Technical Meeting — 3 July 2019

Bert Ritscher, Business Development Manager, Europe, Africa and Middle East, Caterpillar Assert Intelligence, gave a presentation on *Enabling Highest Uptime at Lowest Total Cost of Ownership* to a joint meeting with the IMarEST attended by 36 on 3 July in the Harricks Auditorium at Engineers Australia in Chatswood.

Introduction

Bert began his presentation by saying that you might think of Caterpillar as just the manufacturer of Caterpillar and MaK engines. However, Caterpillar is busy expanding its horizons, via Cat Asset Intelligence, into the field of asset management, and providing digital services to tie in more closely with its customers. The goal is to increase the uptime of assets while reducing the total operating cost.

Reliability and asset management value is provided by obtaining data from machines and sensors, analysing the data with intelligent analytics, and then providing expert advice in the following areas:

- Equipment management: Avoiding failures and reducing cost of maintenance.
- Productivity: Reducing downtime, increasing productivity and increasing fuel efficiency.
- Safety: Reducing unsafe operations and conditions.
- Sustainability: Ensuring environmental compliance.

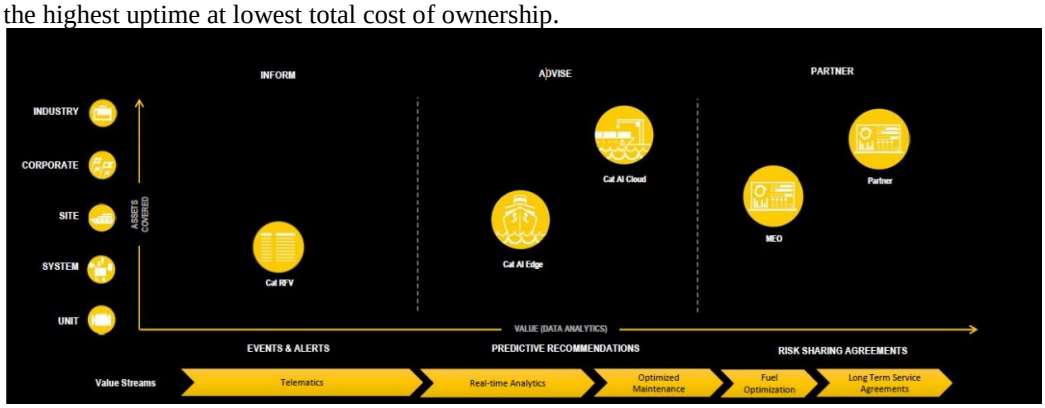
Cat Asset Intelligence

Cat Asset Intelligence (AI) provides three levels of service to customers:

- Inform: Knowing the location, health, and efficiency of the equipment.
- Advise: Increasing the overall operational efficiency, reducing unplanned maintenance costs, optimising maintenance and reducing risks.
- Partner: Risk/gain sharing, providing the highest level of consultative and customised services to enhance the overall digital strategy for reliability and asset management.

Telematics is the gathering of data on board the vessel and its transmission ashore; while analytics is the intelligent analysis of that data and provision of advice based thereon.

Here Bert showed a slide illustrating the three levels of service in the digital portfolio which, in increasing order, deliver the highest uptime at lowest total cost of ownership.



Caterpillar's digital portfolio
(Image courtesy Caterpillar)

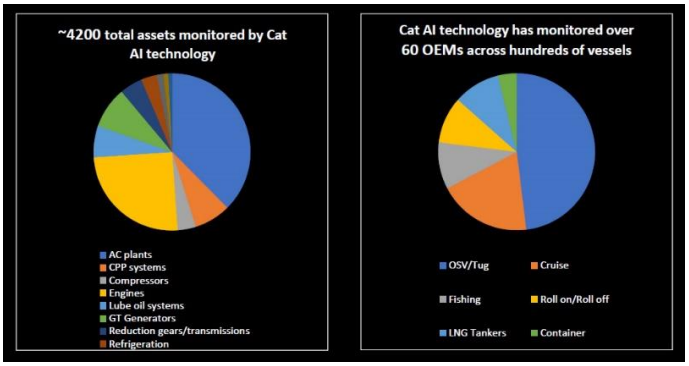
The Inform level offers a simple way to:

- Remotely access information from a single unit or an entire fleet.
- Know more about asset health and performance with the easy-to-use web interface that transforms data into insights.
- Make more informed decisions with accurate information available at your fingertips.
- Reduce repair time and costs with remote troubleshooting, using historical data about Events and Diagnostics.
- Leverage your dealer's expertise to get higher performance and longer life at a lower total cost from your connected assets

The Advise level creates customer value and solves performance problems with operational analytics applied to many different industries and equipment types by providing:

- Lowest operating cost: Schedule the right maintenance at the right time and location with the right cost.
- Highest uptime: Identify anomalies in a single fleet view for maximum efficiency.
- Customised analytics: Customise operational parameters or let the professionals at Cat AI do it for you.

