



Using PI Asset Framework to Achieve Predictive Maintenance ROI in 6 Months and Enterprise Scale

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Speakers



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Introduction Alcoa

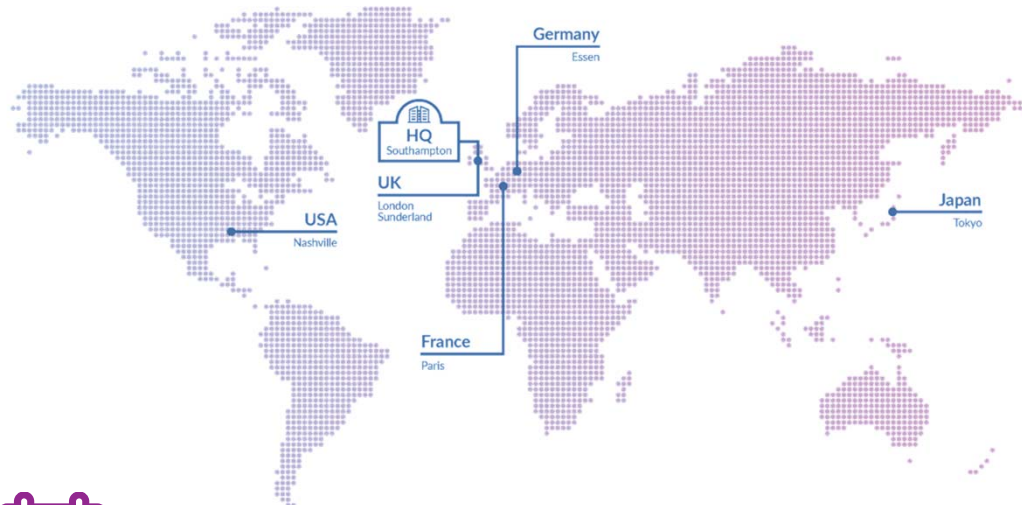


- Founded the aluminum industry in 1888
- Launched as an independent company in November 2016, focusing on bauxite, alumina and aluminum
- Values of “Act with Integrity, Operate with Excellence and Care for People”
- Global network of aluminum industry assets; low cost position in bauxite and alumina
- Operations in 10 countries with approximately 14,000 employees
- 2018 revenue: \$13.4 billion

Senseye Overview

Derived from 'Sensei' (先生) signifies guidance and authority.

Senseye is the leading Automated Predictive Maintenance product.



2014

Established



Industrial & Technology Partners

IIOT, Historian, CMMS/EAM, APM, CMMS, Cloud

osisoft.
PIWorld SAN FRANCISCO 2020

Massive vertical and horizontal scalability.

Category leading ROI.

Deep expertise from the aerospace sector, delivered into the industrial space.

Customers include Nissan, Schneider Electric, Ford, Guardian, AngloAmerican and Alcoa.

Stats

4 Co-founders

5 Years old

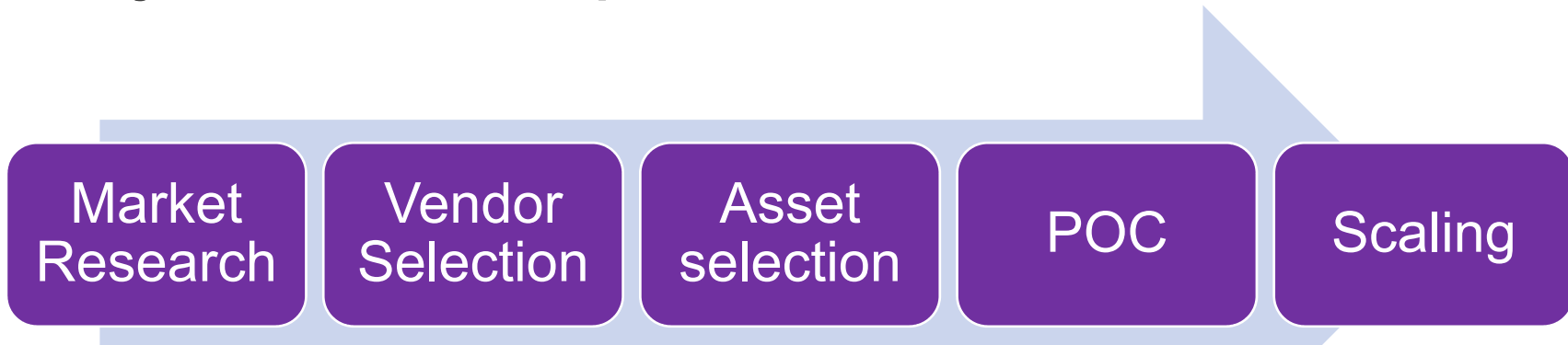
6 Office locations

65 employees

Why Alcoa Deployed Predictive Maintenance?



