



## Online Vibration Monitoring















# Online Vibration Monitoring

- **Brandon DeVier**
  - **My Background**
    - 1992 B.S. Physics
    - 3 years with Predict Technologies
    - 13 years with DLI Engineering
  - **Online Vibration Monitoring Systems Experience**
    - Online Systems Product Manager
    - 3 years planning, installing, start-up and monitoring
  - **Field Experience**
    - Pulp and Paper – CHILE
    - Food Manufacturer – AUS
    - Gasoline Pumping Station - MEX
    - Oil Refinery – HUN
    - Wind Farms – GB, CAN, & IA
    - Distribution Center – CA & WI
    - Paper Products – GA & KY
    - Aluminum Manufacturer – KY
    - Power Plant (Coal Unloader) – MD
    - 2 Oil Rigs – (10 Pumps ea.) – GULF - *Ongoing*

# Online Vibration Monitoring

- Lessons Learned
  - An Online Vibration Monitoring System is not a part number in a catalog.
  - It is an Engineering Project and should be treated accordingly.
  - Re-training the sales force
  - Client misconceptions
    - Online System capabilities
    - Too few accelerometers
    - No Tachometer
    - Scheduling / Planning
    - Assigning Responsibilities

# Online Vibration Monitoring

Plan		Identify Goals & Plan the System
		Procure the System
Install		Install Sensors and Run Cabling
		Configure Network for Main Hardware Components (IT Support Required)
		Install and Test Main Hardware Components
		Install Software and Database
Test and Configure		Setup and Configure Machines in Database
		Verify Sensor Signals
		Verify Online System Functionality
Start System		Start Online System
		Configure and Enable PC Client Interfaces
		Monitor Online Machine Data

# Online Vibration Monitoring

- Identify Goals
  - Type of online monitor?
    - Protection
    - Surveillance
    - Both
  - Why Monitor?
    - Critical equipment
    - Short interval - time to failure
    - Machine accessibility
  - Understand the application
    - Focus on the machines and the best way to monitor them, reconciled with the capabilities of the system.

# Online Vibration Monitoring

- **Identify Goals**

- Consider how the machines fail, what types of faults can be found using vibration analysis, what is the best way to test the machine, where are the best places to locate sensors, and what are the conditions under which the machine can be tested.

