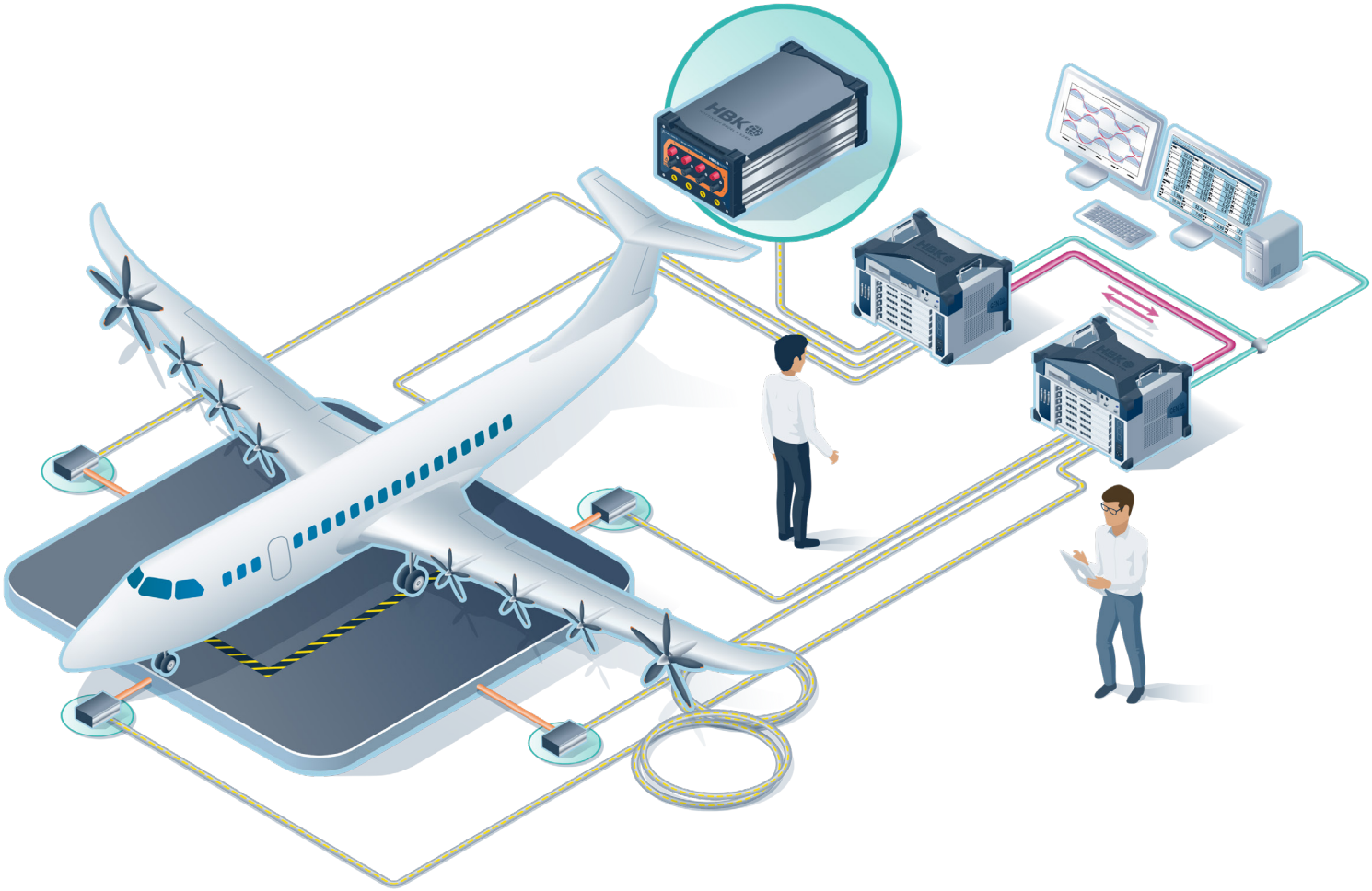
HBK
HOTTINGER BRÜEL & KJÆR



WHITE PAPER

Accelerating Aircraft Certification with Copper Bird Testing for Electric and Traditional Aircraft

08.20.2026
Mike Hoyer, Application Engineer

Aircraft electrical systems are becoming significantly more complex as the industry shifts toward electrification. From conventional transport aircraft to hybrid-electric platforms and electric vertical take-off and landing (eVTOL) aircraft, today's architectures consist of highly distributed, interdependent networks that must meet stringent certification requirements.

Validating these systems presents a major engineering challenge. Failures identified late in development, especially during flight testing, can lead to costly delays, increased risk, and certification setbacks.

Copper bird testing has emerged as a critical solution. By replicating full aircraft electrical systems in a controlled ground-based environment, engineers can simulate real-world conditions, inject faults, and validate system performance before flight.

However, these environments require scalable, high-fidelity measurement systems capable of capturing large volumes of synchronised data while maintaining accuracy in conditions with high levels of electromagnetic interference.