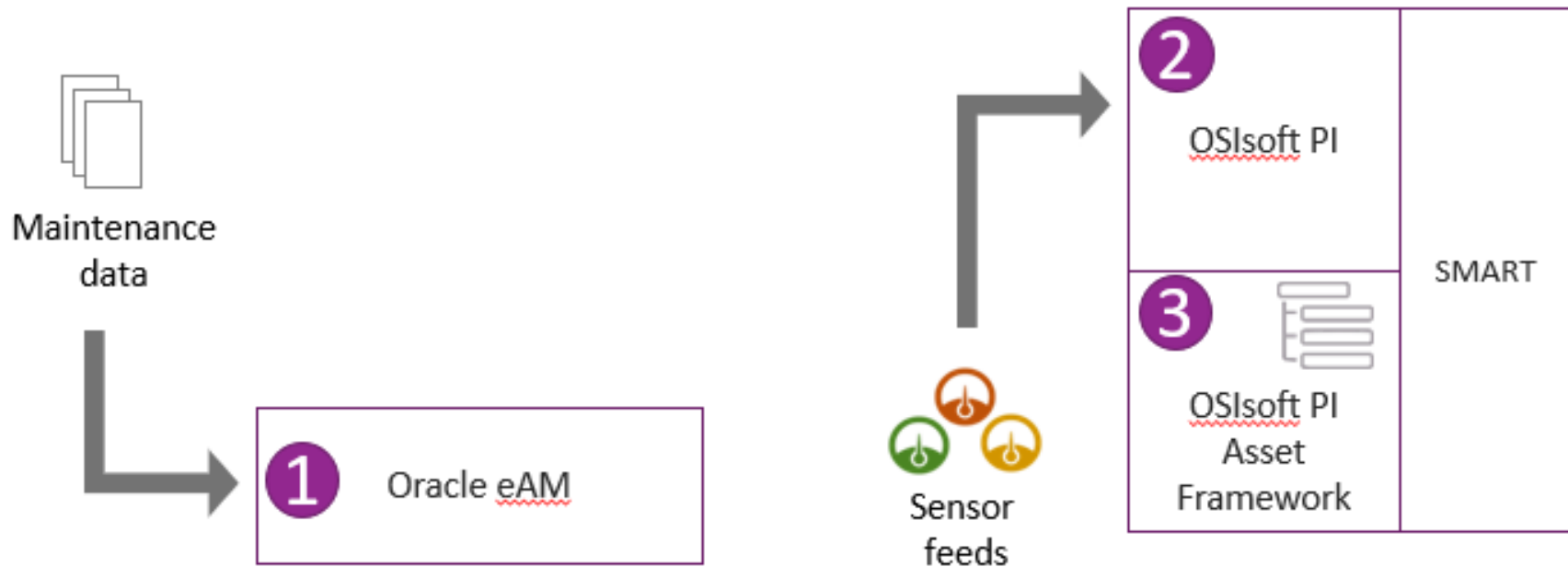
Project Roadmap



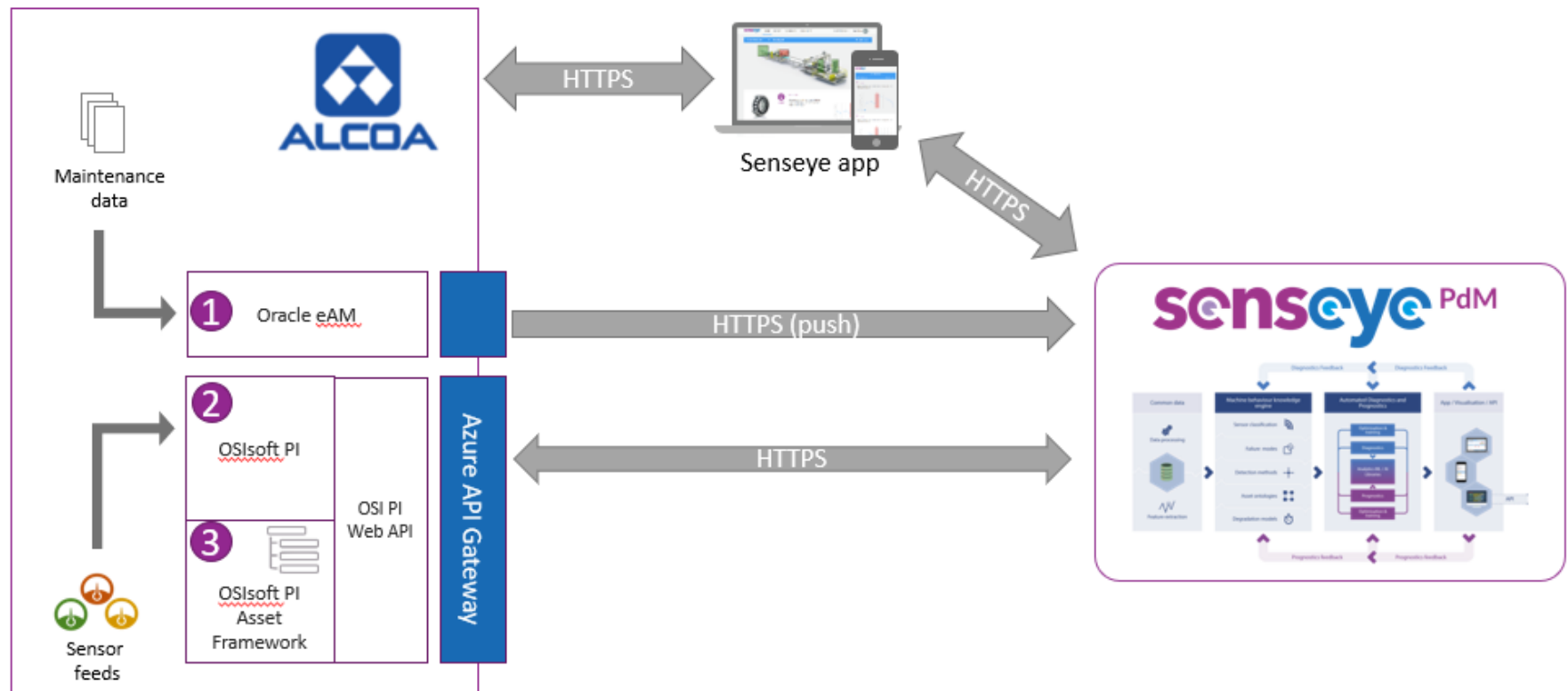
senseye



Alcoa Fjarðaál Existing Digital Ecosystem

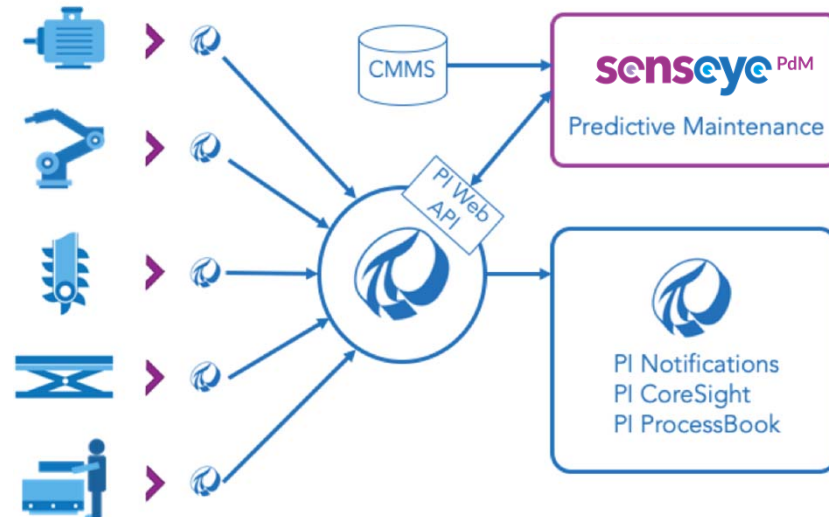


Alcoa Fjarðaál Unified Digital Ecosystem

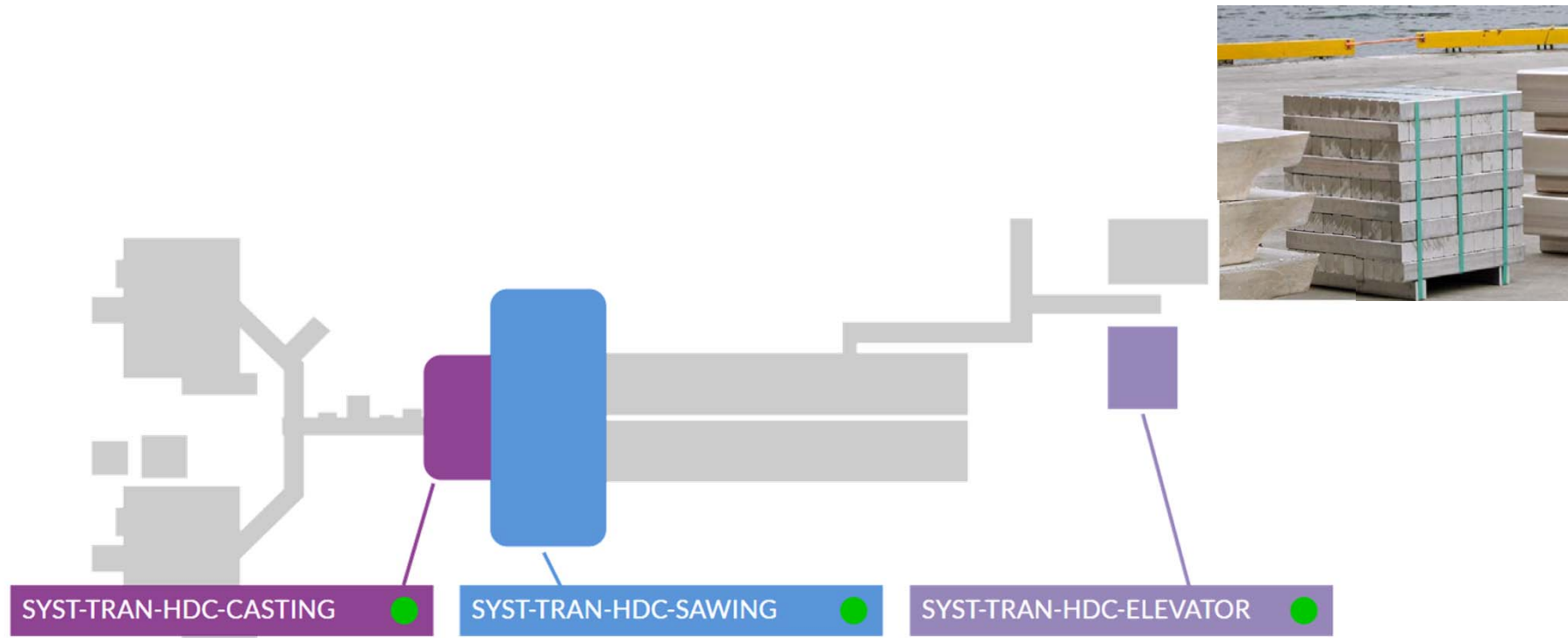


Senseye Connector for OSIsoft PI System

