

SMARTER PLANTS, STRONGER PERFORMANCE

Ben Swisher, Emerson, USA, demonstrates how hydrocarbon producers are using digitalisation to find new ways to do more with less.

The hydrocarbon manufacturing industry has always thrived on efficient, reliable operations. Today, however, complex global markets and expanding consumption have made it more essential than ever to safely and efficiently deliver product. For example, much of the refining industry is currently very capacity limited, so any downtime due to an upset critically impacts the supply of fuel. In fact, even a single incident can dramatically impact regional fuel prices. But refineries typically have thousands of assets, meaning thousands of potential points of failure.

These challenges are not easy to navigate. Today's plants are typically running with limited staff. Experienced personnel are retiring, and new workers rarely stay in a single role for the many years necessary to become an expert. As a result, organisations are focusing more on centralising their remaining expert staff to cover larger areas. However, this often leads to reduced visibility, as well as slow data collection, delayed issue identification and resolution, and poor overall response time. Even areas that are commonly lightly staffed – such as pipelines and compressor stations – still have some critical

assets in need of attention, so reliability teams are often stretched thin.

Fortunately, digitalisation – coupled with the rise of AI technology – is helping teams close the gap to deliver better visibility and increased reliability, resulting in improved centralised support and driving operational excellence. By fusing AI-driven analytics, wireless sensing, and cloud-based reliability platforms, organisations can scale expertise, streamline collaboration, and prevent downtime that once seemed inevitable. This wide array of technologies can help reliability teams collaborate more effectively, leverage existing domain expertise, and share it with the newer personnel emerging in the industry.

Modern solutions, more success

Not only are there more digital reliability tools available than ever before, but those tools are significantly more cost effective



Figure 1. Rule-based first principles analytics delivered by modern continuous condition monitoring devices provide decision support to technicians.



Figure 2. AI-driven edge analytics help users quickly identify the most common problems with rotating assets.

and easier to install and use. Automation suppliers provide a wide range of devices designed to monitor critical, essential, and balance-of-plant assets to help reliability teams of any experience level stay ahead of developing issues. Moreover, those same technologies tie into powerful industrial software solutions to unlock deeper analysis and improved collaboration, making it easier to effectively manage the reliability of a fleet, or even an enterprise, with a much smaller team of people.

Modern devices driven by embedded expertise

Most reliability personnel are familiar with portable handheld vibration analysers. They are typically the first level of digitalisation teams rely on to monitor assets around the plant. Today's most effective analysers provide powerful technology to empower less experienced personnel with decision support in the field. Advanced analysers not only deliver raw spectrum and waveform data, they also use built-in rule-based analytics to turn raw data into clear advice, such as whether an issue is mechanical or bearing-related, or due to a lubrication issue.

Continuous condition monitoring technologies

While the most advanced handheld analysers are a critical tool to help technicians better perform their jobs, most organisations pursuing operational excellence are supplementing manual data collection devices and their associated labour-intensive walkarounds with automatic data collection via continuous condition monitoring devices. Powerful, AI-driven analytics technologies need significant amounts of data to be effective – far more than can be collected manually by plant personnel. Thus, the next step in digitalisation is to collect that data automatically and at a much faster rate via wireless sensing technologies.

Wireless vibration monitors can be installed by a plant's own personnel and then connected via a wireless mesh network for reliable transmission of asset vibration data. The most advanced wireless sensors are equipped with rule-based first principles analytics to not only deliver vibration level data, but to also assign an intuitive asset health score that can be delivered directly to key personnel. Armed with this additional information, technicians can more easily prioritise work and isolate root causes on plant assets (Figure 1).

Many plants also take advantage of edge analytics devices. These powerful monitoring tools can perform the same vibration analysis and health score delivery as basic wireless monitors, but also use built-in, AI-driven edge analytics to quickly identify the most common issues in rotating assets. Technicians can use a mobile device to securely check the health status of assets throughout the plant, bringing real-time health awareness from more assets to plant personnel of any expertise level (Figure 2).

Sending information to software

The best support for today's reliability teams does not stop with the devices collecting and delivering data. As organisations continue to digitalise across the enterprise, they are connecting their continuous condition monitoring tools to powerful industrial reliability software applications – helping build their reliability capabilities into an enterprise operations platform that

extends from the intelligent field, through the industrial edge, and into the cloud.

Machinery health software is a key element of the evolving enterprise operations platform. The software can collect data from a wide range of sensing devices, analyse it using rule-based AI analytics tools, and provide reliability teams with an overview of plant health in real-time, all from a single, intuitive dashboard. These dashboards leverage internal AI engines to help users identify when an asset is likely to fail and why, the life expectancy of the asset, and how changing process conditions might contribute to reliability issues. Teams can load data into the system, and the analytics engines help them predict asset issues long before they become failures (Figure 3).

