



# FORESTALLING THE FUTURE WITH PREDICTIVE MAINTENANCE

PREDICTIVE MAINTENANCE IS one area in transportation that is innovating on two fronts – drawing from both big data and the Internet of Things. And it is growing: A recent survey by Oliver Wyman in the aviation maintenance, repair, and operations (MRO) space found that more than half of the companies surveyed are planning more investment in predictive maintenance over the next five years. That's because a holistic program of predictive maintenance can increase asset reliability and availability, as well as generate savings in areas such as labor and material costs.

The implementation of such programs, however, is anything but simple. To fully capture the benefits of predictive maintenance modeling and analytics can require a level of transformation that companies often initially underestimate and fail to engage around. Predictive maintenance is more than just a technical shop project – it requires comprehensive

support – spanning from procurement and operations planning to top management.

## THE BENEFITS OF PLANNING AHEAD

As its name implies, predictive maintenance uses techniques to determine when in-service equipment is most likely to need maintenance. Timing maintenance procedures to match maintenance needs is improving rapidly, thanks to big data analytics, while smarter equipment is able to provide operators with real-time condition information.

By reducing time-consuming routine maintenance, for example, experts estimate that Airbus's and Boeing's predictive maintenance systems in the aviation space could increase fleet availability by up to 35 percent. Similarly, asset monitoring means that parts are replaced or repaired only when needed, rather than using traditional time- or distance-based

intervals. Train manufacturers estimate that use of asset monitoring tools can reduce material-related costs by up to 15 percent.

By triggering specific maintenance operations only when they are actually needed, predictive maintenance helps optimize maintenance planning and allocation of capacity (such as teams and workshops), which in the airline industry alone could reduce maintenance labor costs by 5-10 percent. Finally, customers benefit too when equipment breaks down less: In Singapore, the introduction of predictive maintenance reduced the number of train breakdowns from 3.3 to 1.3 per 100,000 train-km between 2012 and 2014.

## DEPLOYMENT CHALLENGES

Deploying predictive maintenance is a three-step process, and each step comes with its own trials:

Collection of relevant real-time data: Key onboard metrics must be defined

and data collected from a broad and growing range of sensors that enable increasingly accurate assessment of asset condition. Predictive maintenance algorithms also require collecting relevant data from external sources, such as prior maintenance done on the asset and baseline information from original equipment manufacturers (OEMs).

**Data processing and analysis:** Analyses must be geared toward determining estimated remaining useful life of components and spotting irregularities in asset functionality that might signal a need for maintenance intervention. Typical challenges include developing algorithms that translate data into usable results, scarcity of talent (such as data scientists), and gaining access to data that might be limited by OEMs' proprietary protocols.

**Forecasting and acting:** Defined actions should be triggered based on rules integrated into the predictive model. Finding the right threshold to trigger an action is critical, especially to avoid over-maintenance. Information technology interfaces may require upgrading to ensure actions are triggered across all relevant systems, such as maintenance planning and procurement.

## SOLVING THE PUZZLE

Successfully introducing predictive maintenance requires finding innovative solutions to these challenges, which in turn may necessitate some level of transformation across the company. There are five areas that may require extra attention to make predictive maintenance happen:

**Talent:** According to the *Harvard Business Review*, two-thirds of Fortune

500 companies believe that they have a talent gap when it comes to big data analytics – a critical capability needed to make predictive maintenance work. One way to address this problem can be through cooperation with advanced big data firms. For example, to develop the concept of Digital Twin (a data model of a specific physical asset), GE Aviation collaborated with its sister company, GE Digital, to consolidate the digital capabilities of the industrial group.

**IT infrastructure:** Requirements for predictive maintenance IT usually differ significantly from other systems, as these systems need to be real-time, highly interfaced, and extremely secure. Implementation of predictive maintenance may thus require major modernization of IT systems. The airline industry is dealing with this problem now, for example, as three-quarters of its IT systems were installed prior to 2002.

**Data management:** Data acquisition raises many issues, including quality and usability of data collected and data ownership. One solution widely adopted by leading companies is to set up a dedicated structure, such as a data lab, with responsibility for managing the predictive maintenance system and data flows across the company.

**Functional coordination:** Maintenance planning and parts procurement must be done in real time to make predictive maintenance work, which often exposes a lack of coordination among maintenance, operations, and supply chain teams. In the UK, operator Virgin Rail and manufacturer Alstom Transport developed a tool called HealthHub to align their roles. The tool calculates the remaining useful life of components and automatically triggers

actions across the value chain, such as maintenance activities planning and spares ordering.

**Supplier relationships and contracts:** Predictive maintenance can support stronger operator-supplier relationships and more innovative contract models. By jointly analyzing performance data, for example, operators can negotiate with manufacturers for targeted levels of performance or equipment availability, while manufacturers can secure more lucrative contracts if they can supply spares and repair services in response to real-time equipment needs.

Of course, to make these changes work at a transformative level also requires strong top-down engagement, on-boarding and buy-in across functions, a sound business case, and rigorous program management. Regardless, no crystal ball is needed to understand that predictive maintenance must be part of the future for transportation companies looking to ensure long lives and top-notch performance from their assets.

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