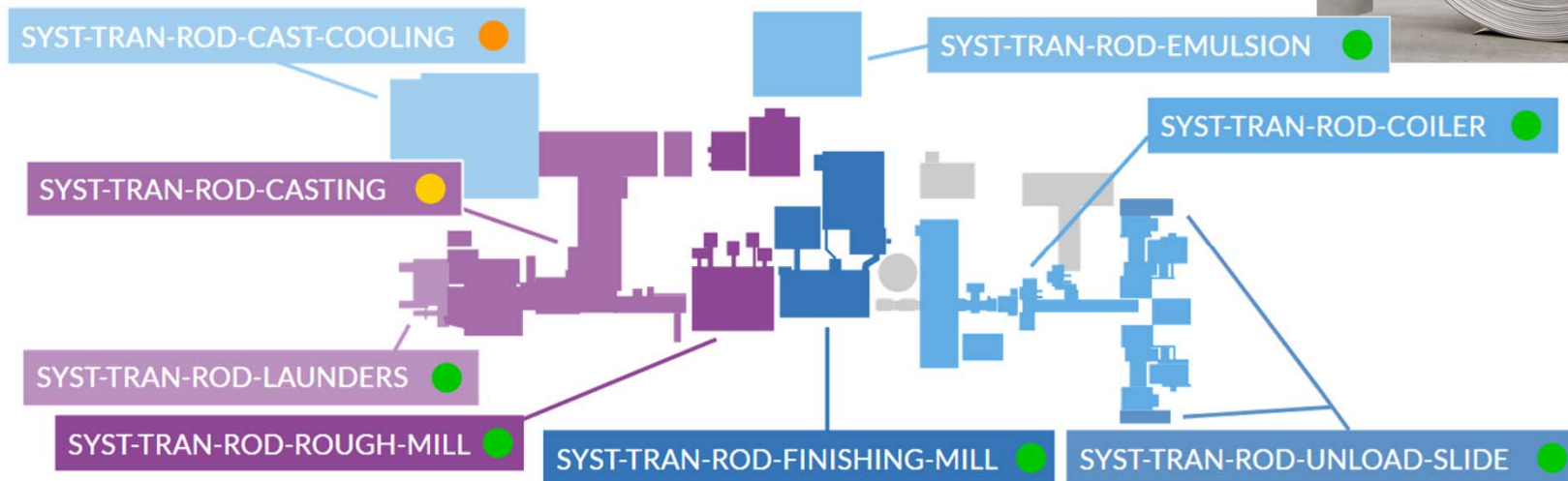
- Enable Senseye to access machine data in your existing OSIsoft PI System™
- Rapid access to current and historic data for all your connected machines
- Utilizes OSIsoft PI Web API – a API – a core part of the OSIsoft PI System product suite



