



ACCELERATING
INNOVATION

2025 Emerson Exchange [4-1509] A Mill of the Future

May 2025

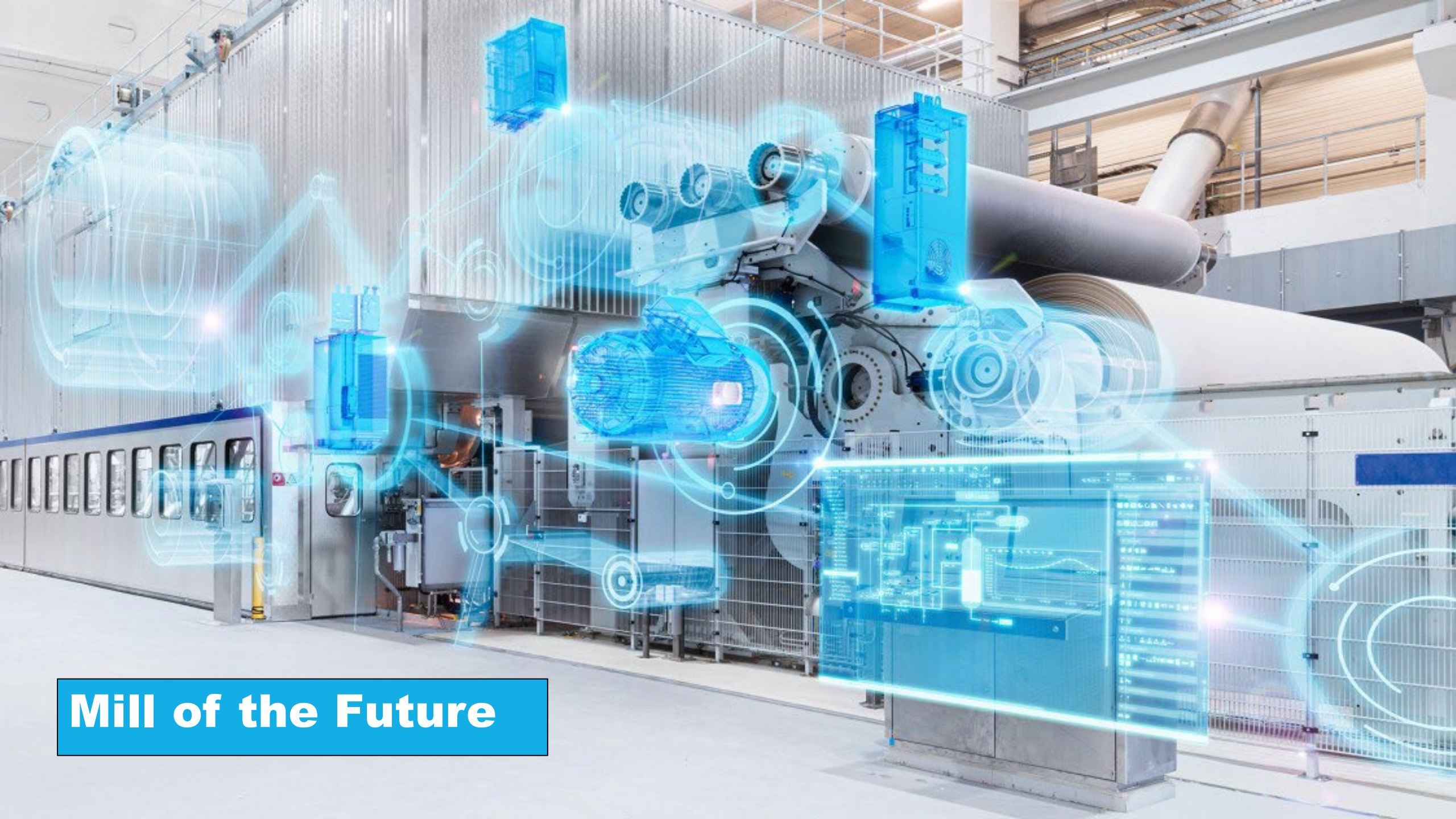
A Mill of the Future: Redefining Asset Health Data Collection



Brian Kelley - International Paper

Todd Schools – R.E. Mason

Jason Ozment - Emerson



Mill of the Future

Agenda

All

Todd Schools

Brian Kelley

Jason Ozment

Todd Schools

Brian Kelley

All

Introductions

Industry Outlook and Pain Points

Our Vision and Journey

The Technology Deployed

AMS Optics

Partnership and Lessons Learned

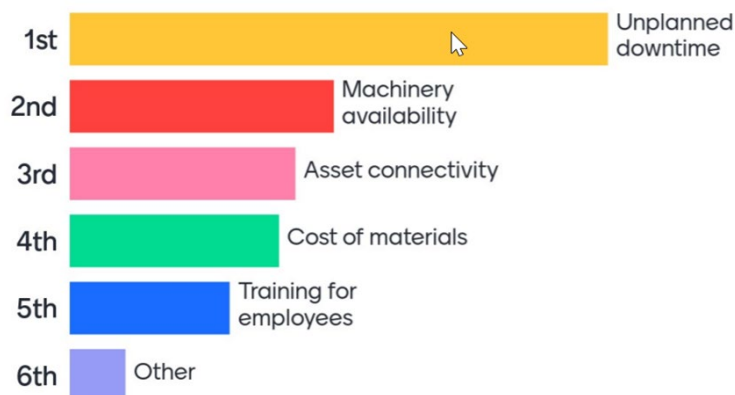
Questions

Pulp & Paper Industry Outlook

Industry Trends

- **Packaging Materials** - Continued growth in packaging demand driven by on-line purchasing and economic growth
- **Hygienic Materials** – Toilet paper, paper towels, wipes, diapers demand to increase based on consumer demand
- **Paper Recycling** – Market may remain flat with continued consumer anti-plastic demand countered with increased plastic recycling efforts in U.S. and Europe
- **Newsprint and Consumer White Paper** – Continued decline in demand for newsprint, magazine print and consumer white paper materials

P&P main pains



Commodity	Growth
Packaging Materials	
Hygienic Materials	
Paper Recycling	
Newsprint, White Paper	

Mill of the Future

Vision

- *Mill of the Future* evaluates and adopts new technology for deliberate step-change improvements with transformation of how we perform work as a result.

Mission

- Implement emerging technologies to transform our manufacturing performance.



MILL OF THE FUTURE

Where did we start?

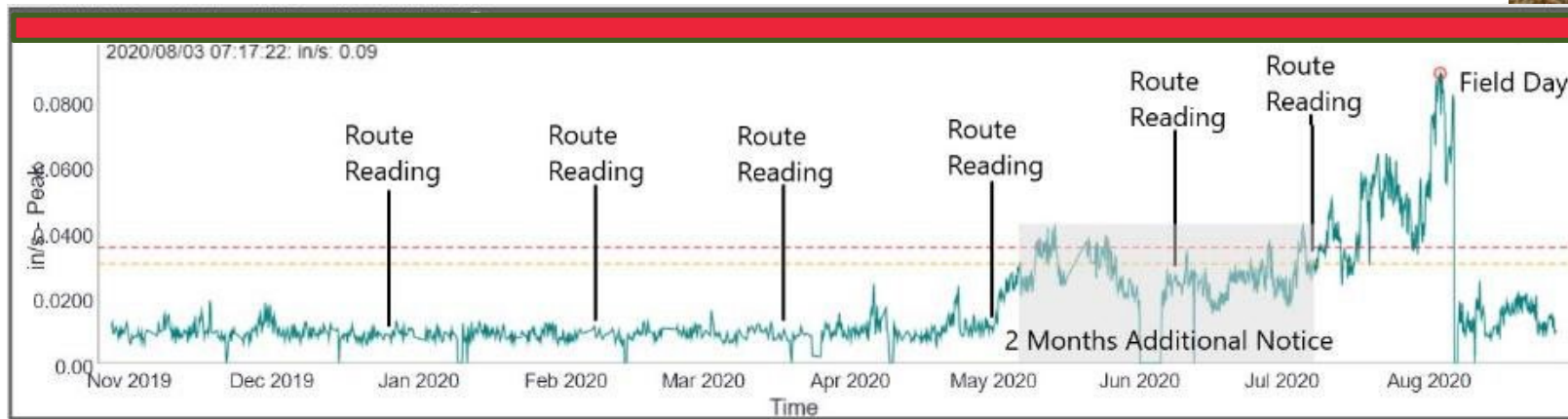
- **Proof of Concept - Start small, learn, then grow!**
- **Transition from manual data collection to continuous and semi-continuous (COLM)**
- **Get the data in front of the right people at the right time**
- **Picking the right technology and partner**
- **Determine which mills to focus on first**
- **What else are we doing?**

“COLM” Success Proof of Concept 2020

Real time health monitoring system provides a more accurate and wider picture of equipment status. It's a tool for maintenance planning in most effective way (i.e. waiting till outage vs immediate repair)

Dryer Bearing Example 1

- Route based data would have delayed problem identification 2 months.
- See photo for extent of outer race damage.

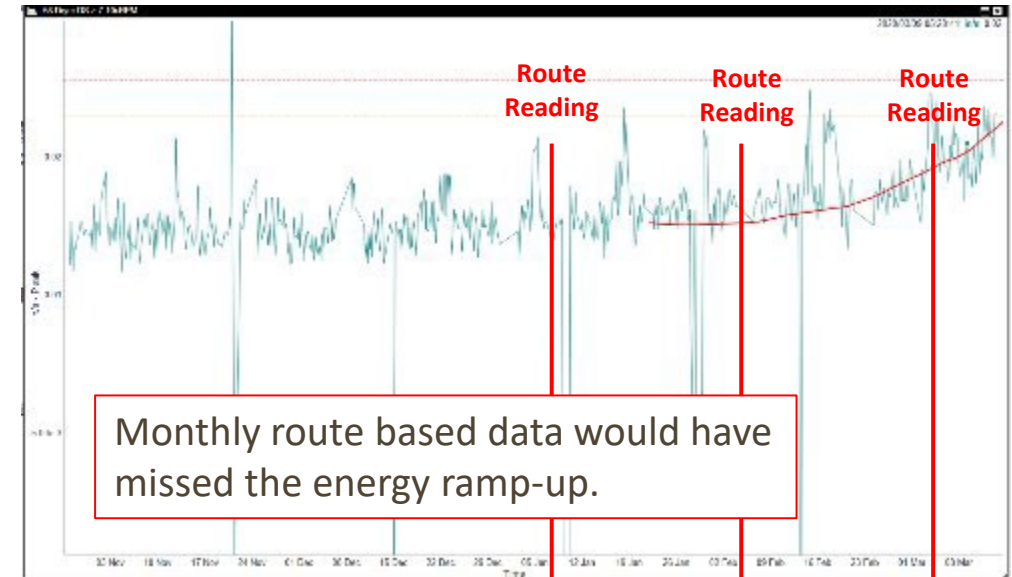


Internal Use Only. Do Not Distribute.

