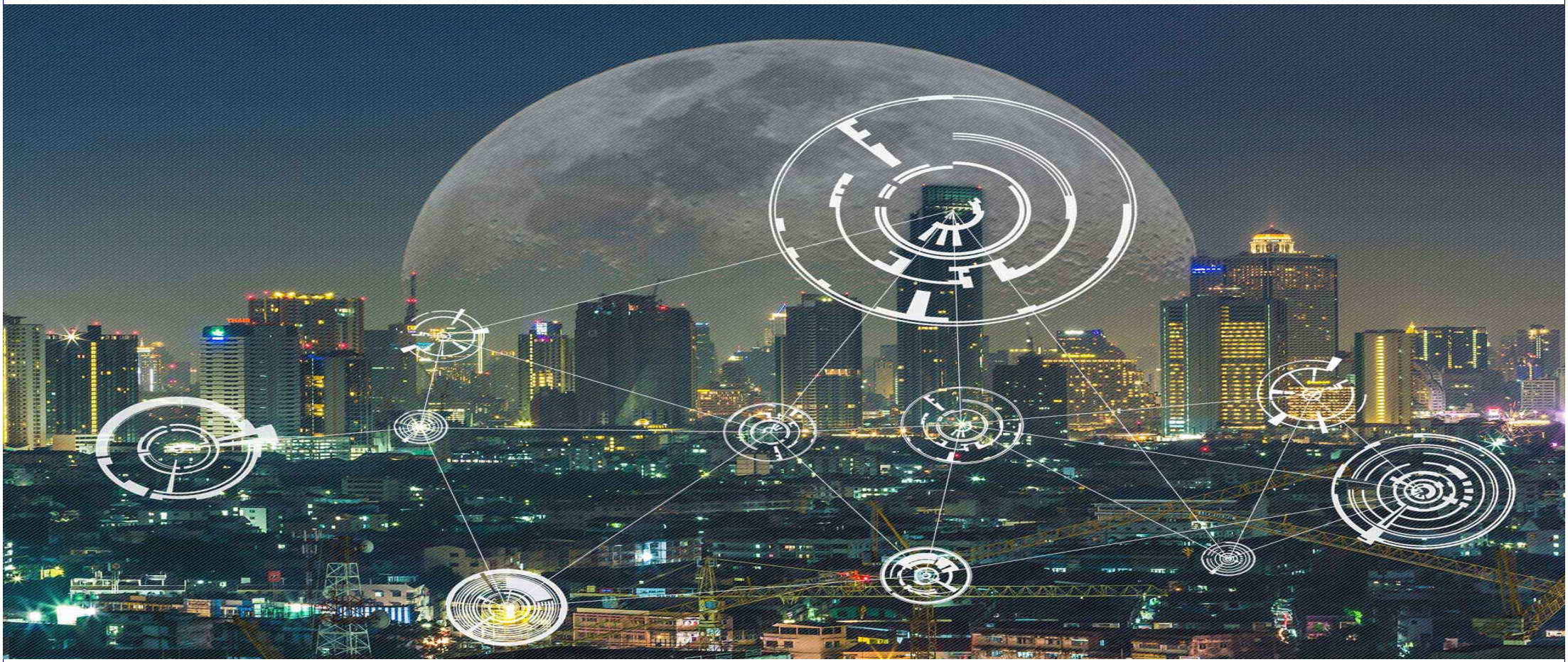
Data Driven Manufacturing



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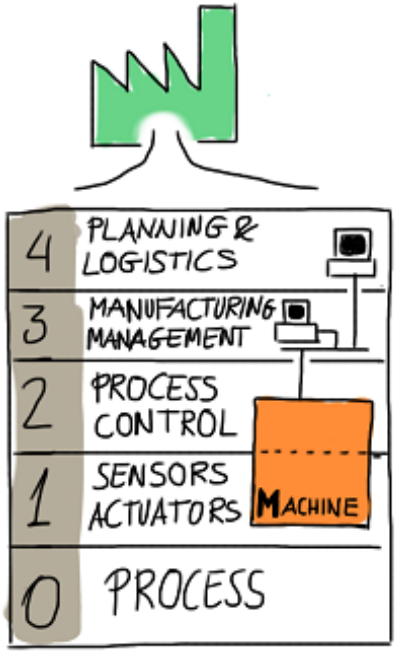
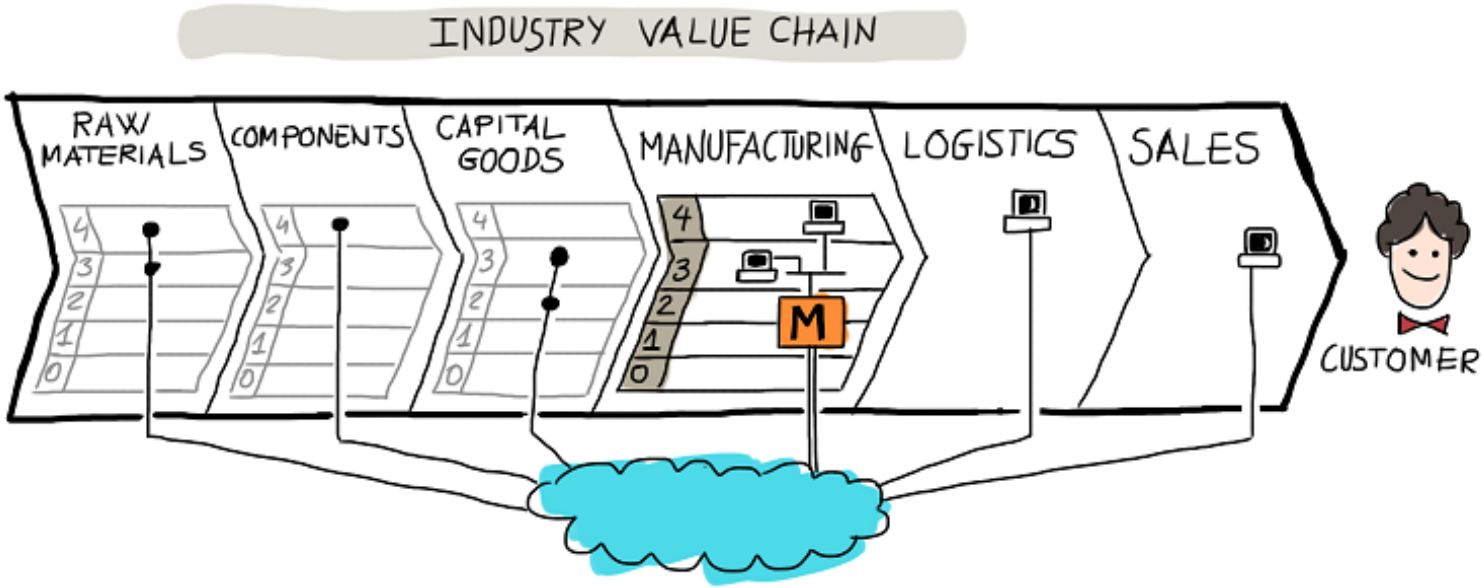
Gen4 – Starting the Journey



INDUSTRY 3.0



INDUSTRY 4.0

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So Why Drive a Digital Transformation?

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Sustained market position

Price quality

Shareholder expectation

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Increased capacity *utilization*

Increased quality *Data mining / analytics (value add)*

Increased profit *New digital revenue stream*

'Uncertainty is the new certainty in the chemicals industry'

Why Gen4?

Common challenges:

- Inefficient assets or machines
- Inconsistent product or output
- Unpredictable issues in quality and / or performance
- Inability to reduce waste from processes or overall plants
- Throughput not being maximised
- Downtime due to unscheduled maintenance
- Inefficient energy usage

Gen4 Solution:

- **Understand** – Detailed assessment of histories to learn and understand what impacts/drives performance and quality
- **Monitor** – Real time data analysis to identify potential issues and improvements
- **Control** – automate actions in response to changes in parameters to optimise outcomes

Benefits

- Understand how to achieve the highest quality and performance then automate that outcome
- Ensure consistency in every process
- Maximise efficiency in inputs, performance, energy and yield
- Minimise disruption and waste

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Industry 4.0 - Getting Started: Assets

1 Understand

with Machine & Equipment Health

OUTCOME: Complete, accurate, and centralized view of your assets, their current state and health indicators.

HOW: Connect your equipment to the Gen 4 Solution and Field Agents and leverage powerful data management & analysis tools.

2 Monitor

Reliability Management

OUTCOME: Early prediction of equipment issues so you can respond before assets fail.

