Presenting:
Industry 4.0 Oil Condition Monitoring

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IoT – From Product to Service
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Opportunities exist to improve operational performance of assets.

Current practice relies heavily on subject matter expertise to improve operational performance.

Scalable decision making solutions have become commercially attractive.

IIOT is an enabler to improved decision making but this often lacks invaluable contextual information.

Existing condition monitoring methodologies are ripe for improved IIOT integration.

Oil Condition Monitoring (OCM) has long been the staple diet for a maintenance engineering practitioner.

OCM is normally performed on discrete systems by subject matter experts.

I4.0 OCM is based on a five year journey towards a fleet based asset management approach underpinned by quantitative and qualitative data analytic decision making.
Monition: An Introduction

- The Monition Way (M-TAC):
  ✓ Assessment and Consultancy (Criticality etc.)
  ✓ Reliability Services (RCM, RAM, APT, RPM, RCA etc.)
  ✓ Condition Monitoring (VA, Motion Amplification etc.)
  ✓ Laboratory Testing Services (Oil Condition Monitoring etc.)
  ✓ Lubrication services (Lubricant selection etc.)
  ✓ Energy Services (Gas and air leak, heat loss, steam etc.)
  ✓ Corrective Services (Laser shaft alignment etc.)
  ✓ Training Services (accredited courses etc.)
i4.0 is essentially...

Connectivity
Promising opportunities through:

- Improved asset utilisation (30-50% reduction of total machine downtime) by:
  - Predictive maintenance,
  - Augmented reality for MRO,
  - Remote monitoring and control,
  - Machine flexibility, Routing flexibility

- Improved service/aftersales (10-40% reduction of maintenance costs) by:
  - Predictive maintenance
  - Remote maintenance
  - Virtually guided self-service

The Journey

**Lab Testing**
Machine Condition Analysis using Oil Analysis

**Biomon Project**
Assessment of bio-oils. Classification and profiling against machine/wear characteristics.

**Intellioil**
Intelligent diagnostics of data from any lab, rule based algorithmic interpretation based on rulesets.

**Janus**
Data Learning platform utilising decision making algorithms, putting collected data into context. Provides INSIGHT.
Oil Condition Monitoring (OCM) is a well known Condition Monitoring (CM) technique which enables understanding of the health condition of industrial assets, particularly the rotatory equipment.

By analysis of the oil used by assets, OCM identifies small problems and recommends proper maintenance actions before these problems cause a failure, with potentially massive cost and health & safety implications.

Macro parameters include: Wear, Chemistry, Contamination and Visual. Each macro parameter consists of a variety of sub (micro) parameters.
Monition’s Industry 4.0 Vision for OCM

Time

2016

2008

2000

Technology Development

Maturity of Market/Client Expectations

Data

Data Collection, Analysis & Storage

IntelliOil 4.0

IntelliOil 4.0 & AHP

Information (Connected Data)

Knowledge/Insight (Connected Info.)

Intelligent & Scalable Maintenance Decision Making

Scalable Asset Diagnostics

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2000

2008

2016
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Reviews biodegradable lubricants, assessing point at which they are no longer biodegradable.

Classification of each type of machine asset and profile against wear characteristics

Builds on the insight achieved through standalone oil analysis and lubricant condition assessment.
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Moving from OCM Data to Information – IntelliOil 4.0 Platform

- Oil Condition Monitoring using the Monition integrated oil data analysis and web-based reporting platform (IntelliOil 4.0)

- Product overcomes limitations of oil analysis data from a single lab, taking data from any lab, interpretation achieved via rule-based algorithms.

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Sample taken onsite and returned to chosen laboratory

Chosen Laboratory performs uniform analytical testing suite in line with the other laboratories to known standards.

Transfer of data directly into IntelliOil via CSV/XLS import

Collated data now unified into a single database. Intelligent trending, manual charting functionality and multiple other fleet management features can now be applied to all held data can now be utilised.
Moving from OCM Data to Information – IntelliOil 4.0 Platform

- Scalability – IntelliOil 4.0 dashboards provide an overview of the health status of assets (Asset Diagnostics) in different levels. These include component, machine, plant and area (Fleet).

- A typical IntelliOil 4.0 report demonstrates the conditions of micro and macro analytical elements of an oil sample in a rule-based traffic light alarm format, along with a maintenance action which is recommended by an analyst/technician.
Gaining Insight

Same lab or different, doesn’t matter provided same methodology (ASTM, ISO etc) is used.

Enables comparative analysis – same component, different usage, location, conditions.

“What’s different?”
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Moving from OCM Information to Knowledge/Insight

Pairwise comparison enables making consistent oil analysis decisions but contributes to standardisation, transparency and traceability of decision making, through a 6-stage process:

1. Define decision problem: Goal, Criteria, Alternatives
2. Development of a tree structure for problem
3. Formation of pairwise comparison matrices
4. Calculation of local importance weights
5. Checking inconsistencies for all matrices
6. Calculation of global weights (synthesis)
Where has this helped us?

- Windfarms
- Rail and Bus Fleets
- Oil Exploration
Case Study of Application

Where this has been applied:

Fleet: Automotive

• Modelling based on maximizing asset lifespan dependent on routes serviced, fleet condition/age and environment.

• Optimisation against the findings of these models based on drivers, be it normalization, financial savings or downtime mitigation.

• Industry-specific factors are drawn into the decision making process for optimal outcomes.
So What does this Mean?

The impact of human error and variability can effectively be limited as part of the decision making process – greatly improved consistency based on the parameters at hand.

- Standardised outcomes based on the data presented, irrespective of source.
- Machine learning – the ability to build self-determined alarm sets based on a variety of factors, not just “localised” data. Data sources and methodologies can even be validated/qualified, and even more importantly traceable.
- The ability to draw on historical data basing from potentially unlimited sources to draw universally consistent outcomes.
- Pooled resource – the ability to draw on the experience of many experts to find an optimal outcome.
Thank You

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