Abstract: **OnDemand Aircraft Maintenance 2.0 | How to Digitize the Daily Check**

Aircraft maintenance has traditionally followed rigid, time-based schedules dictated by regulatory requirements and manufacturer recommendations. This approach, while reliable, often leads to unnecessary downtime, over-maintenance of healthy components, and reactive repairs when failures occur unexpectedly. The concept of Aircraft Maintenance on Demand (MoD), also known as predictive or condition-based maintenance, represents a paradigm shift. It leverages real-time data, artificial intelligence (AI), and advanced sensors to perform maintenance only when evidence-based indicators signal the need. This "just-in-time" model minimizes unscheduled groundings, optimizes fleet availability, and significantly reduces operational costs. Digital solutions such as real-time oil level monitoring and computer vision (CV) inspections of aircraft tyres are at the forefront of enabling this transformation, supported by digital TechOps platforms like AVIATAR.

At the core of MoD is the integration of Internet of Things (IoT) sensors that continuously stream performance data from critical aircraft systems. Real-time oil level monitoring exemplifies this capability. Modern aircraft engines, auxiliary power units (APUs), and hydraulic systems are equipped with advanced fluid-level sensors – capacitive, resistive/potentiometric, or magnetic-float designs. These devices act as electronic dipsticks, providing precise, continuous readings of oil quantity and, in many cases, temperature, pressure, and quality parameters like viscosity or contamination. Data feeds directly into the aircraft's Full Authority Digital Engine Control (FADEC) or centralized health-monitoring systems. When oil levels drop below thresholds or degradation patterns emerge, alerts are generated instantly, allowing ground crews to intervene during the next turnaround rather than waiting for a scheduled check or an in-flight failure. Today, oil-monitoring data is fused with flight logs, vibration readings, and historical trends within predictive analytics platforms. Machine-learning algorithms detect subtle anomalies – for instance, accelerated oil consumption indicating seal wear – weeks or even months before traditional thresholds are breached. Complementing oil monitoring are computer vision systems for tyre inspection – a high-wear component critical to safe landings and ground handling. Aircraft tyres endure extreme loads, heat, and debris, yet conventional inspections remain largely manual, time-consuming, and subjective. CV solutions deploy high-resolution cameras on fixed taxiway mounts to capture detailed images of tread patterns, sidewalls, and bead areas. Deep-learning models then analyze these visuals in real time, measuring tread depth to sub-millimeter precision, detecting cuts, bulges, foreign-object damage, or uneven wear that human eyes might miss.AI classifies defects by severity, maps them to exact tyre positions, and feeds findings into the maintenance management system. This automates what once required technicians on ladders or under-wing crawls, reducing inspection time from hours to minutes while increasing consistency and objectivity. Early detection prevents tyre-related delays or, worse, runway excursions.

These targeted digital tools operate within larger ecosystems. The benefits are quantifiable and multifaceted. Studies indicate predictive maintenance reduces maintenance costs by 18-25 percent, downtime by 15 percent, and boosts labor productivity by 20 percent. Fleet availability improves 5-15 percent, translating to millions in additional revenue per airline. Safety is enhanced: early oil degradation or

tyre wear detection prevents in-flight emergencies. Sustainability gains emerge too – optimized maintenance extends component life, reduces waste, and lowers fuel burn through healthier engines.

Challenges remain. Data integration across legacy fleets requires robust cybersecurity and standardized protocols. Regulatory approval from bodies like the FAA and EASA demands validation of AI predictions. Workforce upskilling is essential; technicians must evolve from manual inspectors to data interpreters. Initial investment in sensors, CV hardware, and cloud platforms can be significant.

In conclusion, Aircraft Maintenance on Demand, powered by digital solutions like real-time oil level monitoring and computer vision tyre checks, is not merely an efficiency upgrade – it is a safety and economic imperative. By shifting from calendar-driven to condition-driven practices, the aviation industry achieves unprecedented reliability, cost control, and operational agility. As sensor technology and AI mature, maintenance will truly occur “on demand,” keeping aircraft flying longer, safer, and more sustainably than ever before.