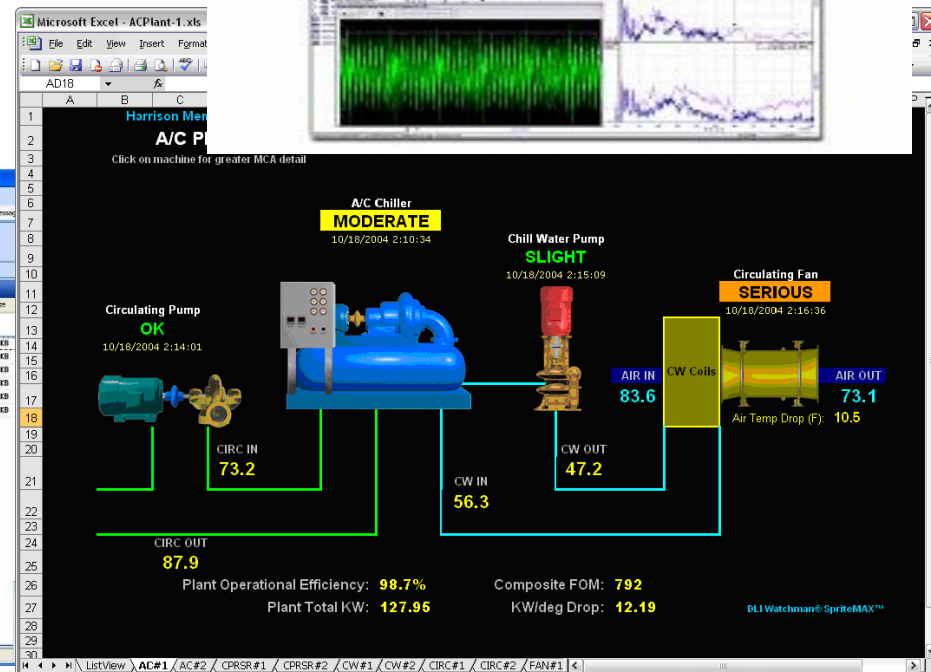
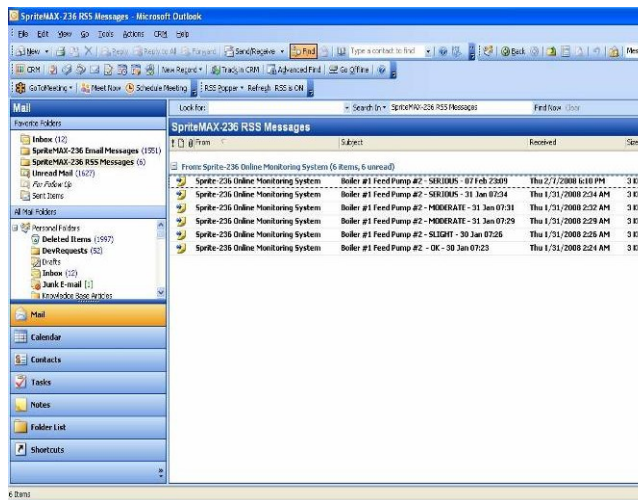
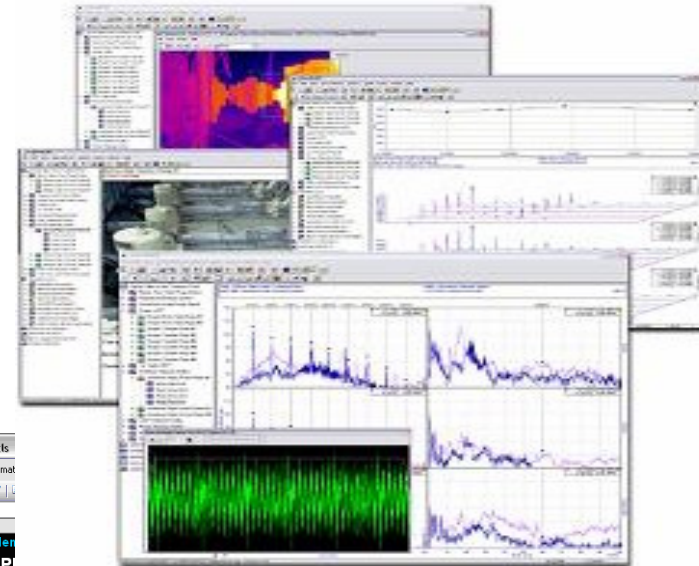
# Online Vibration Monitoring

- **Identify Goals**

1. What machines will be monitored?
2. What identified machine faults can be detected and what results can be expected?
3. How will the system determine the “Running” state of the machine?
4. How often will machines be tested (criticality)?
5. What types of measurements will be collected?
6. What process variables will be monitored? (Will these be accessed from software or hardware?)
7. What types of sensors are required?
8. How many sensors will be required and where will they be mounted?
9. How will automated diagnostics function with these machines?
10. Collect all relative machinery component information

# Online Vibration Monitoring

- Identify Goals
  - Other inputs / outputs
    - DCS
    - OPC / DDE
    - PI
    - Web
    - Email
    - XML





# Online Vibration Monitoring

- Research Vendors
  - System Capabilities
    - Wireless or cabled
    - Power requirements
    - Safety requirements (IP Rating)
    - Intrinsic Safety
    - Environmental
    - Ask for References
    - View a Live Demonstration
    - Price and Warranty
    - Integration capabilities