“COLM” Success Proof of Concept 2020

Dryer Bearing Example 2

- Route based data would have missed the energy increase and delayed problem identification by 3 months.
- Avoided potential failure, where a similar RI event in 2017 resulted in a financial impact greater than \$325k



Status:

Bearing Replaced during August 2020 Field Day.
Cost: ~\$20k

The Move Towards Automated Asset Management

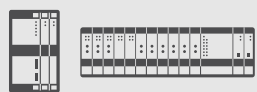
Traditional Condition Monitoring

Digital Transformation

Automated Asset Monitoring



90%
Manual Monitoring



100 racks

CRITICAL



100 racks

100%
Automated Monitoring



"Routes by Inspection"

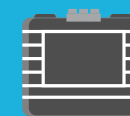


35 units

ESSENTIAL



500 units

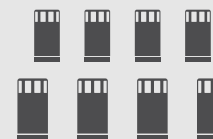


"Routes by Exception"



> 10Units

BALANCE OF PLANT



2,500 units

Power industry customer: "We do not do manual rounds anymore. Only use 2140s when there is an exception to be monitored"

Industrial gases customer: "Our goal is to eliminate manual rounds in the next 10 years across the globe"

What Assets do we focus on?



Turbines

Compressors



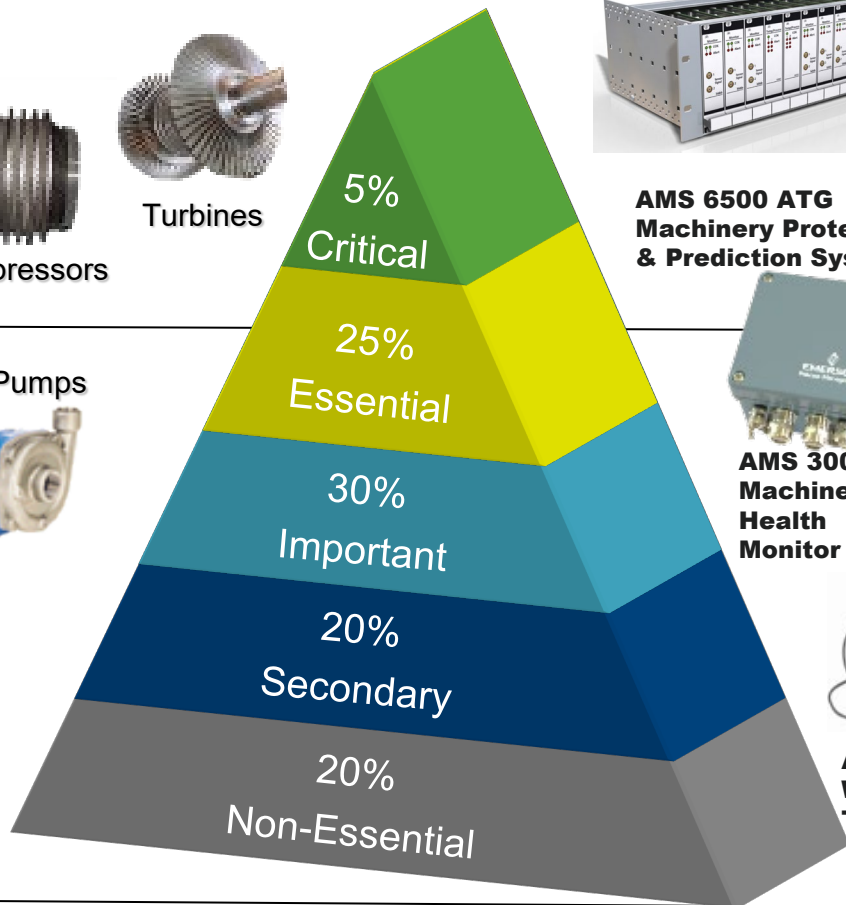
AMS 6500 ATG
Machinery Protection
& Prediction System



AMS 6300 SIS
SIL rated Over Speed
Protection system



AMS 6500
Machinery Prediction System



AMS 3000
Machinery
Health
Monitor



AMS Asset Monitor



AMS 9420
WiHART Vibration
Transmitter



AMS Wireless
Vibration Monitor



AMS 9360
Vibration &
Displacement
Transmitter



AMS 9330
Vibration PeakVue
Transmitter

Fans



Pumps



Motors



Gears



Eddy Current Probes



Eddy Current Convertors



Accel's



AMS 2140
Machinery Health Analyzer

AMS 2600
Machinery
Prediction
System



Portable Data Collection + Analysis



Week 1 Data Route
Week 2 Data Route
Week 3 Data Route
Week 4 Analyze Data

(Repeat Monthly)

- Primary vibration data collection methodology for last ~40 years
- Low capital outlay, but labor intensive
- Spending 90% of time looking for 1-5% of machines having an alert
- Personnel safety considerations of being in production areas
- “Blind Spots” between data collections (30-90 days)
- Resource limitations may prevent coverage of some machines
- Missed measurements due to off-line machines
- Hazardous areas preventing data collection

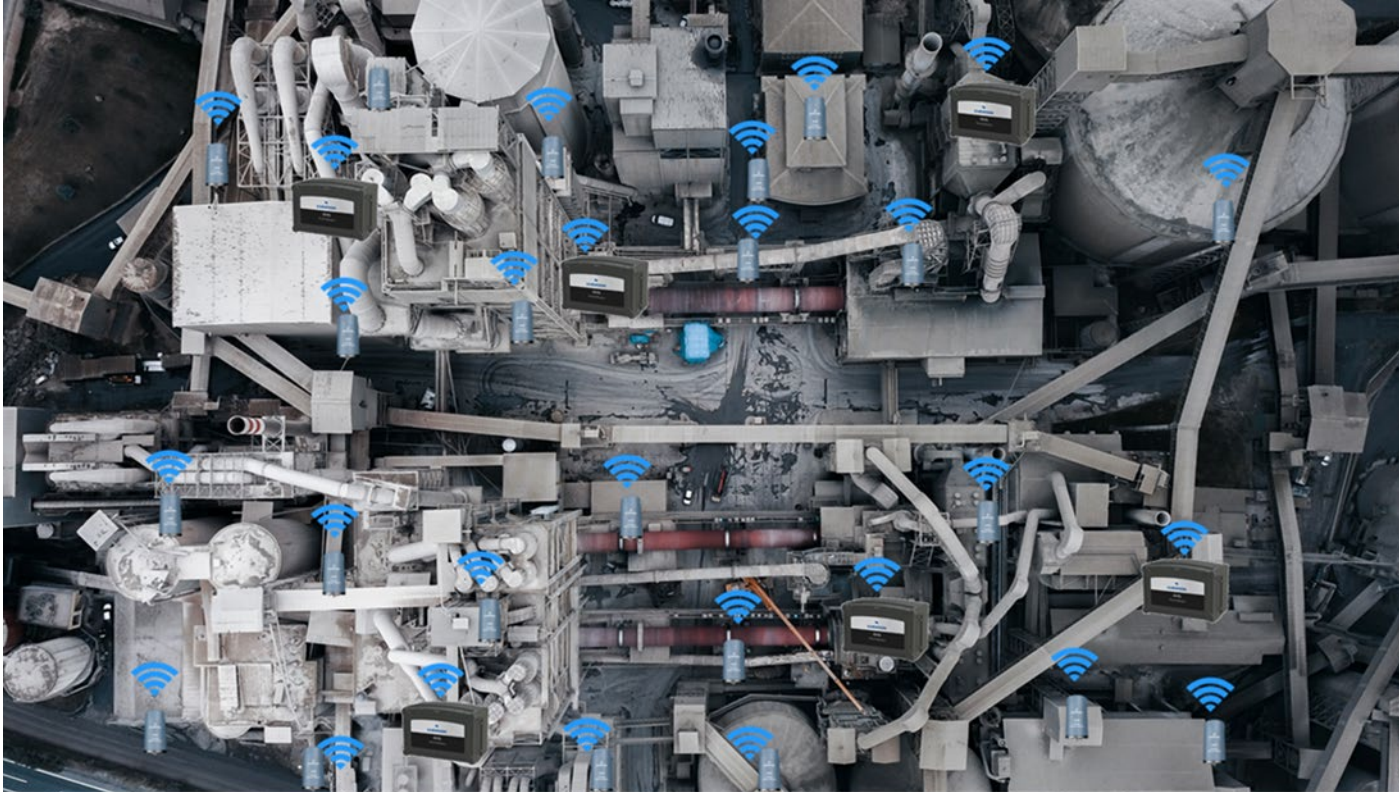
Automated Data Collection + Automated Analysis



