GE
Measurement & Control

Nexen Case Study: Diagnosing a gas turbine problem from 800 km away

Remote diagnostic services are relied upon more and more as a viable alternative to on-site service. When a skilled analyst can access data remotely to diagnose a problem, the inherent delay and expense related to travel are eliminated. With precious time saved, problems can be resolved before collateral damage occurs, and at lower cost. This is one such case. Two GE's Bently Nevada* analysts—one working remotely from a home office in The Netherlands, and another from a corporate office near Aberdeen, Scotland—connected to GE's System 1* condition monitoring software on a North Sea offshore platform complex and successfully diagnosed a problem with one of the gas turbines. Rapid isolation of the root cause enabled the customer to take corrective actions while the impact was still minimal.

A Properly Configured and Maintained System Is a Prerequisite

When the analyst cannot be on-site, the option of simply walking over to a machine to access pertinent data is obviously out of the question. Even picking up the phone to ask a question may be problematic due to time zones. The analyst must have remote access to machine data and other supplemental data over a secure network; this requires that the underlying asset condition monitoring system to be properly configured and maintained.

Fortunately for Nexen, their Supporting Services Agreement (SSA) from GE ensures this. As part of the SSA, GE's Bently Nevada Asset Condition Management team provides continual support for the health and proper operation of Nexen's 3500 series monitoring hardware and System 1 software. It is also noteworthy that several aspects of the SSA such as server maintenance, software upgrades, and configuration are delivered remotely as well.

Case Background

The Nexen Inc. Buzzard complex consists of three interconnected offshore platforms located approximately 100 kilometers northeast of Aberdeen, Scotland. At peak production the complex can produce nearly 200,000 barrels of oil equivalent per day.

Unit C is one of three critical gas turbines that generate the platform's electricity. The unit's primary source of lube oil is an AC-powered pump and switches over to a DC-powered backup pump to maintain a minimal lube oil flow in the event of a power failure. During the course of several unexpected trips, it appeared to local operators that the switch-over logic was functioning normally; however, under close scrutiny by the Bently Nevada Machine Diagnostic Services (MDS) team working remotely, this was found not to be the case.

Case History

Shortly after startup on January 5, Unit C tripped unexpectedly when power to the turbine control system was interrupted. Nexen operators confirmed the successful switchover from AC pump to DC pump and restarted the unit. However, after several cycles of restarting and tripping over the course of two days, operators decided to take a closer look. They found excessive temperatures occurring at one of the bearings during the initial trip (January 6). That's when the MDS team was called on to assist with the analysis. Using System 1 software, the MDS team was able to correlate bearing temperature, gap voltage, and rotor speed measurements; and compared these with archived baseline data. As evident in the Fast Trend Plot in Figure 1, the team noticed that bearing temperatures started to rise when the speed of the unit slowed to around 2400 rpm. They attributed this to bearing rub. Also evident was a corresponding increase in gap volts, suggesting removal of bearing material due to contact between the rotating shaft and stationary bearing pads.

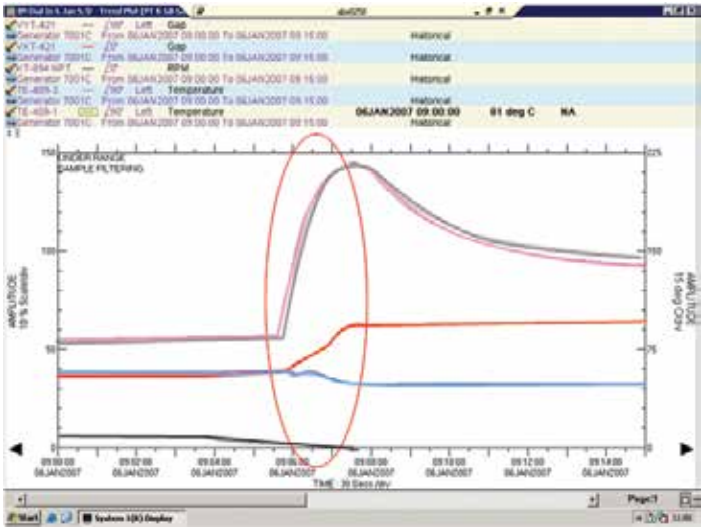

Figure 1. Fast Trend Plot for January 6 trip of Unit C

To confirm, the MDS team compared archived data for a normal coastdown profile, Figure 2 with the coastdown data from the January 6 trip, Figure 3. They observed the coastdown started normally; then, at approximately 2400 rpm the rate of deceleration began to increase rather than decrease.

