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PCB Piezotronics, Inc. Meets ONERA Requirements

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ONERA's Department of Aeroelasticity and Structural Dynamics has a crucial mission to conduct vibration testing on aircraft floors. Several hundred accelerometers are used in this procedure and ONERA chose PCB Piezotronics sensors for the job. Beyond simple reliability, measuring range and accuracy, PCB was selected based on their ability to deliver a product that met the environmental requirements in ONERA's specifications.

Floor vibration testing on an A320 Neo in Toulouse.
PCB Piezotronics accelerometers are used for vibration measurements.

ONERA, a French National Aerospace Research Center, is the top name in its field. It is a multi-disciplined organization with a large capacity for testing in Europe providing expertise to program agencies, institutions and industrial services. The Department of Aeroelasticity and Structural Dynamics has forty large and small-sized vibration exciters to meet industrial demands from companies such as Airbus, Dassault, Eurocopter and Snecma.

PCB Piezotronics, Inc. designs and manufactures sensors that measure physical values (vibration, force, strain, pressure and acoustics). For many years PCB® has provided technical solutions that meet ONERA's requirements and comply with their environmental specifications. PCB® remains a partner with Onera for new projects.

"Since 1972, we have conducted floor vibration testing on all the Airbus planes built in Toulouse. The last three to date include the A380 in 2005, the A350 in 2013 and the A320 Neo in 2014", reports Stephane Giclais, Project Manager for the Experimental Structural Dynamics Department.

ONERA, a major partner for Airbus, Dassault, Snecma and Eurocopter

One departmental objective is a focus on structural dynamic behavior prediction methods, to better calculate or predict mechanical stress behavior in unstable aerodynamic aircraft simulations (vibratory). They perform floor vibration testing in planes or any other system, including landing gear or turbine blades.

"These tests validate the mathematical model of a full or partially filled plane and predict whether the aircraft will resist vibratory stress during flight. Because any turbulence, shock or sudden maneuvers may lead to vibrations that either favorably absorb and eliminate or cause structural

damage", explains Pascal Lubrina, who manages projects in experimental structural dynamics at ONERA's Department of Aeroelasticity and Structural Dynamics.

Instrumenting equipment with reliable sensors for just-in-time production

To ensure completion of this validation, structural vibration tests are performed with electrodynamic shakers, placed throughout the aircraft to excite vibratory responses. ONERA engineers built a modal analysis model of structural dynamic behavior using transfer function analysis that represents responses relative to the excitation level. Model validation requires hundreds of accelerometers (from 500 to 800 on an Airbus), signal conditioners and a data acquisition system that features a post-process approach to evaluating the measured vibration.

Testing time was successfully reduced by 20% due to ICP® and TEDS sensor technology from PCB Piezotronics.

The data acquisition system is designed to read the TEDS (transducer electronic data sheet) information and this eliminates manual entry of the accelerometer's calibration information. This mitigates the risk of data entry errors. ICP® and TEDS technologies contribute to simplification, increased reliability and faster installation of hundreds of accelerometers needed for the test series, while reducing the time needed for configuration checking.

"With the same demand for test data, there is a 20% decrease in test installation time", says Stephane Giclais. This meets the expectations of aeronautical designers, who need test data to validate their digital models quickly, and to verify hypotheses prior to the first test flight. "In only a few years and with increasing technical specifications and size of airplanes, test durations have gone from approximately three weeks down to about one week; all while delivering more information and detailed data analysis to the design engineers", concludes Pascal Lubrina.

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