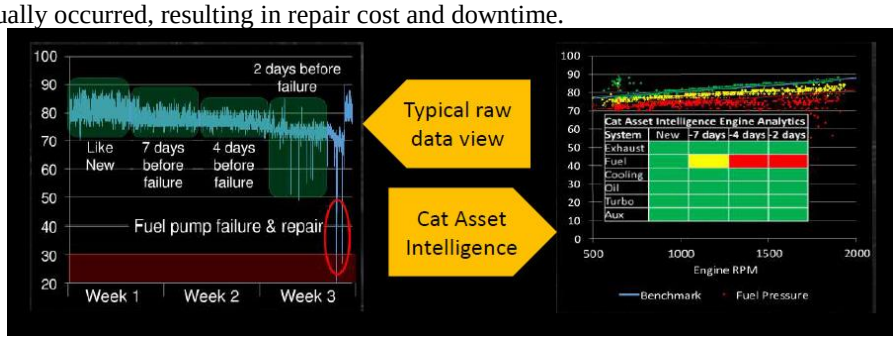
Cat AI has monitored more than 4200 total assets, and more than 60 OEMs across hundreds of vessels.



Cat AI monitoring experience
(Image courtesy Caterpillar)

OSV Case Study

Here Bert provided an example of an engine failure predicted on an offshore supply vessel. Cat Asset Intelligence analytics identified a potential failure of a fuel pump. The issue was not addressed by the crew and, as a result, the failure actually occurred, resulting in repair cost and downtime.



Cat AI prediction of engine failure on an OSV
(Image courtesy Caterpillar)

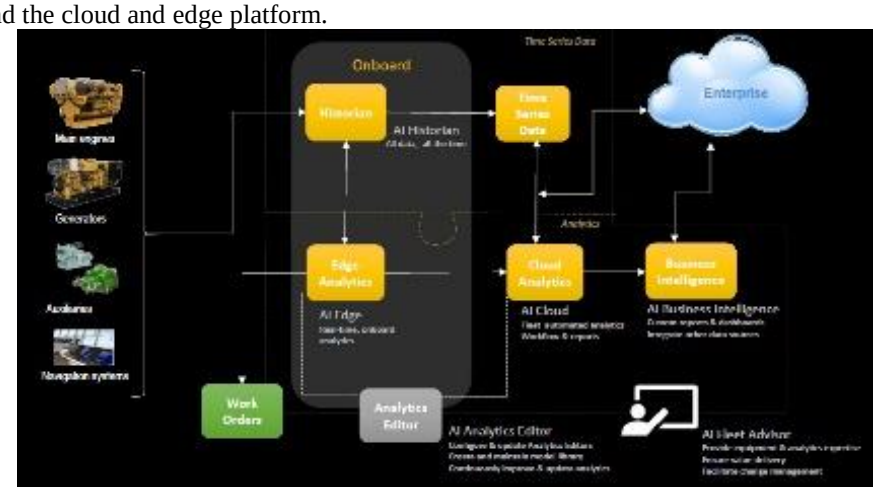
The vertical axis in the graphs represents pressure.
Had the crew addressed the issue, it would have minimised downtime and reduced costs, resulting in a total savings of $53 000.

HVAC Systems Case Study

Cat AI Analytics has monitored and analysed more than 500 air conditioning units. This has enabled significant air-conditioning energy savings (up to $500 000 for a single vessel), and air-conditioning failure avoidance (up to $450 00 for a single failure predicted and avoided).

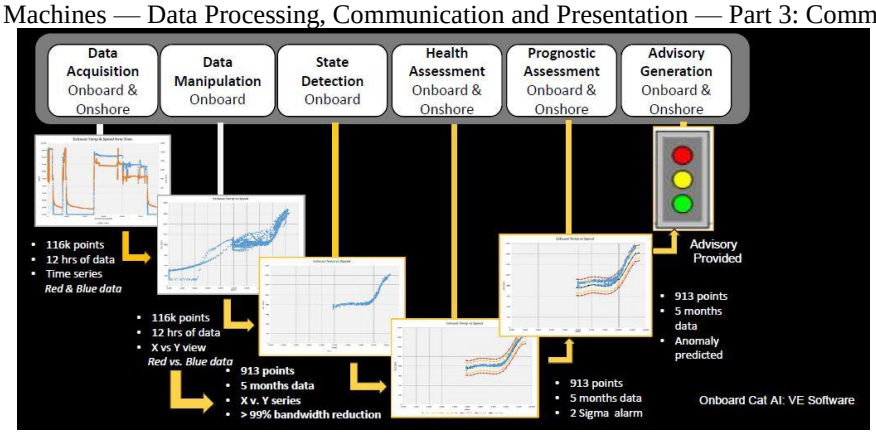
What is Cat AI Intelligence?