The evidence pointed to a wiped bearing and the removal of enough babbitt material to warrant a physical inspection. Nexen agreed. As expected, a wiped bearing was found with signs that the damage was due to lack of lubrication. Attention turned back to the lube oil pumps. Further inspection revealed the oil system's accumulator circuit was not operating as intended, causing a drop in oil pressure during the trip of the AC pump and subsequent start of the DC pump. Although the DC pump had been operational, the lube oil pressure had not been adequate during the switchover. The control system logic was reconfigured to maintain adequate oil pressure, and the unit was returned to service without further incident.

Conclusion

The ability to quickly diagnose this problem was in large part due to remote connectivity to Nexen's system by an experienced machinery diagnostics engineer. This eliminated the inherent delays and expense in traveling to an offshore platform. However, remote diagnostics would not have been possible without an underlying system that was being continually maintained properly to ensure the configuration was correct and complete, and that all necessary supplementary data, such as process conditions, design bearing clearances, archived "baseline" data, etc., were available and remotely accessible. Nexen chose to use a Supporting Services Agreement to ensure the accuracy and availability of their system. As a result, when they needed to rely on the data as well as its interpretation by GE machinery specialists, they were able to do so with confidence.

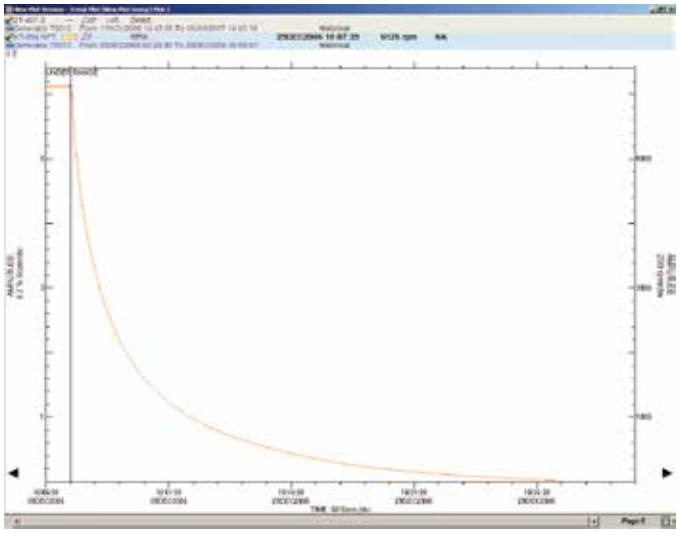

Figure 2. Normal coastdown profile

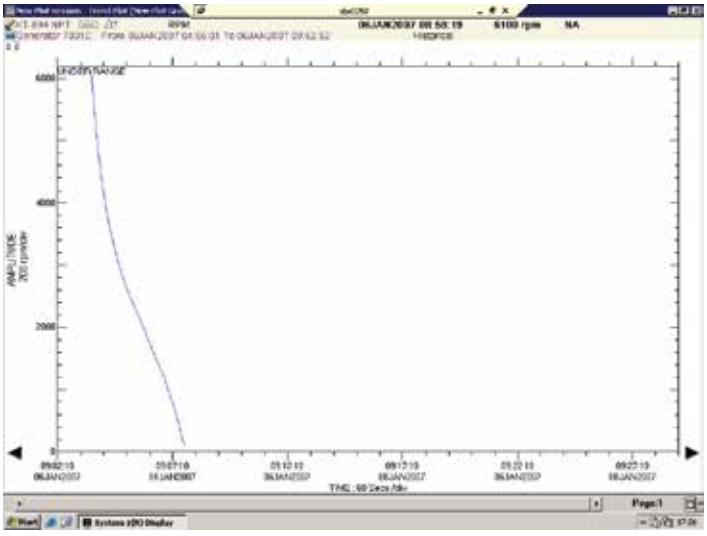

Figure 3. Coastdown data from the January 6 trip

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