HOW: Leverage statistical and physics-based models to detect anomalies before equipment degrades and causes significant damage.

3 Control

and optimise

OUTCOME: Balance reliability, performance, and costs to develop advanced maintenance strategies.

HOW: Scenario planning tools that help guide maintenance plans, factoring the criticality and reliability of each asset.

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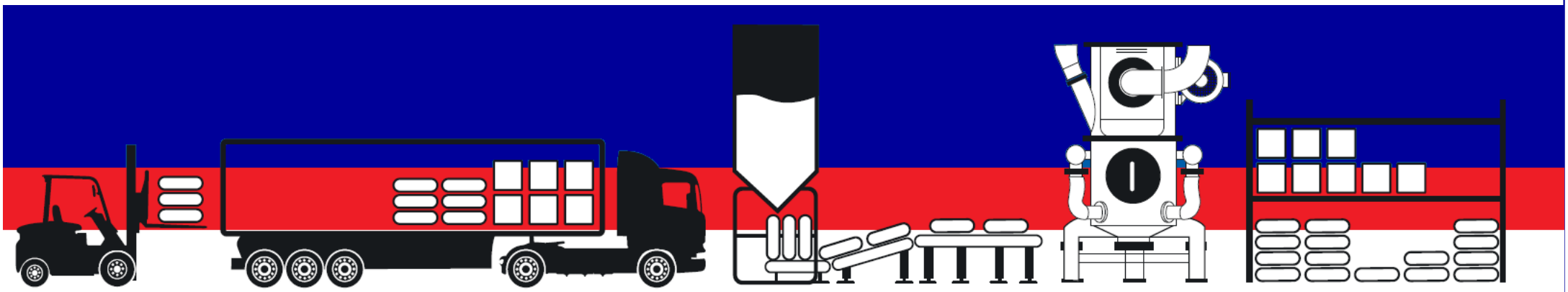
Hosokawa Contract Manufacturing

Hosokawa Micron Limited's (HML's) contract manufacturing processing service is provided at our modern production facilities in Runcorn. We offer a diverse range of powder processing technologies to meet requirements for one-off projects or regular activities.

All supported by a network of particle and powder processing experts that are on hand to create competitive advantages for clients.

Established to handle both multi-tonne lots or ultra small batch processing; materials requiring processing in a contained environment.



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Digital Transformation

Machine connection to increase throughput and improve Yields..

Before	After
Legacy machines without sensors No data export capability	Machines connected

Process is visualized & contextualized

Change Culture

- Reduce Waste
- Improve Yield
- Real Time SPC
- Real Time RCA

machines connected, process connected → Developing analytics transfer functions

Smart Factory: Objectives and Solutions Architecture

Objectives

Laboratory Efficiency: cost, resources & time.

Process Efficiency: improved yields

Improved Product Quality: reduction in out of specification materials

Reduced Operator Error: right first time, every time

Increased Plant Uptime: predictive and prescriptive maintenance to eliminate critical breakdowns

Improved Availability: faster changeover and preparation process

Actions

Improve Throughput & 24/7 production
Remote diagnostics & analysis
Data presentation
Action management

Plant Uptime & Efficiency
Alarm management
Asset management
Predictive analysis
Tech support & maintenance notification

Digital Thread
Link to PLM
Order management
Online particle analysis
Online adjustments

Solution Architecture

1. Connect the edge tools, PLC and sensors
2. Process-enabled software with remote access
3. Expand the data to impact other areas of operation PLM, Laboratory, scheduling and sales

