



# Smart Tools for Smarter Maintenance

*Leveraging Predictive Technologies to Optimize Your Facility O&M Program*

John Rimer, CFM  
FM360online.com





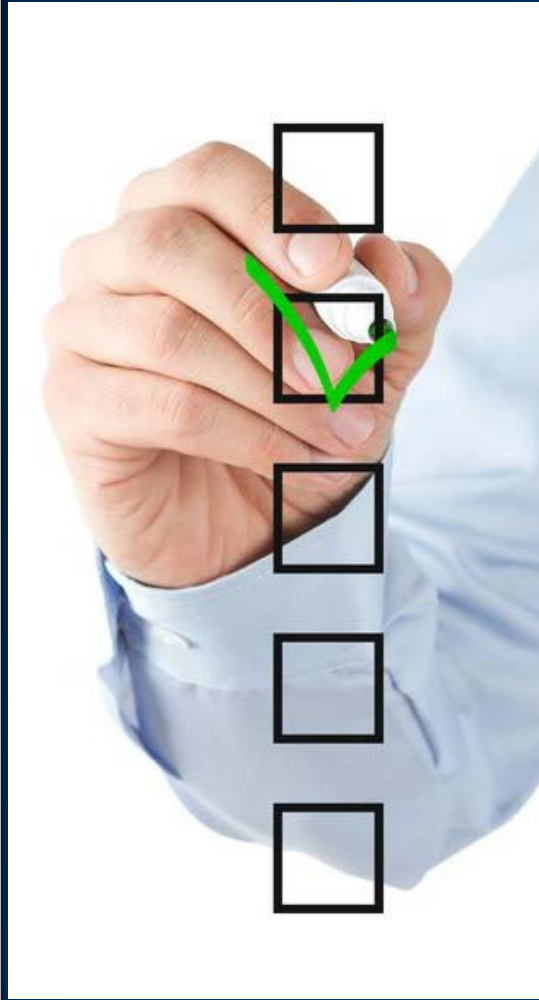
# Introduction

John Rimer, CFM

- 17+ Years Facility Management
- Numerous Industries & Various Roles
- Owner, FM360 Consulting
- Certified Facility Manager (CFM) - IFMA
- Director, Northern Rockies Chapter of IFMA
- IFMA & BOC Qualified Instructor
- PdM Experience
  - Implemented & Managed PdM Programs
  - PdM Consultant
  - Vibration Analyst Level III
  - PdM/Vibration Analysis Instructor



# Agenda



- Maintenance Strategies & Definitions
- Benefits of PdM
- PdM Technologies
  - What They Are
  - What They Tell You
  - When to Use Them
- Incorporating & Integrating Technologies
- Where to Learn More

# Maintenance Strategies

- Run-To-Fail (RTF)
  - Ain't Broke, Don't Fix It...
- Preventive Maintenance (PM)
  - Calendar/Run-Time Based
- Predictive Maintenance (PdM)
  - Data & Trend Based
- Condition-Based Maintenance (CBM)
  - Information Based – Holistic
  - Right Maintenance at the Right Time



# Poll #1



*What would you estimate as your scheduled(PM/PdM/CBM) to unplanned maintenance(CM/EM) ratio? (PM/CM Ratio)*

- 80/20 or Better
- 50/50 or So...
- 20/80 or Worse
- I have no idea...

# Benefits of PdM

## Rule of 100/10/1

- 100 – People/Production
  - Increase Uptime (70%+, Fluke)
  - Schedule Downtime
- 10 – Facility
  - Reduce Maintenance Costs (25%+, Fluke)
- 1 – Utility Costs
  - Lower Energy Costs (15%-25%, MT Online)





# Predictive Technologies



- Vibration Analysis
- Infrared Thermography (IR)
- UltraSound (U/S)
- Ferrography – Oil/Fluid Analysis
- Motor Circuit Analysis (MCA)
- Laser Alignment

## Poll #2



*Which PdM Technologies do you currently use in your facilities? (Select all that apply)*