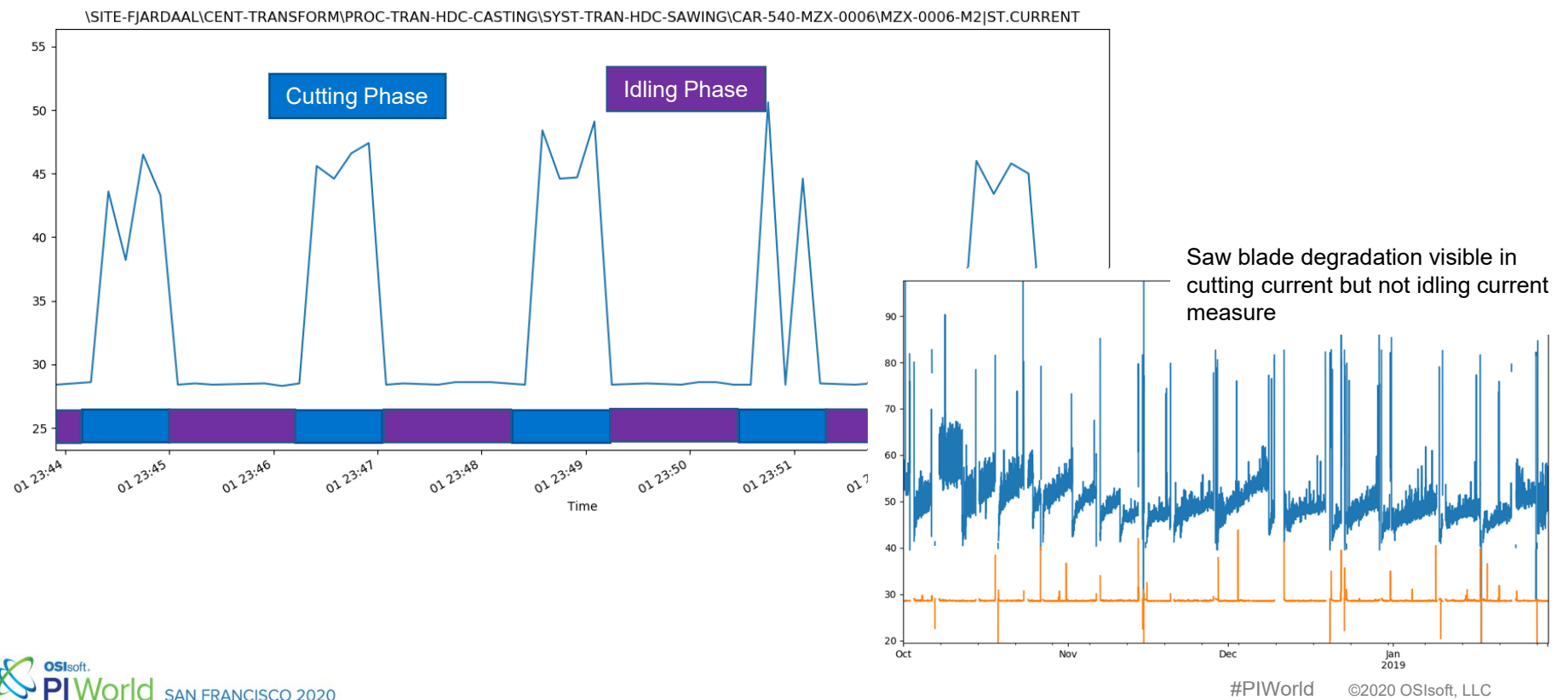
Horizontal Direct Caster – Annotated Schematic



Rod Mill – Annotated Schematic



HDC Saw Motor–Derived current measure features



Event Frames – Element template

The screenshot displays the OSIsoft PI System Explorer interface. The left pane shows a tree of elements, with 'PUMP-540-MPC-0003-M1' selected. The main pane shows the 'General' tab with a table of attributes. A red box highlights the 'eAM.AnalysisTag' attribute, which is set to 'F3A:CAST_ROD-ANALYSIS-MPC_0003_M1'. Another red box highlights the 'eAM.AssetCategorySegment1' through 'eAM.AssetCategorySegment3' attributes, which are set to 'PUMP', 'CENTRALUSAL', and 'eAM.AssetCategorySegment2' respectively. The right pane shows the 'Properties' tab with various configuration options.