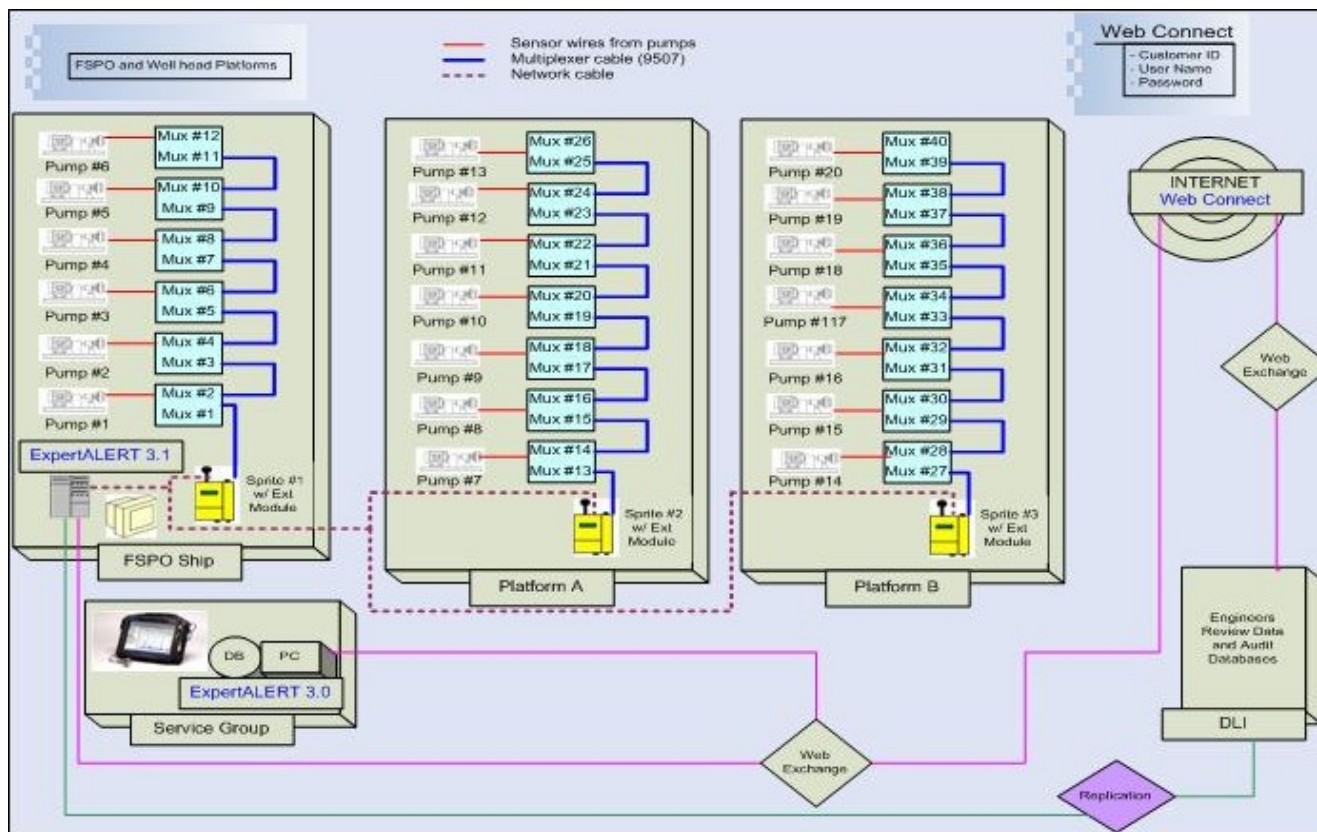
# Online Vibration Monitoring

- **Plan the System**

1. Understand the capabilities and limits of the system (cable length limitations, environmental limits etc)
2. Explore plant and machine layout and distances
3. Diagram system layout (sensors, junction boxes, hardware and Monitor locations)
4. Determine what enclosures may be necessary
5. Understand environmental issues and electrical installation regulations. (Intrinsically Safe areas, special conduit, etc.)
6. Determine computer network access points
7. Plan for expansion

# Online Vibration Monitoring

- Plan the system
  - System Layout



# Online Vibration Monitoring

- Plan the System
  - Hardware Requirements
  - Inputs / Outputs
  - Software Requirements
    - Integration with existing systems
  - Network Requirements
    - IS/IT involvement
  - Responsibilities
    - Who will install system?
    - Who will configure system?
    - Who will monitor the system?