This white paper explores how copper bird testing supports certification readiness – and how HBK's real-time, high-channel-count data acquisition (DAQ) solutions help aerospace organisations reduce risk, accelerate testing, and bring aircraft to market faster.

What is copper bird testing?

Copper bird testing begins well before an aircraft ever leaves the hangar. It simulates an aircraft's full electrical system on the ground in a controlled environment.

All major components – including generators, converters, distribution systems, and loads – are installed and interconnected exactly as they would be in the aircraft. This allows engineers to simulate real-world operating conditions and evaluate system performance at full scale.

Key capabilities include:

- **Simulation of full flight profiles** (take-off, cruise, descent, and emergency scenarios)
- **Injection of faults** such as generator failures, inverter faults, or short circuits
- **Monitoring of system-wide electrical behaviour** across hundreds or thousands of nodes
- Long-duration, high-resolution data acquisition for both **transient and steady-state analysis**

Copper bird testing also enables compliance validation against standards such as:

- **DO-160** (environmental and power quality requirements)
- **FAA Part 25 and Part 33** (aircraft and engine certification)
- **MIL-STD-704F** (power characteristics)

By replicating real-world conditions on the ground, copper bird testing allows engineers to detect issues early, reduce flight test risk, and build confidence in system performance.

Where copper bird testing is used

Copper bird testing isn't just for cutting-edge programmes. It plays a critical part in validating a wide range of systems:

- **Traditional aircraft**

Modern transport aircraft such as the A320 and 787 already rely on complex electrical systems to power actuators, avionics, environmental controls, and passenger systems. As electrification increases, validating interactions between these systems becomes more demanding.

- **Electric and hybrid aircraft (eVTOL/eCTOL)**

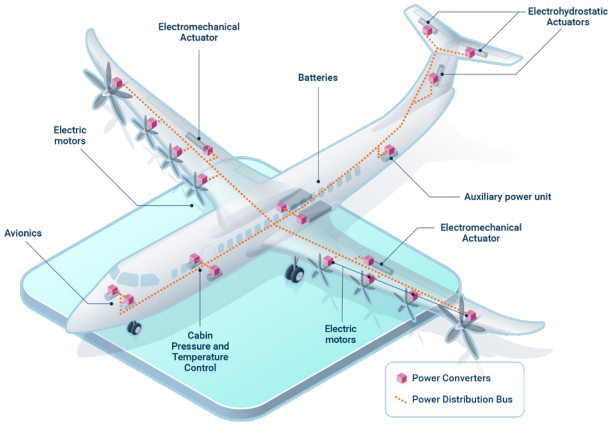
Electric propulsion brings a new set of challenges, including:

  - High-voltage DC systems
  - Distributed propulsion architectures
  - Increased fault scenarios
  - Greater sensitivity to power quality and harmonics

Copper bird testing allows these systems to be validated safely before flight.

- **Suppliers and subsystem manufacturers**

Component suppliers, including inverter, motor and battery system manufacturers, must validate and certify



their systems independently. Copper bird testing provides traceable, high-quality data to support integration with OEM platforms.

Why certification readiness matters

Certification is a critical milestone for any aircraft programme. Failure to meet regulatory requirements can lead to significant delays, cost overruns, and increased programme risk.

Standards such as DO-160 and FAA regulations impose strict limits on:

- Total harmonic distortion (THD)
- Voltage stability and transients
- Electromagnetic interference (EMI)
- Fault tolerance and system resilience

Meeting these requirements depends on:

- High-accuracy measurement systems
- Repeatable and controlled test environments
- Traceable, time-synchronised data

Copper bird testing provides the foundation for achieving this, when supported by the right measurement technology.

How HBK solutions accelerate and enable reliable aircraft certification

1. **Validating complex electrical networks**

Modern aircraft contain hundreds of electrically active nodes – each a potential source of failure or power disturbance. Validating how these nodes interact across every phase of flight is a major engineering challenge, but essential for ensuring performance, reliability, and successful certification.

HBK's DAQ platforms support hundreds of synchronised measurement channels and can scale to more than 1,200 channels. This allows engineers to monitor and analyse voltage and current at every node – particularly important when multiple devices share a common power bus or when downstream loads affect upstream quality.

With real-time analysis, high-speed acquisition and long-duration recording, engineers can monitor and capture the full behaviour of complex networks under realistic conditions.

Example: In one copper bird test, a major OEM used HBK's solution to simulate a full flight using 1,200 channels of synchronised data. The system captured real-time responses across 700 current and 500 voltage nodes, enabling on-the-fly analysis of harmonic behaviour and helping engineers identify areas of concern before flight testing began.

2. **Real-time power quality analysis**

Power quality is central to aerospace certification. Aircraft electrical systems must deliver clean, stable power across all operating scenarios.

Standards such as DO-160 set strict limits on THD, flicker, voltage drop, and other disturbances. These ensure that everything, from avionics to propulsion systems, operates reliably under load.

