PREDICTIVE MAINTENANCE REVOLUTION: WHY DIGITAL TWINS AND SKILLED TECHNICIANS ARE A WINNING COMBO

News / Maintenance / Trainings

Digital twins – virtual copies of real-life machinery – have become an integral part of many industries: from precision manufacturing to logistics. Research by McKinsey shows that investments in digital twin technologies will rise to more than $48 billion by 2026 around the world. More and more airlines and aircraft Maintenance, Repair and Overhaul companies are introducing digital twins into their processes. But can the market supply enough skilled personnel to help companies truly benefit from this technology?

What role do digital twins play in aircraft maintenance?

Before answering this question, we should first expand on what a digital twin is. In essence, digital twins are 1-for-1 virtual models of either the entire aircraft or a separate part, like an engine. OEMs like GE have even developed digital twins for such components as landing gear. These models are only as good as the input they receive, so they must be continuously updated with data from IoT sensors, informing the model both of regular wear-and-tear and any irregularities.

The model itself provides companies not only with an always-ready visual representation, but also with the ability to virtually test potential “what-if” scenarios. This digital twin technology is at the heart of predictive maintenance – an innovative approach to MRO, which not only saves money

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but reduces the likelihood and duration of Aircraft on Ground situations.

Jekaterina Shalopanova, Chief Business Officer at Aerviva commented: "To say that digital twins are a must in aviation MRO would be an understatement. In an industry where every hour of aircraft downtime can cost tens of thousands of dollars, the ability to predict, prevent and schedule AOG events makes for smoother and more cost-effective operations."

According to a Deloitte study, implementing predictive maintenance programs results in a 15% reduction in downtime and a 20% improvement in labor productivity. A McKinsey study further supports these benefits, indicating that predictive maintenance can reduce maintenance costs by 18-25% while increasing availability by 5-15%. For airlines and MROs alike, this means fewer grounded aircraft and more efficient use of maintenance resources.

Artificial Intelligence brings digital twins to a new level

Modern Machine Learning and Generative AI approaches are already being applied to predict simulation outcomes in seconds rather than hours. For instance, in engine maintenance, AI-powered digital twins can quickly assess whether slight deviations in turbine blade geometry will significantly impact performance, potentially reducing unnecessary component replacements.

Airlines, including such major players as Air France-KLM, operating a fleet of more than 500 aircraft, are already investing in sophisticated Artificial Intelligence solutions to bring their predictive maintenance efforts to the next level. According to a report by Reuters, using Gen AI capabilities from Google Cloud, the airline will be able to drop the time needed for data analysis in predictive plane maintenance from hours to minutes.

Another fascinating development related to digital twins and the vanguard of innovation is creating digital twins of… pilots. Lockheed Martin is exploring the concept of an "e-Pilot" digital twin that can monitor both the human pilot and aircraft performance during critical phases of flight. This technology aims to "assist the human pilot in awareness and provide enhanced aircraft control options during flight safety critical situations," according to the company.

The global shortage of digitally proficient aviation professionals

The tech behind digital twins will undoubtedly continue to advance rapidly, providing companies with an even more granular and actionable view. However, the aviation industry is facing a challenge of a different matter. Namely, the lack of skilled professionals to work alongside these sophisticated systems.

According to Boeing's 2024 Pilot and Technician Outlook, over the next 20 years companies worldwide are going to need 716,000 new maintenance technicians. More alarmingly, according to the Aviation Technician Education Council (ATEC), is the lack of qualified instructors who can train the next generation of mechanics.

"If in other industries, you will hear talks about AI replacing people, this cannot be said about aviation. Here, the advent of new technology might translate to higher requirements for everyone involved in the maintenance process. But it also makes this career all the more exciting and promising. The skill gap in MRO is widening at precisely the wrong time," explains Shalopanova. "As digital twin technology becomes ubiquitous, the industry is grappling with the demand for technicians. Companies may invest millions in cutting-edge technology only to find they lack the human expertise to maximize its potential." continued Shalopanova.

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Speaking of the next generation, they will have to soon become more than mechanics. This growing demand goes beyond a traditional MRO skillset, as technicians will be increasingly expected to be able to bridge the gap between mechanical systems and digital tools. Finding an aviation maintenance professional equally well-versed in data analysis, AI, and predictive analytics is going to be a difficult task for many companies.

It must be noted that some MRO training providers are already incorporating digital twin technology and AI into their curricula. Solutions like AK View and AK GO use Augmented Reality to simulate real-life situations, providing a more streamlined and time-efficient experience.

The future of aircraft maintenance is digital, but it lies in the hands of skilled and irreplaceable professionals. For airlines and MROs to truly transform maintenance through digital twins, the industry must address this skills gap with the same urgency and resources it devotes to technological innovation. Only then can the impressive efficiency gains, cost savings, and safety improvements promised by digital twins fully take flight.

21 APRIL 2025

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https://50skyshades.com/news/maintenance-trainings/predictive-maintenance-revolution-why-digital-twins-and-skilled-technicians-are-a-winning-combo

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