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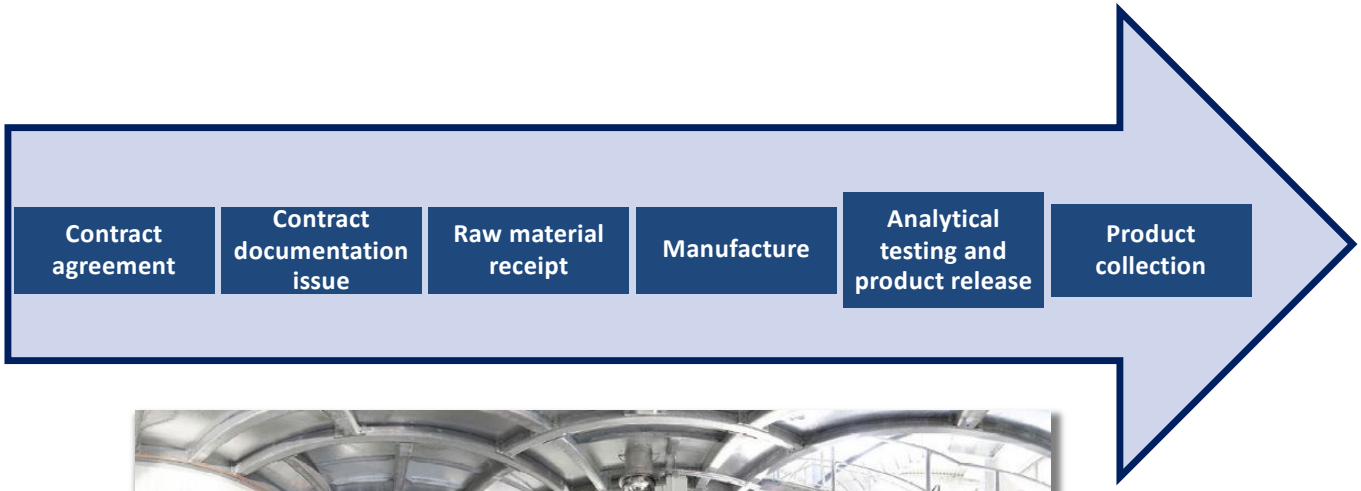
Contract Manufacturing Lifecycle



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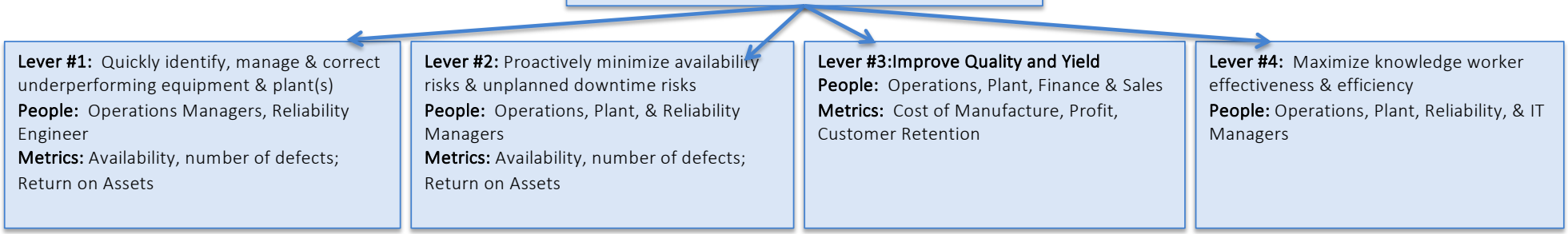
HML Contract Manufacturing: Objective/Needs Map Pre-Installation

Objective: Improve plant reliability
People: MD, Production, Operator & Laboratory



Lever #1: Quickly identify, manage & correct underperforming equipment & plant(s)
People: Operations Managers, Reliability Engineer
Metrics: Availability, number of defects; Return on Assets

Barriers:
- Islands of disparate data
- Lack of equipment condition & state visibility
- Lack of time due to firefighting resource limitations
- Lack of data analysis capability
- Lack of automated processes

Req'd Capabilities:
- Prioritization of equipment Issues
- Equipment data aggregation, analysis & visualization
- Single communications tool promoting collaboration across all operators and management

Lever #2: Proactively minimize availability risks & unplanned downtime risks
People: Operations, Plant, & Reliability Managers
Metrics: Availability, number of defects; Return on Assets

Barriers:
- Lack of equipment condition & state visibility
- Inability to prioritize equipment health & assess potential operational impact
- Weakness of single-channel alarms
- Excessive reactive & emergent work
- Lack of BOP instrumentation & sensors
- Production demands limit operational flexibility

Req'd Capabilities:
- Equipment health data measurement & monitoring
- Scalable, maintainable early detection & alarming capability
- Problem resolution tracking

Lever #3:Improve Quality and Yield
People: Operations, Plant, Finance & Sales
Metrics: Cost of Manufacture, Profit, Customer Retention

Barriers:
- Visibility of tolerance issue early enough
- Operator awareness
- Lack of traceability to customer
- Rework increased