Attribute	Value	Description
eAM.AnalysisTag	F3A:CAST_ROD-ANALYSIS-MPC_0003_M1	eAM Asset Category Segment 1
eAM.AssetCategorySegment1	PUMP	eAM Asset Category Segment 1
eAM.AssetCategorySegment2	CENTRALUSAL	eAM Asset Category Segment 2
eAM.AssetCategorySegment3	eAM.AssetCategorySegment2	eAM Asset Category Segment 3
eAM.AssetCriticalityCode	NON CRITICAL NO BACKUP	eAM Asset Primary Key
eAM.AssetSRK	1,363E+05	eAM Asset Primary Key
eAM.Description	CASTING MACHINE PUMP 1	The "Asset Description" when linked to an eAM element
eAM.Group	BL<PUMP-540-MPC-0003-M1	CASTING MACHINE PUMP 1
eAM.GroupDescription	CASTING MACHINE PUMP 1	
eAM.Maintainable	True	
eAM.Number	PUMP-540-MPC-0003-M1	eAM "Asset ID"
eAM.SerialNumber	PUMP-540-MPC-0003-M1	Serial Number in eAM
PI.Tag.Analysis		
PI.Tag.Prefix	540-0400_PU0001-MPC_0003_M1	
PI.Tag.Suffix	540-0400_PU0012-MPC_0011_PCV_01	
PLC.Number		

Event Frames data

Attribute	Value	Description
Average Pressure Actual	119.1 PSI	The average pressure in the system
Average Pressure Set Point	120 PSI	The average pressure in the system
Average Pressure Valve open %	0 %	How much the valve needs to be open to return the set pressure

RAW data

Attribute	Value	Description
PID.OUT	0	Pressure Control valve OUT %
PID.PV	120.121	Pressure PV
PID.SP	120.121	Pressure Setpoint
ST.RUN	NO_RUN	Run signal

Event Frames - Analysis

The screenshot displays the OSIsoft PI System Explorer interface. The left pane shows a hierarchical tree of elements, with 'SYST-TRAN-ROD-CAST-COOLING' selected. The central pane shows the configuration for the 'SYST-TRAN-ROD-CAST-COOLING_PUMPS' event frame template. The 'Start triggers' section is highlighted with a red box, showing the expression 'ST.RUN = "RUN" AND Second('*') = 0' with a 15-second interval. The 'End triggers' section shows the expression 'ST.RUN = "NO_RUN" OR Second('*') = 0'. The 'Outputs at close' section lists three outputs: 'TagAvg('PID.OUT', EventFrame("StartTime"), EventFrame("EndTime"))', 'TagAvg('PID.PV', EventFrame("StartTime"), EventFrame("EndTime"))', and 'TagAvg('PID.SP', EventFrame("StartTime"), EventFrame("EndTime"))'. The right pane shows a list of functions, including 'Abs', 'Acos', 'And', 'ArrayLength', 'Ascii', 'Asin', 'Atan', 'Atan2', 'Avg', 'BadVal', 'Bod', 'Bom', 'Bomn', 'Ceiling', 'Char', 'Compare', 'Concat', 'Contains', 'Convert', 'Cos', 'Cosh', 'Cot', 'Coth', and 'Abs(number x)'. A red arrow points from the 'Event Frame Template' dropdown in the central pane to the 'SYST-TRAN-ROD-CAST-COOLING_PUMPS' entry in the right pane.

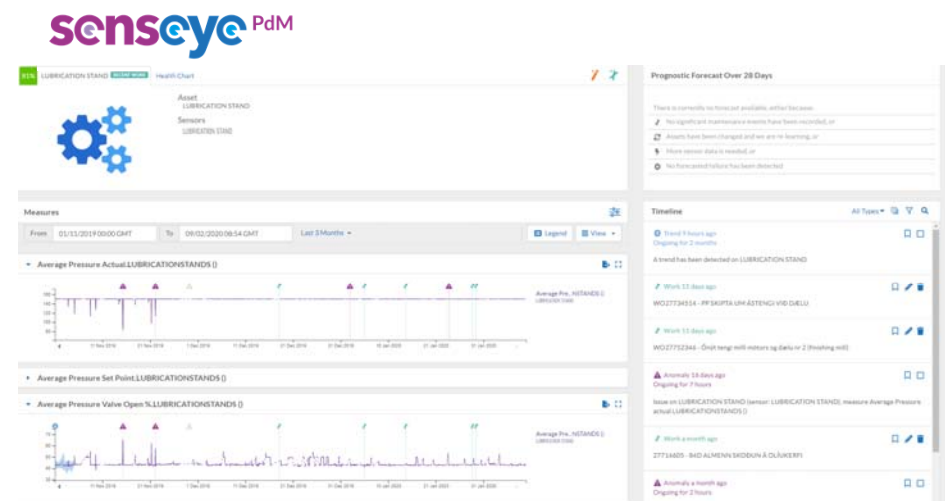
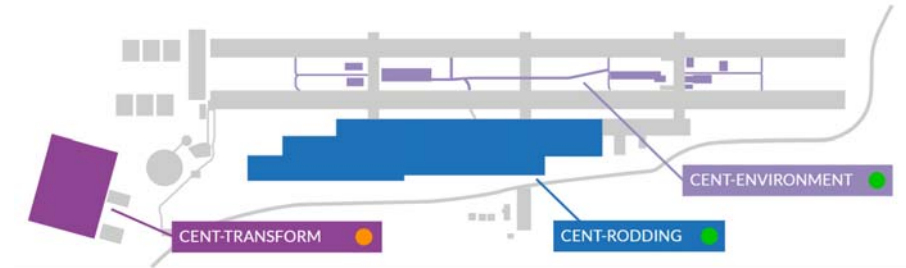
Event Frame Template: SYST-TRAN-ROD-CAST-COOLING_PUMPS

Name	Expression	True for	Severity	Output Attribute
Start triggers				
Start trigger1	'ST.RUN' = "RUN" AND Second('*') = 0	15 seconds	None	
End trigger	'ST.RUN' = "NO_RUN" OR Second('*') = 0			
EndTriggers				
Outputs at close				
Output1	TagAvg('PID.OUT', EventFrame("StartTime"), EventFrame("EndTime"))			Average Pressure Valve open %
Output2	TagAvg('PID.PV', EventFrame("StartTime"), EventFrame("EndTime"))			Average Pressure Actual
Output3	TagAvg('PID.SP', EventFrame("StartTime"), EventFrame("EndTime"))			Average Pressure Set Point

- Designed for conditions
- Allows for event frame templates that can be easily replicated
- Simplifies calculations in given states
- Easy to backfill for historical data extraction
- Configured to use maximum of 15-minute time period (Some events at Alcoa can last over 200 hours!)