Here Bert showed a diagram of the real-time analytics platform, which includes the industry diagnostics, OEM diagnostics, and the cloud and edge platform.



Cat AI real-time analytics platform
(Image courtesy Caterpillar)

AI's approach to predictive analytics is in accordance with ISO13374-3:2012 Condition Monitoring and Diagnostics of Machines — Data Processing, Communication and Presentation — Part 3: Communication.

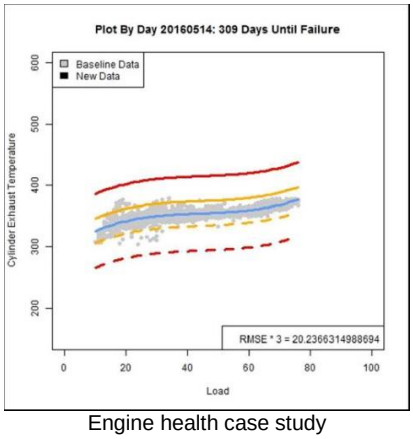


Cat AI predictive analytics
(Image courtesy Caterpillar)

In the right-hand graph, the data can initially be seen to be within the normal bands. However, as time progresses, the data gradually approaches, and then exceeds the upper limit, and an anomaly—or failure!—would be predicted.

Engine Health Case Study

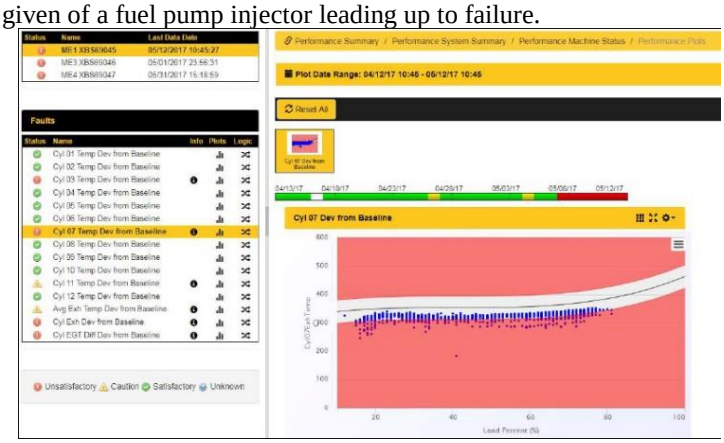
Bert then showed an example of the health of an engine being monitored by the relationship between load and exhaust temperature. Starting 309 days before failure, the relationship is seen to be within the "healthy" boundaries of the plot. The video brought to life the data, which gradually transitioned outside of the "healthy" boundaries. At "-1 Days Until Failure" (or one day after replacement) the data visibly jumped back into the "healthy" boundaries.



Engine health case study
(Image courtesy Caterpillar)

Fuel Pump Injector Case Study

An example was also given of a fuel pump injector leading up to failure.



Fuel pump injector case study
(Image courtesy Caterpillar)

Conclusion
Caterpillar has extended its horizons from the manufacture of diesel engines into the field of asset management and the analysis of condition-monitoring data to better manage the assets in a system. Case studies have shown that significant savings can be made via increasing uptime and reducing total operating costs.

Questions
Bert fielded many questions on the way through his presentation, but question time at the end elicited some further interesting points.
Cybersecurity is not really an issue. Caterpillar uses standard firewalls, and ship-owning companies may also have their own. However, the classification societies will not allow the remote operation of equipment from outside the vessel, so this cannot be hacked. Data only can be transmitted.
Caterpillar has not yet joined the autonomous vessel bandwagon, although Damen has. Caterpillar has entered the field with the big mining trucks which haul the ore and operate autonomously, providing safety, reliability and efficiency.
The raw data which is collected on board the vessel, and the processed data, is all owned by the customer.
Vast amounts of data are collected, for each item of equipment on board a vessel and, hence, for a fleet of vessels. Wider still, for the whole merchant fleet! Caterpillar is not at the stage of monitoring industry-wide data. They can analyse the data for 3500-series engines, in order to build better engines, but not to give the data to others.
Cat AI is happy to provide the analytics for all equipment apart from their own; Caterpillar, MaK, MAN, Cummins, Wartsila, MTU, etc. The customer owns the vessel and has the option to integrate the systems and the data using whichever provider they wish.

Bert Ritscher (L) accepting his certificate and “thank you” bottle of wine from Geoffrey Fawcett
(Photo Phil Helmore)

The vote of thanks was proposed, and the certificate and “thank you” bottle of wine presented, by Geoffrey Fawcett.
[*If you are interested in finding out more about Cat Asset Intelligence, then visit www.catassetintel.com*—Ed.]