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STATIC AND DYNAMIC EXPERIMENTAL ANALYSIS OF A FULL-COMPOSITE VLA AIRCRAFT

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ABSTRACT

This work shows some important results from a test campaign conducted on the Dardo Aspect, a wet-laminate full composite very-light aeroplane (VLA) designed and built by CFM Air. Both static and dynamic experimental analyses have been carried out. All the results and methodologies utilized in this paper take into account compliance with certification requirements of EASA CS-VLA – Certification Specifications for Very Light Aeroplanes [1] and 14 CFR Part 23 – Airworthiness Standards: Normal Category Airplanes [2].
First, non-destructive and destructive static tests of the composite wing are discussed. The test article was attached to the test rig so as to accurately simulate the wing connection to the fuselage. The load was applied through a hydraulic piston and with no feed-back signal, for reasons of simplicity. The wing-up bending test was realized by distributing the piston load at the location of the ribs via a whiffle tree. Particular attention has been focused on accurate displacement/strain acquisitions through Digital Image Correlation (DIC) technique, which is a non-contact, optical methodology that employs tracking and image registration techniques to measure full field, three-dimensional displacements and superficial strains [3].
Ground vibration tests (GVT) are, hence, summarized. In this case, the full aircraft was suspended with dedicated springs so as to simulate free-free boundary condition and to minimize leaks and nonlinear effects. A lightweight, multichannel vibration data acquisition hardware and proper excitation systems (impact hammer, shaker) were used along with PC-based software tools for acceleration acquisition and elaboration of modal characteristics. Subsequently, results from GVT were compared with those from flight tests for flutter clearance. Wherever possible, experimental tests have been compared with finite element solutions from commercial software tools and advanced modelling techniques developed by the Mul^2 research group in Politecnico di Torino.

REFERENCES

[1] European Aviation Safety Agency (EASA). *Certification Specifications for Very Light Aeroplanes (CS-VLA)*, 2009. Amendment 1.

[2] Code of Federal Regulations (CFR). *Title 14 - Aeronautics and Space, Chapter 1 - Federal Aviation Administration (FAA), Department of Transportation, Sub chapter C - Aircraft, Part 23 - Airworthiness Standards: Normal Category Airplanes.*

[3] A. Pagani, E. Zappino, A.G. de Miguel, V. Martilla, E. Carrera. Full field strain measurements of composite wing by digital image correlation. *Advances in Aircraft and Spacecraft Science*, **6(1)**, pp. 69-86 (2019).