Plant Services
SPECIAL REPORT

Modern-Day STOs

How to look beyond the fixes and find opportunity in the outage

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Planned outages are notoriously time- and cost-constrained. Planners and schedulers of shutdowns, turnarounds, and outages (STOs) work diligently to squeeze into the extended downtime as many fixes as possible. However, in the quest to prioritize corrective actions, valuable opportunities for modernization may be overlooked.

Finding opportunity in the outage begins with expanding the conventional STO mindset:

- Would replacement sensors and technologies make life easier, less risky, and less expensive?
- Are smarter, more efficient maintenance tools available to validate service quality and shorten the outage time?
- Are spare parts quantities and complexities overly burdensome?

Having maintenance tasks dominate the focus at the expense of strategic technology investments can be counterintuitive. STOs are the ideal time to incorporate new technologies and processes that reduce operational risk, increase efficiency, and are more cost effective in the long run. Instead of just fixing things, strive to take outage planning to the next level and realize better outcomes.

TIMING IS EVERYTHING

Many maintenance and overhaul opportunities are only feasible when the underlying machine is down. Planned outages are the preferred time for valve repairs or replacements; instrument calibration; eddy-current sensor chain replacements; obsolete protection system replacements; bearing replacements; pump impeller replacements; seal replacements; gear replacements; alignment and balance of machine trains; and more. Performing such tasks on an operating machine may not be possible or may cause it to shut down or leave it unprotected.

Unfortunately, some missed opportunities will only come to light upon asset failure. If a plant takes insufficient advantage of predictive technologies, or if reactive (run-to-failure) maintenance is preferred, maintenance that could have been proactive and planned instead becomes hurried and less organized. If the necessary parts or personnel are not readily available, the effects of the delay will quickly permeate the organization as every minute of unscheduled downtime compounds the costs to the business.

VALUABLE OPPORTUNITIES

To help scope STO work and facilitate maintenance prioritization and planning, numerous predictive intelligence technologies are available. Vibration analysis, ultrasonic analysis, motor current signature analysis, infrared thermography, and oil analysis are among the methods available to detect degrading asset conditions before failure occurs.

There are also machine health analysis tools that add analytics to integrated predictive maintenance data, and application-specific options such as online valve diagnostic tools for monitoring control valve health and performance.

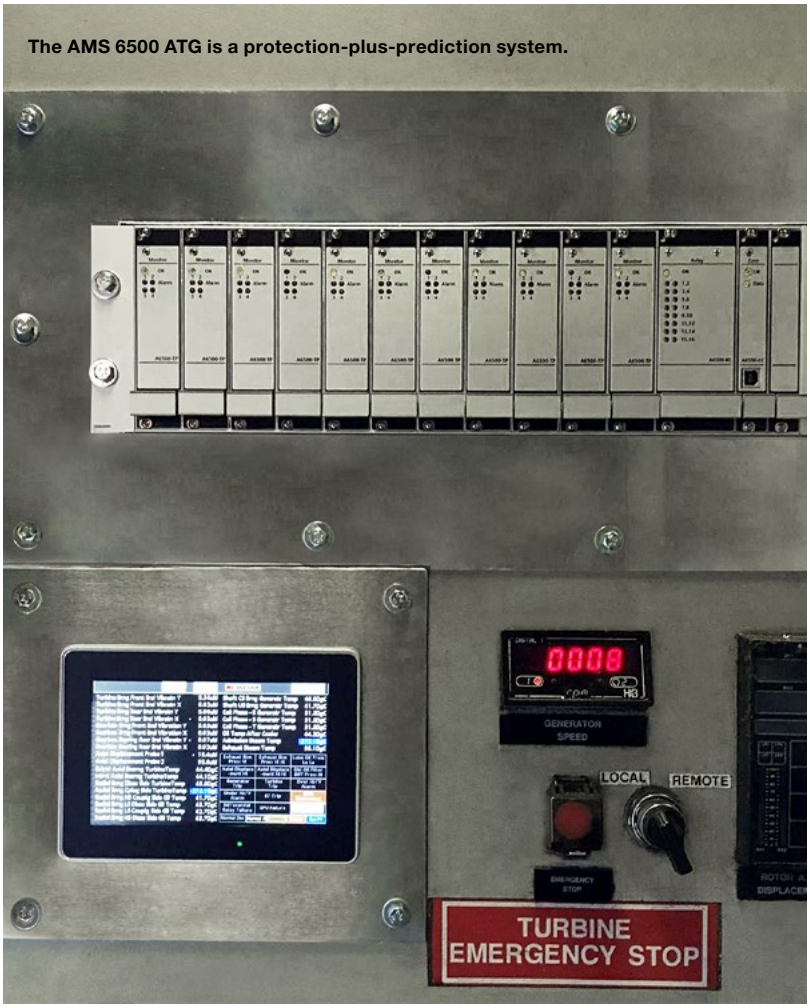
Furthermore, today's smart field instrumentation can be connected online via HART or Foundation Fieldbus protocols to device management software; online and wireless monitoring technologies can be connected to Industrial Internet of Things (IIoT) platforms; and mobile apps can be used to stay connected to asset management software.

