

Online Equipment Health Monitoring Supports Production Efficiency Improvements

Alcino Beirao from Emerson Process Management explains how wireless monitoring of critical and essential offshore equipment such as pumps and compressors, can help support a cost effective maintenance programme leading ultimately to increased production efficiency.

BY ALCINO BEIRAO

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Reduced oil prices have increased the need for greater production efficiency from assets in the North Sea. The region currently suffers from poor average levels of production efficiency and high cost of exploration. The condition and availability of equipment plays a significant role in production efficiency and effects operating costs. To maximise production, operators must aim to reduce the frequency of unplanned outages whilst looking for ways to maintain or

increase equipment efficiency and reduce overall maintenance costs.

These improvements must be achieved despite an already stretched workforce, a general lack of available experienced maintenance engineers and a high turnover of staff. There are also the day to day logistical challenges associated with the maintenance of offshore assets. These include finding suitable accommodation for specialist onshore maintenance teams and organising helicopter flights. Tighter safety controls including a ban on flying in the most severe weather can prove to be a particular challenge if urgent repairs are required to failed equipment.

Essential and Critical Equipment

Offshore equipment is usually categorised as either “essential” or “critical”. The good way of differentiating between the two categories is that should “critical” equipment go offline this results in an immediate production or processing outage. Because of this, critical gas driven turbines, water

injection pumps or compressors will have protection or failure prediction systems in place. On the other hand, when essential equipment such as pumps, cooling fans or heat exchangers go offline, this tends to cause a disturbance that affects process efficiency.

But in terms of making improvements it is not as straight forward as just focusing attention on critical equipment. Production and process cycles are inter-linked, therefore an operator must also carry out due diligence on essential equipment too. Unfortunately, when some of the now ageing assets were constructed, the significance of automated monitoring of essential equipment was not considered. As a result engineers have to perform scheduled manual checks of this equipment.

Reactive and Scheduled Maintenance

Due to limited available resources and sometimes a lack of expertise on board to spot potential problems, reactive maintenance is prevalent. This is counter-productive as maintenance managers

spend most of their time “fighting fires” rather than seeking out the root cause of problems and trying to spot issues before they can effect production. In the short and long term, reactive maintenance is extremely expensive and has a negative impact on OPEX, which is the opposite of what the duty holders are trying to achieve.

As well as performing reactive maintenance, operators also undertake scheduled maintenance. This is time-consuming, inefficient and place workers in hazardous areas. Different conditions and use means that equipment wears at different rates and therefore may not require maintenance at that time. With limited resources available, it is not a good idea to have a maintenance engineer tied up overhauling a perfectly good piece of equipment when they could be looking at another pump or valve that really needs attention.

Taking these factors into account, it comes as no surprise to learn that relying only on reactive and scheduled maintenance has a negative effect on OPEX because it is



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disruptive, time consuming and worse of all, it is linked to lost production.

Pump Failures are a Big Cause of Unplanned Outages

Essential pump failure is one of the biggest causes of unplanned outages on offshore assets. Pump failure can be initiated by an array of factors such as corrosion, vibration, cavitation, seal leakage or simply poor installation. What maintenance teams want to know is, how long can a pump last until it needs to be replaced? Or, how long will it be before it fails? These questions are not always easy to answer. For example, some pumps can last 15 years, but in offshore applications these pumps are working 24/7 in a harsh environment with corrosive and abrasive fluids passing through. These fluids and their rates are forever changing and the only way to be sure is to monitor pump health.

A typical offshore asset would have about 15% of pump systems, which are deemed “critical”, covered by online monitoring. Most “essential” pumps on the other hand do not have online monitoring and some operators only service these once every eight to 20 weeks. However, scheduled maintenance does not really tell you when a pump will fail and failures often occur between service intervals.

Monitoring Essential Equipment

Online, continuously monitored equipment supports predictive maintenance, enabling engineers to become proactive so that maintenance can be scheduled only on equipment that needs attention. Predictive and proactive maintenance also cuts the amount of time that personnel are exposed to hazards. Parts can be ordered in advance and problems with the availability of bed space for maintenance engineers are avoided.