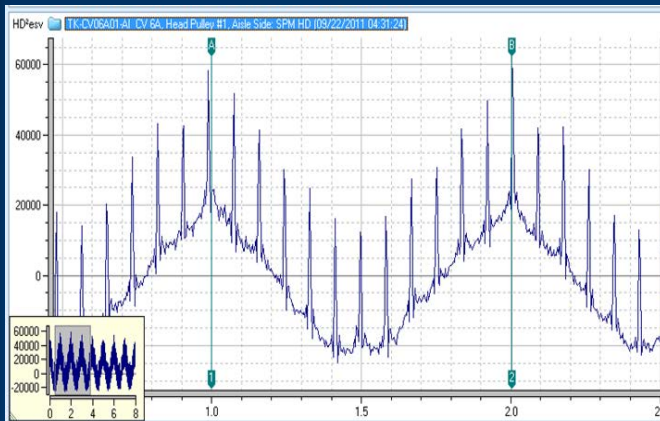
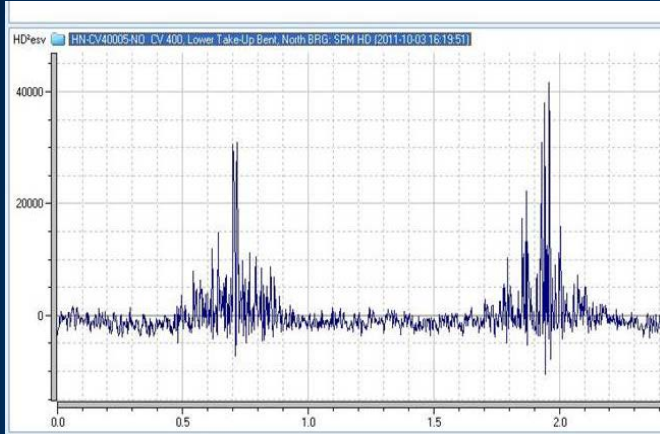
- Infrared Thermography
- Vibration Analysis
- Ultra-Sound
- Ferrography/Fluid Analysis
- Motor-Circuit Analysis
- Laser Alignment



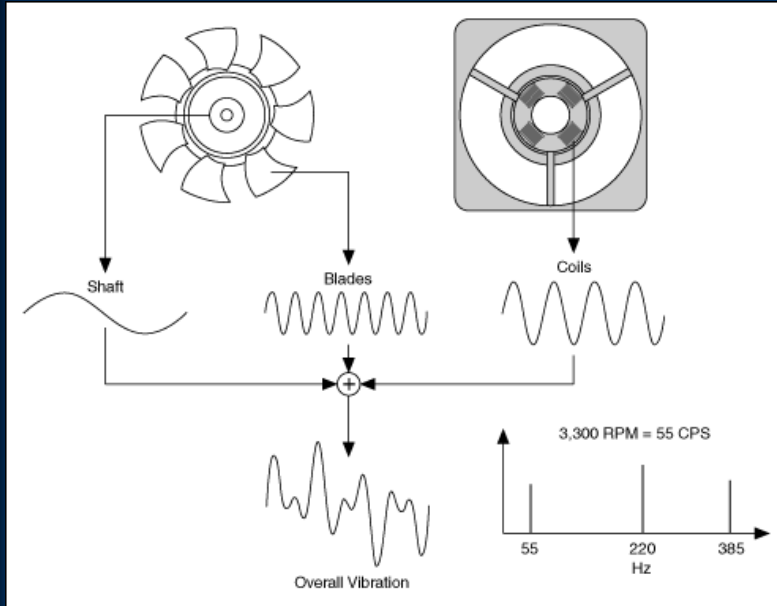
# Vibration Analysis

*Measures vibration to identify faults and potential failure modes*

- Overall Vibration
- Fast Fourier Transform (FFT)
  - Amplitude vs. Frequency
  - Velocity (in/s) and Acceleration (g)
  - RPM/Shaft Speed or Multiple of 1X

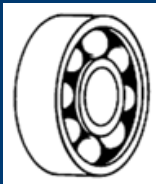
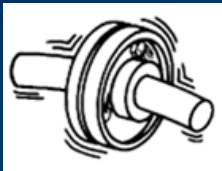


