DESIGN OF A SMART LEADING EDGE DEVICE FOR LOW SPEED WIND TUNNEL TESTS IN THE EUROPEAN PROJECT SADE

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Abstract

The presented paper describes the pre-design and sizing of a smart leading edge section which is developed in the project SADE (Smart High Lift Devices for Next Generation Wings) which is part of the seventh framework program of the EU. SADE aims at a major step forward in the development and evaluation of the potential of morphing airframe technologies. The development of morphing technologies in SADE concentrates on the leading and trailing edge high-lift devices. At the leading edge a smart gap and step-less droop nose device is developed. For the landing flap a smart trailing edge of the flap is in the focus of the research activities. The main path in SADE follows the development of the leading edge section and the subsequent wind tunnel testing of a five meter span full-scale section with a chord length of three meters in the wind tunnel T-101 at the Russian central aero-hydrodynamic institute (TsAGI) in Moscow. The presented paper gives an overview over the desired performance and requirements of a smart leading edge device, the smart leading edge concept of the DLR what has been selected for the wind tunnel tests and the pre-design and sizing of the full-scale leading edge section which will be tested in the wind tunnel.

Keywords: Morphing, Smart Droop Nose, High-Lift, Smart Leading Edge.

1. Introduction

To meet the ambitious goals defined in the VISION 2020, technologies to consequently reduce drag and airframe noise will be necessary. The recommendations of the ACARE group for the reduction of emissions per passenger kilometers are CO2 < 50%, NOx < 80% and noise < 50% until 2020 (ACARE, 2008). To achieve the targeted limits new aircraft concepts and with it new concepts for high lift devices have to be developed. The developed systems have to comply with the next generation aircraft requirements like high surface quality and lightweight design. In conventional high lift configurations, devices on leading and trailing edges open slots to achieve the additional lift. However, the slots and especially slat gaps at the leading edge have been identified as the dominant source of airframe noise in approach. In the DLR project LEISA different high lift devices were investigated in an interdisciplinary way for the assessment of high lift system design for low noise exposing high lift devices (Wild, 2006; Kreth, 2007; Pott-Polenske, 2009). In Fig. 1 a weight comparison of the investigated high-lift configurations is given. The evaluation of the investigated configurations in LEISA includes the

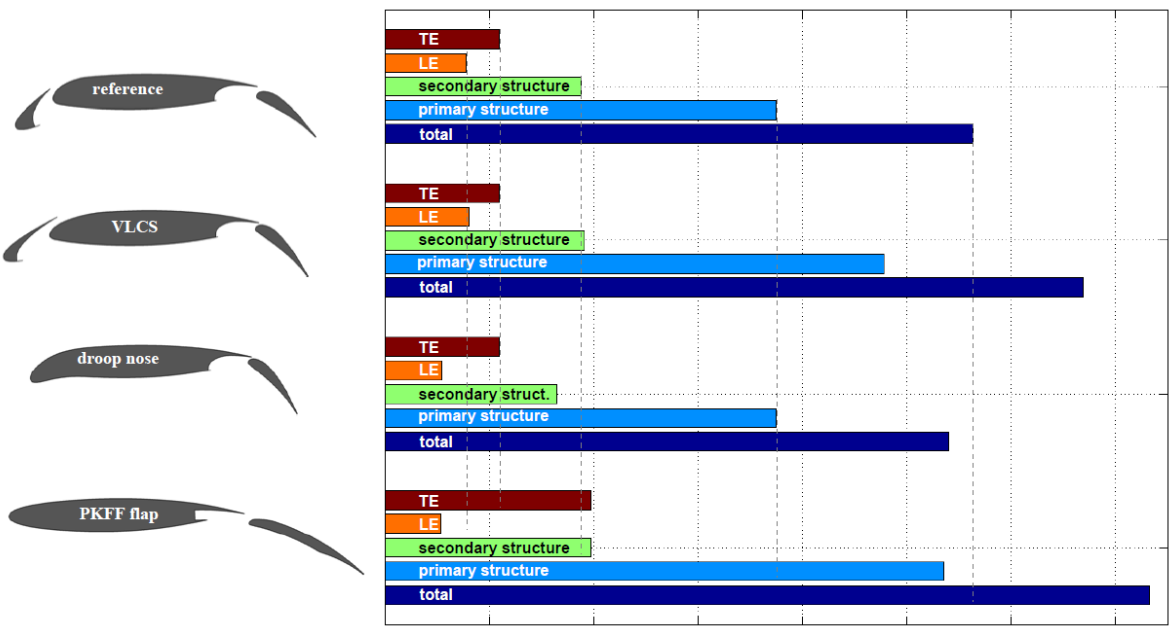

Fig. 1: Weight comparison of investigated high lift in the DLR project LEISA