



Design and aerodynamic analysis of a regional turboprop innovative configuration

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ABSTRACT

This paper deals with the fundamental results of the first loop of design and aerodynamic analysis of a new regional turboprop concept.

The aircraft has a low wing and two innovative architecture of turboprop engine installed at the horizontal tail tips. It can seat up to 130 passengers with a design range of about 3000km. It is designed to fly at Mach number of about 0.62 at a cruise altitude of 9000m with an efficiency about 18. The required maximum lift coefficients in clean, take-off and landing conditions are 1.6, 2.4 and 3.0 respectively.

Wing sections have been specifically designed to comply with the very challenging requirements in terms of minimum drag (natural laminar flow), maximum clean lift coefficients and compressibility effects. The high lift devices have been designed too. A single fowler flap layout has been considered. To augment the aircraft maximum lift capabilities in landing condition, preserving the wing laminar flow, the effects of a simple droop nose have been investigated. To improve climb performance a specific winglet design has been assessed, results show that a reduction of about 10% of the induced drag during both climb and cruise phase could be achieved.

All the criticalities emerged during the first loop will feed a second design loop to well asses this innovative concept.

KEYWORDS: *Aircraft Design, Aerodynamic analysis, Aircraft performance, Innovative Turboprop*

NOMENCLATURE

ADAS - Aircraft Design and Analysis Software
CFD - Computational Fluid Dynamic
CIRA - Italian Aerospace Research Center
DAF - Design of Aircraft and Flight Technologies research group
DATCOM - USAF Stability and Control (Data Compendium)

FL - Flight Level
FusDes - Fuselage Design Methods
IRON - Innovative turbopROP configuration
ISA - International Standard Atmosphere
JPAD - Java-Based Framework for Aircraft Preliminary Design and Optimization
MLW - Aircraft Maximum Landing Weight