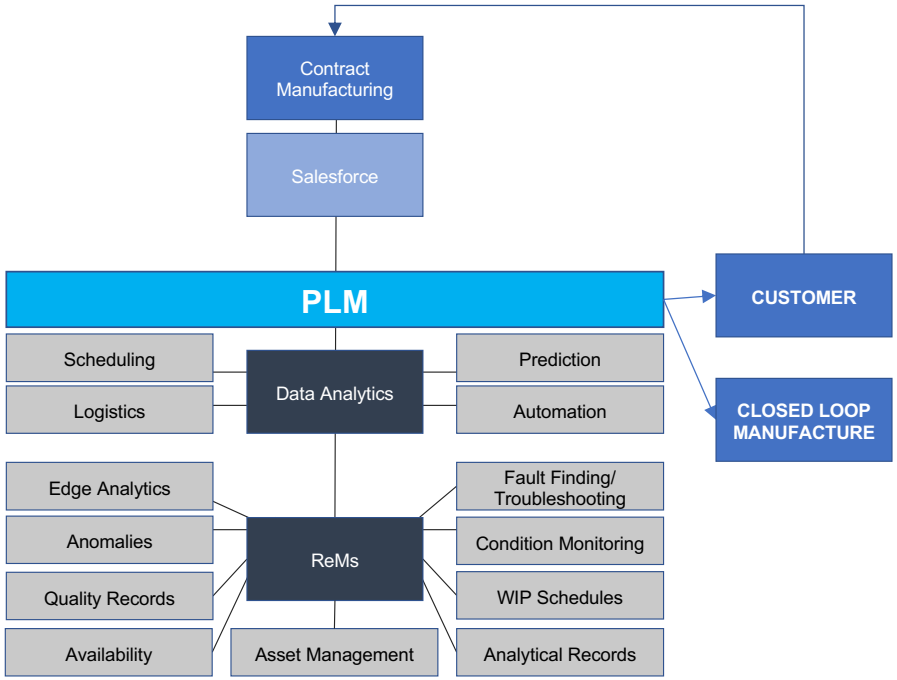
Req'd Capabilities:
- Readily available data to promote quick, informed business decisions
- Equipment data aggregation, analysis & visualization- remote
- Dashboards & reporting to promote best practice

Lever #4: Maximize knowledge worker effectiveness & efficiency
People: Operations, Plant, Reliability, & IT Managers

Barriers:
- Lack of data analysis capability
- Excessive reactive & emergent work
- Too much time spent on assembling reports
- Aging workforce
- Limited cross-functional knowledge sharing

Req'd Capabilities:
- Ability to readily consult with management on pending issues
- Work process aids to improve cross-functional knowledge sharing & issue resolution for critical equipment & plant issues
- Visualization/Reporting/ Mobility solutions

HML Digital Strategy: Contract Manufacturing



Example of the QR code used for asset and product tracking and management

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Process

Dedicated processing rooms for chemicals, minerals, metals and food products

Dedicated warehousing for mitigation of product contamination

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Application Overview: ReMS of HML's Contract Processing Suite

Remote monitoring of industrial equipment for the contract manufacturer of industrial powder processing equipment.

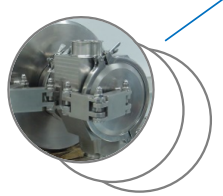
Multiple Site based equipment

Asset 1

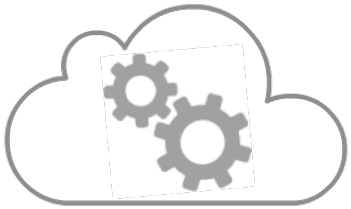
Asset 2

Asset 3

Asset n



Anomaly Detection & Alarm Management at the Edge

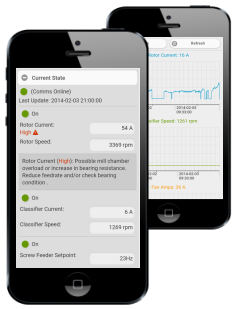


Condition Monitoring & Decision Analytics in the Cloud

Reports and data analysis

Role based alerts

Inspections & actions



Smart Mobile Apps

Diagnostic & trouble-shooting
Performance improvement advice
Trending Plant operating data