# Vibration Analysis



## More than Bearings...

- Unbalance
- Misalignment (Coupling/Sheaves)
- Bent Shaft
- Gear/Gearbox issues
- Looseness
- Belts
- Fan & Impeller Issues
- Electrical & Motor Issues
- Resonance & Beat Frequencies



# Vibration Analysis

## When to Use Vibration Analysis

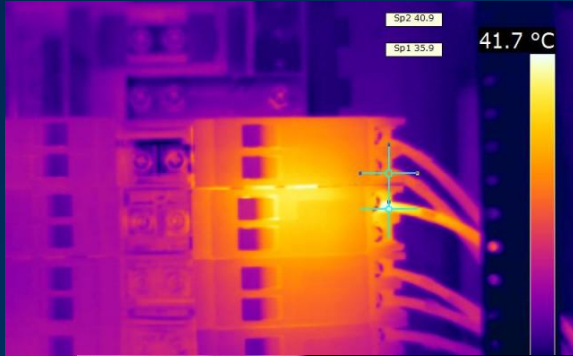
- Rotating or Reciprocating Equipment
- 10HP or larger
- Critical Equipment/Systems
- Monthly to Quarterly Readings

## How to Implement

- Resources
  - Tools & Software
  - Training/Certification
- In-Source vs. Out-Source
  - Overall Vibration Tester
  - Call-in Experts when Needed

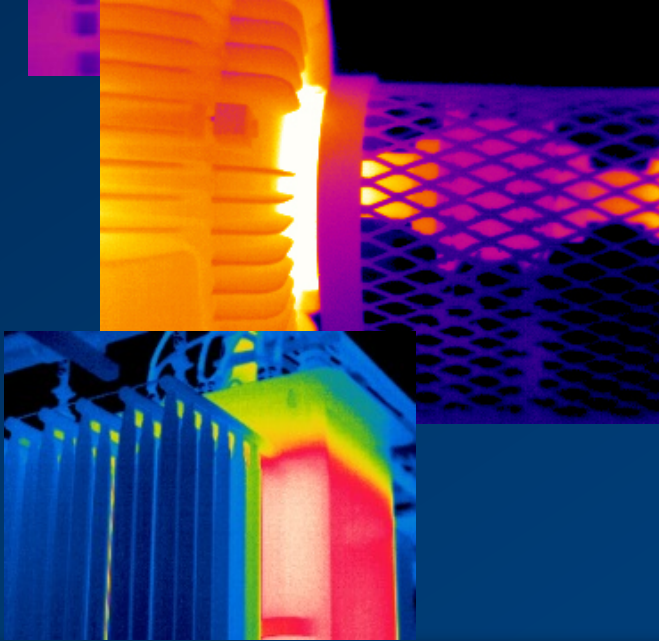


# Infrared Thermography (IR)



*Uses infrared imaging, detecting radiation in the infrared range, to measure and visualize relative heat of objects*

