
Innovation Spotlight Report: Novity™

July 2022



Novity

This is the third in a series of Innovation Spotlight Reports that provide deep dives into Xerox's investments in disruptive technologies across software, augmented reality (AR), artificial intelligence (AI), additive manufacturing, industrial Internet of things (IIoT), and cleantech. In this Spotlight report, we focus on Xerox's predictive maintenance (PdM) business, Novity.

Novity was incubated at Palo Alto Research Center (PARC) and launched as a business in March 2022 to commercialize PARC's PdM technology solutions for industrial companies. Novity is an IIoT technology solution, utilizing advanced equipment sensors and a combination of machine learning and physics-based models to predict equipment failures with 90 percent or better accuracy and provide operators with machine failure notification lead times of months, instead of weeks or days. The result: less unplanned downtime and significant savings for manufacturers.

PARC's AI efforts date back to the 1970s when PARC pioneered knowledge-based models to enable low-powered computers to process information in a human-like manner. Over the last 15 years, PARC added expertise in machine learning. Now PARC is a leader in Hybrid AI, which combines knowledge models and machine learning to solve problems where there is a scarcity of machine training data – as is the case with industrial equipment, where faults are extremely costly but infrequent, and therefore difficult to predict.

This report will provide an overview of Novity, its unique value proposition and its market opportunities.



A SIGNIFICANT MARKET OPPORTUNITY IN SEARCH OF A BETTER SOLUTION

Unplanned downtime is a key pain point for manufacturers and has been exacerbated in recent years by supply chain disruptions. Unplanned downtime occurs when there is an unexpected failure of equipment or a manufacturing process, often resulting in a loss of production and loss of revenue. Besides productivity losses, unplanned downtime also necessitates additional maintenance, repair, and replacement costs, and it produces a host of unwanted environmental effects often associated with critical machine failures.

The financial impact of productivity losses varies by cause and the size of operations. According to studies conducted by Novity, the average oil and gas company experiences almost a month of unplanned downtime annually, with costs ranging from \$33–88 million. For the mining and materials industry, roughly 23 hours per month are lost due to machine failures, costing firms up to \$187,000 per hour.

Deloitte estimates that unplanned downtime costs industrial manufacturers an estimated \$50 billion each year¹.

The field of predictive maintenance is poised to significantly reduce unplanned downtime by *predicting* machine failure, rather than reacting to it, as is the case with other forms of sensor-based



▲ Novity Demo

maintenance practices. PdM uses sensors to monitor the condition of industrial equipment and applies (near) real-time analytics to proactively predict upcoming machine failures. Through PdM, engineers and plant operators can obtain information needed to assess the health and lifespan of equipment and more efficiently plan maintenance.

While interest in PdM is growing, a recent Novity survey² found that most industrial process companies still use antiquated approaches to monitor the health of their assets. In fact, three-quarters of respondents said they have no IoT or predictive maintenance in place, and instead use either visual inspection, which relies heavily on an inspector's expertise or instrument readouts, or simply react to machine failure upon occurrence. However, many forward-looking companies are looking to deploy advanced analytics to improve asset utilization, with almost 50% of organizations planning to increase their adoption of PdM in the next 2–3 years. According to a third-party study³, PdM is a roughly \$7 billion market and expected to grow at a 31% CAGR through 2026.

