Optimizing Predictive Maintenance at Barrick Gold

Integrating Asset Data and Process Data

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Agenda

1. Introduction to Barrick Gold
2. Push for Digital Transformation
3. Petasense Asset Reliability & Optimization
4. Pilot at Cortez Process
5. The Path Forward
Barrick Gold

One of the world’s largest gold producers

- HQ in Toronto, ON, Canada.
- Global company with a focus on the Americas
- 75%+ of our gold production comes from the Americas region
- Additional mining operations and projects in Australia, Chile, Papua New Guinea, Saudi Arabia, and Zambia
- 64.4 million ounces – Barrick gold reserves

Barrick Nevada Cortez Operations

- 100 kilometers southwest of Elko, NV
- Cortez Mining District mining since 1862
- Proven and probable gold reserves at 10.0 million ounces

Digital transformation journey

Barrick Gold, like many world-class companies today, has embarked on a digital transformation journey

- Harness the transformational potential of digital innovation across the whole enterprise
- Strategic intent to transform Barrick into a Digital Enterprise

“A productive, safe, environmentally friendly, socially responsible, low cost digital enterprise that leverages technology and data as a competitive advantage.”
Barrick is a big user of OSIsoft PI

- Using PI across the enterprise for nearly 10 years; have an Enterprise Agreement

- Primarily used for
  - Analytics & visualization
  - Process modeling
  - Planning
  - Process monitoring

- Over 250K tags
... but limited use for predictive maintenance
## Predictive Maintenance until now

### Limitation

- Infrequent data collection
  - Data collected every 4-5 weeks
- Only taken in horizontal direction
- Time-consuming data collection
  - 350 points = 2-3 hours each day
- Tedious analysis process
  - 3-4 hours for each hour of sampling

### Consequence

- Increased failure risk (asset condition may change between data collection)
- Misses important signals in vertical and axial directions
- Increased failure risk (asset condition may change between data collection)
- Results in infrequent and rushed analysis

### All resulting in big risks

1. Increased risk of unplanned downtime
2. Increased cost of repairs
3. Unnecessary preventive maintenance
Our goal is to modernize our predictive maintenance practice

We identified

Petasense
4 disruptive technologies are paving the way for a digital future

- Pervasive Wireless
- Inexpensive Sensing
- High-performance Cloud Computing
- Data Science & Machine Learning
Petasense plug-n-play tech brings it together

Asset Reliability & Optimization for the Digital Plant
Petasense Asset Reliability & Optimization System

1. Wireless Sensors
   - Vibration Mote: Vibration + Temp Sensor for Rotating Machines
   - Transmitter: Multi-sensor Input Module for Any Industrial Asset

2. ARO Cloud
   - Machine Learning Analytics
   - Deep Asset Knowledge Database
   - Enterprise-grade Security

3. Web & Mobile Apps
   - Intuitive Dashboards and Charts
   - Advanced Vibration Analysis Tools
   - Real-time Event Notifications
Integration with OSIsoft PI

ARO CLOUD

- Petasense IoT Database
- Petasense PI Interface

BARRICK PI SERVERS

- Scheduler
- PI Vision
- Petasense UFL Client
- Asset Framework
- UFL Connector (REST server mode)
- PI Data Archive (Tags, PI points, Time series data)

API Request
API Response
Machine Learning based Asset Health Score

- Enables reliability teams to identify defects in real-time
- Sophisticated algorithms + deep asset knowledge of rotating machines
  - 40 features from each measurement
  - Velocity, Accel, Triaxial data, RMS, P2P, Crest factor, Amplitudes of Spectrum Harmonics, etc
Petasense Trial at Barrick Cortez

Elko, NV
Pilot Scope

25 Vibration Motes & 20 Transmitters
- Wireless data collection every 3 hours (instead of every month)

Monitoring 10 Machines
- Tails Pumps, Barren Pumps, Mercury Scrubber Fan, Cyclone Feed Pump, Electrowinning Fan, Agitator, Ball & Sag Mill

PI Integration
IIOT vibration sensors in action
Quick deployment, quick results

- Purchase Order: Feb 15th
- Network Setup: Apr 5th
- Motes installed: SYSTEM LIVE
- 1st Defect Caught: June 11th (36 days after deployment)
  - Mercury Scrubber
  - Loose frame bolts
First Defect Caught
Mercury Scrubber Fan - Loose Frame Bolts

Avg Vib Trend - June 8 to 14

Defect Identified

Loose Bolts Repaired

Frame Crack Repaired
First Defect Caught
Mercury Scrubber Fan - Loose Frame Bolts

Vibration Spectrum - June 11
(Before Repairs)
1X Amplitude at 1.2 in/s

Vibration Spectrum - June 13
(After Repairs)
1X Amplitude at 0.15 in/s
Second Defect Caught
Barren Pump - Elevated Vane Pass

Spectrum Chart - June 11

Inspected Pump and was found to be cavitating
Integrated Petasense Vibration Tags with Pi

Types of tags integrated

- RMS Acceleration in all axes
- RMS Velocity in all axes
- Surface temperature
- Machine Learning based Asset Health Score
Asset and process data together tell a better story
Benefits gained by using Petasense

1. Reduced manual rounds & associated costs
2. Reduced unplanned downtime = Increased production
3. Reduced repair costs due to early detection
4. Ability to integrate with PI
5. Upgrade from Rockwell eMonitor to modern IIoT & Cloud based technology
Path Forward
Implement across Barrick Nevada and beyond

1. Implement Petasense System across Cortez Process
   - 100 Machines
   - 300-500 Vibration Motes
   - Several Transmitter Applications
   - Leverage Asset Reliability & Optimization System

2. Deeper integration with PI
   - Pull in all tags - sensor data and machine learning based tags
   - Analyze process data alongside predictive maintenance data

3. Expansion to other Barrick sites
   - Cortez Open Pit (Surface) & Underground, Goldstrike, Turquoise Ridge
BARRICK GOLD

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CHALLENGE

Leveraging PI to optimize Predictive Maintenance

- Increased Risk of Unplanned Downtime
- Increased Cost of Repairs
- Unnecessary Preventive Maintenance

SOLUTION

Implement an IoT-based Predictive Maintenance system

- Petasense Asset Reliability and Optimization (ARO) System
- Industrial IoT Sensors and Machine Learning Software
- Ability to Integrate with PI

RESULTS

Successful POC with Petasense’s PdM System including Integration to PI

- Several machine defects identified within just 2 months
- REST APIs enabled easy integration into PI Vision
- Plans to deploy the system across more assets and other sites
Questions?

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