- "Picture is worth a thousand words"
- Identifies but does not Specify

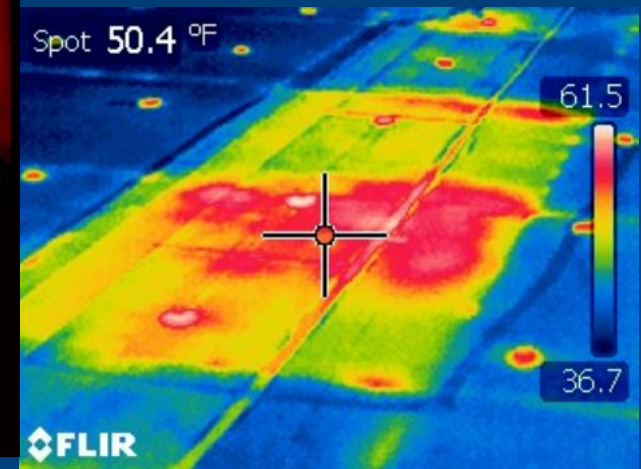
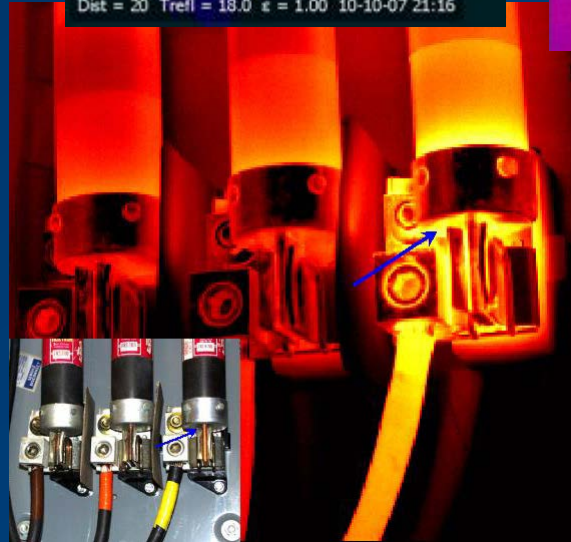
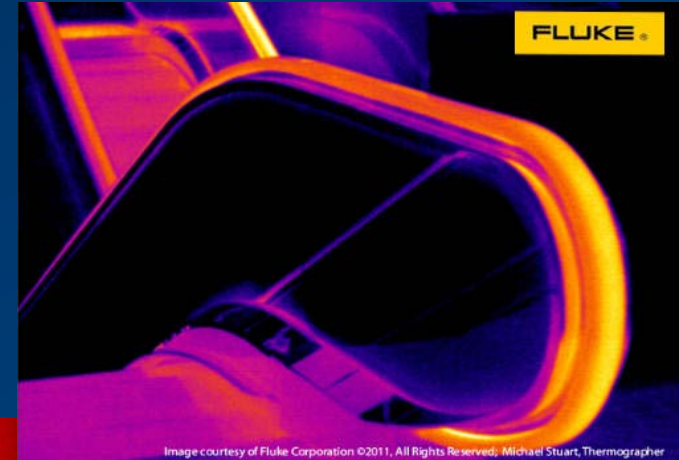
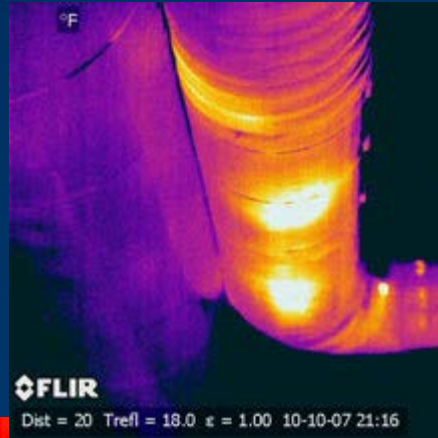




# Infrared Thermography (IR)

## Applications...

- Mechanical Systems
- Transformers
- Breakers
- Switches
- Envelope Testing
- Conveying



# Infrared Thermography (IR)

## When to Use IR

- Annual PdM
- 200A or larger
- Troubleshooting
- Selling...

## How to Implement

- Resources
  - Tools & Training
- In-Source vs. Out-Source
  - In-House Camera
  - Call-in Experts when Needed
- IR Ports





# UltraSound (U/S)



*Acoustical analysis at the ultrasonic level - hearing things we can't...*

- Steam/Air/Gas Leaks
- Steam Traps
- Transformers
- Bearings
- Lubrication
- Cavitation



# UltraSound (U/S)

## Examples

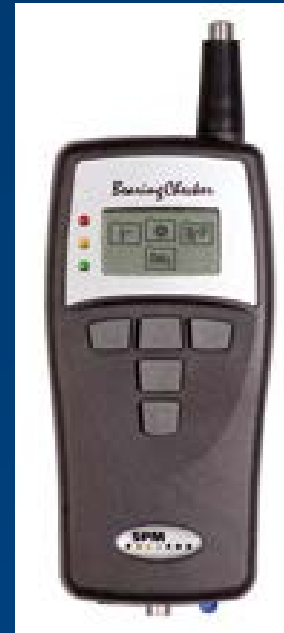
- Indiana University - \$300k/yr savings on ~3000 traps
- 1" pipe @10psig = \$162/month