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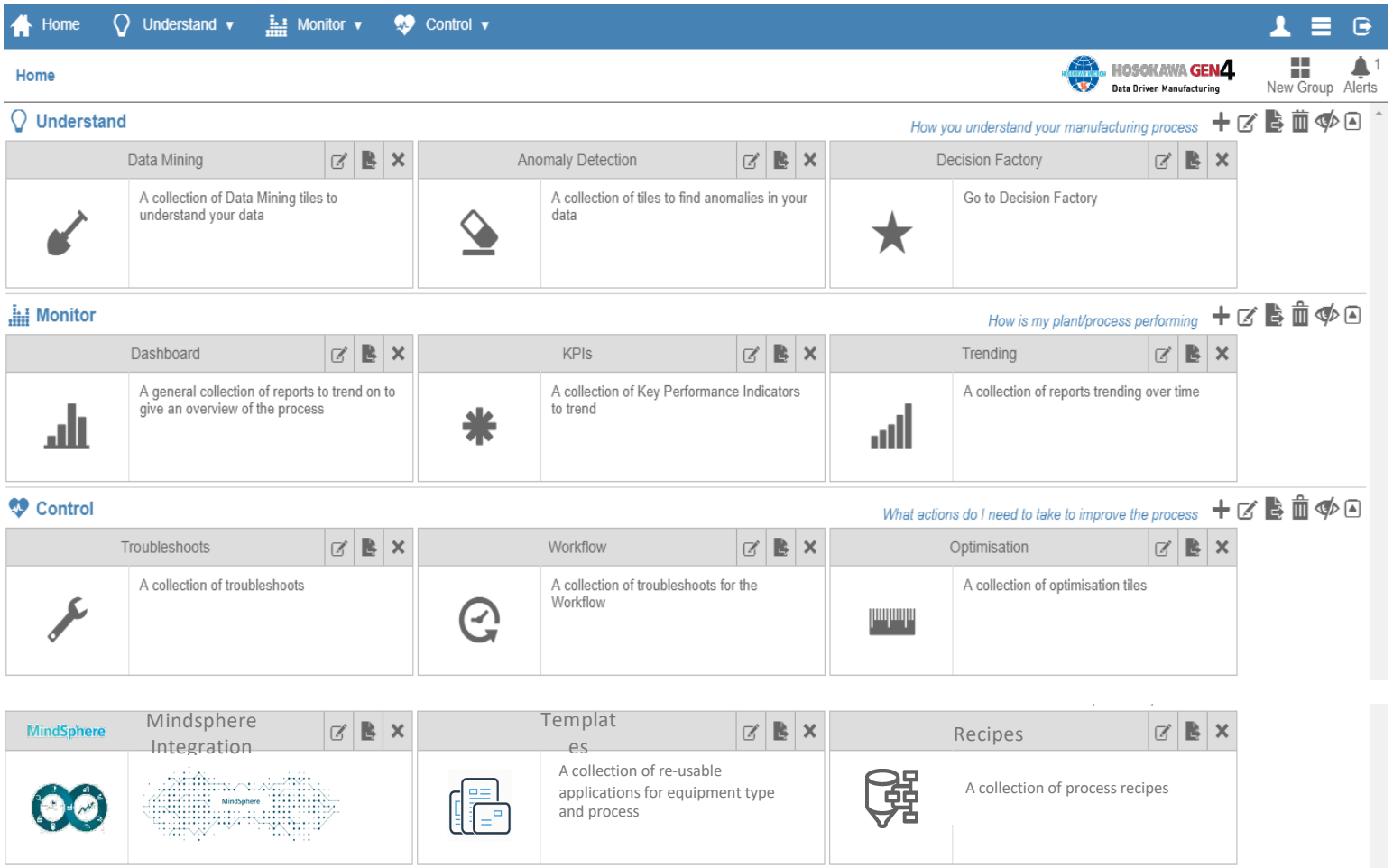
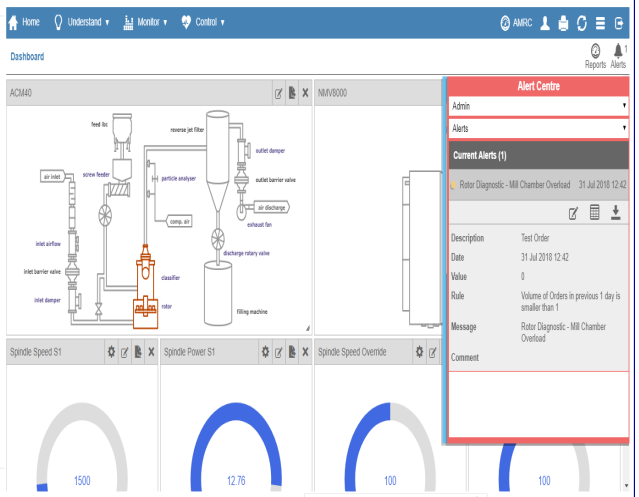
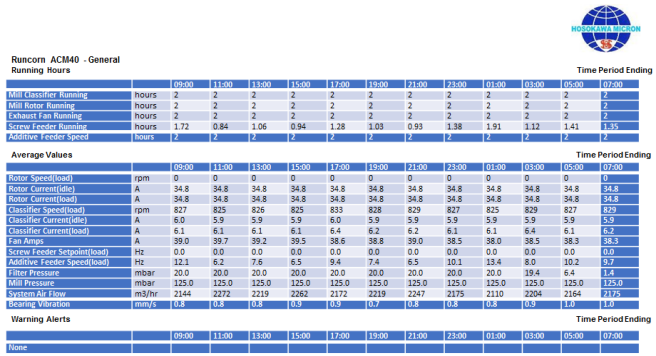
Manufacturing Portal



