Low Speed Take-Off Aerodynamic Analysis

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ABSTRACT

In the frame of the EU funded H2020 project AGILE (Aircraft 3rd Generation MDO for Innovative Collaboration of Heterogeneous Teams of Experts) detailed CFD simulations were made to analyze the high lift system of an optimized regional aircraft. The paper presents shortly how the different components of the aircraft were obtained. CFD calculations were carried out, and the results are discussed.

KEYWORDS: MDO, CFD, High-Lift

1. INTRODUCTION

Aircraft multi disciplinary optimization is a highly complex process requiring the involvement of a large number of specialists from a wide range of disciplines. Each of these specialist use their own tools, and these tools often have different levels of fidelity (= representation of the physics involved).
Tradionally the aircraft design process is divided into 3 phases, the Conceptual, the Preliminary and the Detailed Design. In the Conceptual Design phase many variants need to be studied and a fast turn around time of the tools being used is important. This means that mainly low fidelity tools are used in this phase, having the risk that this leads to flaws in the design requiring costly redesign at later stages in the design process.
Since the middle of 1990's efforts are underway to increase the fidelity of the tools being used in the Conceptual Design phase through the so called 'Virtual Product' that was defined as a 'high-fidelity mathematical/numerical representation of the physical properties and the functions of a product' [1, 2]. Critical to the success of the 'Virtual Product' is the capability for rapid generation of high-fidelity information from all disciplines involved, and the implementation of new multidisciplanary simulation and optimization environments [3].
Aircraft development programs are today organized as collaborative and multi-organizational processes. A major challenge hampering a cost effective design is the integration of multidisciplinary competences in the so called 'Virtual Entreprise'. The challenge becomes even larger when the required competences are provided by heterogeneous tems of specialists distributed in different organizations and across nations. This requires new multi Disciplinary Optimization (MDO) methodologies using a standard approach and interface for communication between disciplinary modules.
The AGILE (Aircraft 3rd Generation MDO for Innovative Collaboration of Heterogeneous Teams of Experts) Horizon 2020 funded project is developing and implementing the next generation of aircraft MDO processes targeting a reduction of 20% in time to converge the design of an aircraft and a 40% reduction in time needed to setup and solve the MDO probem using a team of heterogeneous specialists.
The AGILE project involves a team of 19 industry, research and academia partners from Europe, Canada and Russia. The AGILE project has formulated the so called 'AGILE Paradigm' [4] accelerating the deployment of collaborative, large scale design and optimization frameworks, and in particular (as shown in Fig. 1):