Week 1	Week 2	Week 3	Week 4
Data	Data	Data	Analyze
Route	Route	Route	Data

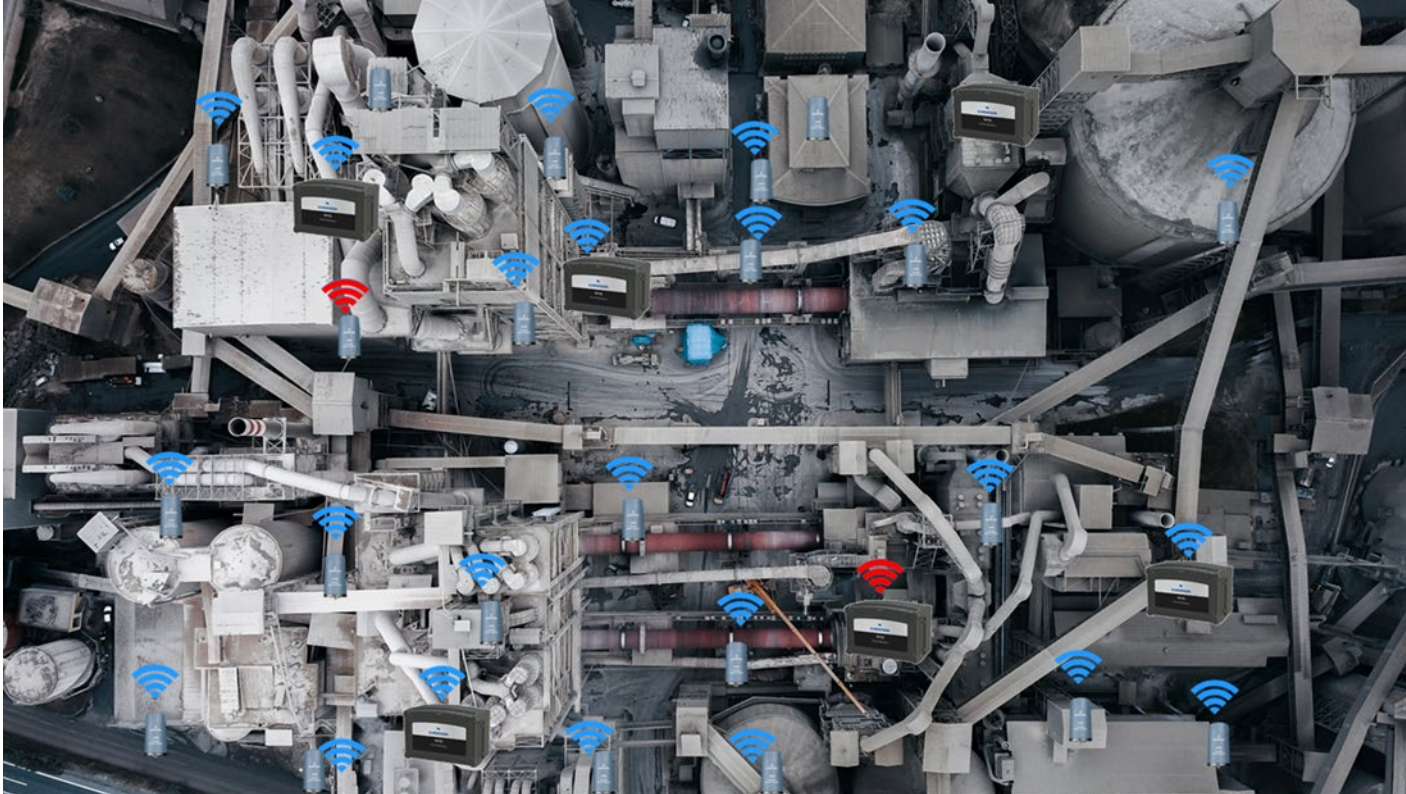
- More frequent data collection to avoid “blind spots”
- Automated and prescriptive analytics to identify issues
- Spend analysis time on assets with alerts or significant data change
- Cover all assets in your facility, even in hazardous and remote areas
- Keep personnel in safe areas
- Remotely access machine health wherever you are
- Continuous monitoring of assets through weekends, holidays, PTO...

Automated Data Collection + Automated Analysis



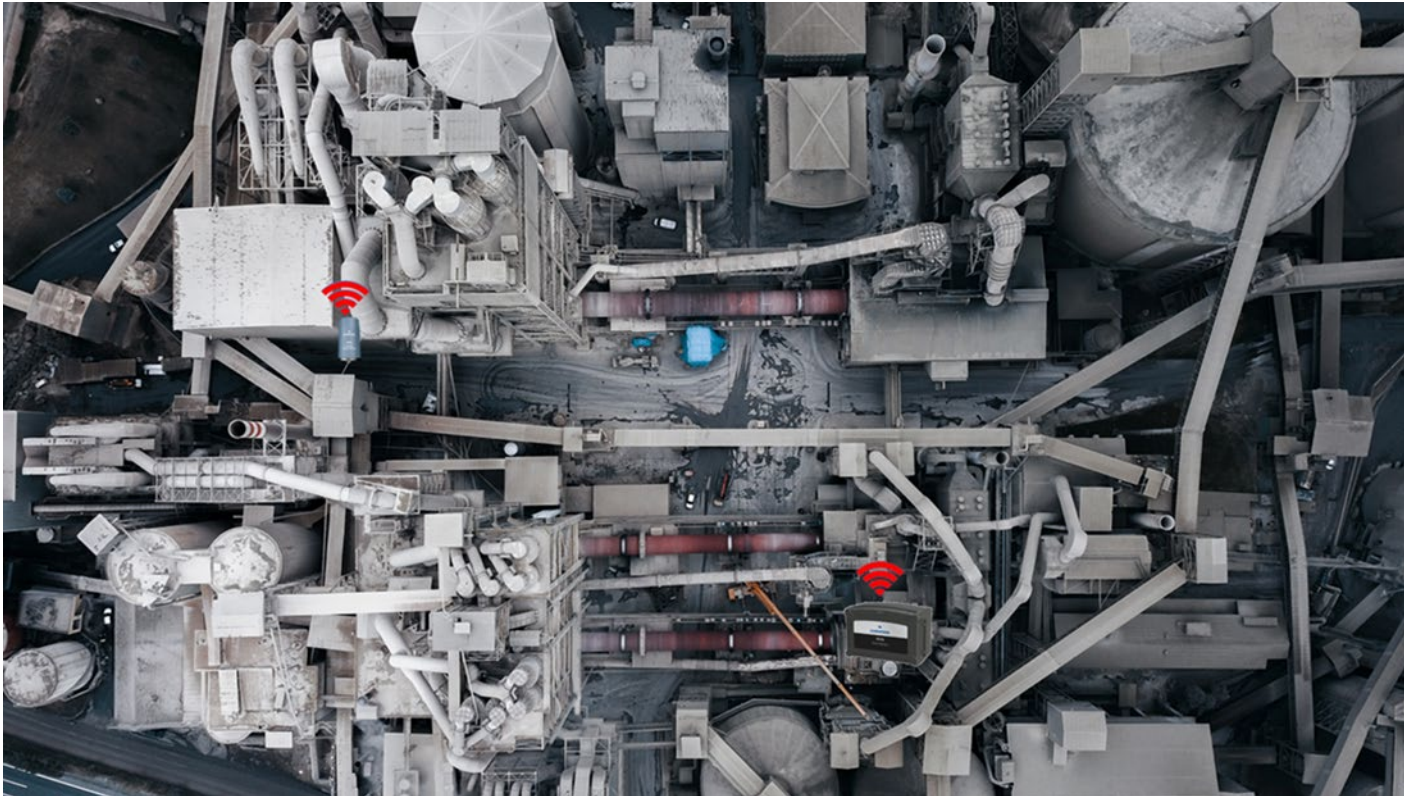
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Focused troubleshooting on Assets with Degraded Health Conditions



- Changing asset health conditions alerted by automated monitoring systems
- Dashboard reflected with asset health status
- Focused troubleshooting by skilled personnel to verify and diagnose
- Detailed testing and data collection with AMS 2140 Machinery Health Analyzer
- Corrective action taken as needed

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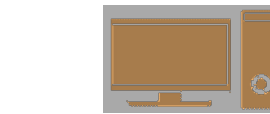


Mill of the Future: Partnered with Emerson



Reliable Equipment

Use of continuous equipment health indicators and advanced analytics give early warning of issues and predict needed maintenance.



AMS Machine Works Software



Optics Portal Software



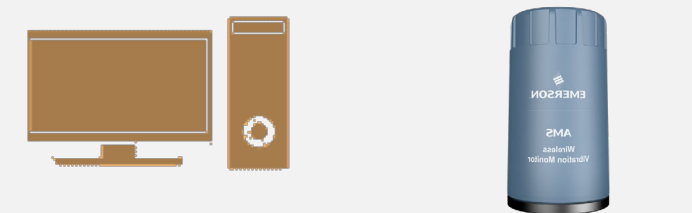
(500 Units)



(2500 Units)

Mill of the Future - COLM: From Vision to Reality

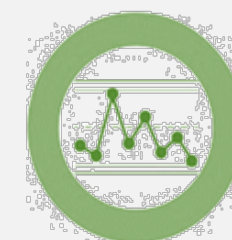
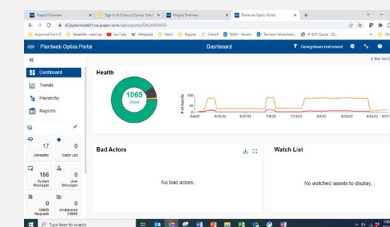
- Mill Wide Wi-Fi and WiHart
- Wireless on Critical Few Equipment
- Asset Monitors
 - Paper Machine Rolls
 - Variable speed applications
 - Slow speed applications
- Machine Works at each Mill
 - Analysts at each mill
 - Some routes, some analysis by exception
- Data Analytics at Corporate
 - Reliability Data
 - Process Data
 - Pattern Recognition



AMS Machine Works Software



(500 Units)



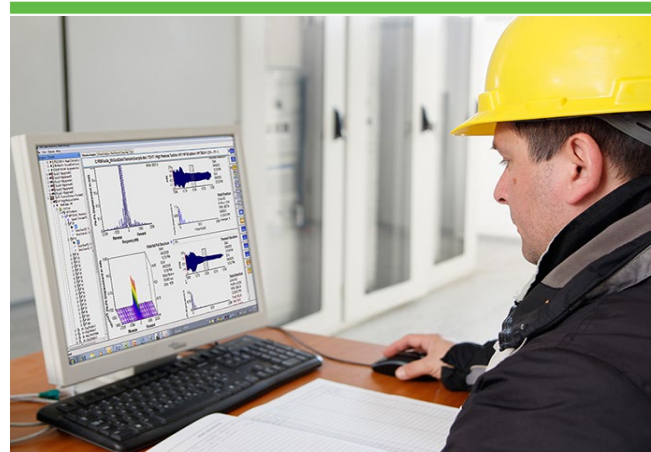
Start with: AMS Machine Works

Built Using Latest Technologies



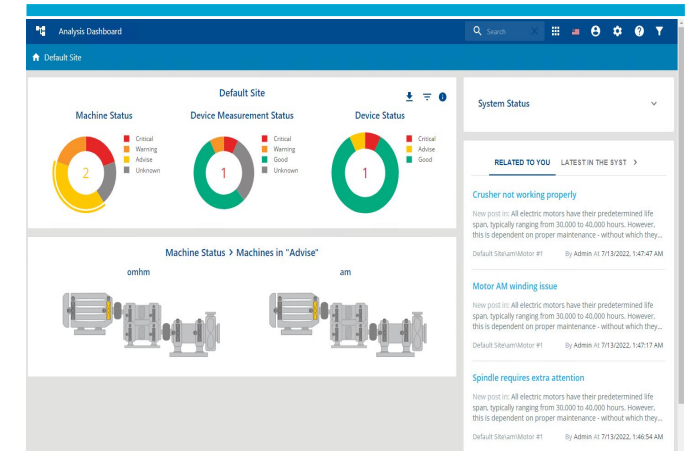
- Thin Clients
- Active Directory Support
- OPC UA Server

