Jack Poley

Evaluating hybrid strategies

Gathering data is a critical element in understanding this complex process of planning a condition monitoring program.

Health care has changed over time, although what hasn't changed is the rising costs, which are now more expensive than ever. But in progressive societies it also has gotten more sophisticated (i.e., better), particularly with the treatment of such monster afflictions like heart disease, diabetes and cancer.

As I've stated before, oil analysis is also making the journey of continuous improvement and sophistication in a very parallel, if not as dramatic, way.

Demanded and inspired by the oil monitoring analyst community and evaluators (those whose job it is to interpret data and render vital commentary), today's available instrumentation is both varied and focused toward oil analysis condition monitoring problems.

With some notable exceptions, like ferrography and magnetic ferrous debris detection in any form, previously extant instruments have been adapted to accommodate oil analysis needs. Examples of this include wear and additive metals spectroscopy (ultraviolet spectral region, primarily)—the heart of most CM oil analysis and infrared spectroscopy (FTIR), which utilizes and requires a computer for Fast Fourier Transforms.

Titration for various data, such as acid number (AN) or Karl Fischer water, is yet another adapted technology—and today titration itself is currently under attack by FTIR, as methods for the latter technology have emerged to inspect for previously undependable measurements of fuel and water contamination, in addition to the more routine determination of soot, oxidation, nitration and sulfation.

Additive-specific detection and measuring methods also have been developed via FTIR. More recently, proven chemistry has been developed to allow measurement of AN and BN (base number). Viscosity is in this mix, too.

As there is a drive to gain increasingly more information at the machine, so is there a drive to gain increasingly more information in a single testing effort, such as FTIR, perhaps the most promising technology in this regard. FTIR is now available in a handheld unit, which is likely a precursor to a sensor-based FTIR that can withstand the torture of inline exposure.

It is the continuous drive toward instant gratification—quick, incisive results—that should drive maintenance managers toward a hybrid program, particularly for critical equipment, inasmuch as it will likely be awhile before the all-inclusive sensor arrives. The notion of hybrid CM amounts to a composite approach to monitoring one's equipment: that is, the incorporation of more than one monitoring strategy. There are at least three distinct strategy levels that can be availed, as shown in Figure 1.

Each strategy has its advantages and disadvantages. More

Figure 1

OIL MONITORING STRATEGIES					
Type of Monitoring	Possible description or configuration	Information available	Timeliness	Possible issues	Comment
Inline	• Single sensor • Array of sensors	Limited-to-Good	Virtual	False sense of security: Sensors have been known to foul or otherwise become dysfunctional	Select a sensor or sensors that yield good earlywarning indications for the expected problem(s)
Onsite	• Single additional test • Handheld device • Fully-equipped laboratory	Good-to-Excellent	Minutes-to-Hours	Availability of skilled personnel when a formal laboratory doesn't exist (OMA certification desirable)	Handheld instruments of complexity and depth now exist, but require some formal training to utilize
Offsite	Fully Equipped Laboratory • Commercial • Central-Private	• Good-to-Excellent • Inspections not available by any other means	Days-to-Weeks	Laboratory personnel may not be intimately familiar with the venue and application, possibly limiting the data evaluation	Most problems revealed by oil analysis can 'wait' a week or two to be addressed, but which ones?

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can certainly be stated about each approach, but the idea is to understand what each can deliver in the way of information and benefit and then decide on how to best apply them to each component that will be participating in the program.

Critical components, those that are expensive in any form (production loss or cost to replace) or pose any sort of safety problem, should get the most attention. You should be willing to spend a considerable amount protecting such equipment.

Here is a further elaboration on the table in Figure 1:

Sensors. Additionally these could be vibration, temperature and pressure sensors, as well.

Entry level. Choose one or more that represent the types of problems you expect to encounter (history is a key indicator). Will a general sensor for "oil condition" suffice? Is water contamination frequent? Is the component unfiltered and, therefore, likely to have significant, revealing, ferrous debris in the sump?

Most encompassing level. Consider an array of sensors (more is better, expense not withstanding)—calculate loss of production if you are having difficulty getting your wallet out of your pocket.

Onsite. What arsenal should you assemble? Whatever it takes to resolve the sensors' indications, one should always test the oil when sensors suggest a potential problem. Occasionally you'll also get lucky and find a problem not revealed by the sensor.

Single bench or wet chemistry test add-on. Perhaps a BN or AN is particularly important in determining a safe lube drain extension.

A well-stocked portable test kit might be a good middle-of-the road approach. AN, BN, viscosity, soot, water and more can be addressed by such kits (*See Figure 2*).

Figure 2 *(Courtesy of Kittiwake Developments, LTD)*

Advanced. There are a number of portable or handheld devices that raise the sophistication level that are now available. Particle counters and, more recently, FTIR devices (*see Figure 3*) are among these types of instruments.

Figure 3 *(Courtesy of Spectro, Inc.)*

Holistic. There is enough critical machinery to justify setting up a complete laboratory facility, obviating the need for offsite testing in most instances.

Offsite. Ostensibly the most complete analysis available and, therefore, always a good idea when a sensor reading is abnormal, especially if no onsite analysis is available.

Routine. The standard approach of wear metals, FTIR, viscosity and so forth.

Particulate add-ons. Routine and a selection from particle counting, PQ (particle quantifier).

Holistic. Analytical ferrography and other forms of microscopy, as well as more specific tests when indicated. *This is the testing employed for decision-making when machinery stoppage and disassembly is contemplated.*

The bullets under each strategy type are arranged from least expensive to most expensive. For critical components, it should not be difficult to justify going deep into the bullets. Moral: Don't be a penny-pincher with a million dollar risk consequence in the balance.

One last thought in this scenario: What are you going to do with all the information you now have? You've employed several sources to gather it, so it's no longer possible to rely on a single source for the evaluation, the reasoning and recommended action and decision-making—it's now your baby. Here are the alternatives:

- **You know what you're doing and can do it yourself:**
  - You have the mechanical background.
  - You understand lubricants.
  - You understand the interplay of current information (sensor) and previous information (sample histories).
  - You have the time and skills to do it properly.

- **You hire someone else, or a service, to do it:**
  - You don't have the time or skills to do it properly.
  - You have confidence in the personnel, their experience and the methodology involved.
  - There is a delivery system (Web-based or other GUI) so that the evaluation is pertinent and timely.

This is, of course, a huge simplification of a complex process, but it is a process that must be absolute in one's overall thinking and planning for a world-class oil monitoring program. Data are the evidence that leads to the evaluation. Without a proper evaluation there's no point in gathering data, is there? TLT

Jack Poley is managing partner of Condition Monitoring International (CMI), Miami, consultants in fluid analysis. You can reach him at ***jpoley@conditionmonitoringintl.com.*** *For more information about CMI, visit* ***www.conditionmonitoringintl.com.***