INDUSTRY CHALLENGES

**Unplanned Downtime**
- Unexpected equipment failure and bad maintenance
  - 92% of maintenance shutdowns unplanned
  - $61M loss per year

**Sold Out Asset Capacity**
- Tough to find more operating efficiency
  - $60B in lost opportunity in 2017
  - $1M miss per day

**Balancing Asset Reliability with Maintenance**
- Too much, too little maintenance and failed maintenance
  - 45% of maintenance causes new problems
  - $55M cost per Year

**Loss of Expertise**
- Aging workforce and new employee job tenure
  - 12 months to train a new hire for 24 months in the role
  - 10K retire per day

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*250,000 barrel per day facility

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WHAT IS APM 4.0?

“Asset Performance Management (APM) encompasses the capabilities of data capture, integration, visualization and analytics tied together for the explicit purpose of improving the reliability and availability of physical assets. APM includes the concepts of condition monitoring, predictive forecasting and reliability-centered maintenance (RCM).”

Gartner Definition
...NOT ADDRESSING ALL OF THE NEEDS

“All of these systems generate a lot of data making it practically impossible for site engineers to gather, correlate and analyse data to predict and prevent equipment failures”

Customer quotes, Refining

“Timely data correlation, analysis is key to us understanding process and equipment related issues in order to reduce lost production and maintenance costs”

- PRODUCTION, ASSET & MAINTENANCE SYSTEMS ARE SILOED
- UNABLE TO TURN DATA INTO ACTION IN A TIMELY MANNER DECISIONS
Overview of the Discussion

A
Connectivity Of Data Sources

B
Application of Rules, Models and Analytics

C
Closing The Loop with People & Workflow

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HOW DO I GET THE DATA?

New ControlEdge GW
Edge to Cloud

Honeywell Connected Plant Asset Performance

3rd Party Cloud

SDX
Historian

DCS

Data

CEGW

Data

Stranded Assets

Secure Data Exchange

LIMS
ERP
Plan
MES
CHM

Data

DCS

OEM

Data

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HOW DO I GET THE DATA?

Cloud Applications
- Asset Analytics
- Connected Historian
- KPI Dashboard
- Visual Analysis
- Collaboration Environment
- Process Analytics

Secure Data Transport
- Plant Gateway

Advanced Analytics (New)
- Edge Gateway

Data Aggregation
- DCS Server
- Historian
- SCADA

Basic Analytics (New)
- Stranded-Asset Data Acquisition Edge Device

Data Collection
- DCS Controller
- PLC
- RTU

Full-Capability Edge Devices
- Traditional Control System

System-to-System Data Flow (FUTURE)

Valuec Assets
- Asset Data

Process Data
- Smart Protocol IO
- Traditional IO

Ancillary/Environmental Data
- Low-Cost Sensors
- Lab Test Data

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NOW WHAT HAPPENS TO THE DATA?

Data Ingestion

- Graphics & Trends
- Event Management
- Notifications
- Manufacturing Intelligence

Data & Event Streaming

- Self-Serve Analytics
  - Cloud Historian
    - High Performance Storage
  - Data Lake
    - Data Lake Big Data Storage
  - Batch Analytics / Machine Learning

- Data Cleansing & Preprocessing
- Calculations / Digital Twins
- Real-Time Analytics
- Fault Monitoring & Event Detection
ANALYTICAL APPROACH

RUN TIME ANALYTICS

Real-time model execution engine to ‘operationalize insights’

Condition & Performance Monitoring:
- First Principle Models
- Calculations
- Empirical / Data Driven
- ML Models

CONNECTED ANALYTICS TOOLS

Analytic tools using a variety of methods used to refine model creation

Packaged 3rd Party Tools & Developed Applications

Data Ingestion

Data & Event Streaming

Cloud Historian

Data Lake
Big Data Storage
High Performance Storage

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EVENT MANAGEMENT & VISUALIZATION

EVENT MANAGEMENT

Real-time early event detection and management

Event, Deviation Detection, Fault Modelling
- Heuristic
- Rule Based
- Model Trained

Fault Prioritization
- Fault Severity *
- Asset Criticality

VISUALIZATION

Data Ingestion → Data & Event Streaming → High Performance Storage → Data Lake Big Data Storage → Cloud Historian
### Honeywell Connected Plant Asset Performance

<table>
<thead>
<tr>
<th>Honeywell Connected Plants</th>
<th>Plant A Site(s)</th>
<th>Plant B Site(s)</th>
<th>Plant C Site(s)</th>
<th>Plant D Site(s)</th>
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<td>Asset_D</td>
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Customer and partner collaborate on the same asset, using the same data and analytics.

**Ecosystem Partners**

Ecosystem partners can only see those assets for which they are providing service.

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CLOSING THE LOOP WITH MAINTENANCE

Data → Analyze → Predict → Event Detection → Notify → REVIEW

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CLOSING THE LOOP WITH MAINTENANCE

Data → Analyze → Predict → Event Detection → Notify → REVIEW

DO → ADJUST → PLAN

- Identified Lubrication May Be Required within next 5 days

**NEXT PLANNED LUBRICATION IS IN 10 DAYS**

- Do I slow down or do I adjust or modify the plan?

- Planned Work Order is now modified to a Corrective and planned to take place in the next 3 days
Closing the APM Loop - A Holistic Use Case

Connected Plant | Honeywell Sentience

EAM/ERP Integration

HCP Asset Performance Insight

HCP Skills Insight

HCP Connected Historian

Orange, TX

Plant B

Plant C

Orange Training / HSSE / Field Ops

Operator Rounds

Work Instructions

AR/VR Training Simulations

Remote Expert

Operator Rounds

AR/VR Training Simulator for Critical Work Processes

Remote Expert & Work Instructions

Orange Maintenance & Reliability

Early Event Detection

Root Cause

Decision Support

Maint. Planning

PMT Maintenance CoE

Train Models

What if Analysis

Visual Analytics

KPI Reporting

Remote Expert

Identify Rules / Models to Improve, Train Models, Add New Sensors

Monitor model quality, and benchmark performance

Validate in real time data stream before deploying

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START TODAY. GET RESULTS FAST.

Asset Performance Insight allows you to increase asset reliability and process performance, reducing unnecessary maintenance. We connect disparate data sources and use advanced analytics to turn that data into actionable insights, and collaboration with internal and external expertise.

1. ASSET & PROCESS PERFORMANCE
   PERFORMANCE MONITOR
   • Identify critical assets & processes
   • Begin with existing data sources
   • Continuous surveillance & early event detection

2. EXPAND YOUR INSIGHTS & EXPERTISE
   PERFORMANCE MONITOR PRO
   • Connect to a wider set of assets
   • Add OEM edge, analytics and expertise
   • Add Premium Analytics and Collaborate with Visualization and KPIs

3. CLOSE THE APM LOOP - DECISION SUPPORT
   PERFORMANCE MONITOR PRO
   • Integrated workflows
   • Collaborative Decision Support
   • Integration to EAM

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HONEYWELL CONNECTED PLANT
Address the dynamic relationships between the performance of people, assets, and processes.

ENTERPRISE

PEOPLE

ASSETS

PROCESS

STOP REACTING... START PREDICTING
Connect, collaborate and proactively manage asset and process performance to optimize your operations and maintenance.