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REDESIGN OF DE BOTHEZAT HELICOPTER : THE WAY FORWARD FOR THE ROTORCRAFT INDUSTRY

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ABSTRACT

This paper outlines the possibility of redesigning the de Bothezat helicopter. This helicopter uses a 4 rotor configuration and the basic structure is a 3 Dimensional truss girder. It flew in 1921 but failed to meet set performance targets and had control problems. Despite of this, the 4 rotor configuration has its promise. The limited success of the YURI 1 Human Powered Helicopter (HPH) in 1994 which uses the same configuration at least confirm that such configuration can give very meaningful lift to weight ratio for very minimum power (1/3 hp). Recent works on Rotary Micro Air Vehicles (MAV) such as the successful Mesicopter of Stanford University also uses a 4 rotor configuration. Control is obtained by differential thrust. For a bigger Remote Control (RC) Model, the Dragan Flyer II also uses the 4 rotor configuration with three gyrostabilizers to augment the stability of the differential thrust system. The rotors are all rigid. Rigid Hang Glider technology can be used to fabricate future large rotors for this

4 rotor configuration. This redesign offers much promise. The two main problems that have to be addressed are control and weight. A Multidisciplinary Design Optimization (MDO) methodology is essential to explore the full potential of this 4 rotor configuration.

Introduction

This paper looks at the possibility of redesigning the de Bothezat helicopter. In creative design, we should learn from previous mistakes and utilize the lesson learnt to move forward. In the beginning era of powered flight, published work on new innovative design was not available freely and the designers of that epoch were restricted in their choice of materials, power plant and construction techniques.

Helicopter rotor configuration concepts discussed in Raymer¹ are single-main, co-axial (e.g. Kamov) intermeshed (e.g. KAMAN K-MAX), "side by side" (e.g. Russian Mil V-12) and tandem (e.g. Boeing CH47 and H-21 Flying Banana). The 4 rotor configuration is not featured at all as there is no successful large 4 rotor helicopter flying today.

It is interesting to note that the tandem concept was used to provide a wide center of gravity range for a cargo helicopter. Lift at the rear of the fuselage provides significant structural weight

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