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## **APPROACH TO FULL-SCALE FATIGUE TEST OF THE MiG-29 VERTICAL STABILIZER WITH REPAIR OF COMPOSITE STRUCTURES**

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### **ABSTRACT**

One of most important test blocks in developed new repair technology is full-scale fatigue test. The technology concerns composite skin of the vertical stabilizer of the MiG-29. The authors presented in the article phases of test preparation. Starting from building of the geometrical model, it continues with development of loads, design and preparation of the test stand to perform the test.

**Keywords:** fatigue, composite, vertical stabilizer, repair.

### **INTRODUCTION**

The fatigue test of the MiG-29 vertical stabilizer with repair on the composite skin is one of the tasks in the MiG project. The project is implemented by ITWL for the Ministry of National Defense. The aim of the project is to develop a verified, ready-to-implement technology for repairing composite and sandwich structures of MiG-29 aircraft

Preparations for the test included three main blocks: Definition of load spectrum, design of the test bed and repair on the composite skin of a vertical stabilizer. Locations in which the repairs were made were selected on the basis of the analysis of the location of previous damage on planes of the Polish Armed Forces. The difference in quality and strength between the composites produced in the vacuum bag and the autoclave (Baker, 2003; Davis, 2007) were considered. The repairs were made in autoclave technology in accordance with current trends in primary structure repairs (Whittingham, 2009; Caminero, 2013).

### **SUMMARY AND CONCLUSIONS**

The completed fatigue test proved the durability of repairs. Ultrasonic structure tests did not show damage in the area of repairs. It should be noted that despite the advantages resulting from the use of autoclave technology (Whittingham, 2009), non-destructive testing of the pasted chamfered patch is a difficult issue. The difficulty results from the thickness variability of the adhesive and the smoothly changing thickness of the repair package. After disassembly of test stand, a teardown inspection will take place to assess internal damage.

During the test, the deflection of the vertical stabilizer at high values of loading forces was also measured. This information was used to verify the FEM model, which will be used for strength analyzes of specific repair cases.

The process of developing the spectrum for the fatigue test was several-stage. The CAD model of the entire aircraft was made on the basis of 3D scans. The model was used for aerodynamic calculations. Calculations were carried out for the configuration selected based on analysis of the frequencies of occurrence of individual cases. Some important load cases were considered, despite the very low number of occurrences. The statistical analysis uses data from over twenty years of operation of all Polish MiG-29. In total, more than 20 flight configurations (orientation, speed, acceleration) have been considered in aerodynamic analysis. The results of the calculations were compared with the readings of strain gauges recorded during flight tests finding a high level of correlation.

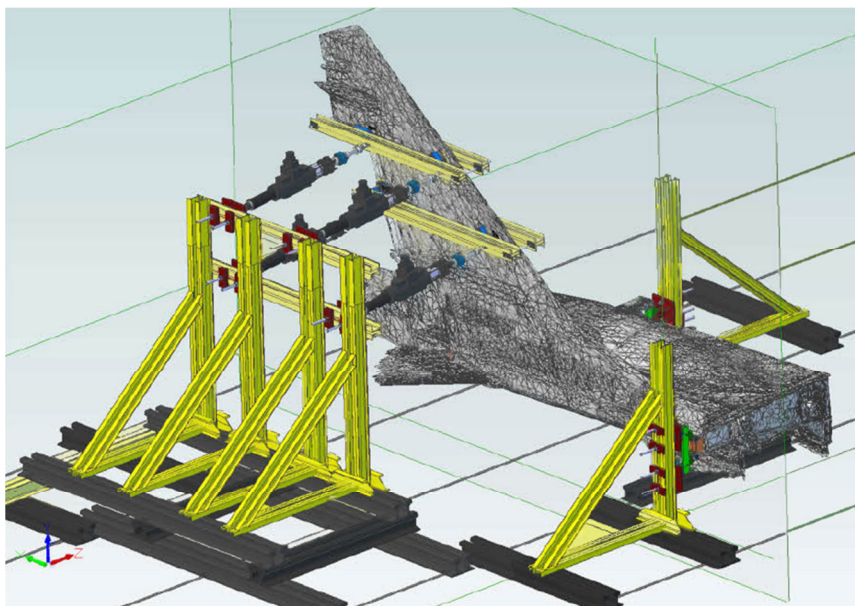


Fig. 1 - Test stand

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