

AERODYNAMIC ANALYSIS AND DESIGN OF A TWIN ENGINE COMMUTER AIRCRAFT

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Abstract

The present paper deals with the preliminary design of a general aviation Commuter 11 seat aircraft. The Commuter aircraft market is today characterized by very few new models and the majority of aircraft in operation belonging to this category are older than 35 years. Tecnam Aircraft Industries and the Department of Aerospace Engineering (DIAS) of the University of Naples "Federico II" are deeply involved in the design of a new commuter aircraft that should be introduced in this market with very good opportunities of success. This paper aims to provide some guidelines on the conception of a new twin-engine commuter aircraft with eleven passengers. Aircraft configuration and cabin layouts choices are shown, also compared to the main competitors. The research activity also deals with the aerodynamic design that has been performed at DIAS during 2011 and it was focused on a general aerodynamic analysis and a deep investigation on some particular effects (such as the wing-fuselage interference or the nacelle lift contribution and their effect on wing span loading). The aerodynamic analysis was also essential to have an accurate estimation of aircraft stability and control derivatives (both longitudinal and lateral-directional) and to lead to a right sizing of tail surfaces. The aerodynamic analysis have been carried out through the use of a 3-D panel code internally developed and the aerodynamic analysis performed through 3-D panel code calculations have been also supported by semi-empirical estimation methodologies. Design of winglets to improve climb performance will be presented.

1. Introduction

Many in the industry had anticipated 2011 to be the year when the General Aviation manufacturing industry would begin to recover. However, the demand for business airplanes and services, especially in the established markets of Europe and North America, remained soft and customer confidence in making purchase decision in these regions remained weak. This inactivity, nonetheless, was offset in part by demand from the emerging markets of China and Russia. While a full resurgence did not take place in 2011, the year finished with signs of recovery and reason of optimism. GAMA (General Aviation Manufacturer Association) 2011 Statistical Databook & Industry Outlook [1], which is usually a very useful and impressive source of data and statistics for general aviation, reports that the average age of general aviation registered aircraft is 46 year for single-engine piston powered aircraft and 15 years for single-engine turboprop aircraft. The average age for twin-engine 8-12 seats aircraft is 42 years for piston powered models and about 29 years for twin-engine turboprop commuter aircraft. These impressive data dramatically show the need of new aircraft model which will be characterized also by the application of new technologies like composite, light structures, new engines (with lower weight and lower fuel consumption) and new avionics and flight control systems.

Since 1990 Tecnam Aircraft Industries (www.tecnam.com) is involved in the design, development and construction of several light and ultra light aircraft with 2 and 4-seat,