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Autoren	G. Dargel
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Abstract

The way towards a “green aircraft” is driving a new effort to investigate the technology of natural laminar flow for the next smaller aircraft generation. A lot of research work had been performed by research organizations and aircraft manufacturers in the 1980s and 1990s mainly in the aerodynamic field. The current activities within the Airbus internal technology project LDA (Low Drag Aircraft) are linked in a close cooperation between the major disciplines of aerodynamic, structure and manufacturing to find a common solution on aircraft level. The aerodynamic design of a NLF wing does not only determine the performance of the wing, it also defines the wing shape with allowable space for the Krueger device integration. To achieve natural laminar flow the surface quality of this wing shape is the driving parameter for the application of a NLF wing. The surface tolerance, formulated by the aerodynamic design, has a great impact on the structural design and the manufacturing process, which at least decides if the production is possible in cost and time. The main focus of the presentation is on showing the effect of surface imperfections like waviness and steps on the stability behaviour of the boundary layer and the definition of the allowable surface tolerances. After the study of the scale and sweep effect on stability a corresponding NLF wing design with reduced sensitivity to surface imperfections in terms of surface waviness is discussed. The design and off-design behaviour of this wing are shown with variation of lift and Mach number. In order to design a NLF wing the presentation starts with a description of the transition mechanism of a swept wing and its prediction.