## When to Use U/S

- At least Annually
- Troubleshooting

## How to Implement

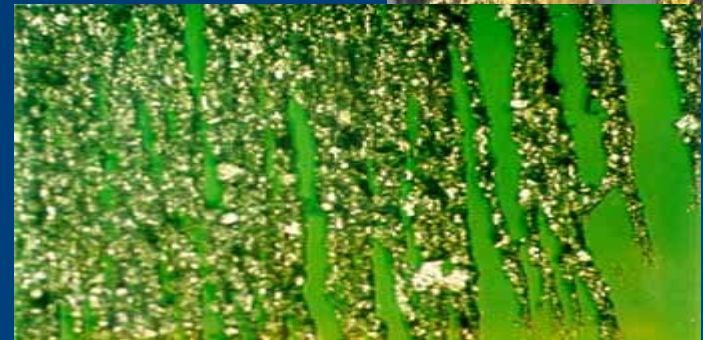
- In-Source vs. Out-Source
  - Size of Plant/Number of Equipment
  - Bearing Tester



# Ferrography

Analyzing the particles present in fluids that indicate mechanical wear

- Oil Analysis
- Refrigerant Analysis
- Coolant Analysis



Oil Analyzers INC.															COMPANY INFORMATION																																																																																																																																	
UNIT ID: K205 A-1100 SECOND ID: #2 OILWELL P199A200/16-6266 UNIT TYPE: RUMP APPLICATION: ON-SHORE DRILLING																																																																																																																																																
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TRACKING #: MANUFACTURER/MODEL: OIL WELL A-1100 LUBE MFR: 76 LUBRICANTS LUBE TYPE - GRADE: GL 5 SAE 85W140 MICRON RATING: 600 FILTER TYPE: SUMP CAPACITY: 00000 HYD SYSTEM PRESSURE: 00000 FLUID ADDED:															LAB # 536200 LOCATION H ANALYST KH																																																																																																																																	
FLUID ANALYSIS REPORT COMMENTS: Check for possible source of ABRASIVES entry (such as faulty filter elements, filter housing, breathers, fill points etc.). Abrasives (Silicon) are at a SEVERE LEVEL; Lubricant change is suggested if not done at sampling time; Water is at a MODERATE LEVEL; Gear and/or bearing metal is at a MODERATE LEVEL; Aluminum is most likely in the form of alumina/silica (Dirt); Potassium is at a MINOR LEVEL; BARIUM IS COMMONLY FOUND IN DRILLING MUD; Unit and/or lube time missing: N/A																																																																																																																																																
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# Ferrography