Senseye PdM in use


- Senseye PdM implemented
- Senseye PdM provides focus for people on the floor
- Multiple examples of hidden failures detected
- Reliability engineer monitors system
- Equipment unplanned downtime tracked and reported
- Maintenance work hours used on the system




In Senseye

senseye PIM Cases Explore Reports Dashboard Support Settings Robert Russell Alcoa

Alcoa SITE-FJARDAAL CENT-TXFORM



PROC-TRAN-HDC-CASTING



PROC-TRAN-RODMILL-CASTING

Statistics For This Location

Current open cases: 4

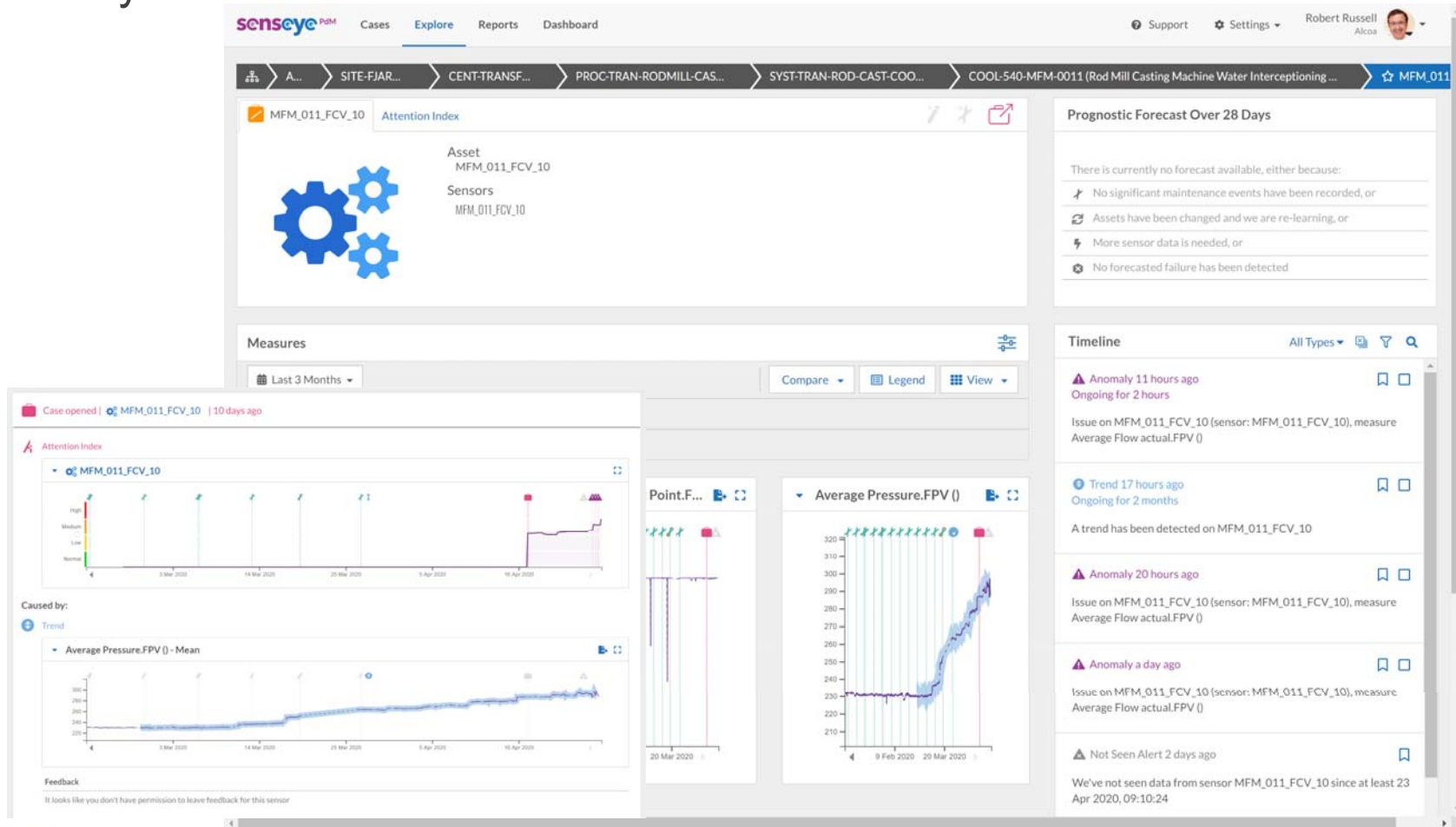
	Downtime avoided	Work events
Last 28 days:	3 hrs	97
Last 12 months:	39 hrs	1305