NOVITY TRUPROGNOSTICS™ – A PATH TO ZERO UNPLANNED DOWNTIME

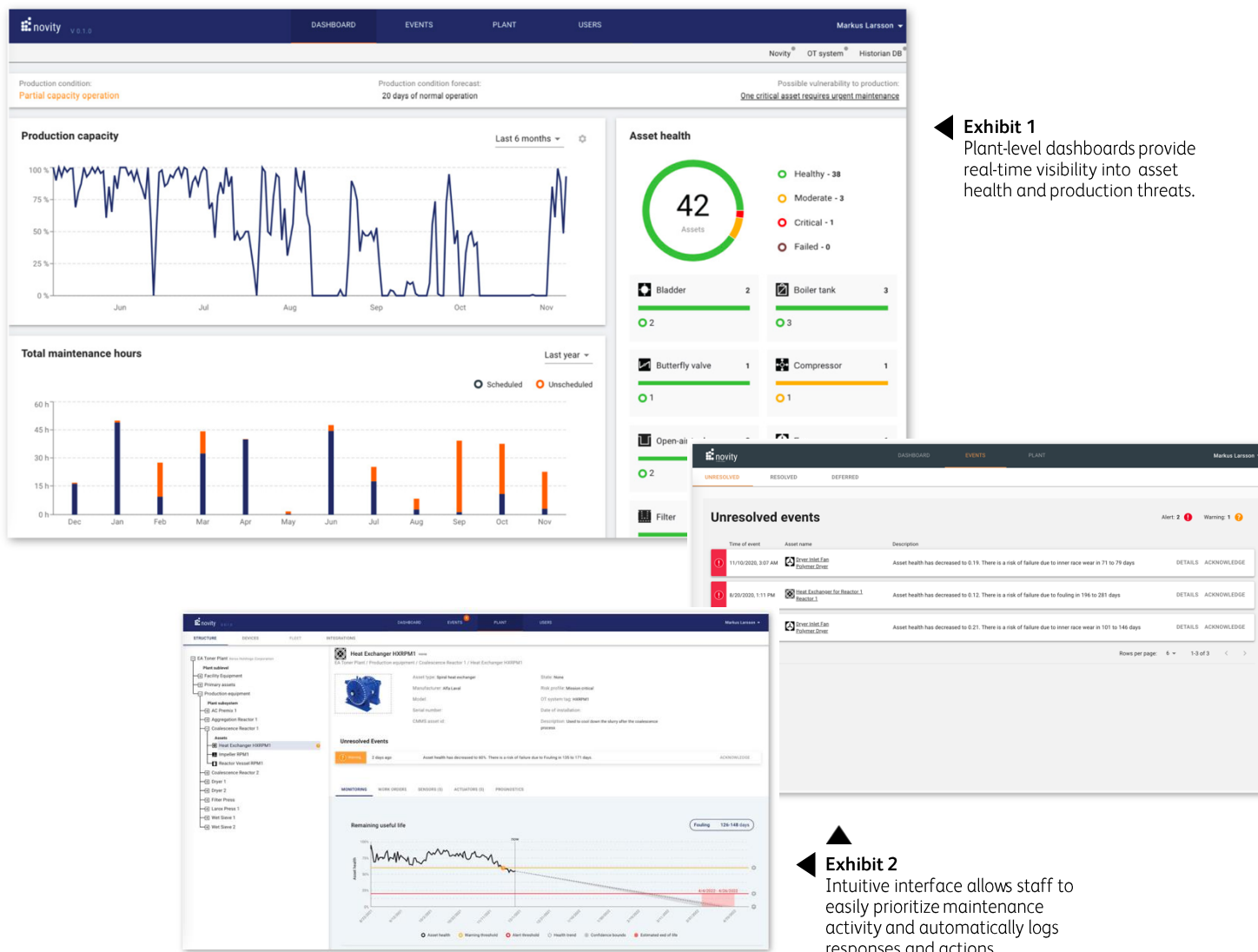
Novity's PdM engine, TruPrognostics, leverages PARC's research expertise in AI and sensor-based technology to deliver predictive machine performance that is more accurate than solutions currently available on the market. Novity's competitive advantage lies in its use of physics-based models, which are empirically more effective in the application of predictive maintenance than ML and AI alone.

AI and ML on their own require significant amounts of data to inform predictive models. And for most manufacturers, that data either doesn't exist or is prohibitively time-consuming to acquire. The Novity solution utilizes a library of pre-built physics-based equipment failure models to make predictive maintenance accessible to all

manufacturers – including those that lack the large amounts of historical data typically required by competitive solutions.

Another advantage of the Novity solution is its extended prediction window. Typical PdM failure predictions come only one or two weeks before the failure occurs. To extend that time horizon, Novity 1) utilizes physics-based models that target specific fault mechanisms and 2) deploys advanced sensors, which are more suitable for observing early signs of damage than standard process control sensors.

The Novity TruPrognostics engine can predict asset failures months in advance, providing ample time for operators to procure spare parts and schedule downtime – greatly minimizing the impact of required maintenance on the production process. Importantly, Novity achieves a greater than 90 % failure accuracy rate, well above the standard industry rate of 50–75 %.