Full Suite of Analytical Tools



- PeakVue™
- Long/Transient Waveforms
- Fault Frequencies
- Common tools for all hardware

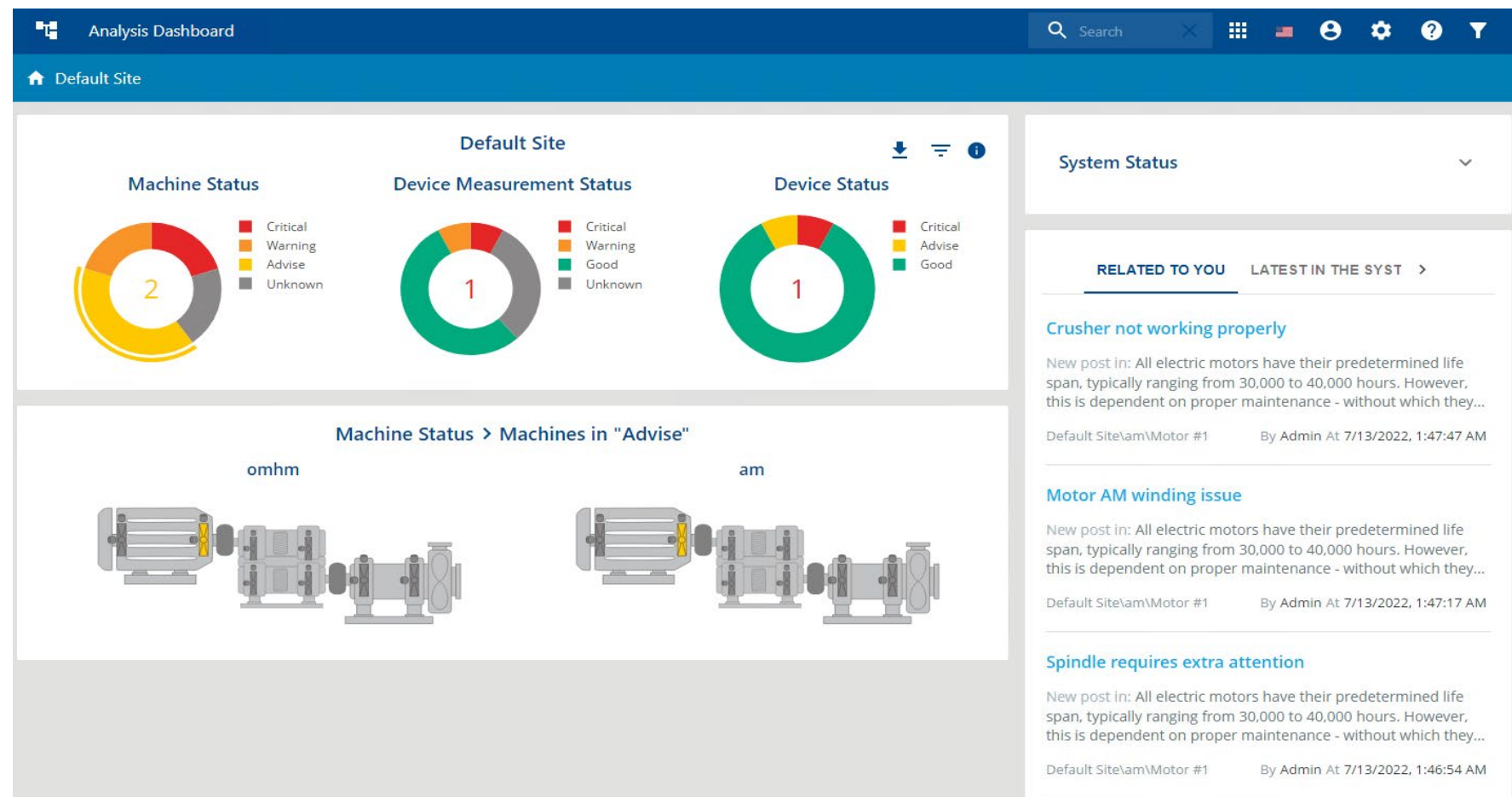
Greater Machinery Health Awareness



- Analysis Dashboard allows users to easily identify what's important
- Interactive anomaly documentation
- AMS Optics integration

AMS Machine Works – Analysis Dashboard

- Quick glance at machine, device, and system health
- Persona specific view
- View of Machine Journal activity and events
- Launch in context to items of importance (middle section is context sensitive to selected KPI)
- Filter by area or asset type
- Thin client, web based
- View on your phone or tablet (while connected via Wi-Fi or VPN)



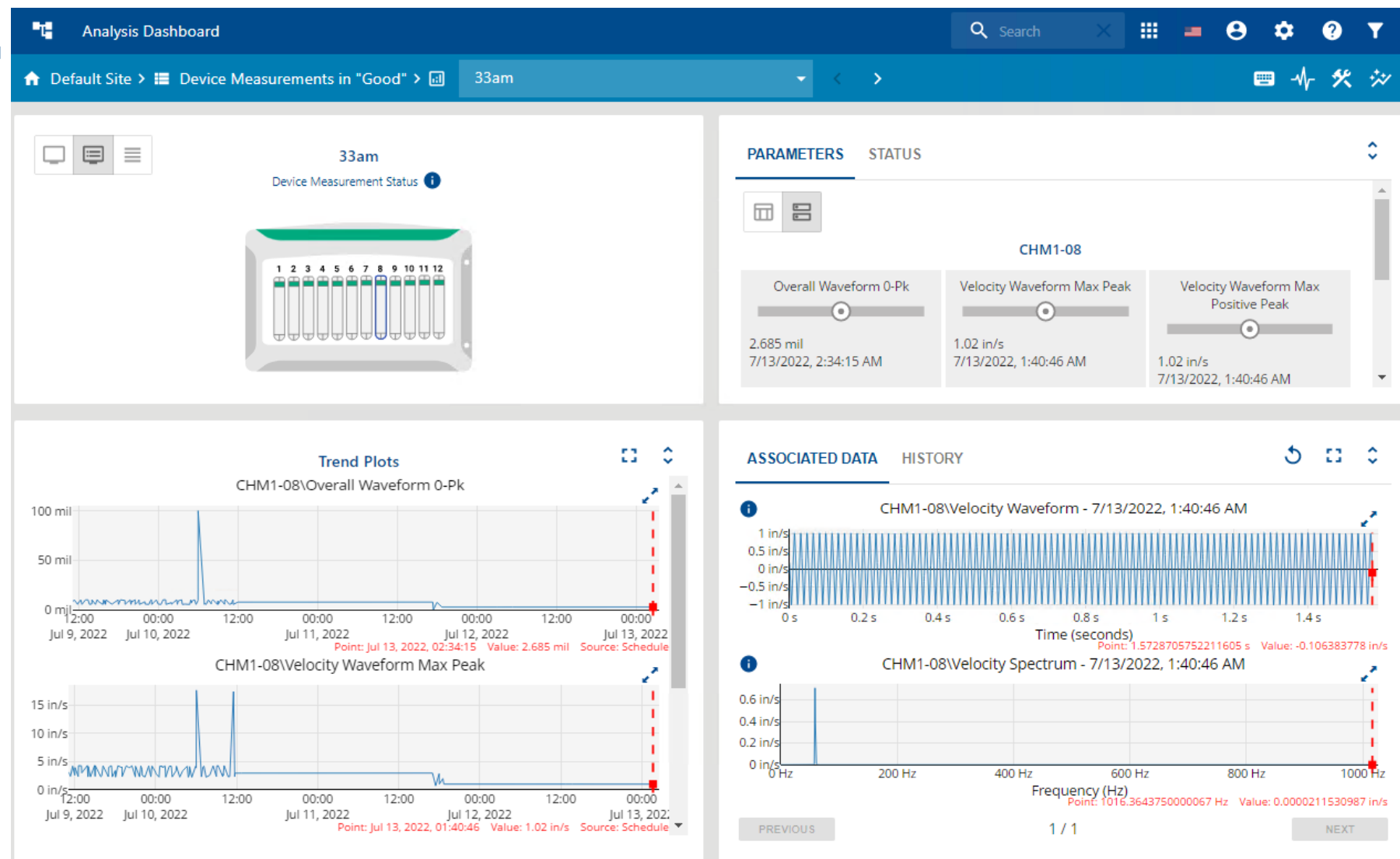
AMS Machine Works – Machine Details

- With a single click you can view your machine information on a single screen
 - Machine status with colored bearings and sensors
 - Trend plots
 - Associated waveform and spectrum
 - Latest values
 - Events
 - Journal
 - Configuration
- Responsive design automatically scales for viewing on tablet or phone



AMS Machine Works – Device Details

- With a single click you can view your device information on a single screen
 - Device status with colored inputs
 - Trend plots
 - Associated waveform and spectrum
 - Latest values
 - Configuration
- Responsive design automatically scales for viewing on tablet or phone



AMS Asset Monitor



Hardware

- 12 Channel DeltaV CHARM technology
 - AI, DI, DO, TC, RTD
 - Vibration CHARMS with PeakVue™
- Hazardous Area Rated
 - CSA Cl. I, Div. 2 / ATEX/IECEX Zone 2
- 7.3 kg (16.3 lb.)
- 238 mm (9.4") x 384 (15.1) x 196 (7.7)