Process Data





Runcorn ACM40 - General

Running Hours — Time Period Ending

		09:00	11:00	13:00	15:00	17:00	19:00	21:00	23:00	01:00	03:00	05:00	07:00
Mill Classifier Running	hours	2	2	2	2	2	2	2	2	2	2	2	2
Mill Rotor Running	hours	2	2	2	2	2	2	2	2	2	2	2	2
Exhaust Fan Running	hours	2	2	2	2	2	2	2	2	2	2	2	2
Screw Feeder Running	hours	1.72	0.84	1.06	0.94	1.28	1.03	0.93	1.38	1.91	1.12	1.41	1.35
Additive Feeder Speed	hours	2	2	2	2	2	2	2	2	2	2	2	2

Average Values — Time Period Ending

		09:00	11:00	13:00	15:00	17:00	19:00	21:00	23:00	01:00	03:00	05:00	07:00
Rotor Speed(load)	rpm	0	0	0	0	0	0	0	0	0	0	0	0
Rotor Current(idle)	A	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8
Rotor Current(load)	A	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8
Classifier Speed(load)	rpm	827	825	826	825	833	828	829	827	825	829	827	829
Classifier Current(idle)	A	6.0	5.9	5.9	5.9	6.0	5.9	5.9	5.9	5.9	5.9	5.9	5.9
Classifier Current(load)	A	6.1	6.1	6.1	6.1	6.4	6.2	6.2	6.1	6.1	6.4	6.1	6.2
Fan Amps	A	39.0	39.7	39.2	39.5	38.6	38.8	39.0	38.5	38.0	38.5	38.3	38.5
Screw Feeder Setpoint(load)	Hz	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Additive Feeder Speed(load)	Hz	12.1	6.2	7.6	6.5	9.4	7.4	6.5	10.1	13.4	8.0	10.2	9.7
Filter Pressure	mbar	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	19.4	6.4	1.4
Mill Pressure	mbar	125.0	125.0	125.0	125.0	125.0	125.0	125.0	125.0	125.0	125.0	125.0	125.0
System Air Flow	m3/hr	2144	2272	2219	2262	2172	2219	2247	2175	2110	2204	2164	2175
Bearing Vibration	mm/s	0.8	0.8	0.8	0.9	0.9	0.7	0.8	0.8	0.8	0.9	1.0	1.0

Warning Alerts — Time Period Ending

	09:00	11:00	13:00	15:00	17:00	19:00	21:00	23:00	01:00	03:00	05:00	07:00
None												

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What Next?

