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Powering the future

**Vibration & Condition Monitoring**

*A Flexible, Cost-Effective Alternate to Online  
Condition Monitoring*

January 2010



- **Permanent Installed Vibration Systems**
- **Portable Devices**
- **Applications**

## Why do we need Vibration Analysis



- **Vibration Analysis will not prevent mechanical devices from failing**
- **Minimize secondary more costly damage**
- **Minimize lost production by forecasting the failure to low wind seasons**

# Permanent Installation of Vibration Analysis System



## Benefits

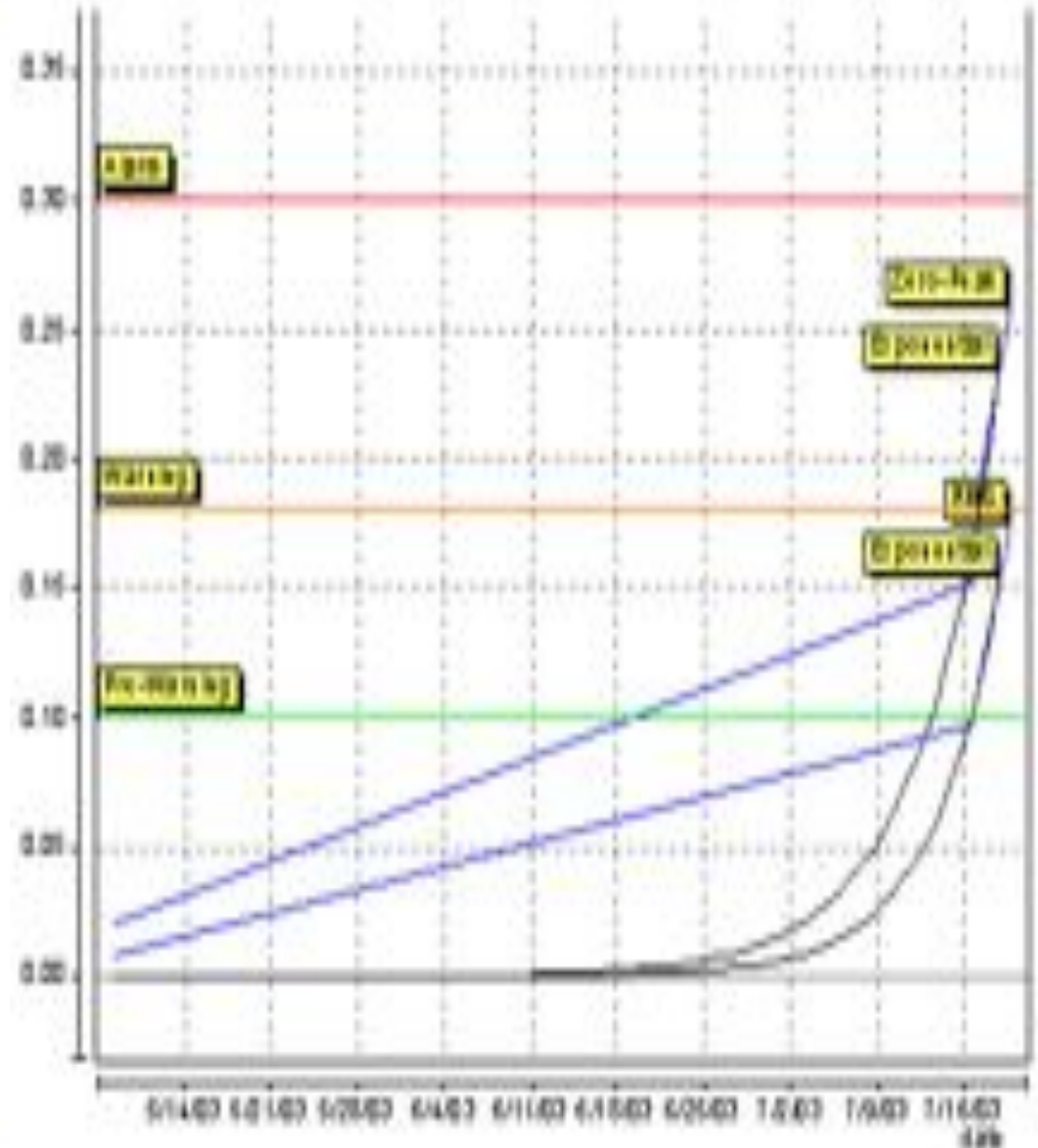
- Detailed real time analysis of drive train components
- Long term trending of individual turbines
- FFT for each Turbine
- Early detection of failures
- Supports Predictive Maintenance programs