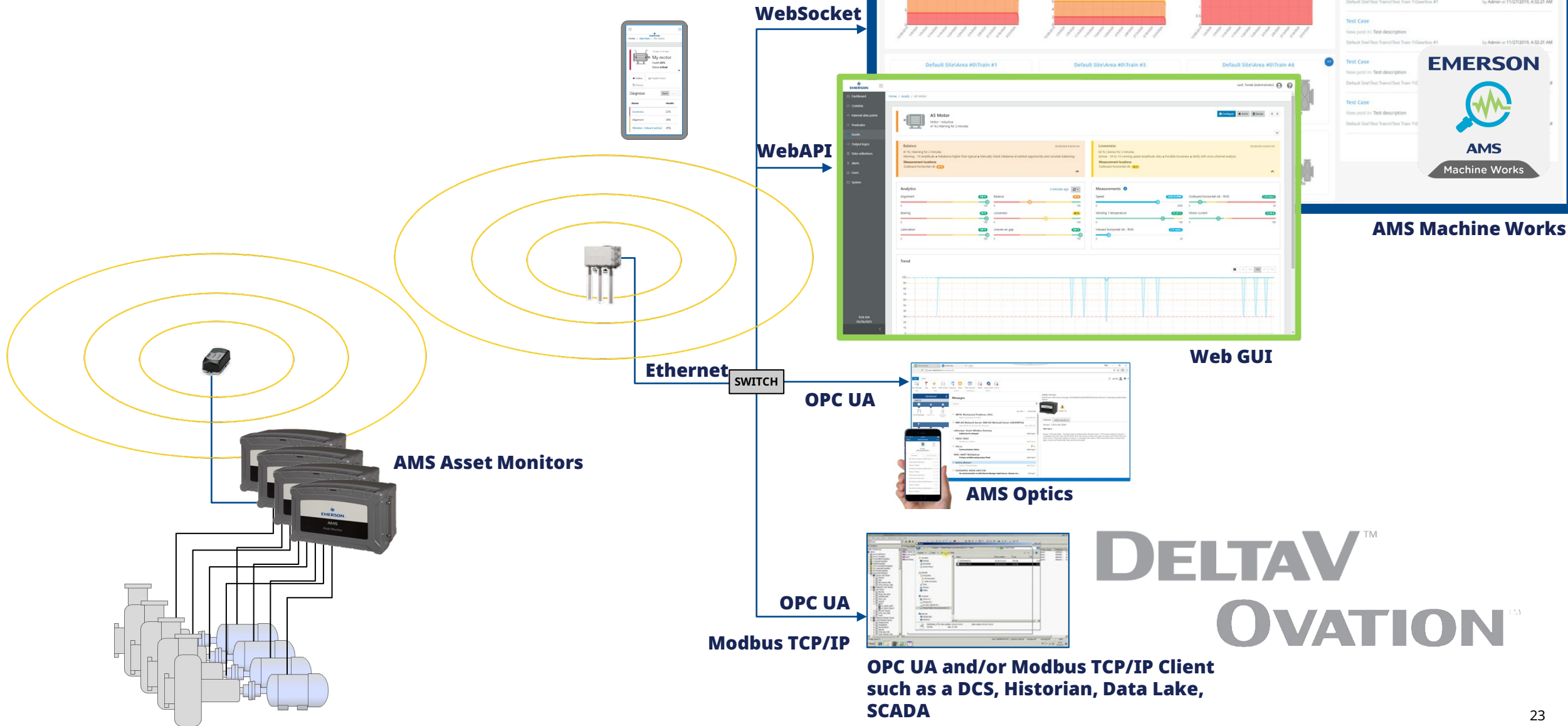
Software and Analytics

- Web interface (configuration & GUI)
- Embedded Edge Prescriptive Analytics (automated detection of typical issues at all popular rotating asset types)
- OPC UA & Modbus TCP (R/W)
- Current Waveform and Spectrum
- MTP Export for easy DCS integration

Optional Interfaces

- AMS Machine Works interface
 - Common dashboard providing fleet-view of multiple assets
 - Long term trends
 - Waveform and Spectrum analysis tools
 - Store on Alert, Store on Demand
 - Machine Journal history log
- AMS Optics interface

AMS Asset Monitor Connectivity



Critical Few Equipment: Wireless Data Collection AMS Wireless Vibration Monitor

- **Triaxial Accelerometer with Temperature**
- **High Frequency Impact Detection – PeakVue**
- **MEMS elements**
 - Z-axis is an **enhanced MEMS** with a 20 KHz frequency range
- **User configurable Fmax, Filters, Interval Bands**
- **More data available – up to 13 key parameters and then some...**
- **Prescriptive Analytics**
- **CI I, Div 1 and CI 2, Div 1 / IP66 / NEMA 4X Enclosure**
- **Easy installation**
 - Mounting
 - Axis alignment
- **Battery Life – 3 – 5 years**
 - Easy battery replacement
 - Battery replacement in Hazardous Area
- **Distance – 100m (~300 ft line of sight)**
 - Mesh networking enhances this parameter



AMS Wireless (WIHART) Vibration Monitor

13 Trend Values

Shaft Condition

Impacting

Lower Frequency

Faults

Higher Frequency

Faults

Prescriptive

Diagnostics

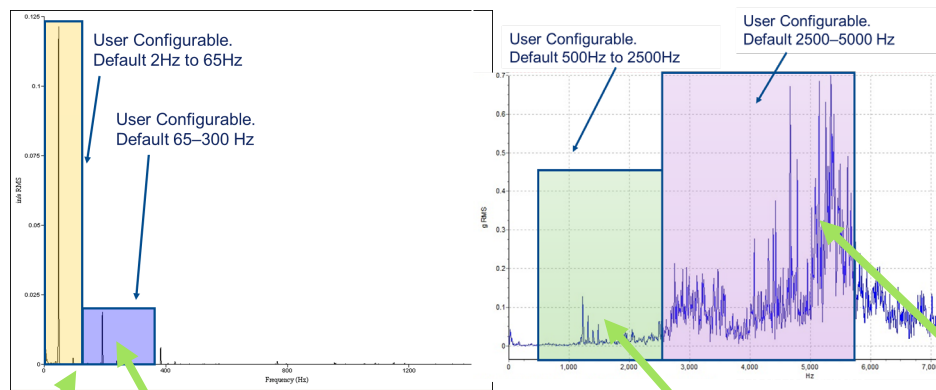
RPM

Friction

Battery Life

- ✓ X-axis Overall Velocity
- ✓ Y-axis Overall Velocity
- ✓ Z-axis Overall Velocity
- ✓ Z-axis PeakVue Acceleration
- ✓ Velocity Parameter 1
- ✓ Velocity Parameter 2
- ✓ Acceleration Parameter 1
- ✓ Acceleration Parameter 2
- ✓ Bearing/Mechanical Severity
- ✓ Lubrication Severity
- ✓ Calculated Speed
- ✓ Skin Temperature
- ✓ Supply Voltage