Asset List

Showing open and closed insights & alerts

AI	Name	Insights	Prognostic Insights	Alerts
🔍	MFM_011_FCV_10 ... PROC-TRAN-RODMILL-CASTING > SYST-TRAN-ROD-CAST-COOLING > COOL-540-MFM-0011 (Rod Mill Casting Machine Water Interceptioning Unit)	4	0	0
🔍	MFM_011_FCV_11 ... PROC-TRAN-RODMILL-CASTING > SYST-TRAN-ROD-CAST-COOLING > COOL-540-MFM-0011 (Rod Mill Casting Machine Water Interceptioning Unit)	1	0	0
🔍	MFM_011_FCV_01 ... PROC-TRAN-RODMILL-CASTING > SYST-TRAN-ROD-CAST-COOLING > COOL-540-MFM-0011 (Rod Mill Casting Machine Water Interceptioning Unit)	1	0	0
🔍	MFM_011_FCV_05 ... PROC-TRAN-RODMILL-CASTING > SYST-TRAN-ROD-CAST-COOLING > COOL-540-MFM-0011 (Rod Mill Casting Machine Water Interceptioning Unit)	1	0	0
🔍	MTR-540-MFM-0002-M1 (Rod Mill Caster Type C44 - motor) ... PROC-TRAN-RODMILL-CASTING > SYST-TRAN-ROD-CASTING > CAST-540-MFM-0002 (Rod Mill Caster Type C44)	1	0	0
🔍	MFM_011_FCV_09 ... PROC-TRAN-RODMILL-CASTING > SYST-TRAN-ROD-CAST-COOLING > COOL-540-MFM-0011 (Rod Mill Casting Machine Water Interceptioning Unit)	1	0	0
🔍	MFM_011_FCV_04 ... PROC-TRAN-RODMILL-CASTING > SYST-TRAN-ROD-CAST-COOLING > COOL-540-MFM-0011 (Rod Mill Casting Machine Water Interceptioning Unit)	1	0	0
🔍	MTR-560-MJE-0001-M1 (Stack Elevator motor For Hdc No.1) ... PROC-TRAN-HDC-CASTING > SYST-TRAN-HDC-ELEVATOR > ELEV-560-MJE-0001 (Stack Elevator For Hdc No.1)	2	0	0
🔍	MTR-540-MFM-0006-M1 (Rod Mill Finishing Mill Motor) ... PROC-TRAN-RODMILL-CASTING > SYST-TRAN-ROD-FINISHING-MILL > MILL-540-MFM-0006 (Rod Mill Finishing Mill)	2	0	0
🔍	TANK-540-MPL-0008 (Rod Mill Finishing Mill Lubrication Unit Tank)	2	0	0

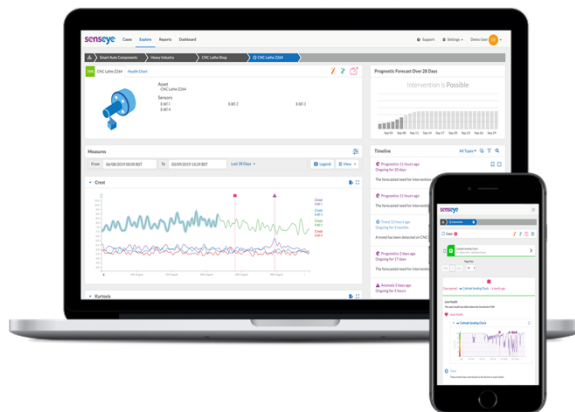
In Senseye



HDC saw motor case study

Issue: Belt guard came loose and was in contact with the sawing drive, damaging belt

Action: Replaced belts and fastened the belt cover



senseeye PdM



Asset Name	MTR-540-MZX-0007-M1 (Saw Carriage 2 motor)
Location	SYS-TRAN-HDC-SAWING
Failure mode	Loose Component
Shown on existing systems	No
Unplanned downtime avoided	12 hours



TO - Case raised on saw motor due to increase in idling motor current



TO+2d - Case reviewed and issue being investigated



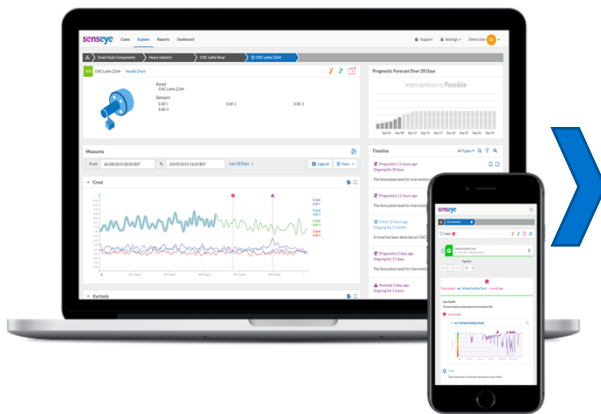
TO + 1w - Issue resolved during maintenance shutdown

Coiler Rod Cropping Shear Motor



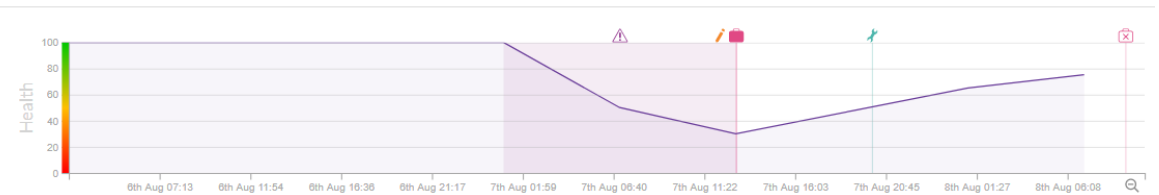
Issue: Lower pinch roller sensor came loose – leading to a sharp increase in shear motor torque

Action: Re-fastened sensor which returned the measured motor torque to normal levels

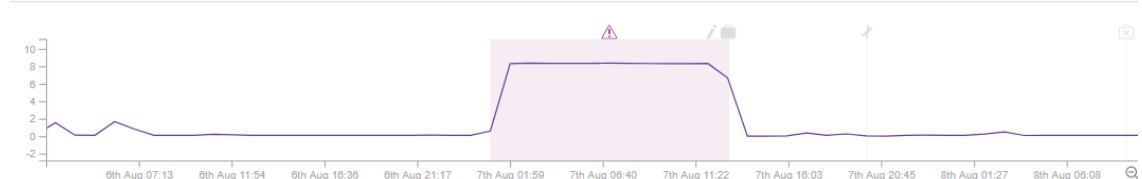


senseye PdM

▼ MTR-540-MFM-0026-M1 (Coiler Rod Cropping Shear Motor)




