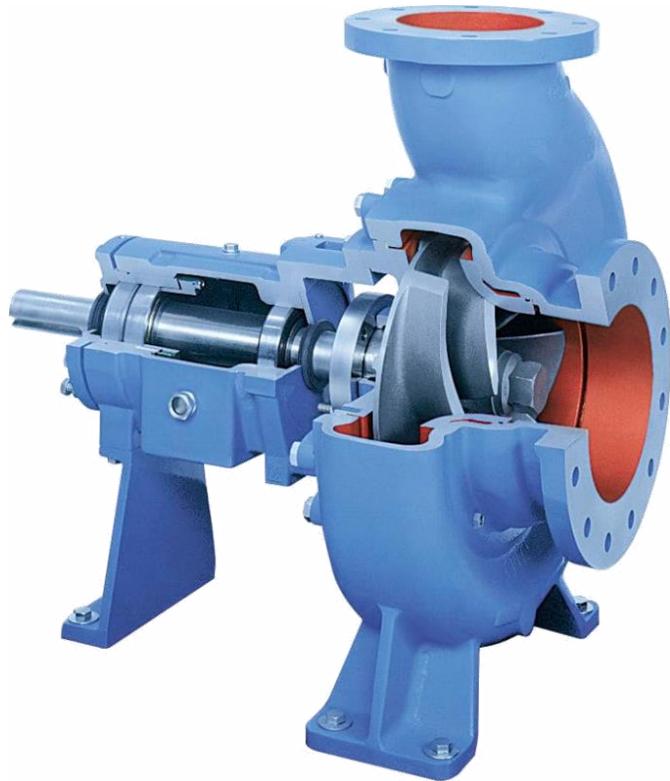


### Analyst Comments

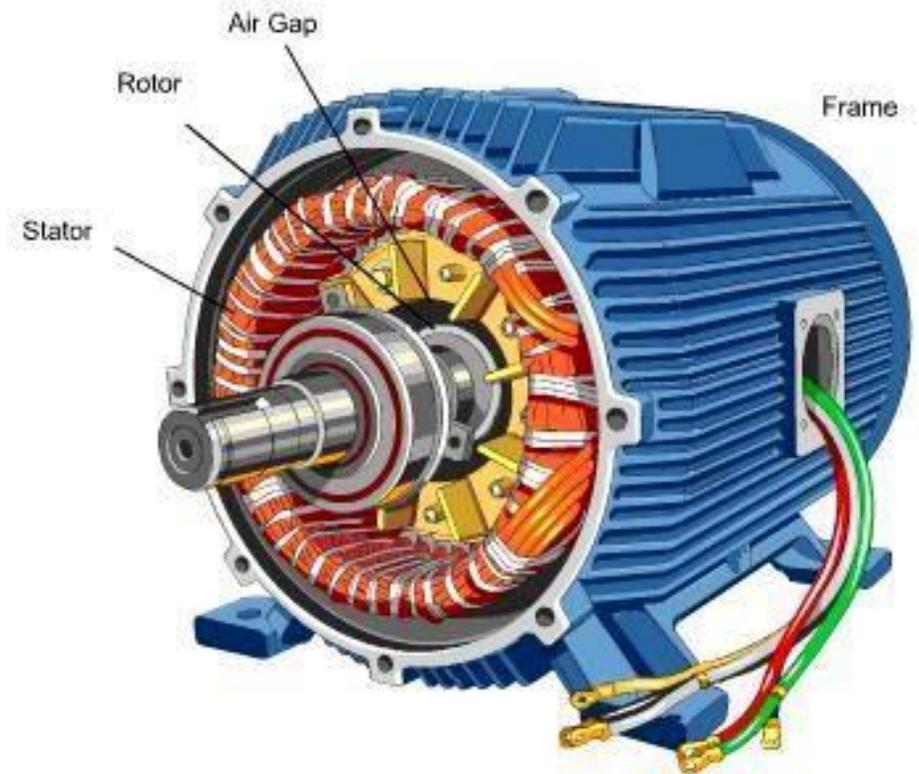
Fault has increased in severity since last month's reading, prompting an escalation to Important recommended action.

