Jack Poley

# Continuous oil analysis

*We're not there yet, but emerging technologies and profit considerations are surely moving us in this direction.*

In September we discussed hybrid monitoring and testing strategies for oil analysis as being the harbingers of the inevitable evolution of a seamless process to condition monitoring. Oil and vibration analysis are the two dominant CM components and are likely to remain dominant for the foreseeable future.

The missing ingredient from an encompassing real-time approach to equipment monitoring has been the lack of discriminating, dependable (rugged enough) oil-circuit sensors that can provide early warning of impending problems not discernable with vibration monitoring. These types of products, however, are now becoming available, as mentioned in this column.

We have also seen the advent of thermography and, more recently, various applications of acoustic monitoring to assist in isolating trouble spots in machinery techniques that can greatly enhance the effectiveness of maintenance efforts once suspicious oil analysis data or vibration readings are present. Nevertheless, these tools are usually more effective in conjunction with oil and vibration monitoring.

It seems obvious, once oil sensors are vetted and fully accepted, to collate vibration data with oil analysis data (including both sensor and offline analysis) to fully maximize the information yield, thereby maximizing the accuracy and return on the CM program. There are numerous companies employing both oil analysis and vibration analysis, but in many of those situations, curiously, the two disciplines are not viewed in a composite manner because different maintenance groups are involved, therein not availing the most information possible. Sometimes there may be no consequence to this disconnect, but there will clearly be times when all available information will result in better decision-making.

Figure 1 is a block diagram of how one might approach the integration of techniques, as noted above:

This diagram represents critical pieces of a holistic system concept for continuous CM. The segmentation is as follows:

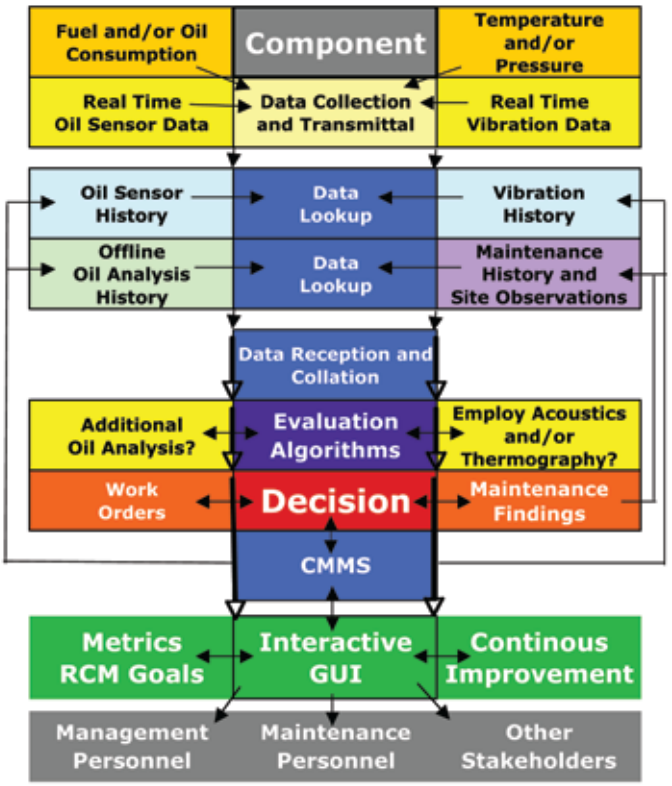


Figure 1

## ONSITE DATA COLLECTION AND TRANSMITTAL

- **Fuel (if applicable) and oil consumption data**. This information will tend to influence oil analysis data normalization.
- **Temperature and pressure readings.** These data have been routinely monitored for decades and can readily and directly influence or temper evaluations of other data.
- **Sensor readings.** Monitored in real-time.
- **Data collectors** (onsite software and firmware).

- **A means to transmit collected data from the site** (hard-wire cabling, bluetooth, satellite, etc., dependent on logistics and data to be collected).

## OFFSITE DATA RETRIEVAL (LOOKUP)

- **Historical data from oil and vibration sensors,** wherein statistical trends are developed and applied in order to possibly modify or fortify the various evaluation algorithms and decision-making.
- **Past maintenance and available machine condition history.** Again, to be used as modifiers for evaluation algorithms. When data patterns suggest problems found previously, these problems become the most likely targets for inspection.
- **Offline oil analysis data.** Even though sensors may well enable lengthened oil analysis sampling intervals (and such policy should be carefully considered outside of sensor manufacturers' claims), these devices are not nearly ready to perform all the functions of a comprehensive oil analysis. As mentioned in a previous column and suggested in Figure 1, offline oil analysis history can sometimes play a key role in deciding what to do with abnormal sensor readings, wherein a problem is suggested, but not specified.

## DATA RECEPTION, COLLATION AND EVALUATION

- **Data upload software to the CMMS** (Computerized Maintenance Management System).
- **Evaluation algorithms (software).** Discriminating expert systems to arrive at practical, effective maintenance procedures and decisions.
  - Recommend additional oil analysis when needed to render an opinion with sufficient confidence.
  - Recommend deployment of thermography, acoustic aids and other problem isolation technology when uncertain of the location of the problem.
  - Render a logical maintenance action (decision) and work order to be electronically forwarded to the machine site.
  - Modify the expert system to reflect actual findings over time.

## PRESENT DATA TO MAINTENANCE AND MANAGEMENT

- **GUI (Graphical User Interface)** that allows macro- and micro-views of the maintenance system, data and actions recommended and taken, presenting information in an easy-to-understand and easy-to-use format via good visual ergonomics with options and controls for how data are to be presented to the viewer. A GUI is an essential component to a holistic system because it is the portal to the maintenance arena for a given operation, allowing users to understand and respond to alerts with precision and confidence. The GUI should allow the qualified user to interact with, even override computer-generated decision recommendations when, in the user's opinion, such action represents the best overall response. The system can later help verify the wisdom of such overrides. As well, other stakeholders such as lubricant suppliers or OEMs can be allowed to participate in order to share knowledge and, perhaps, provide additional insights.
- **Calculated metrics based on management goals.** This would include comprehensive data review to isolate trouble spots with lubricants, machinery types or models, individual venue performance and so forth. RCM (Reliability-Centered Maintenance) goals, improvement goals and ROI (Return on Investment) would, of course, be paramount in the metrics mix, providing justification and proof of performance.

Easier written about than accomplished, a holistic approach to CM or "site-direct" continuous monitoring, support and decision-making, guided by expert systems and collaborative technology, is highly desirable and ultimately most profitable in maximizing machinery utilization and production. Too, it is likely an inevitable development, given available technology. The stakes would seem to demand we move in this direction. TLT

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