## Challenges

- Initial large cost investment – \$8-14K per turbine
- Large data storage servers and communication network
- Manufacture specific software
- Detailed understanding of information
- Turbine specific setup

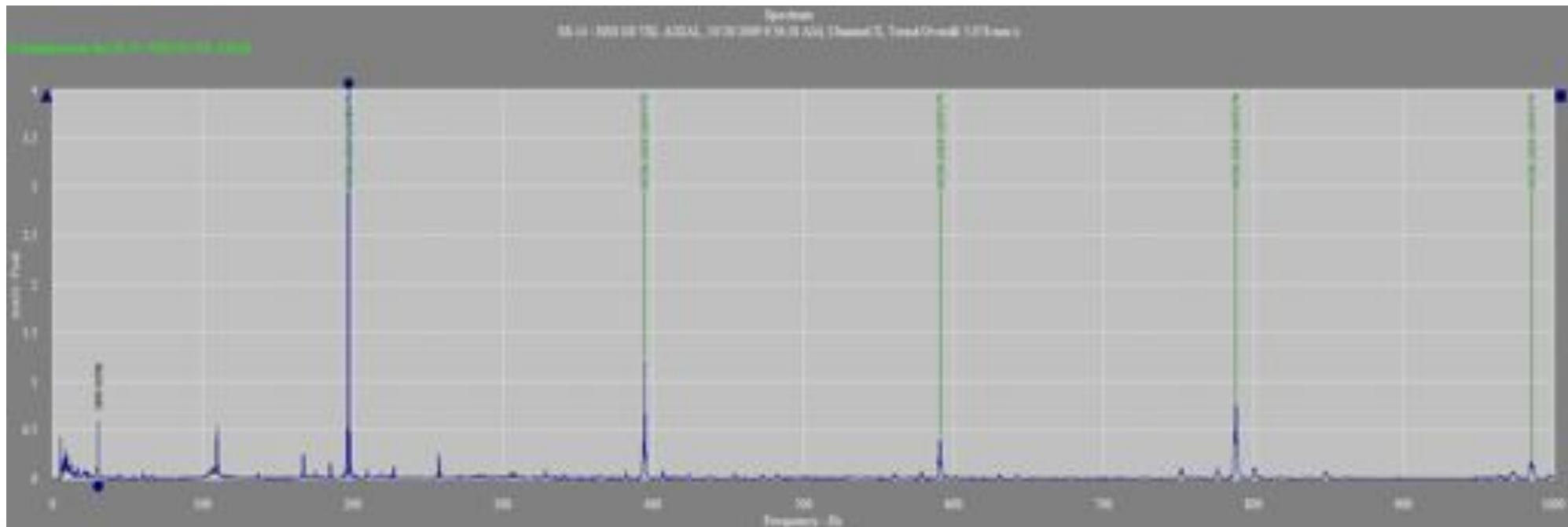
# Overall Vibration

1. Primarily utilized by Individual controller software systems
2. Establish a baseline with many data points over a long period of time.
3. Good for Pass / Fail limits
4. Does not account for variables (wind, loading, power, tower sway, etc.)
5. Cannot distinguish between sources of vibration.
6. If overall vibration is high then requires full system diagnostics including FFT, borescope, etc.



