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FEATURE

Issue: APRIL/MAY 2018

Scanning the skies

20 April 2018

Andrew Williams finds that 3D scanning systems that can pinpoint dents and imperfections on aircraft body panels are being welcomed by aviation businesses to replace manual inspection

The aviation industry demands a high-quality surface finish of body panels and other parts, not just for aesthetics, but also for a number of technical reasons. Examples include how rivet heads are flush to the surface to keep rivet indentations in the outer skin of an aircraft as small as possible. Although inspectors are often able to see a large proportion of surface defects, such visual evaluation is often subjective and depends heavily on individual capability.

In an effort to tackle this challenge, several companies have created imaging-based equipment to help aerospace companies pinpoint the location of defects in aircraft bodies. One interesting example is German company INB Vision, which has carried out test measurements for various customers in the aviation industry for a variety of different applications. As Jörg Schulze, sales engineer at INB Vision, explained, the aim of surface inspection with the INB Vision technology is to achieve an objective and reproducible evaluation of the deviations in order to make decisions with regard to component tolerances.

To meet this goal, the company has developed a number of different methods that systematically recognise relevant deviations from the surfaces and objectively evaluate them. A notable example is the SurfaceControl product line, designed specifically to inspect diffusely reflecting surfaces – for example, electroplated metallic surfaces – as well as plastics and ceramics. The product

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operates based on the fringe projection principle; it scans the surface generating a 3D point cloud and is able to measure areas of a few square centimetres up to 0.25m². The 3D sensors comprise at least two cameras and one projector, with the cameras calibrated using a calibration target.

'The structured light from the projector enables identical points to be found in both cameras using the Gray code and the phase shift method. Triangulation then enables the calculation of the x, y and z coordinates of the surface that are stored in a 3D point cloud. The 3D point cloud is then evaluated with special methods to detect 3D surface defects,' explained Schulze.

At present, Schulze said that there are several different application areas in the aviation industry for such imaging equipment. SurfaceControl has proven suitable for testing the outer skin of an aircraft fuselage before painting. Here, the system detects the smallest of dents and bumps caused during fuselage mounting, which Schulze said can only be recognised after the painting process and often led to complaints in customer acceptance tests.

'Furthermore, flush rivet heads and the smallest possible rivet indentations in the outer skin of an aircraft are technically and aesthetically critical. We have already successfully measured these characteristics with our technology,' he said.

In addition to versatile applications on the outer skin of an aircraft, the interior also offers different fields of application: for example, the inspection of flaps on hand luggage compartments, armrests and wall coverings. SurfaceControl also offers an automated surface inspection process. The sensor can be guided by a robot to inspect large components.

Over the next few years, Schulze predicts that the trend in the development of optical sensors will be towards miniaturisation, on the one hand, and the speed of data acquisition and evaluation on the other.
'High-precision measurement in motion will also become an important innovation in the coming years,' he added.

INB Vision's SurfaceControl scanner is designed to inspect diffusely reflecting surfaces

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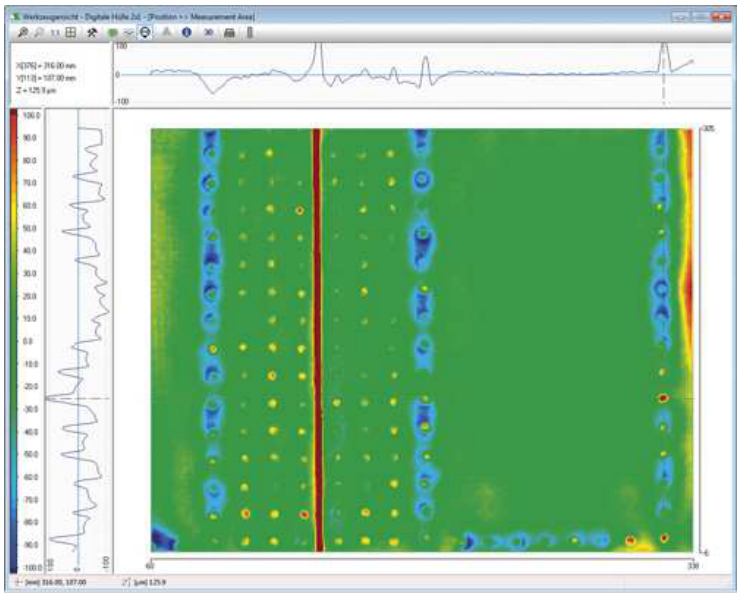
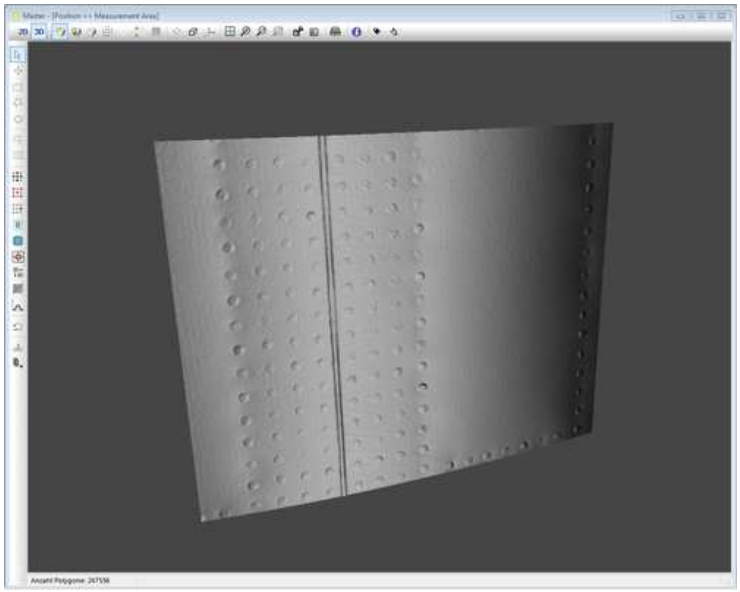


A map of the defects found on an aircraft fuselage. Credit: INB Vision



A 3D point cloud of an aircraft fuselage. Credit: INB Vision