INTRODUCTION

Aircraft structures are facing high stress during the usage in their lifetime. Therefore, a constant control and maintenance of those structures is necessary. In this application report possible damages to aircraft structures on aluminium honeycomb panel was simulated. Such as top-layer – core delaminations, back-layer core delaminations and Impact damages.

An aluminium honeycomb core panel (400mm x 400mm x 27mm) was used for the measurements.

Lateral image of structure

Front side view (measurement side)

Front side of the panel with non-visible defects and marks that show their location.

Impact damage
Delamination: core - rear layer
Delamination: top layer - core
Back side view (measurement side)

Impact damage (7 mm depth, punched with a sphere – 32 mm diameter)

Simulated top layer - core delamination (drilled 25 mm diameter, depth 25 mm)

Simulated rear layer - core delamination: (drilled 30 mm diameter, depth 12 mm)

**APPRAOCH**

The specimen was tested using the Steinbichler shearography system ISISmobile 3100 with vacuum excitation.

Positioning of ISISmobile 3100 sensor with gasket adapter for vacuum loading
RESULTS

Vacuum Loading Test

For the vacuum loading, a reference pressure of -40 mbars was set. After having reached the pressure level, the reference image was initiated. Then, the loading pressure of additional -40 mbars was applied to the structure.

Phase Image

**Test Setting:**
- Excitation Type: vacuum
- Reference Pressure: -40 mBar
- Loading Pressure: -40 mBar

Demodulated Image

Impact and delamination core - rear layer barely visible (image scaling necessary)

Delamination top layer - core clearly visible
Results show that the simulated top layer – core delamination is superposing the results of the other two damages that are slightly visible. Rescaling and exclusion of the superposing defects makes those defects clearly visible.
SUMMARY

The results of these images show that shearography is able to detect material anomalies in with different sizes even on the opposite side of a 27 mm aluminium honeycomb material.

As the main advantages of shearography are speed, full-field images (A4 or A3 paper size measurement fields) and contact-less operation, this method means a step forward in carrying out faster maintenance cycles and, thus, represents a reliable tool for the quick and reliable assessment of aircraft structures.