HBK addresses this with real-time calculation of power quality metrics, integrated directly into the DAQ system. Engineers can analyse THD, detect voltage sags, and monitor transient behaviour during testing – on a half-cycle basis, rather than hours later during post-processing or with separate equipment. This allows issues to be identified immediately and tests to be repeated with greater control and lower cost.

This is particularly valuable in dynamic test scenarios, where conditions change quickly, or when flight-like loads, such as the simultaneous operation of cabin systems and propulsion systems, place the system under stress.

3. **Reliable measurements in high-interference environments**

Electromagnetic compatibility (EMC) is a constant challenge in high-voltage electrical systems.

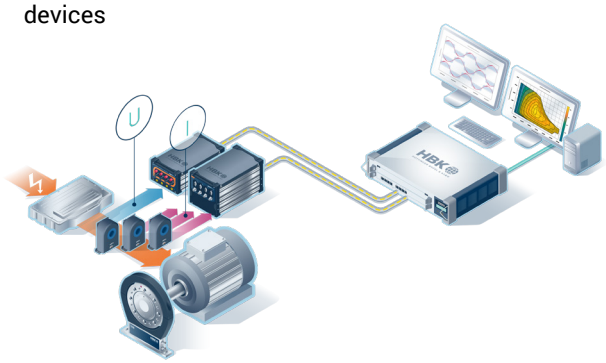
As systems become more powerful and more densely packed, managing EMC becomes increasingly difficult.

In traditional test setups, noise and interference can corrupt data and delay analysis, leading to misdiagnosis, failed certification, or hard-to-trace anomalies.

That's why HBK developed Remote Probes: high-voltage fibre-optic measurement probes designed specifically for aerospace environments. These probes provide:

- **EMC-immune fibre-optic communication** to minimise interference and signal degradation

- **High signal fidelity**, even over cable runs of up to 100 metres (328 feet) and in the presence of switching devices

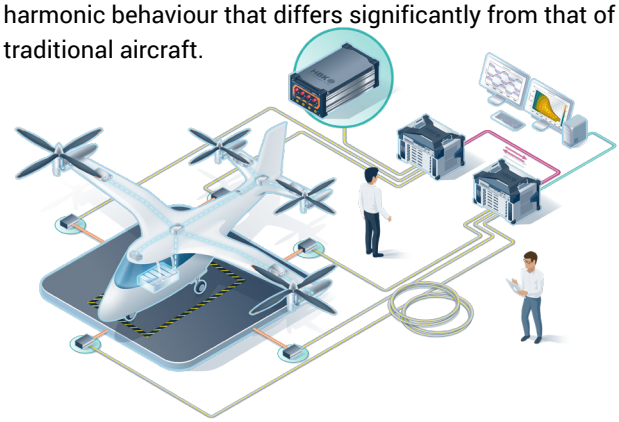


- **Ultra-fast sampling**, capturing data at rates of up to 20 MS/s per channel, with real-time analysis up to 4 MS/s per channel
- **Consistent accuracy** in voltage and current measurements, even in aircraft test benches affected by proximity-induced noise

In test benches with high-voltage switching devices and complex grounding topologies, Remote Probes give engineers confidence in their data and help avoid chasing phantom faults.

4. Validation of electrical propulsion and DC systems

Electric aircraft add a new layer of complexity to certification. Within electric propulsion systems, high-voltage DC buses, distributed electric motors, and battery systems introduce new failure modes, along with harmonic behaviour that differs significantly from that of traditional aircraft.



HBK supports these scenarios with DAQ systems that enable:

- **Fault injection testing** – synchronising DAQ data to analyse both cause and effect within a single dataset
- **Real-time harmonic analysis** on both AC and DC buses
- **Traceable, time-stamped data recording** that aligns measurements with fault codes, controller events, and flight phases – all admissible in certification review processes

Example: One electric aircraft developer used HBK's DAQ system to simulate motor faults, battery anomalies, and unexpected load conditions across six electric propulsion units. With all six units running on dynamometers, engineers were able to inject faults and record full flight sequences – complete with synchronised electrical and CAN bus data – to prepare for certification.

The runway to certification starts on the ground

As aircraft electrification advances, certification challenges will continue to grow in complexity. Validating these systems now requires more than traditional testing approaches. It demands scalable, high-fidelity, real-time insight into system behaviour.

Copper bird testing provides the environment to simulate real-world conditions and uncover issues early. When combined with advanced scalable data acquisition and real-time analysis, it becomes a powerful way to reduce risk and accelerate certification.

HBK supports this with:

- **Scalable, high-channel-count** DAQ systems from 6 to more than 1,200 channels, adapting to any test setup
- **Real-time power quality analysis**, capturing events as they happen
- **Long-duration data storage**, retaining all raw data for post-event analysis without rerunning tests
- **EMC-resilient measurement technology**, maintaining accuracy in high-voltage, high-noise environments

The result is faster validation, lower programme risk, and a more efficient path to certification.

As the industry moves toward electrified aviation, those who master ground-based validation will be best placed to lead the next generation of flight.