# Online Vibration Monitoring

- Plan the system
  - IT/IS configuration
    - Internal access, external access, FTP, Web, VPN
  - In-house personnel vs. contractors vs. vendor
    - Sensors, cables, and hardware components
      - Installed during outage
    - Network, Software, Configuration
      - Installed while machines / plant is operational
  - Assign responsibilities
    - Electrical contractors
    - Mechanical contractors
    - IT / IS personnel
    - Vibration Specialists

# Online Vibration Monitoring

- **Plan the system**


1. What are the roles of the individuals who will interact with the system?
2. What is your network infrastructure?
3. What network security issues exist?
4. Do people outside of the plant network need to access the system?
5. What happens if the system finds a machine fault? (Who will be notified and how?)
6. Will the monitoring system be integrated with other systems?
7. Who will manage the system?
8. Who will be responsible for analyzing data or signing off on reports?
9. Create a diagram of the software layout
10. Determine who will install and configure system software components and output adaptors

# Online Vibration Monitoring

- Plan the system
  - Schedule Tasks

ID	Task Name	Jun 2006				Jul 2006				Aug 2006			
		5/28	6/4	6/11	6/18	6/25	7/2	7/9	7/16	7/23	7/30	8/6	8/13
1	Sales Visit	█											
2	Electrical, IT Department	█	█										
3	Layout Diagram, Budgetary Quote	█	█										
4	Engineering Site Survey			█	█								
5	Invoice for Site Survey				█								
6	Develop Project Proposal				█	█							
7	Purchase System (Hardware & Software)					█	█						
8	Order Confirmation, Planning					█	█						
9	Pre-commissioning Visit						█	█					
10	Prepare for Install, Load Software						█						
11	Install Hardware, Configure LAN						█	█	█				
12	Run cables, Remote Access to Sprite							█	█	█			
13	Configure Muxes, Shake out sensors							█	█	█			
14	System Integrity Verification							█	█				
15	Offsite Setup, Support Install							█	█				
16	Create EA, Configuration							█	█				
17	Commission System Visit								█	█			
18	Hardware checks, Software setup								█				
19	Baseline Selection, "Is Running"									█			
20	Visit to Train EA & Online									█	█		
21	Engineering F/U Visit										█	█	
22	Mature Baselines, Fine-tune Program										█		
23	Project Complete – Warranty & Support											█	█
24	Remote Services, Offsite DB Review											█	█

# Online Vibration Monitoring

-  Procure the system
  - Purchase spares – 10%
  - Extend the Warranty
  - Verify quantities
  - Verify components function properly