Another key benefit to machinery health software is emerging cloud capability. Many of the best machinery health software tools can be hosted in the cloud, empowering a wide range of plants across an enterprise to send their asset health data to a centralised location. Armed with all of this data, a centralised team of experts can monitor sites 24/7, providing expert advice and guidance – for example, by offering suggestions to optimise efficiencies across the entire organisation. Companies can make better use of their limited expert staff by providing them with the tools to support and upskill many personnel at disparate sites across the enterprise.

Automation suppliers up their game

AI tools built into reliability technologies are changing the way personnel meet emerging hydrocarbon industry challenges. As needs continue to change, those reliability teams will need even more powerful tools to increase their capabilities and productivity. Fortunately, automation suppliers are not just embedding AI technology in reliability tools; they are also using their own AI systems to accelerate development of new technologies. Today, forward-thinking automation suppliers are applying AI to bring more robust products to the market more effectively.

More efficient innovation

Innovation and development cycles are accelerating as suppliers leverage AI to speed software development. Historically, software development has been an extremely labour-intensive process, and iterative design took a very long time. Today, AI tools are helping to accelerate the up-front development process, allowing development teams to more quickly turn ideas into action. Not only can AI tools help speed early-stage coding, making it easier for developers to build initial frameworks, but they can also identify areas where coding strategies and design can be improved to deliver more reliable, robust products.

Unmatched testing capabilities

Perhaps even more importantly, AI is helping automation solution providers to improve the testing process. Companies have always needed to intensively test new software – a process that requires tremendous amounts of time. AI not only helps reduce the time spent testing new products, it also increases the thoroughness of the process. Even given as much time as possible, humans can only run so many tests. AI can test thousands or millions of use cases and push as many inputs as needed into the system in the testing phase to iron out far more potential bugs than with manual testing.

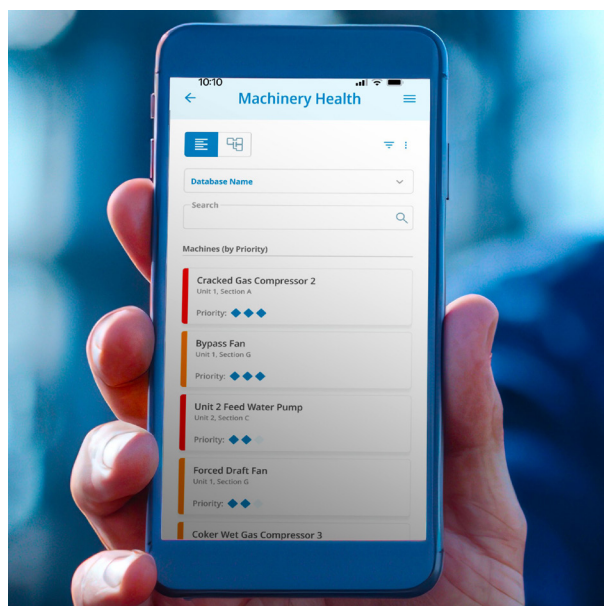


Figure 3. Machinery health software helps teams quickly translate data into action.

More fit-for-purpose solutions

Another area where AI helps automation suppliers deliver better solutions is in sales and support. Even within one area of the hydrocarbon industry – upstream, midstream, or downstream – individual organisations' needs vary widely. One group of users may have very specific needs tied to a unique configuration or use case, and an organisation in one world area may need access to different solutions for different locations. Ultimately, few solutions are one-size-fits-all.

Today, automation suppliers are enlisting the support of built-for-purpose AI large language models to provide users with the ideal solutions for their unique applications. These generative AI tools can explore a wide range of previous implementations – across industries – to help identify the most effective solutions to common problems and best practices for operational excellence. They can also provide a wide range of innovative options to help engineers more quickly derive the best automation solutions for a given scenario.

Ultimately, AI is helping automation solution providers deliver more effective, robust technologies to users. Reliability teams capitalising on these new technologies will see faster return on investment (ROI), more cohesive, integrated ecosystems, and more effective decision support as they continue to digitalise and modernise their technology investments.

Digitalisation drives the future

The complexity of operating hydrocarbon manufacturing operations in a challenging, global marketplace is not going away any time soon. Expert personnel will continue to retire, just as the pressure to do more with less continues to increase. Fortunately, just as challenges are hitting their highest level, new digital technologies – including but not limited to AI – are helping teams close the experience gap and drive operational excellence, not just across the plant, but also across the entire enterprise. [t3i](#)