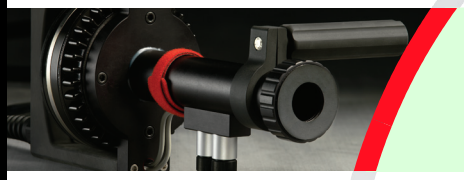

CASE STUDY

GKN Aerospace
Isle of Wight, UK

Europe

Aerospace

Portable Impedance Meter

GKN Aerospace is the aerospace operation of GKN plc. It is a first-tier supplier of structural components and systems for military and civil aircraft. Current aircraft programmes include Airbus A380, Boeing 787, Bombardier Challenger 300 and Airbus A350-XWB.

***Fig. 1** Zero-splice, composite double-layer acoustic panel – QA test using Portable Impedance Meter Type 9737*

Photographs by kind permission of GKN

GKN Aerospace Success with the Portable Impedance Meter

The GKN site in Cowes, Isle of Wight, UK, has long experience in the design and manufacture of passive sound insulation systems for air-intakes and by-pass ducts of aircraft engine nacelles.

Dr. Armando Vavalle, Technology Development Engineer from GKN reports here on impedance tests conducted with Brüel & Kjær's Portable Impedance Meter Type 9737 for the development of such new acoustic liners.

Brüel & Kjær

Developing New Acoustic Liners

Fig. 2
Brüel & Kjær's Portable Impedance Meter Type 9737

New stringent noise regulations, responding to increased public concerns regarding noise pollution from aircraft operating from/to main city airports, require that advanced acoustic liners are developed for current and future aircraft engine programmes. These novel designs, expected to provide a significant noise reduction, will still need to be lightweight and low-cost to be successfully placed in the extremely competitive aircraft market.

Research conducted in the EU, within the SILENCE(R) framework FP6 project and in the USA, within the Quiet Technology Demonstrator 2 project, has demonstrated the benefit of the elimination of the axial joints holding separate parts of the acoustic panel in a conventional intake engine duct design.

GKN Aerospace, Cowes site, has developed an acoustic and mechanical design and a manufacturing process for a zero-splice, all-composite, intake acoustic liner, expected to enter full production in the next two years. In this one-piece acoustic panel, a cell-aligned, double-layer honeycomb core material is employed. The combination of the elimination of the joints and the new core material will allow significant enlargement of the frequency bandwidth within which conventional designs are effective, as well as increase the actual atteNon-destructive Acoustic Impedance Tests with Type 9737nuation rate of the engine fan tones at the blade passing frequency.

Non-destructive Acoustic Impedance Tests with Type 9737

Development activity for a zero-splice, single-layer core, perforated liner has just been started with the scope of proposing to the market a very low-cost solution that is still expected to enhance the noise attenuation performance provided by a classic two-piece construction for this type of intake acoustic liner. For the development of such new acoustic liners, GKN has conducted non-destructive acoustic normal impedance tests with the new Brüel & Kjær Portable Impedance Meter Type 9737.

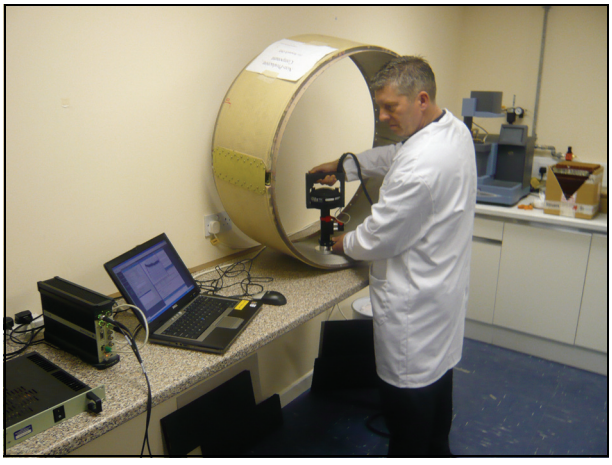

Fig. 3
Two-piece, single-layer linear liner – QA test

GKN has carried out pure tone tests at a user-specified frequency and broadband noise tests, up to 155 dB overall sound pressure level, measured at the face-sheet, on small scale, flat acoustic material specimens, as well as full scale panels. This is within a design down selection exercise, whereby a comparative analysis of these measurements with the prediction of a proprietary normal impedance prediction model, has also been performed.

Tests for measuring the acoustic resistance versus overall root mean square particle velocity are also conducted. The ability to perform such a test is expected to cut down development costs very significantly as, in contrast with the traditional DC flow measurement, it enables measurement of the Non-linear Factor for the full-bonded panel in its final production form. Comparisons with GKN DC flow measurements were made, showing excellent agreement on acoustic material flat samples.

Successful QA Test Procedures with the Portable Impedance Meter

Brüel & Kjær's Type 9737 system has been successfully employed for trials regarding the definition of the new Quality Assessment (QA) test procedure for the final zero-splice, double-layer acoustic liner product. Fig. 1 shows a QA test for a completed, composite barrel unit for a business jet application. Fig. 3 shows a QA test for the conventional, two-piece, single-layer linear liner.

Low-frequency leakage from sound waves propagating laterally at the edge of the tube is significantly reduced by the use of flanges profiled to match the curvature of the surface of the acoustic panel.

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