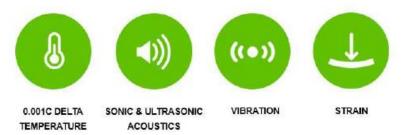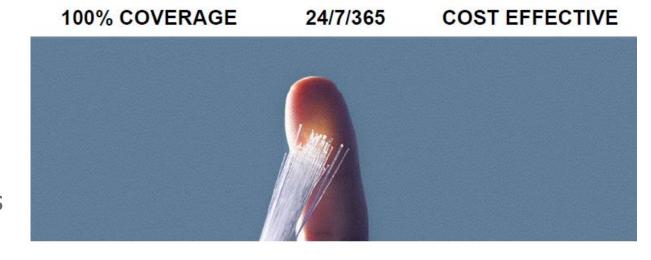# Hifi Competencies to support technology development

- Proven solution used in Pipeline & Slope Monitoring

- Monitors **thermal**, **acoustic**, and kinetic energy (**strain** and **vibration**) to alarm on multiple types of events, including:
  - Abnormal temperatures
  - Pipeline strain and movement
  - Hillside erosion and other geotechnical event detection including active or residual earthquakes
  - Security Intrusions detected via acoustics
  - Leaks

CONTINUOUS - EVERY CENTIMETER is sensitive with high DYNAMIC RANGE
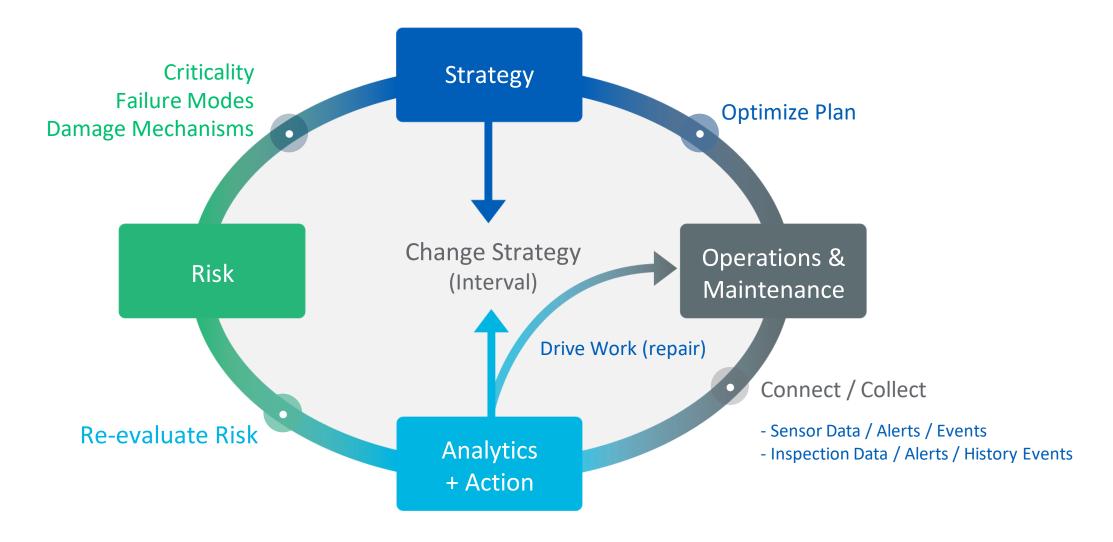
0.001C DELTA TEMPERATURE