The Future of the Digital Factory Initiative

- Connect to Sales for live scheduling
- Connect to Finance
- Develop and utilise digital twin for live scheduling
- Roll-out to additional HMG Contract Manufacturing suites (NL, DE, JP)
- Availability to 3rd Parties through Hosokawa Gen4







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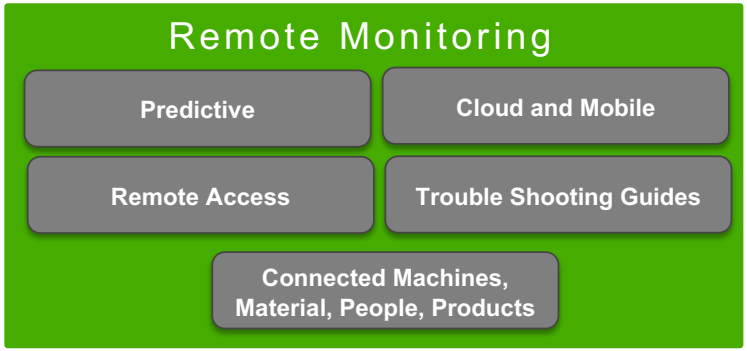
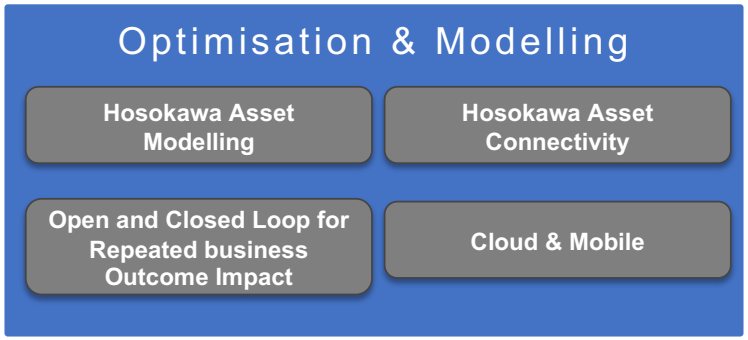
Gen4 IIOT Service Offerings
Hosokawa Asset & 3rd Party

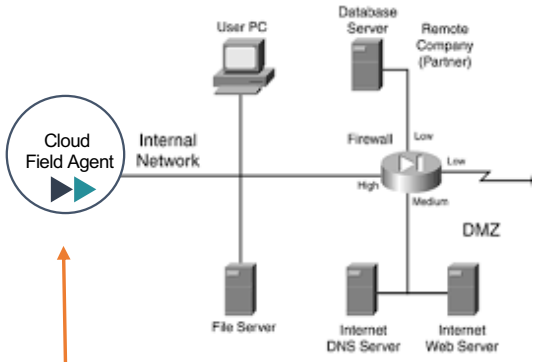




Gen4 Digital Services and Products
(6 Steps to Digital)

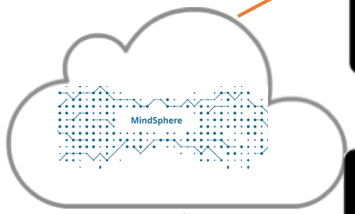
3

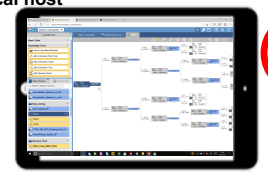
Connectivity On Premise or Cloud
Set up services
Asset Connectivity to platform services
Cyber



4

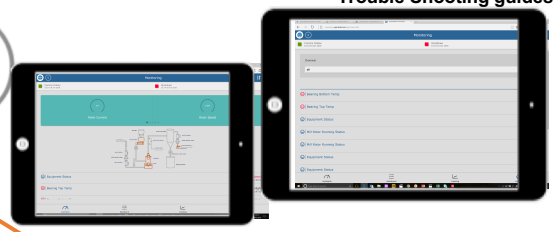
Connectivity to cloud of choice
Or Use Hosokawa Cloud
Or set up as an On premise local host



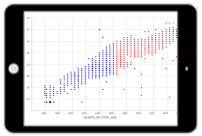


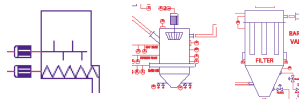
5

Data Rules Engine Developed
Remote Monitoring Tools
Predictive analytics
Process Optimisation Tools based upon real time Data
Reporting and regulatory
Tracability
Trouble Shooting guides



Customer Interface and Business Outcome Tools





Hosokawa Template Library being developed

2

Health Checks
Plant Upgrades
Data Discovery
Instrument Upgrades
Control System Reviews/upgrades
New Plant Design

1

Co Development of Digital Strategy

6

The Future:
Digital Twin Developed
Develop a bespoke app for business outcome
Virtual Reality Solutions

Product Lifecycle

Thank you for your attention

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