So what are the obstacles that are

currently stopping operators from achieving this? You might think that the only issue would be the cost of implementation? But there are in fact many challenges to be overcome such as laying new cable trays, installing additional field cables and cabinet wiring, development of drawings and work packs, and the involvement of third party contractors. This all adds up to additional bed space, travel, and risk, and the increased weight on the platform. Each wired measurement device adds about 30 kilograms on average through wiring, cable trays etc. So the installation of 100 new instruments would add three tonnes of extra weight, and that doesn't include the additional I/O cabinet space required.

There are also the issues associated with control system hardware and software, and legacy system compatibility (i.e. no HART® pull-through), plus all of the manpower and disruption issues required to achieve this implementation. Added to this there is the need for either on-site expertise to evaluate the data being created, or a communication system to transmit the data to asset specialists at a remote location (for example at an onshore control centre). It's all well and good having all this data available, but if there isn't a trained engineer available to evaluate it, these efforts are wasted.

Wireless Helps Measure Health Parameters on Essential Assets

In an ideal world, operators would like to have the machinery health data available for both their essential and critical assets. In addition they would like dynamic readings of pressure, temperature, flow, and rotational speed etc., available in one place, allowing them to make a better diagnosis of the overall asset health. The latest wireless

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asset monitoring solutions provide the solution.

WirelessHART technology enables various dynamic readings from different parts of the plant to be configured into a single suite of software so that engineers can see what effect an increase in pressure, temperature or flow has on vibration and vice-versa. Data is communicated back to the wireless gateway and readings can then be easily integrated into any host DCS via Modbus or OPC. Issues of data reliability and security, cost, installation and integration with legacy systems or whether the technology can withstand the harsh offshore conditions have all been addressed by WirelessHART technology.

Performance and machinery health data can also be communicated to a remote onshore control room using satellite communications where it can be analysed by specialists. This enables onshore operations to monitor the performance of critical assets remotely and predict, detect and correct conditions that could potentially lead to equipment failure and unplanned downtime. By removing the need to have offshore based engineers, costs are reduced and safety is enhanced. Assets can be monitored

even in adverse sea or weather conditions, providing increased visibility of production processes and enhancing operational decision making.

By installing wireless transmitters to a typical pump this will provide an operator with the multi-parametric information needed to build a clear picture of its health and also that of the process. Wireless devices can transmit pressure, temperature and vibration data. Using this data, vibration analysis software enables the detection of multiple fault conditions on bearings, shafts, motors and other critical components. In addition, hydrocarbon leaks from rotating equipment can be detected using sensors mounted next to couplings, joints or flanges. In accordance with the Pump Seal standard, API 682 Edition 4, which recommends the use of transmitters instead of switches when monitoring dual mechanical pump seals, wireless pressure, temperature and level transmitters provide a cost effective way of alerting you to a seal fail or if the seal fluid in the reservoir needs replenishing.

Where erosion in the pipework may be a problem, wireless corrosion transmitters and sand/erosion



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transmitters can be used to detect these conditions. There are also wireless adapters that effectively turn a wired transmitter into a wireless device. This allows stranded diagnostic data from the measurement device itself to be accessed, helping to see when instruments are not working correctly, or need recalibrating. The latest asset monitoring solutions are very cost effective, for example, Emerson's Essential Asset Monitoring solution will give the operator a multi-parametric model that monitors not only pressure, temperature and flow, but also vibration. There is also the option to measure level and the ability to detect leaks and corrosion too. The solution uses the Embedded Diagnostic Intelligence in the devices to provide an overall indication of the Asset Health – helping operators to deploy their maintenance resources.

Predictive and Proactive

Wireless technology makes it possible to continuously monitor essential equipment installed on offshore platforms. Predictive maintenance enables engineers to become proactive and much smarter so that maintenance can be scheduled only on equipment that needs attention. Predictive and proactive maintenance cuts the amount of time that personnel are on the platform exposed to hazards.

Parts can be ordered in advance and problems with the availability of bed space and work permits not being ready on time can be a thing of the past. The scenario of an engineer coming on board by helicopter and not knowing what to expect, or when they can start or leave no longer applies. Predictive and proactive maintenance reduces OPEX and increases the net present value of an offshore asset. ■

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