4 user configurable Analysis Parameters: 2 Velocity and 2 Acceleration



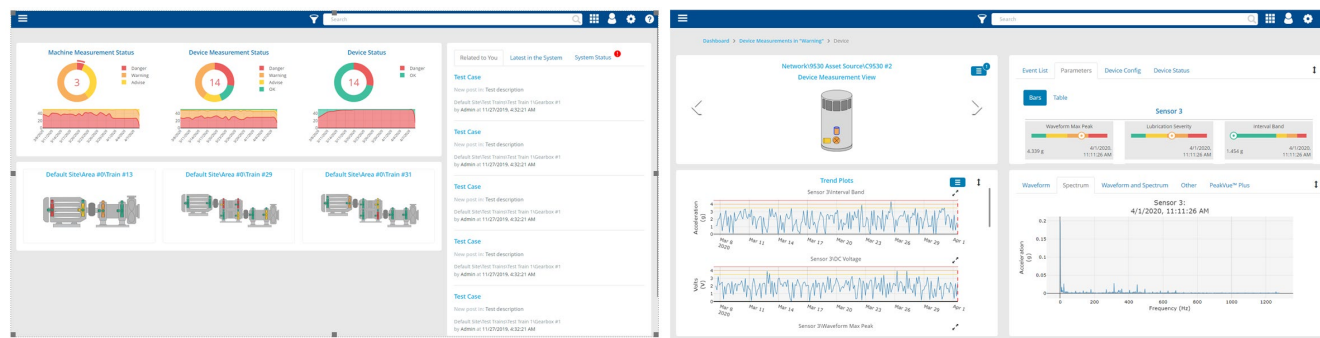
Imbalance

Misalignment, Looseness,
Blade Pass, Vane Pass

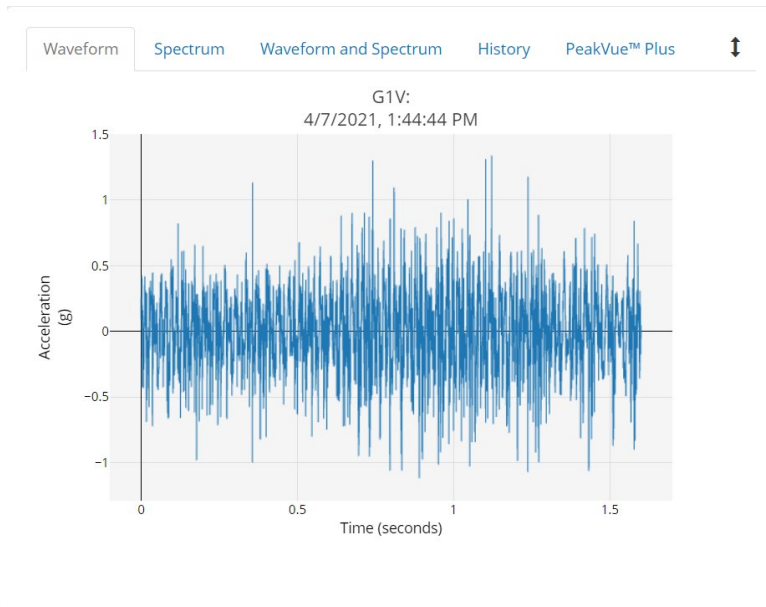
Rolling Element
Bearing Defects



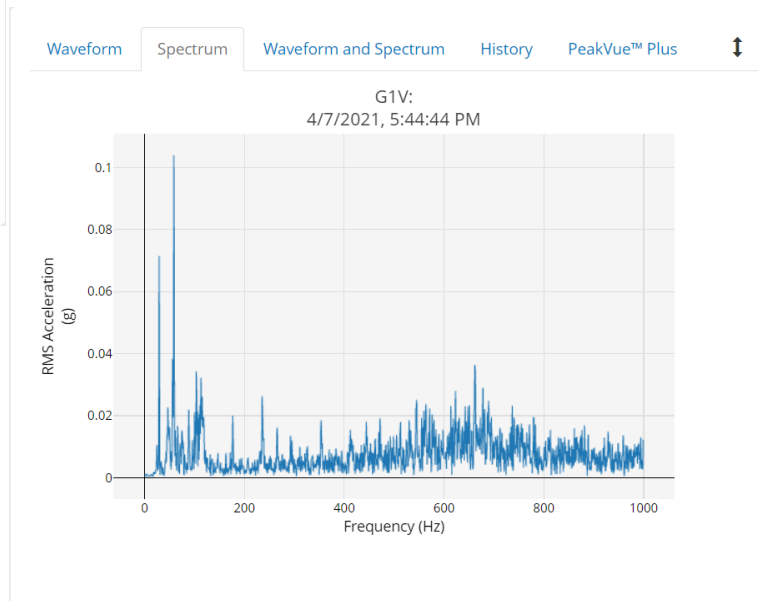
Lubrication,
Cavitation



Wireless Data Collection – Available Data



Waveform and Spectral Data



Spectrum and Waveform Data

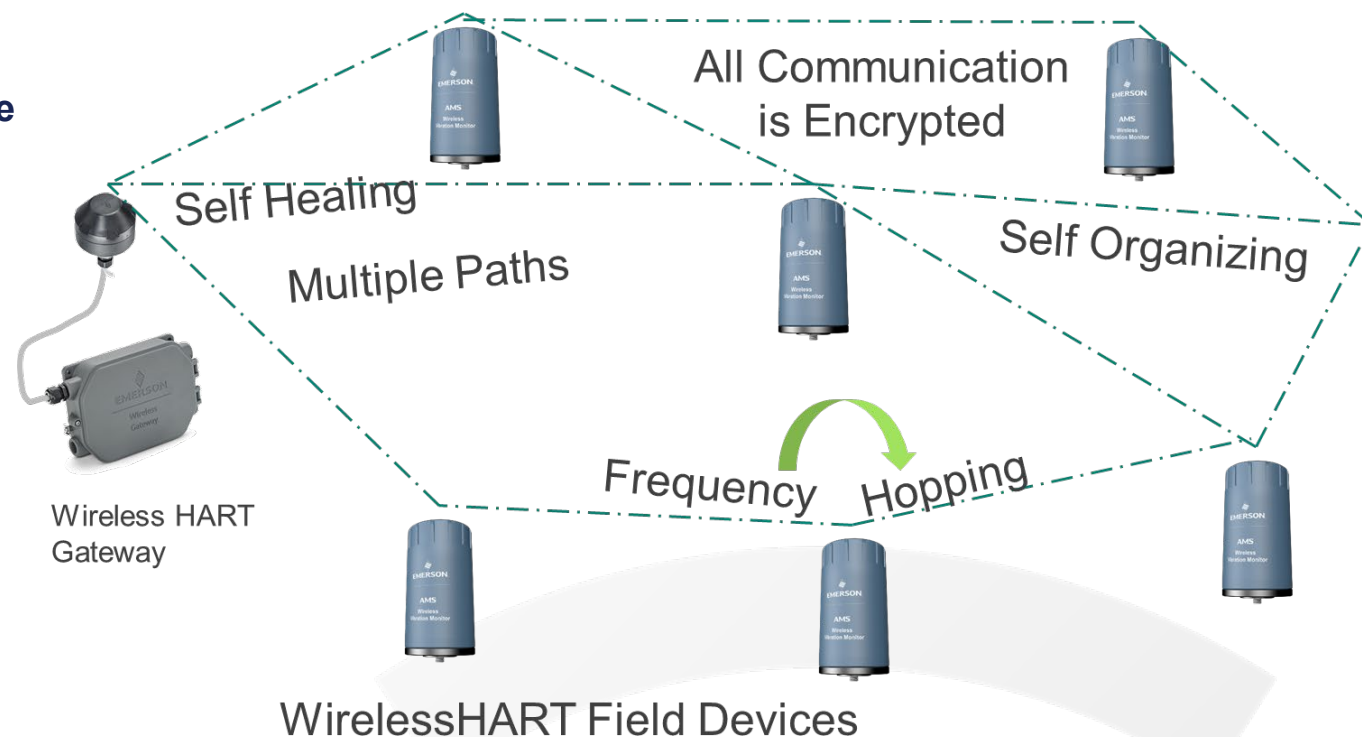
- X-axis Spectrum and Waveform
- Y-axis Spectrum and Waveform
- Z-axis Spectrum and Waveform
- PeakVue Spectrum and Waveform

Other Data

- Additional scalar values calculated from waveform data
- Alert bits available for external systems
- Network performance data available for each wireless device

Software Connectivity

- **WirelessHART (IEC 62591 Open Standard)** is based on the industry standard HART Protocol, with devices available since 2008
- Protocol is designed for industrial use
- **Interoperable** between device and control system manufacturers
- **Low Power** to enable battery power-based instruments (typically 5 to 10 years, dependent on update time)
- **Fault Tolerant** to ensure maximum connectivity in changing plant conditions
- **Cyber-Secure** with end-to-end encryption, channel-hopping, single use keys, and other security features built in and non-configurable
- **Unlicensed Spectrum (2.5GHz)** to ensure global consistency and simplify implementation
- Managed by the independent FieldComm Group

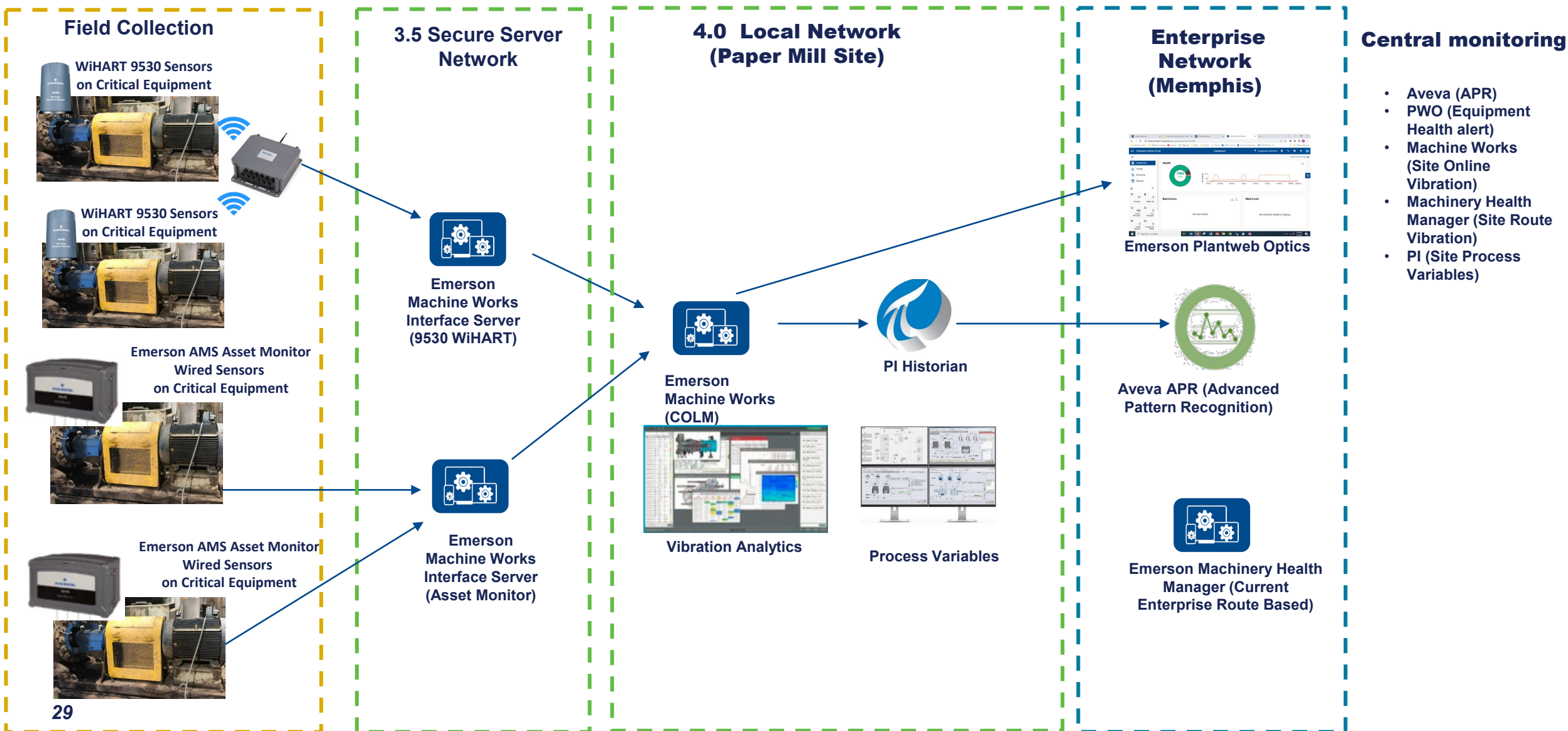


Where did we start? Wave 1 Mills

- Vicksburg, MS (PM)
- Pensacola, FL (PM)
- Columbus, Mississippi (CF)
- Port Wentworth, GA (CF)