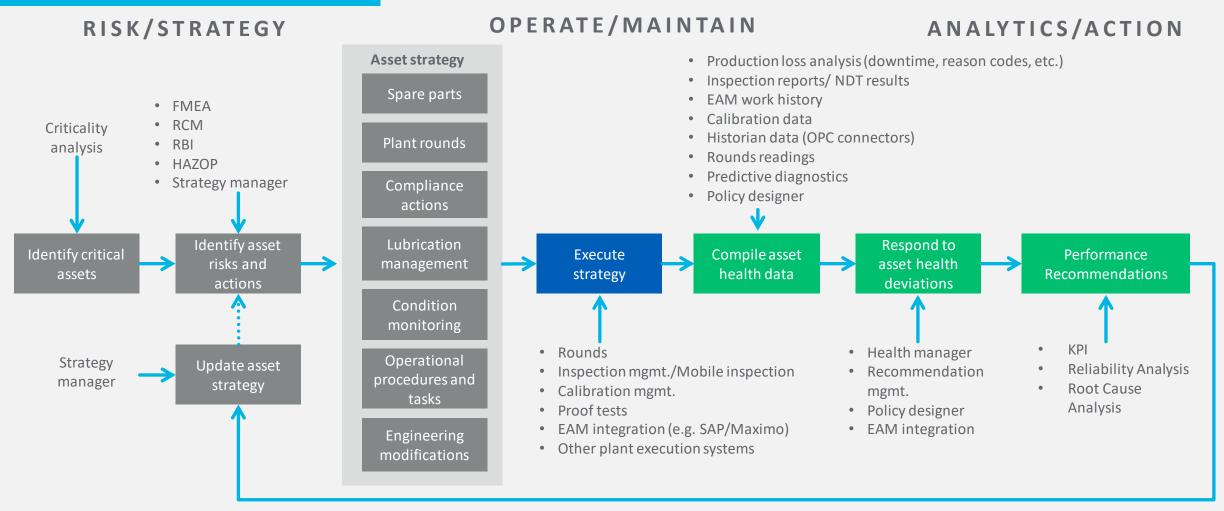SONIC & ULTRASONIC ACOUSTICS

VIBRATION

STRAIN

100% COVERAGE   24/7/365   COST EFFECTIVE

Wabtec CORPORATION

Asset Performance Management

Enabling a continuous improvement work process

APM Work Process

RISK/STRATEGY   **OPERATE/MAINTAIN**   **ANALYTICS/ACTION**

Criticality analysis

- FMEA
- RCM
- RBI
- HAZOP
- Strategy manager

Strategy manager

Asset strategy

- Spare parts
- Plant rounds
- Compliance actions
- Lubrication management
- Condition monitoring
- Operational procedures and tasks
- Engineering modifications

- Production loss analysis (downtime, reason codes, etc.)
- Inspection reports/ NDT results
- EAM work history
- Calibration data
- Historian data (OPC connectors)
- Rounds readings
- Predictive diagnostics
- Policy designer

Identify critical assets → **Identify asset risks and actions** →

Update asset strategy

Execute strategy → **Compile asset health data** → **Respond to asset health deviations** → **Performance Recommendations**

- Rounds
- Inspection mgmt./Mobile inspection
- Calibration mgmt.
- Proof tests
- EAM integration (e.g. SAP/Maximo)
- Other plant execution systems

- Health manager
- Recommendation mgmt.
- Policy designer
- EAM integration

- KPI
- Reliability Analysis
- Root Cause Analysis

Toward Operational Excellence

Summarized

- Matured Integrated edge to cloud maintenance and operational applications

- Single Pane of Glass
  - Analytical insights driven by integrated information
  - Value driver tree visualization

- Curation and deployment of analytics

- Alerts Framework, Case Management and Knowledge Base

- Full Digitally Enabled Monitoring Services

Conveyor Belt
Solution Map

Idler temperature and vibration profile monitoring
Fiber Optic Sensing measuring temperature and vibration of idlers along the length of the belt

- Real time visibility on idler health
- Alarm location along length of belt
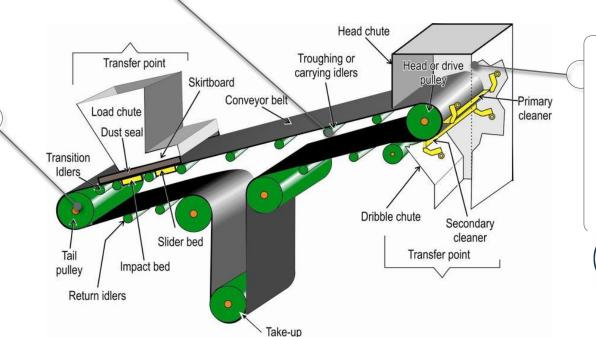- Reduce engineering cost in troubleshooting
- Prevent unplanned downtime

Belt Integrity and Operation
Real time belt integrity/rip monitoring and belt alignment detection. PSA and volumetric measurement.

- **Reduce damage on belt**
- **Reduction in safety risks**
- **Proactively detect potential belt failures**

Stone 3 Digital

Predictive Analytics
Pre-emptive detection of eminent failures on the drive and gearbox using digital twins

- **Reduce unplanned downtime**
- **Remote monitoring augmenting engineering team**

GE Digital APM

Asset Centric Application
Unified analytics and visibility of operational performance and how the conveyor system relates to the up- & downstream operation with Value Stream Mapping, KPI Driver Trees and Bottleneck Identification

- **Continuous improvement on production capability**
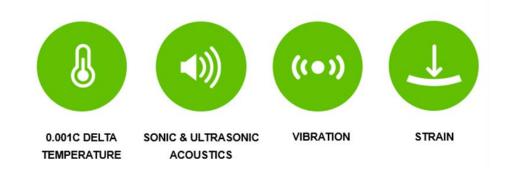- **Operational performance improvement**

Wabtec CORPORATION

Wabtec CORPORATION **Digital Mine**

BEST IN CLASS SENSING FOR ASSETS

CONTINUOUS - EVERY CENTIMETER is sensitive with high **DYNAMIC RANGE**

Multiple Measurements = High Confidence

LEAK!   LEAK!   NO LEAK

0.001C DELTA TEMPERATURE

SONIC & ULTRASONIC ACOUSTICS

VIBRATION

STRAIN

100% COVERAGE   **24/7/365**   **COST EFFECTIVE**

| 1 EVENT OCCURS | 2 FIBRE RELAY SIGNAL | 3 HDS™ SYSTEM PROCESSES SIGNAL | 4 RAW DATA ANALYZED | 5 HDS RUNS ALGORITHMS | 6 FILES STORED IN PREDIX CLOUD | 7 REAL-TIME DATA IN OPERATOR CONTROL ROOM |

hifi FIBRE

hifi HDS™ SYSTEM