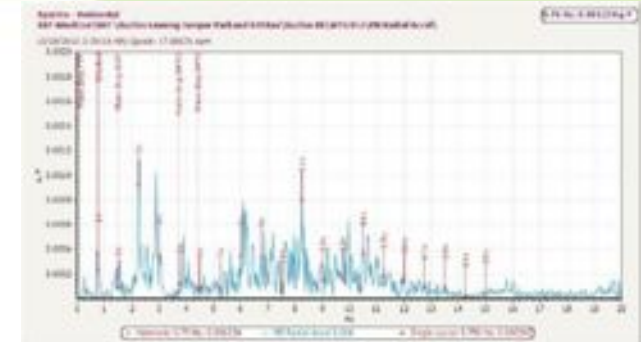
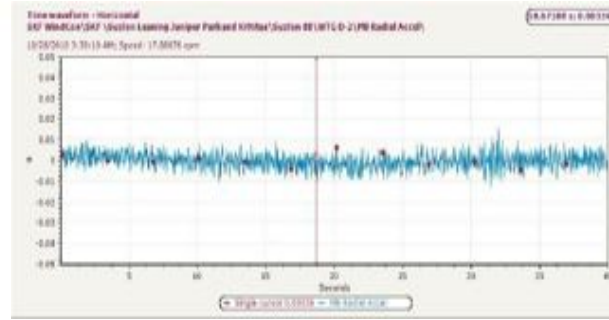
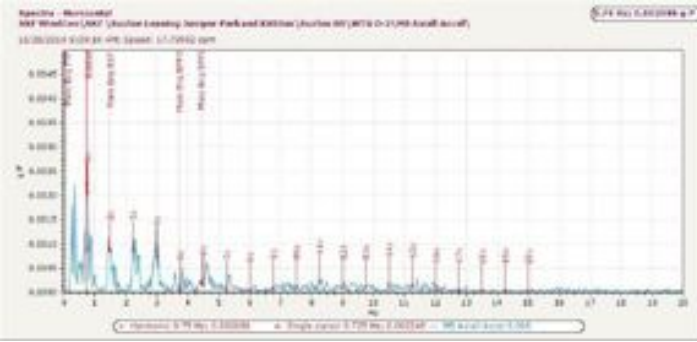
## Detailed FFT-Frequency Spectrum

1. Provides detailed FFT for each frequency (Hz) and amplitude (mm/s or m/s/s).
2. Can distinguish between most all known sources of vibration (bearing components, exact gear mesh, alignment, etc.)
3. Excellent for detailed analysis of bearing, gears, etc to predict/forecast component failures.

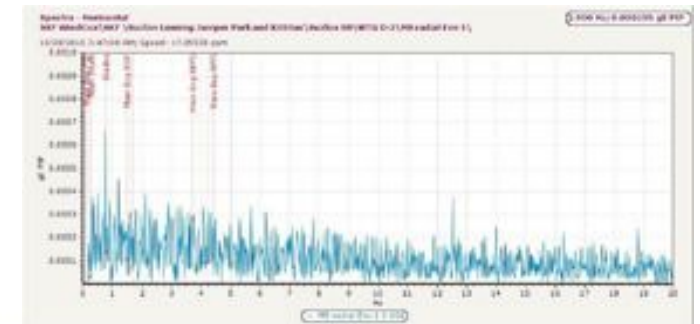
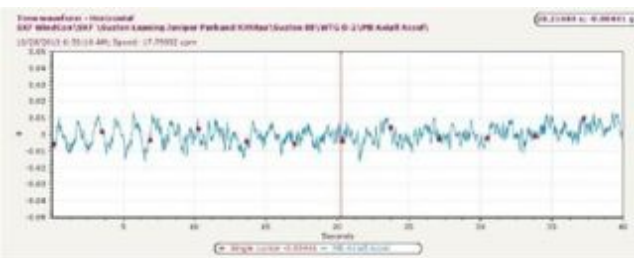




# Information Overload



- Turbines average between 8-14 Sensors
- Up to 3 different data points for each sensor
- → 40+ data points per turbine to manage
- Data Overload → Not utilized correctly
- Harm versus Benefit risk



## Hand Held Vibration Units

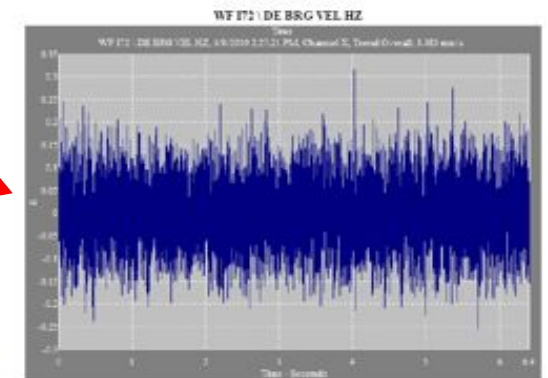
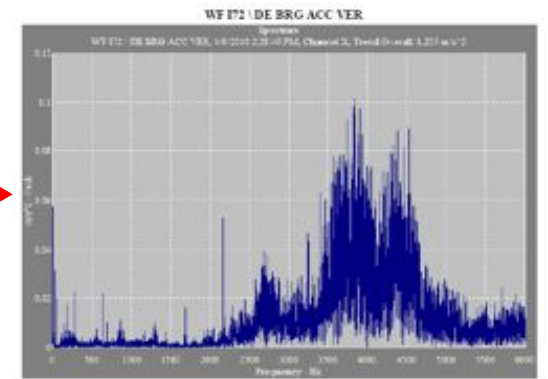
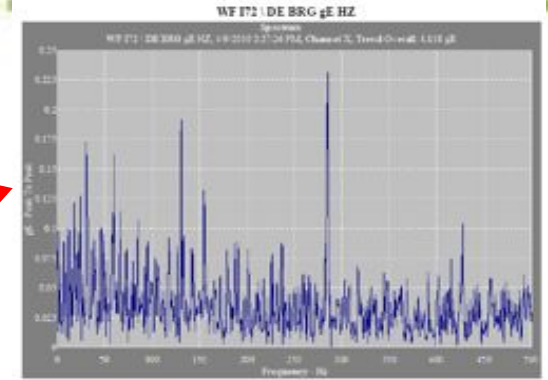
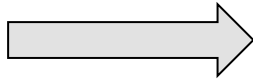
- **Benefits**
  - Portable
  - Multiple users per license
  - FFT and Overall for each Turbine
  - One time setup for each configuration
  - Smaller initial investment – \$18K per Unit
  - Decrease response time for decisions
- **Challenges**
  - Manufacture specific software
  - Detailed understanding of information
  - Manual Data Management