To better understand the opportunities posed by modernization during outages, let's look at three example technology innovations:

an advanced machinery protection system, smart eddy-current sensor and converter, and multi-purpose machinery analyzer.

ADVANCED PROTECTION SYSTEM

Many installed protection systems are decades old and no longer maintainable. For obsolete yet functioning systems, it can be difficult to build a business case to upgrade to another protection-only system. A next-generation, scalable, protection-plus-prediction system is a much easier investment to justify, and STOs provide an ideal opportunity to swap out the technology.



The AMS 6500 ATG is a protection-plus-prediction system.

(Source: Emerson)

For example, Emerson's AMS 6500 ATG protection system with built-in prediction capabilities simplifies plant management and reliability roles by helping to identify developing machinery faults before failure, without any additional footprint. Some other protection systems that offer prediction data are inflexible and costly to implement, and the users must visit the control room or field cabinet in order to view the data.

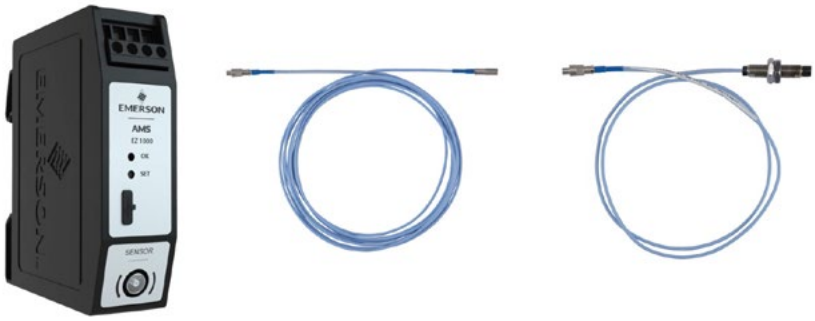
Embedded predictive diagnostics in the AMS 6500 ATG enable real-time viewing of data such as order analysis (including peak and phase), band analysis (with up to eight programmable filter bands), energy in bands, time waveform, frequency spectrum, trend, and impacting data (from gearboxes and bearings). It comes with two easily configurable monitoring cards, making it flexible and scalable for any type of prediction measurement or late changes needed during the STO.

With its built-in Modbus and OPC-UA communications, the predictive data can be imported from the AMS 6500 ATG to Emerson's AMS Machinery Manager or other business or control systems via an Ethernet connection for further condition analysis, including regular parameter trend updates, spectrum, waveform, and orbit plots or graphical MHI updates.

For those seeking full prediction capabilities, an optional Prediction Extension license delivers advanced prediction functionality including shutdown protection for balance-of-plant assets such as fans, boiler feedwater pumps, and assets located in hazardous environments which require agency-approved monitoring solutions.

SMART EDDY-CURRENT SENSOR AND CONVERTER

Another STO opportunity is modernizing the eddy-current sensors and converters used with machinery protection systems. Measurement chains are vulnerable by nature: the sensor probes may break off over time; cables running across the floor can get stepped on, melted, or damaged; and converters may eventually fail.



(Source: Emerson)

ONE CONVERTER FIT TO USE WITH ANY CHAIN

Having a spare converter on hand for every eddy-current measurement chain is cost prohibitive. One completely configurable converter can eliminate the clutter, expense, and lost time.

