Testing Approach for Over Wing Doors using Curved Fuselage Panel Testing Technology

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The A321neo ACF (Airbus Cabin Flex configuration) contains newly designed Overwing Doors (OWD) that provide an automatic opening function for the case of evacuation. Due to the significant structural differences between the previous "hatch" design used on A319 and A320 aircraft and the new OWD design it has been decided to test the OWD's and the surrounding fuselage structure to demonstrate the Fatigue and Damage Tolerance capabilities of the structure.
This demonstration should be done by means of a fatigue and damage tolerance test. An appropriate test set-up had to be selected. Two generally different approached were investigated. One was a simplified barrel test approach, the other was based on the curved fuselage panel testing methodology. A comparison of both was made based on FE analyses predicting the achievable stress field quality, the complexity of the rig and the size of the required specimen. This selection process led to the decision to follow the curved fuselage panel test method.

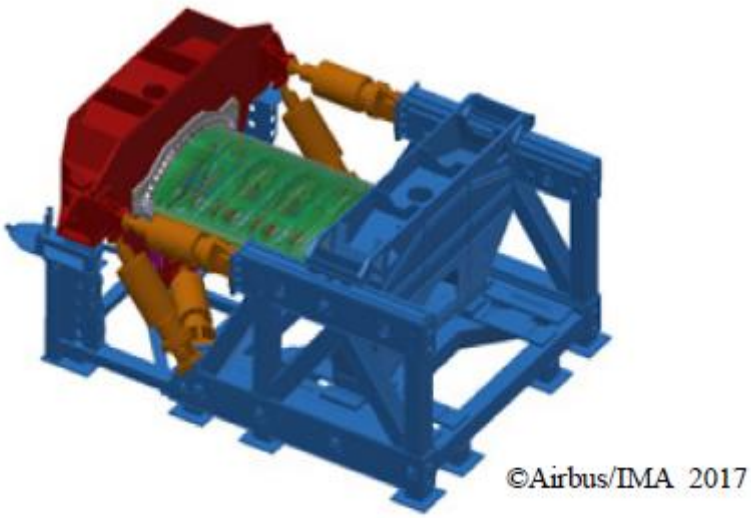

Figure 1. Overview of Test Set-up

Curved fuselage panel testing was developed in order to test undisturbed, regular panels. During the last years, this method was improved to allow testing of panels with major non-regularities, for instance door cut outs, floor beams or similar features. The size of the specimen compared to the special features is not large enough to allow evenly distributed loads at the panel boundaries. Due to the complex nature of the boundary conditions of such panels in combination with the naturally limited granularity the definition of test loads is an important part within the whole project. This paper will show the fatigue load development for the panel in question, given the boundary conditions defined in the development.
The achieved strains in the panel are compared to the requirements for several load cases. These load cases are selected from all flight situations. The results of this comparison will be presented in the paper as well.