

THE AILERON GAP SEALING MODIFICATION FOR IMPROVED AILERON EFFECTIVENESS

Anna Szewczak, MSc

Airbus Poland S.A. / Warsaw University of Technology

aszewczak@meil.pw.edu.pl

One of the main areas of Airbus Poland S.A. activity is the production and service of PZL-130 Orlik aircraft, used for many years in the Polish Air Force training system. As a part of creating so-called aerodynamic package for PZL-130 Orlik, it has become apparent that the modification of the aileron area is needed. The purpose of the aileron modification analysis described herein is to improve the flight handling by eliminating adverse phenomena, such as aileron shaking movements, without the risk of deterioration of flow characteristics during maneuvers. It was also crucial to reduce aileron forces occurring on the control stick. Numerical CFD analysis of the aileron system with modifications of sealing in the aileron gap area were performed. The effect of the caulking strip at the upper surface of the aileron gap was determined, as well as caulking at the entrance to the aileron gap on the bottom surface of the airfoil. A solution has also been proposed, consisting in completely closing the aileron gap by using a diaphragm.

The 3D flow analysis was carried out, which allowed localization of flow disturbances and detachments in the aileron gap at cruising speed. The flow visualizations present the impact of subsequent seals on the flow characteristics and the amount of hinge moment coefficient determining forces on the control stick. Analysis were performed in the operational range of the angles of attack for three aileron positions – maximum up, maximum down and in neutral position.

It has been shown, that the use of subsequent sealing means has a direct impact on the hinge moment value. The CFD analysis are consistent with the flight test observations, confirming that the more closed aileron gap is, higher aileron forces are generated on the control stick. Completely closing the flow in the aileron gap changes the nature of the force generated on the control stick. Further modifications planned concern remodeling the shape of the aileron gap.



Figure. PZL-130 Orlik TC-II aircraft with aerodynamic package.