Traditional parts replacement is complicated by the need for exact matches between the sensor, extension cable, and converter in order for the chain to function properly and maintain calibration. In addition, most sensors and converters in use today must be factory-calibrated. As a result, excessive spare parts inventory must be kept on hand to address a multitude of sensor chain combinations and avoid long-lead-time replacements. Inevitably you will not have the right spare when the need arises, resulting in delays while waiting for the shipment from the supplier.

The new AMS EZ 1000 from Emerson is an eddy-current sensor and converter that is evolutionary in its approach. Users can field-calibrate their eddy-current sensor chains to whatever length or sensor is needed in order to quickly get the machine back into operation. The sensor can be calibrated at the push of a button in most cases, and the entire sensor chain can be configured in a quick, three-step process.

The total cost of eddy-current measurements is reduced with the AMS EZ 1000. Because the sensor and converter can be easily reconfigured to match any cable length or type on hand, it simplifies the ordering of extension cables by reducing the variety and quantity required. Because it works with Emerson as well as third-party sensors and converters, it eliminates the need for multiple types of eddy-current converters. Users can consolidate on a single, configurable, digital converter SKU for maximum simplicity and spare parts reduction.

Although the AMS EZ 1000 will create some initial extra STO work as the existing sensors are switched out, it will ultimately expedite maintenance and reduce inventory levels, ensuring a sound return on investment.

MULTI-PURPOSE MACHINERY ANALYZER

New, multi-purpose machinery health analyzers allow field technicians to carry and operate fewer tools during maintenance and inspections. The AMS 2140 Machinery Health Analyzer from Emerson is a single instrument that serves three functions: portable vibration analysis, wireless laser alignment, and field balancing.

Because excessive vibration in rotors and shafts cause damage to seals and bearings, returning them to smooth-running operation is necessary to prevent excessive degradation and failure. The AMS 2140 allows users to precision-balance rotors and laser-align the shafts of machine trains while they are idle during STOs. It is also useful for verifying vibration measurement

tolerances and performing off-line diagnostic tests such as resonance and bump testing during the STO.

In addition to these corrective actions, the AMS 2140 can be used year-round to collect and analyze vibration data on rotating equipment. Its simultaneous four-channel plus phase data collection and peak detection capabilities identify early signs of failure. The findings help to determine which machines require immediate attention, and which can be included in STO planning.

This multi-purpose machinery analyzer includes laser shaft alignment capability.

For example, if excessive vibration is detected by the AMS 2140 in pump motor train #3, a work order can be planned for the next STO. During the scheduled outage, that same tool can be used by the technician to confirm the condition, perform alignment and balancing, and also validate the correction.

When more urgent conditions are found during routine vibration data collection or unscheduled downtime, the tool allows for on-the-spot corrective action rather than removing the unit and taking it to the shop for maintenance, or waiting until the next planned outage. One fertilizer manufacturer saved a total of $100,000 by performing in situ balancing of a critical, problematic motor. Using the portable vibration analyzer to balance the equipment avoided the costs of rotor replacement, manpower to remove and reinstall the equipment, and paying the vendor for a second round of balancing. It also shortened the motor downtime from three days to less than one day.

A NEW WAY OF THINKING

STOs are like maintenance pit stops for a race car; when it's time for service, it is important to know ahead of time which assets are doing fine, which ones require maintenance, what parts will be needed, and whether the technology used offers optimum efficiency and effectiveness.

STOs provide a valuable opportunity to upgrade and augment existing capabilities and take your reliability program to the next level. Review your equipment, technology, and work processes for replacement and upgrade options, determine which investments are most worthwhile, and incorporate them into your STO planning processes. Don't just fix things during planned outages – use the time to modernize. ☐

Additional Resources

Modernizing Your Protection System - Plants looking for the advantages of a modern protection system are turning to Emerson's AMS 6500 ATG – an API 670-compliant protection system with embedded, field-proven prediction technology.

» CLICK HERE

Measurement Chain Failure No Longer Impacts Production - The AMS EZ 1000 measurement chain simplifies ordering and reduces the total cost of ownership for eddy current measurements.

» CLICK HERE

Applications for the AMS 2140 – The AMS 2140 offers a suite of maintenance applications including alignment, balancing, and advanced diagnostics.

» CLICK HERE

Monitoring the Conditions of the Plant Assets - Condition monitoring is acknowledged as a critical best practice, but it's not without its challenges. Understanding the right technology for the application is critical.

» CLICK HERE