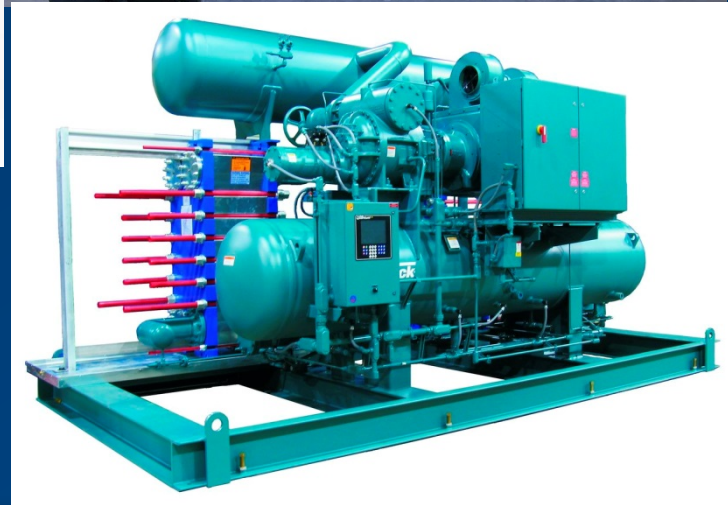
## When to Use Ferrography

- Generators
- Chillers
- Transformers
- Gearboxes
- Transmissions

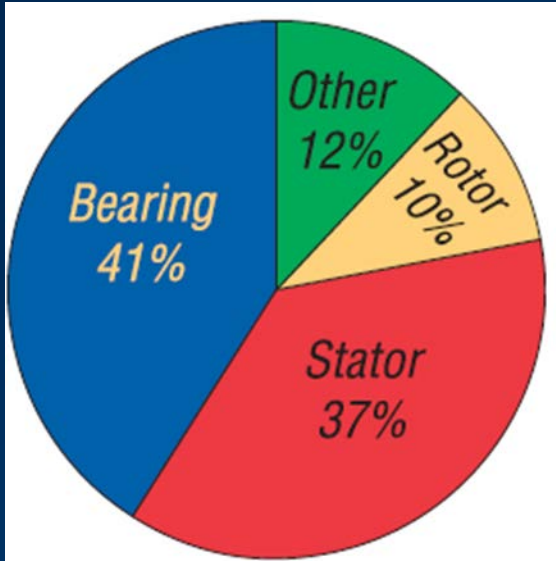


## How to Implement

- Collect Samples & Submit to Lab
- Most Lubrication Suppliers have Labs
- Conducted by Service Provider

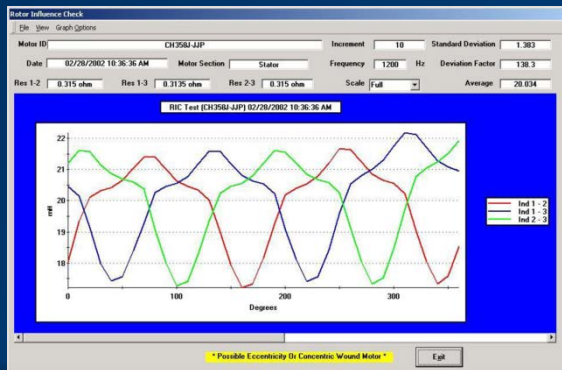


# Motor Circuit Analysis (MCA)



*Ascertains motor health through detection of electrical imbalances and insulation degradation*

- Winding Defects
- Cable Defects
- Rotor Issues
- Integrity of Insulation
- Load Problems
- One-Time or Routine
- Online & Offline Tests
- Couple with Vibration Analysis
- Providers - Motor Shops



# Laser Alignment



*Aligning rotating equipment within recommended specifications*

*Nearly 50% of all breakdowns in rotating machines are due to misalignment (Vibralign)*

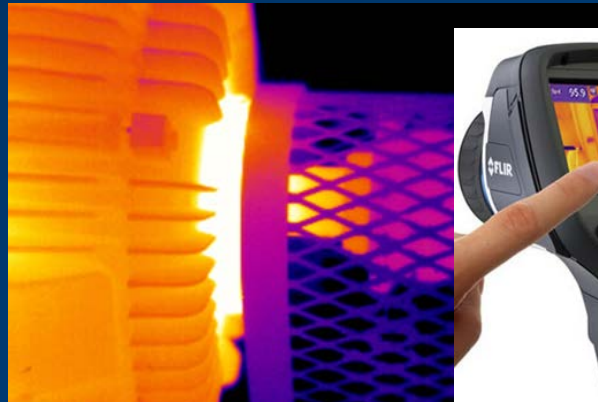
- Couplings
- Belts/Pulleys
- Example
  - 14% amp draw