# Vibration AI: Automated Fault Codes Examples

Identifies number of pump vanes



Identifies number of motor rotor bars



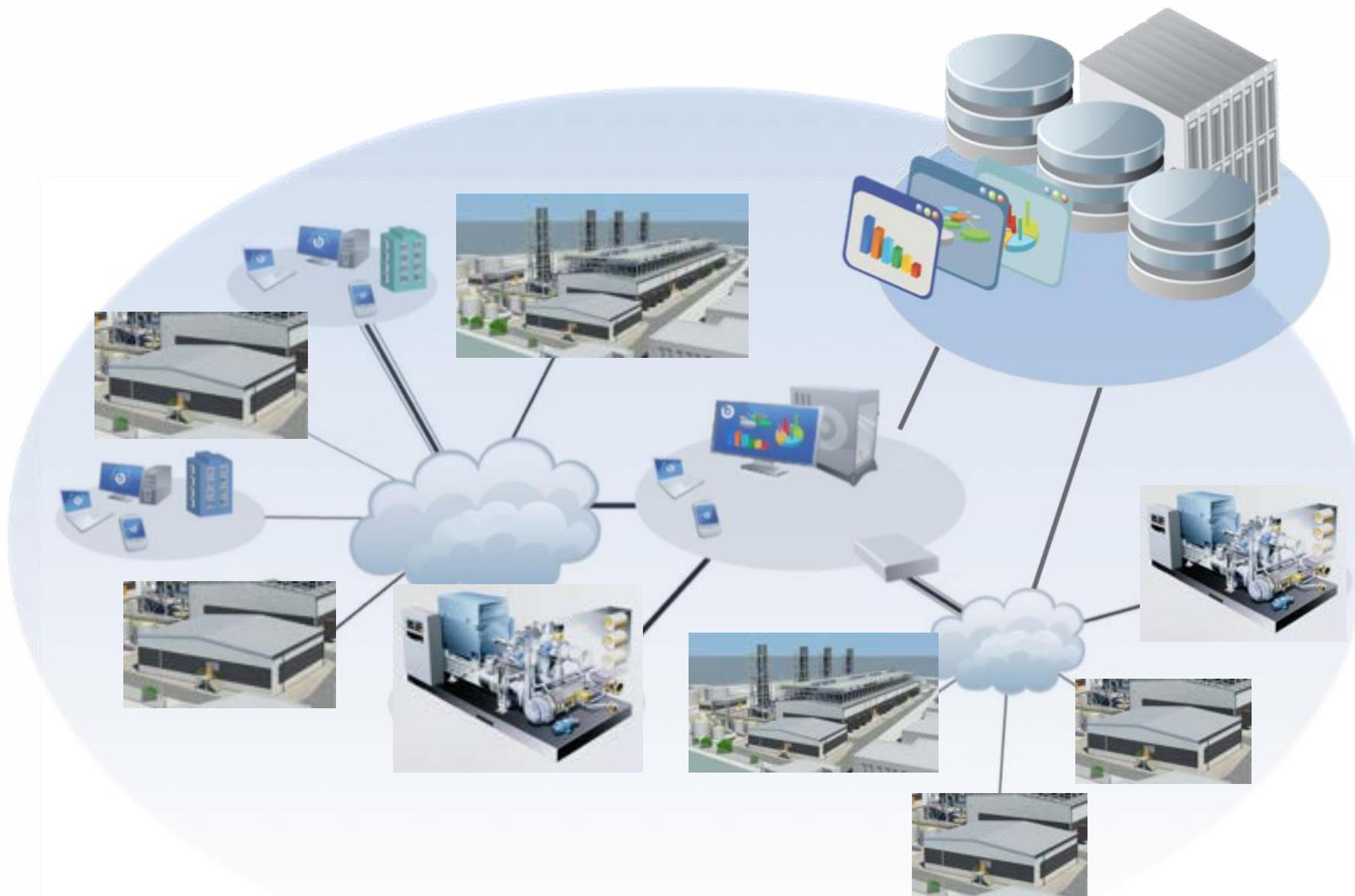
## Challenge – Delivering Results



## Requirements:

1. **Must present business metrics**
2. **Must be visible to all stakeholders**
3. **Must be relevant, up-to-date**
4. **Must be actionable, understandable**
5. **Must align with all business**

# Solutions - Centralized CBM

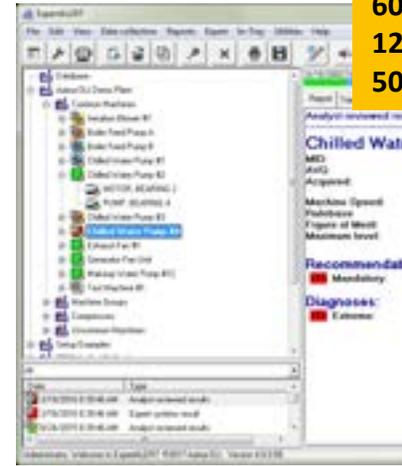


# Watchman™ System

Remote Setup App



Expert Automated Diagnostic System



Vibration AI

6000+ Trained Diagnostic Rules  
1200+ Identifiable Fault Conditions  
50+ Asset Component Library

### Asset Data Lake

- 100,000**  
Unique Assets
- 150,000**  
Asset Components
- 3,000,000**  
Machine Tests
- 150,000**  
Component Specific Faults
- 100 Trillion**  
Individual Vibration Test Points  
approximately



### Watchman Portal™

Latest Diagnostic Result  
Jun 13, 2023, 03:04 PM

**Identified Problems:**  
SERIOUS Pump Bearing Wear

**Recommended Actions:**  
IMPORTANT Replace Pump Bearing  
ALERT OPEN

**Confidence:** High

**Completion Profile:** Needs Motor Run, done overnight

**Analyst Comments:** Current results continue to show non-synchronous vibration in the high range data with impact detected in Time Waveform energy at levels that warrant serious concern.



Program Management



Vibration Data Sources

### Watchman Services

- 25 Level 2, 3, 4 ISO Certified
- 50k Assets Monitored
- 540k Annual Machine Tests



## Considerations:

- Data Collection w/ existing labor
  - Wireless for most machines
  - Utilize technicians / operators
- Data Analysis w/ technology
  - High utilization rate
  - Intelligent & automated
- Delivering Results
  - Full Visibility
  - Business Metrics

## Watchman™ Programs:

- Reduces man-power
- Leverage asset knowledge
- Leverage existing resources
- Centralized management
- Tech-enabled services





**FLUKE®**

Reliability

**THANK YOU!**