Average Torque.MOTOR () - Mean



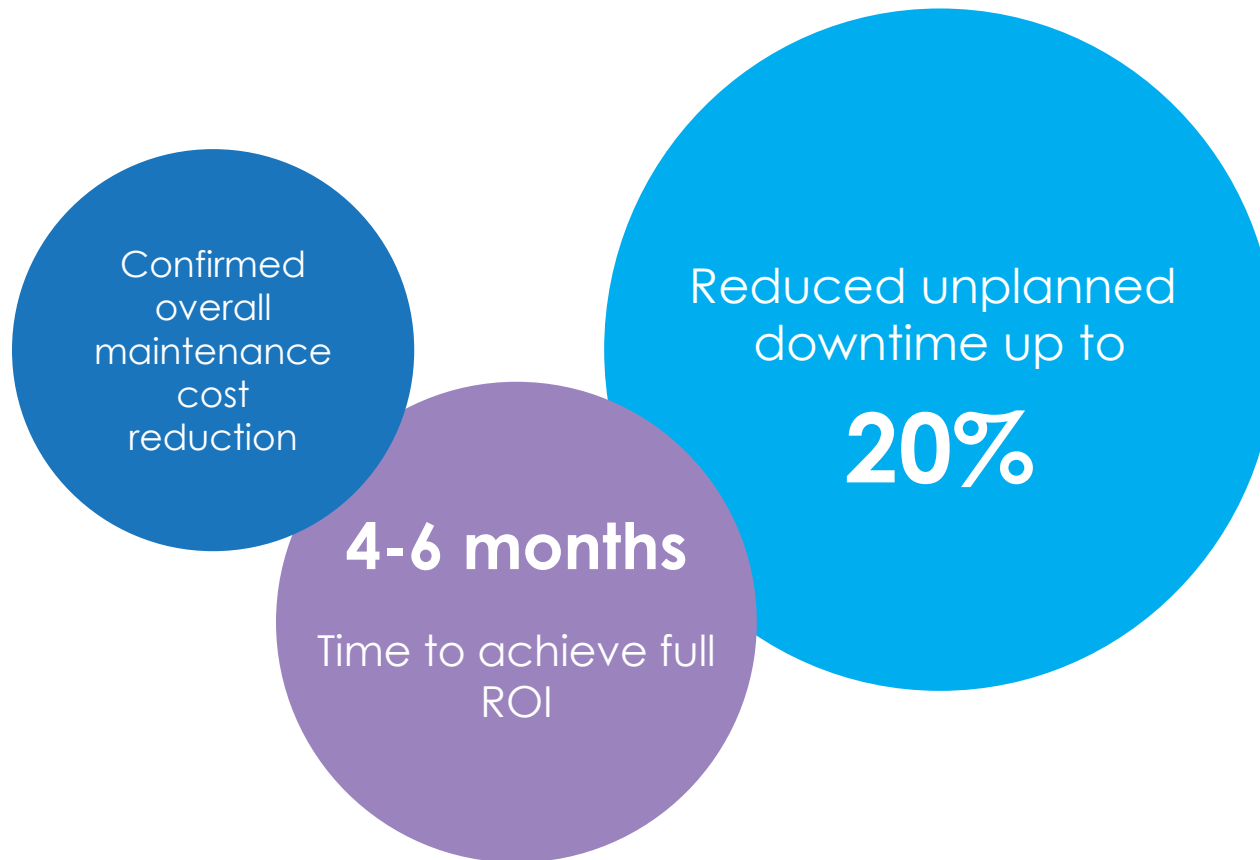
Asset Name	MTR-540-MFM-0026-M1 (Coiler Rod Cropping Shear Motor)
Location	SYS-TRAN-ROD-COILER
Failure mode	Loose Sensor
Shown on existing systems	No
Unplanned downtime avoided	3 hours

 TO - Case raised on rod cropping shear motor due to sensor failure

 TO - Insight, case reviewed, issue being investigated

 TO - Sensor re-fastened and motor torque issue resolved

Predictive Maintenance Results



Learnings for other Alcoa plants for global roll out:

- Types of measurements which are most effective
 - Data preparation and aggregation for best performance
 - Usage of OSI PI System templates for identical identical equipment
-

Next steps - Alcoa

- Expanding to 1k+ assets in Fjarðaál
- Alcoa is currently looking for opportunities in other sectors of the business to making use of this initial work
- Diverse assets & sites across the company
- PI System and Asset Framework used to template the data transformations for rapid rollout at global scale

Next steps - Senseye

- Research & design work on larger machines & assets that are coupled
- Deeper integration with PI System and Asset Framework for quicker onboarding
- Ongoing proprietary algorithm updates

Alcoa – Summary Slide



CHALLENGES

- Equipment data available in PI System but not utilized for condition monitoring purposes in any scale
- Complexity of operations affecting data

SOLUTION

- Build precise Asset framework element model and utilize Event frames to aggregate relevant data for condition monitoring
- Implement Senseye PdM to deliver predictive analytics on top of PI System to analyze and monitor the data and provide guidance towards equipment to focus on

BENEFITS

- Increase operations knowledge of their equipment process and equipment data
- Reduced equipment downtime
- Lowered maintenance cost
- ROI in 6 months



We are pleased to have partnered with Senseye on this corporate initiative to enable Predictive Maintenance and improve operational efficiencies. The results and ROI were executed in a prompt manner and our users are thrilled with the ease of use of the Senseye PdM product.



Questions?

Please wait for
the **microphone**

State your
name & company



Save the Date...



REGISTER YOUR INTEREST

AMSTERDAM

October 26-29, 2020



