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MDO APPLICATIONS TO CONVENTIONAL AND NOVEL TURBOPROP AIRCRAFT WITHIN AGILE EUROPEAN PROJECT

Luca Stingo*, Pierluigi Della Vecchia*, Giovanni Cerino, Fabrizio Nicolosi*, Agostino De Marco***

***Department of Industrial Engineering (DII) – University of Naples *"Federico II"*, **Leonardo Company**

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Abstract

In this paper, multidisciplinary design optimization within the AGILE European project is applied to two turboprop aircraft. The first one is a conventional configuration characterized by wing mounted engines, while the second one is an innovative configuration with rear engines installation on the horizontal tail tip with an innovative power plant architecture. Both configurations are suited for 90 passengers, a design range of 1200 nautical miles and a cruise Mach number equal to 0.56.

The methodologies used to analyze both configurations include aerodynamic performance in clean, landing and takeoff configurations, mission performance, weight and balance, stability and control, emissions, in terms of Global Warming Potential parameter, and Direct Operating Cost estimation. The latest two will be considered as objective functions for the optimization loop.

Aim of this paper is to compare both configurations highlighting benefits and limits. Particular attention has been posed on the innovative approach used to analyze the use cases. The whole design process is made up of different tools belonging to a specific partner. Each partner is specialized in a specific discipline. The design process has been setup to be completely automated so that, partners, distributed worldwide are able to communicate and exchange results through remote connection. In this way each discipline has been assigned to the suited specialist.

1 Introduction

The present paper deals with the Multidisciplinary Design Analysis and Optimization (MDAO) applied to two turboprop aircraft configurations within AGILE (Aircraft 3rd Generation MDO for Innovative Collaboration of Heterogeneous Teams of Experts) European project [1].

AGILE is a three years project coordinated by the DLR and funded by European Union (EU) through the HORIZON2020 program and it aims to create an evolution of MDO, promoting a novel approach based on collaborative remote design and knowledge dissemination among various teams of experts. The aim of the project [2][3] is to develop advanced MDO and efficient multisite collaboration techniques to reduce convergence time and to face the lack of knowledge on how to setup optimization workflows involving lot of disciplines.

The paper presents the analyses comparison of a conventional and an innovative turboprop configuration analyzed during the third Design Campaign (DC) of the project within the Work Package 4 (WP4), in which the task 6 (T4.6) has been leaded by University of Naples Federico II (UniNa) as both specialist and integrator [4]. In this WP, six different disruptive aircraft configurations have been analyzed starting from specific Top Level Aircraft Requirements (TLARs). In T4.6, TLARs have been assigned by LEONARDO company which is the task architect. Turboprop use cases have been assigned to UniNa team because in the last three decades it gained and improved its experience in