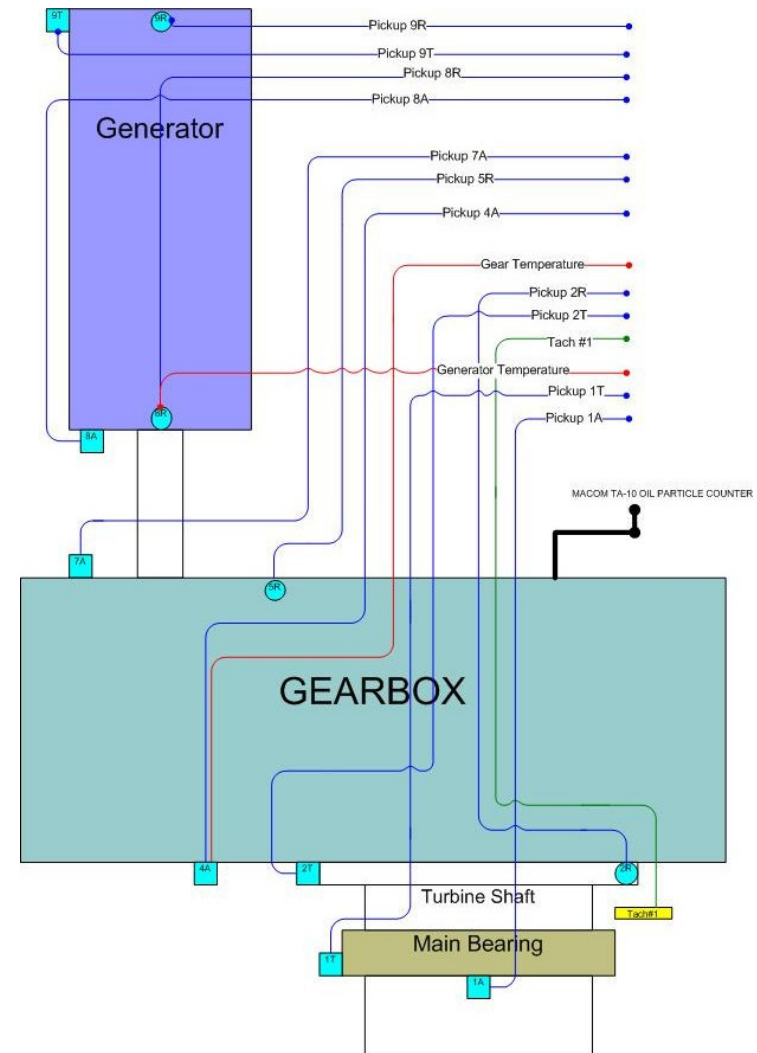
# Online Vibration Monitoring



## Installation

### – Sensors and Cable

- Choose efficient (short) cable runs
- Tachometer for variable speed machinery
- Process parameters



# Online Vibration Monitoring

- Installation
  - Main Components
    - Proximity to machine
    - Accessibility – Security
    - Configure for network access
  - System and Software Installation
  - Start the System

# Online Vibration Monitoring

- Installation
  - System Integrity Verification
    - Sensor checks
    - Hardware configuration checks
    - Wiring checks
    - Data flow checks
    - Data integrity checks
    - Database configuration checks (in terms of defining sensors correctly in the database)
    - Ethernet / Internet communication integrity
    - Proper “Is Running“ condition setting verification

# Online Vibration Monitoring

- **Installation**
  - **System Integration**
    - Configure System Software and applications
    - Verify communication and data-flow with other systems
  - **Establish Baselines**
    - Review the vibration data and results
  - **Fine-tune the system**
    - Baseline Data
    - “Running” condition parameters
    - Alarm levels
    - Data acquisition parameters

# Online Vibration Monitoring

- **Monitoring the Online System Results**
  - Who will monitor?
    - Maintenance Staff
    - Engineering Staff
    - Operators
    - Management
    - Remote monitoring service
  - How often?
    - Continuous, Daily, Weekly, etc.
  - Reports
    - What kind of report(s)?
    - Who gets them?

# Online Vibration Monitoring

- **System Maintenance and Ongoing Support**
  - Refresher training
  - Technical support
  - Data review
  - Database audit services
  - Remote monitoring services
  - Failed sensors and cables
  - Software / hardware upgrades
  - Spare parts
  - Re-configure the system when machines are overhauled or replaced by other models.

# Online Vibration Monitoring

- **Avoid Pitfalls and Delays**
  - Too few sensors for accurate diagnostics
    - A tachometer signal is especially important for variable speed machinery
  - IT / IS involvement (network configuration)
  - Validate Signals
    - Sensors, cables, non-functioning hardware.
    - Garbage In → Garbage Out
  - Poor planning / scheduling
  - Lack of proper training
  - Expectation of capabilities
  - Monitor the Online System Results

# Online Vibration Monitoring

- Keys to Success
  - Set Goals
  - Proper Planning
  - Scheduling
  - Assign Responsibilities
  - Monitor the Results



# Online Vibration Monitoring

- Questions?

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