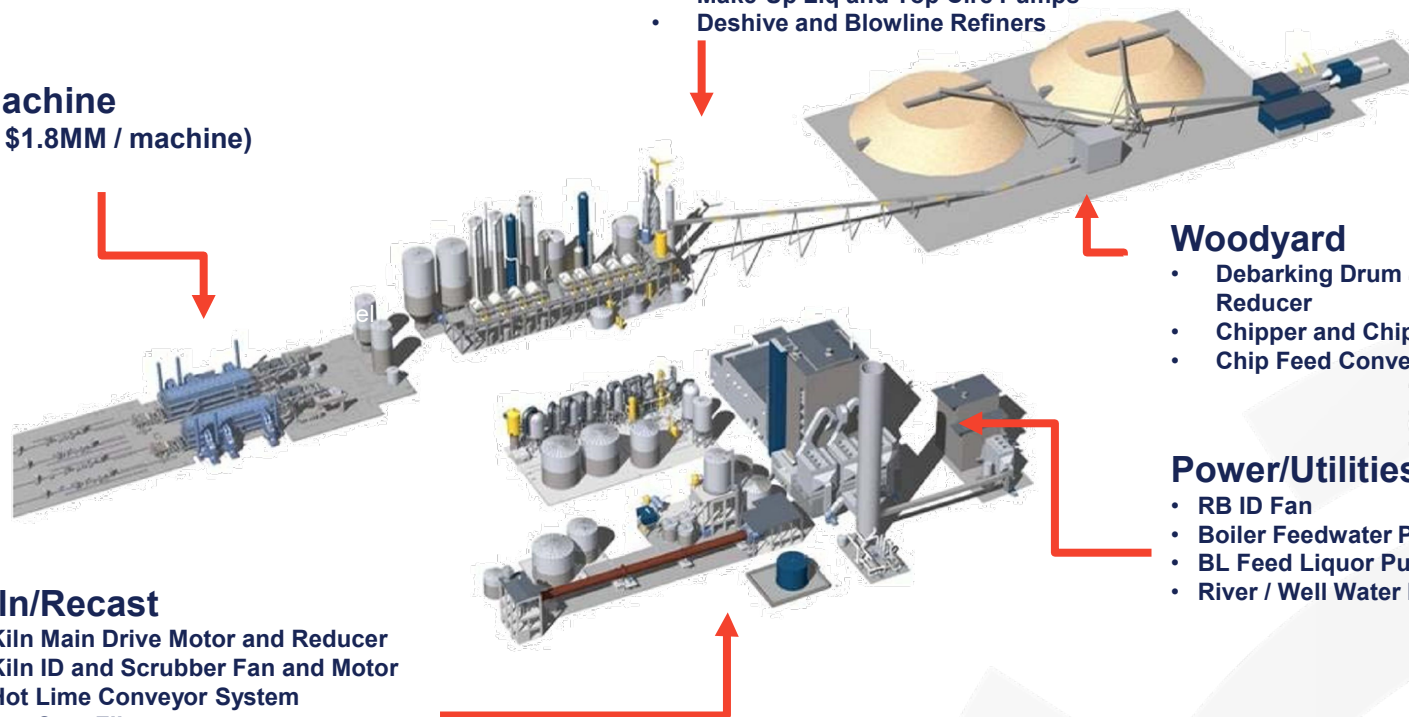


Mill of Future COLM (Continuous Online Monitoring) and Equipment Health



Critical Equipment Replication

Paper Machine (Basic Est \$1.8MM / machine)



Pulp Mill (Fiberline)

- Continuous Digester HP and LP Feeders
- Digester Outlet Device Motor and Reducer
- Digester Top Separator
- IV Top Separator and Outlet Device
- Diffuser Scraper Drive
- Make-Up Liq and Top Circ Pumps
- Deshire and Blowline Refiners

Woodyard

- Debarking Drum Drive Motor and Reducer
- Chipper and Chipper Motor
- Chip Feed Conveyor Motor/Drives

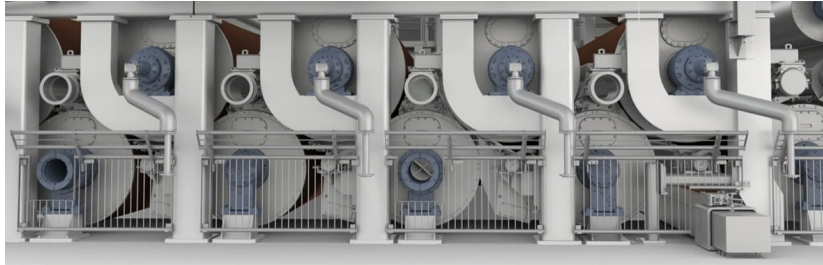
Power/Utilities

- RB ID Fan
- Boiler Feedwater Pumps
- BL Feed Liquor Pumps
- River / Well Water Pumps

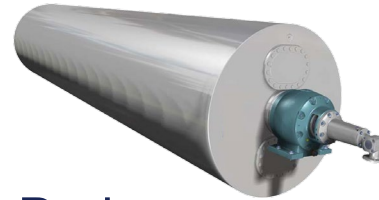
Kiln/Recast

- Kiln Main Drive Motor and Reducer
- Kiln ID and Scrubber Fan and Motor
- Hot Lime Conveyor System
- Pre-Coat Filter
- Lime Feed Screw
- Precipitator Dust Conveyor
- GL, WL and Lime Mud Clarifier Rake/Agitator

Drying Section



Dryer Can & Felt Rolls



Drying
Cylinders



Drivers



Yankee Roll

Emerson Solutions

Key Differentiators:

- ✓ PeakVue & PeakVue Plus
- ✓ Adaptive Monitoring
- ✓ Embedded Analytics provides condition report
- ✓ Order Tracking
- ✓ Remote connection
- ✓ Slow Speed monitoring

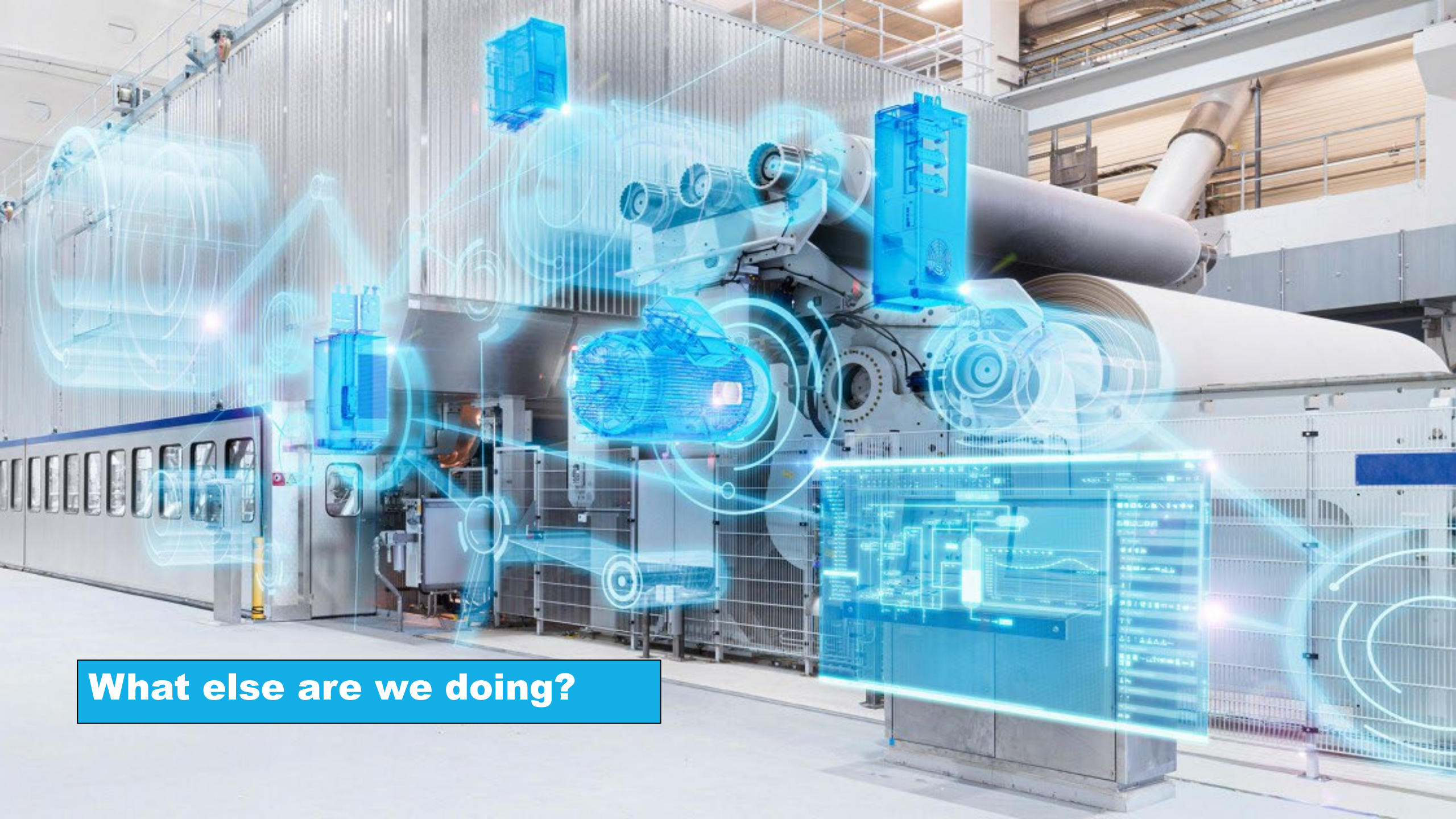


AMS Asset Monitor



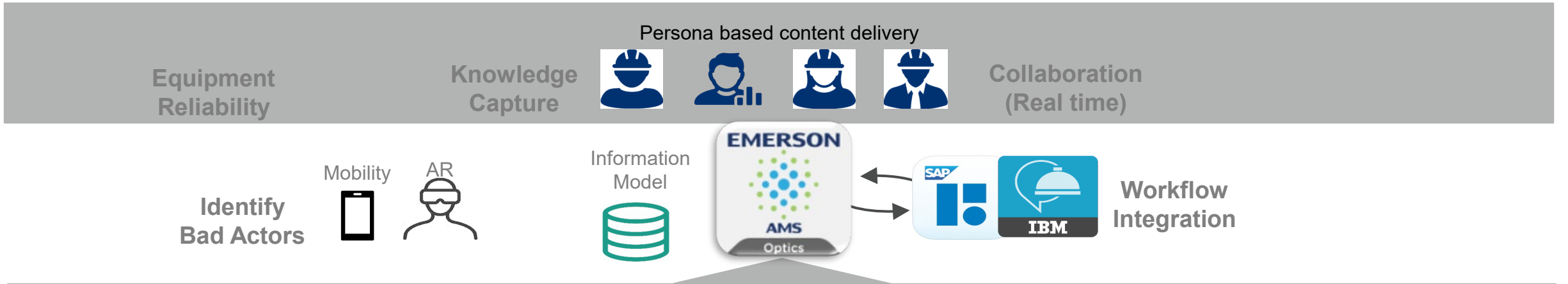
AMS Asset Monitors & Wireless Vibration Monitors





What else are we doing?