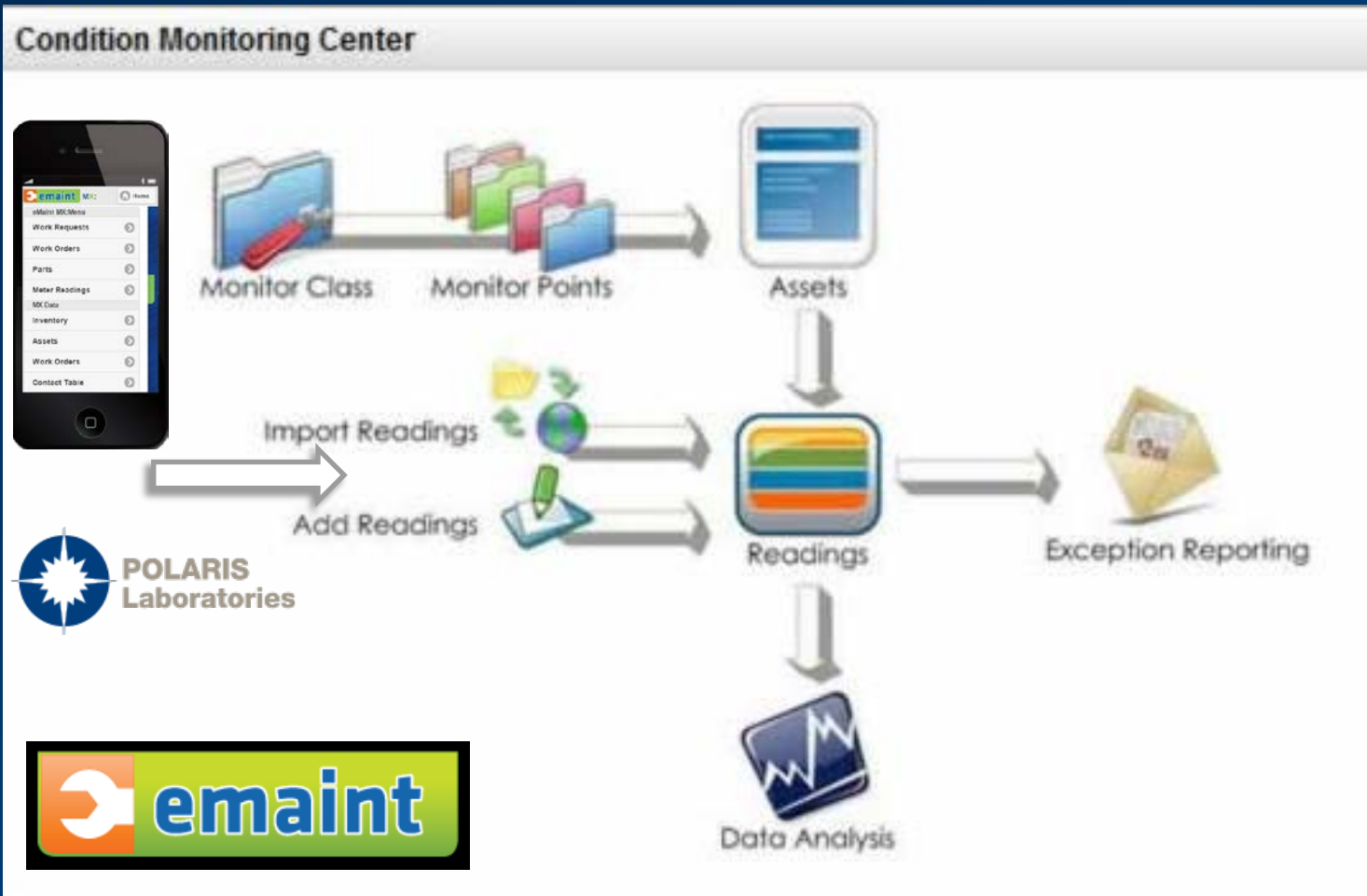


# Incorporating & Integrating

*The Whole is Greater Than the Sum of its Parts*



# Leveraging a CMMS for PdM/CBM



# Where to Learn More



- [www.reliabilityweb.com](http://www.reliabilityweb.com)
- Maintenance Technology ([www.mt-online.com](http://www.mt-online.com))
- Society for Maintenance & Reliability Professionals ([www.smrp.org](http://www.smrp.org))
- Uptime Magazine
- Manufacturers' Websites
- FM360's Online Training



## Poll #3



*What is the biggest obstacle to implementing a robust maintenance program?*  
*(Select all that apply)*

- Lack of management support
- Too busy firefighting
- Politics/Business relationships
- Team doesn't see value
- Don't need one



*Questions?*



John Rimer, CFM

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