CASE STUDY: XEROX TONER PRODUCTION

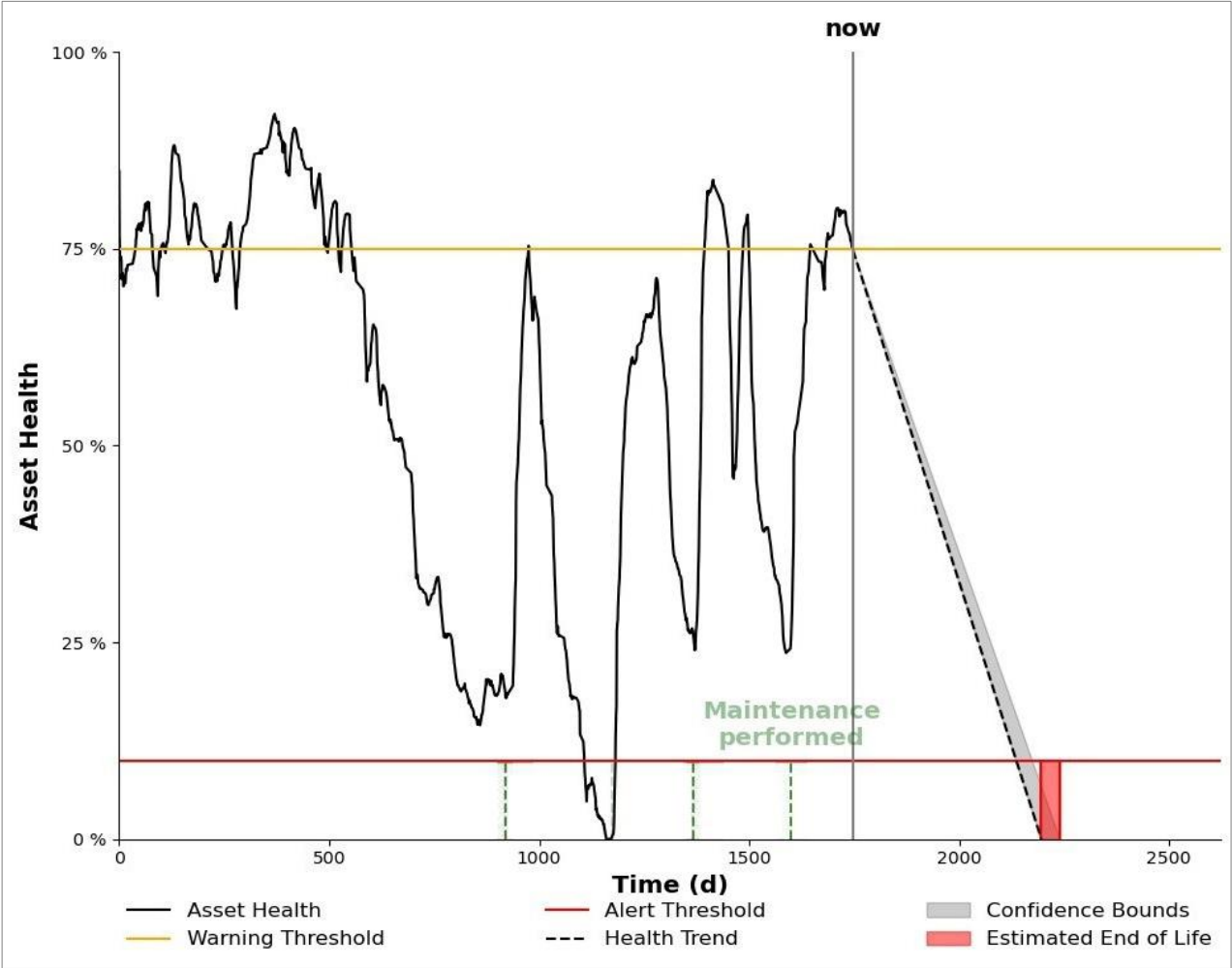
Since 2018, Xerox’s Project Own It has instilled a culture of continuous improvement across the entirety of Xerox operations – including the manufacture of toner. Like any manufacturer, Xerox is susceptible to unplanned downtime. With Novity’s assistance, Xerox embarked on a project to reduce unplanned downtime for toner production to a level that was previously not possible.

After fully assessing Xerox’s toner production process, Novity honed in on the spiral heat exchanger, which is often subject to fouling. Fouling is the accumulation of unwanted deposits on heat transfer surfaces, which is not directly observable in a sealed heat exchanger system. Fouling only becomes apparent through observation of long-term trends in machine performance and end-product results. While cleaning cycles generally help reduce fouling, finding the right cleaning regimen requires numerous trial-and-error runs.

To address this issue, Novity devised a physics-based model using external observations such as slurry temperature and flow rates to estimate the fundamental operating properties of Xerox’s heat exchangers. When historical data was analyzed, the progression of fouling and the impact and relative strength of optimal cleaning cycle regimens were immediately apparent. The Novity TruPrognostics engine was able to help Xerox plant operators determine an ideal cleaning regimen for its spiral heat exchangers while keeping product quality at the forefront.

Thanks to the Novity solution, the calculated fouling level was predicted far in advance, and plant managers could schedule cleaning at a time of their convenience. By giving plant managers the ability to see into the future, Novity optimized a previously inefficient process, eliminated excess and unnecessary downtime and delivered better business results.

Exhibit 3: Heat exchanger health over time.



LONG TERM VISION

The Novity TruPrognostics engine mitigates a number of the issues that have limited wider adoption of PdM within the industrial manufacturing sector. By using a combination of real-time analytics, machine learning, physics-based models and embedded systems, Novity is able to dramatically improve manufacturers' production processes.

Novity's current focus is process industries, such as the oil and gas and chemicals sectors, which are currently most conducive to reaping the benefits of Novity's PdM solution. Over time, Novity plans to broaden its aperture to serve all manufacturing sectors. Novity's PdM technology can provide any manufacturing company with enhanced production process visibility; and with greater process visibility, manufacturers can simultaneously improve productivity while reducing accidents, enhancing the value of manufacturing processes for all stakeholders.

Ultimately, Novity believes the science underlying its predictive technology can be applied to other aspects of a client's business as well, including logistics, supply chain management, procurement and personnel management.



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FOOTNOTES

- ¹ Source: Making maintenance smarter – Deloitte University Press.
<https://www2.deloitte.com/us/en/insights/focus/industry-4-0/using-predictive-technologies-for-asset-maintenance.html>
- ² Source: “BAO Inc Survey conducted in Q4 2020 that polled 100 U.S. process industry leaders.”
- ³ IoT Analytics, “Predictive Maintenance Market Report 2021–2026”, 2021