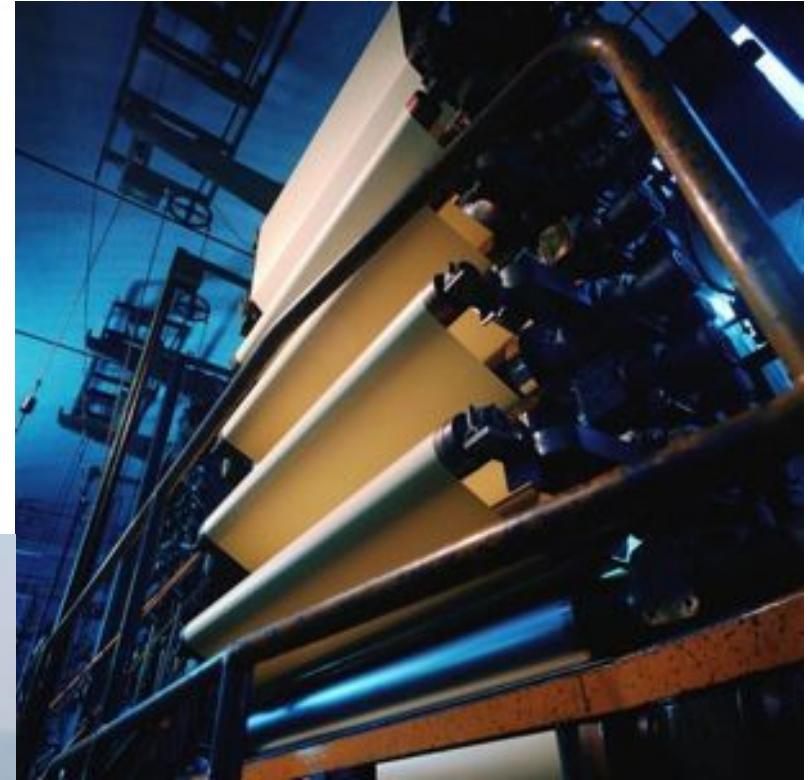


# Focused Vibration Analysis

Teamed with SKF



# Industry Standard Application



## End of Warranty Inspections

- **Easy to calibrate to individual designs**
- **Ease of training on how to operate**
- **Limit necessary Licenses**
- **Data Collection is focused as a snapshot**
- **Can be applied to all components in a Turbine**
  - **Drive Train**
  - **Eigen value**
  - **Motors, Pumps Fans**



## Scheduled Maintenance Integration

- **Commissioning to Operation turnover**
- **Add to established Maintenance Programs**
- **Pair with Laser Alignment tools**
- **Baseline comparison is turbine specific**
- **Key up proactive replacement of equipment**
- **Shift from proactive to predictive maintenance intervals**





# Application of Portable Devices

## Learning

- **Develop vibration expertise**
- **Establish baseline information on each turbine**
- **Build cost benefit analysis for return on investment**
- **Multiple configuration learning – Drive train components**

## Troubleshooting

- **Temperature of fault initiation**
- **Uncover**
- **Ascertain if support from manufacture is needed – Gearbox**



# Which do you Choose?

**Fully  
Installed**

**Portable  
Device**



**THANK YOU**

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