AMS Optics – Holistic Enterprise-wide Asset Management



Instruments and Valves

AMS Device Manager

Control Loops

DeltaV

Complex or Widely Distributed Assets

EMERSON PLANTWEB optics Analytics

EMERSON PLANTWEB insight

Rotating Equipment

Machinery Management Software

OT Connectors

MongoDB

OPC UA

OPC

MQTT

Modbus

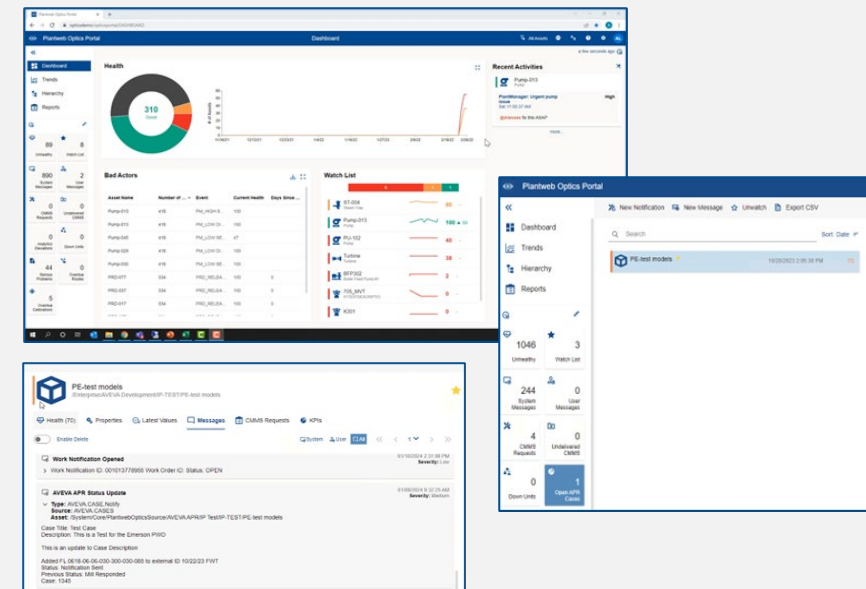
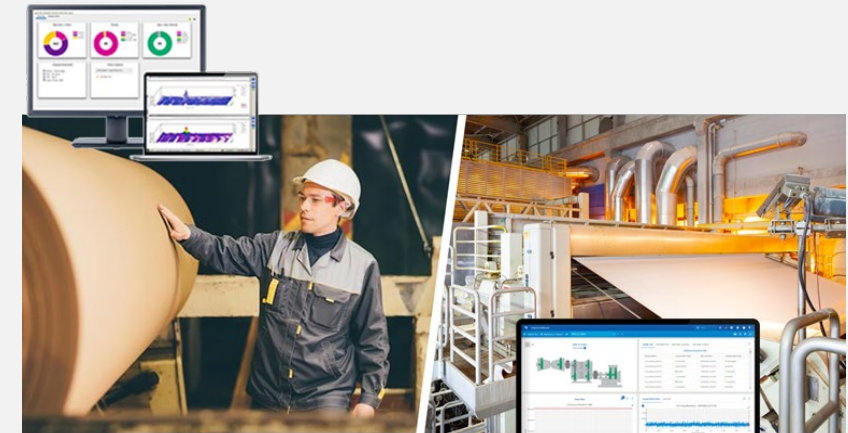
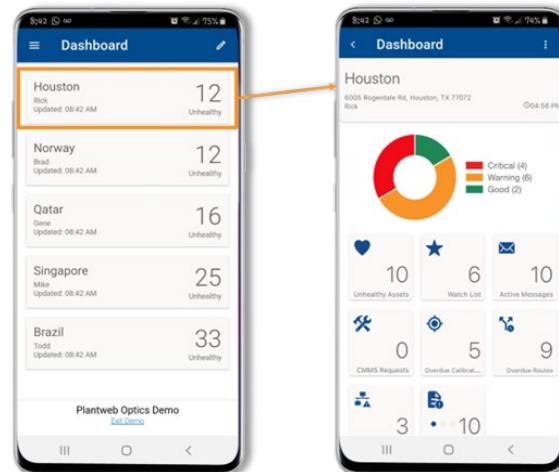
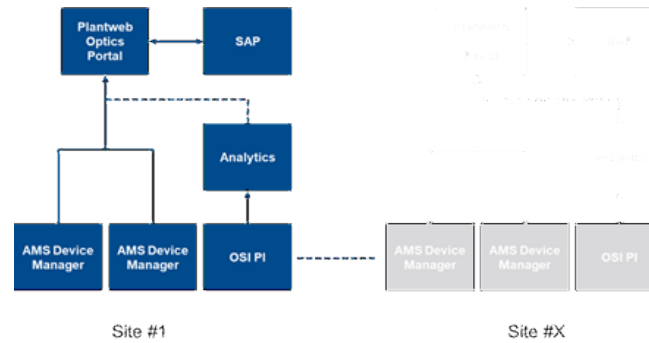
Optics Platform

Deployment:

- 4 mill locations
- 4 AMS Device Manager systems
- 1 Corporate WAN Machinery Manager
- 4 Machine Works

Value Drivers:

- Enterprise oversight of machinery health
 - Visibility of intelligent device alerts and recommended actions (not trapped in the field)
 - Easily drive corrective action through generation of SAP notifications
 - Modern tools for next generation mobile worker
 - Workflow Management with Mobile Portal
- ## Third-party system interfaces:
- Integration with enterprise analytic system to feed predicted alerts into SAP



Partnership Insights and Learnings

EMERSON'S PERSPECTIVE ON IP PARTNERSHIP: SUCCESSFUL PROGRAMS REQUIRE SUCCESSFUL PARTNERSHIPS BUILT ON TRUST

Alignment

- Objectives
 - Each other and our internal Teams; all Stakeholders
- Timelines
 - Realistic Fulfillment
- Outcomes
 - What defines Success
- Reinforcement
 - Regular Cadence Calls/Meetings

Transparency

- Proactive Communication
 - Cadence Call Forums
 - Minimal surprises
 - Time to adjust
 - Documentation



Continuous Improvement

- Progress Reviews
 - Debriefs & Actions
 - Before & After Snapshots
 - Resources & Processes
 - Flexibility & Creativity
 - Success Recognition

Our Partnership is Committed to Continuous Improvement

FEED (Front-End Engineering & Design)

- Include FEED for each site
- Detailed scope, which is reviewed with all relevant stake-holders
- Build reasonable risk into scope any unexpected

Supply Chain Mitigation

- Order early, include spares & track lead time proactively; both Emerson content and Buy-outs (e.g. Sensors and installation items/tools)

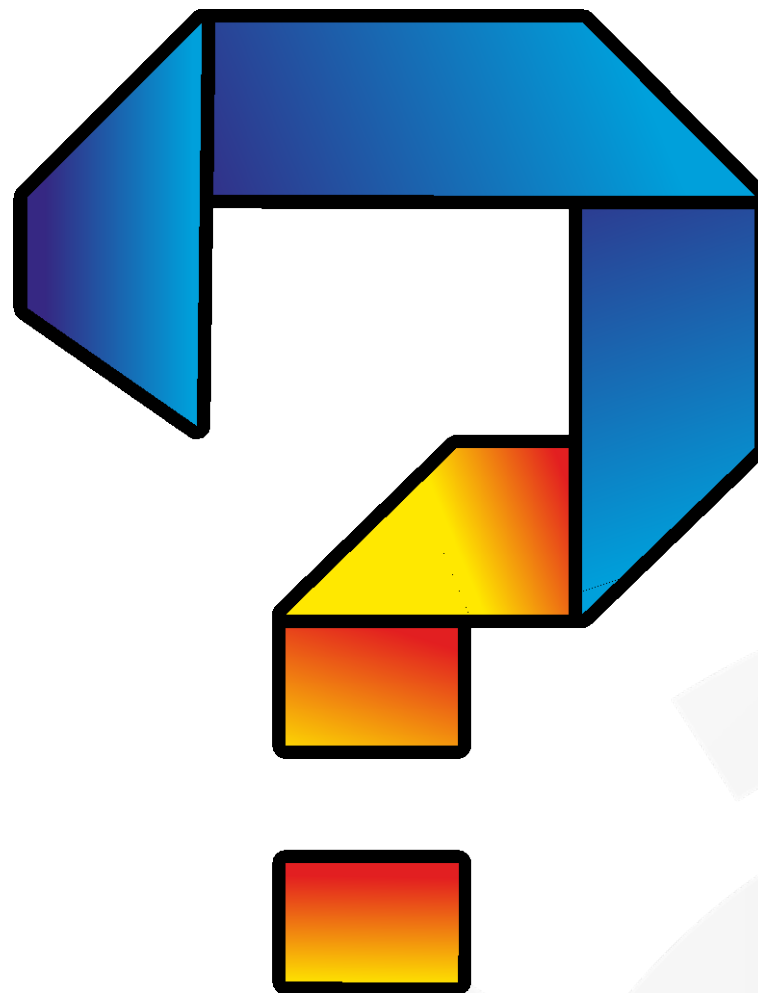
Alignment & Communication

- Review existing process
 - Emerson, Sub-Contractors, RE Mason/PPM, Other Emerson Impact Partners, IP Project Team, IP Mill Team
- Resource Needs & Readiness
 - Emerson has invested in additional resources to support program; new hires & transfers

Evergreen Lessons Learned

- Adopt/Formalize a separate monthly cadence call to document and discuss areas for improvement
- Mill Readiness; Installation & Deployment

Questions?





EMERSON EXCHANGE 2025

ACCELERATING
INNOVATION

Thank You