

Changing the Philosophy of Full-Scale-Fatigue-Tests derived from 50 Years of IABG Experience
towards a Virtual Environment

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Over the last 50 years of full-scale fatigue testing, IABG has continuously developed new techniques in order to improve time, cost and quality for full-scale fatigue tests. Last year the performance of Airbus A350XWB EF2 full-scale fatigue test at IABG test lab in Erding has been completed faster than any other full-scale fatigue test in the past. Recent and ongoing testing activities on Airbus A220 (Bombardier C-Series) and Pilatus PC24 have confirmed the same speed-up by covering three life times within one single year of pure test performance.

With the advancement of virtualisation of the aircraft development and certification process, questions have to be raised as to how full-scale fatigue tests can be incorporated into these processes and how virtualisation can benefit from physical testing.

Virtualisation speeds up aircraft development to its next level. Virtual design rooms, linear numerical simulations with virtually unlimited number of elements and off-the-shelf software solutions from sketch to 3D printing – all these radical developments are changing time, cost and planning expectations. Does fatigue testing still fit into this context?

Nevertheless, the current EASA Part-21 AMCs still demand physical tests for new aircraft types. Drawing from the testing experience, failures are often first detected only during the full-scale fatigue tests. These aspects, in connection with the mental barrier to sacrifice the proven processes for the sake of economic gains, underline that full-scale fatigue tests are still state-of-the-art.

Considering the limits and the related efforts of a full-scale fatigue tests, virtualisation as a set of methodologies has increased safety probably more than pure fatigue testing and that both methods combined are today's standard in order to keep aircraft safety on its mandatory level. The purpose of full-scale fatigue tests are changing. The amount of available but unused information gathered during fatigue runs is still sizable, and changing the attitude towards fatigue tests could increase the return of investment.

This will lead to introducing new agile methods and processes into fatigue tests to allow the numerical methods to evolve continuously with the available experimental data. This could also result in a new philosophy of full-scale fatigue tests, moving from flight-by-flight testing towards purely artificially triggered load sequence in order to detect blind spots in the numerical analyses. This does require the certification philosophy to evolve hand-in-hand.

The present paper will discuss, based on 50 years of IABG experience in testing and simulation within and beyond the aerospace industries, the possible future tasks and challenges of full-scale fatigue tests and their benefits to the aircraft industry.



Figure 1. Full-Scale Fatigue Testing

Keywords:

Virtual testing, full-scale fatigue test, certification, faster testing