New VTOL Design

P. Spanoudakis, L. Doitsidis, N. C. Tsourveloudis, K. P. Valavanis, R. R. Murphy

A rather challenging joint research effort has been initiated between research teams from the Technical University of Crete (Machine Tools, and Intelligent Systems and Robotics Laboratories) and the Center for Robot-Assisted Search and Rescue (CRASAR) of the University of South Florida, with support from the Greek General Secretariat of Research and Technology/EU-5th Framework, EADS-3SIGMA S. A., and initial funding from Office of Naval Research (ONR), to design and eventually manufacture a prototype VTOL. After a thorough survey of existing VTOL models and considering the potential application areas, proposed specifications (that have resulted from P. Spanoudakis' M.Sc. Thesis) are as shown in **Table 1**.

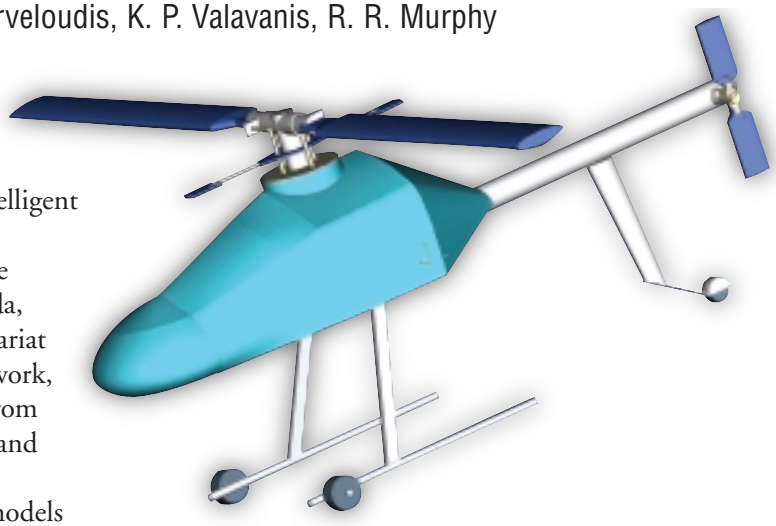

Figure 1: Preliminary CAD design.

Applications	Inspection, Surveillance, Reconnaissance, Target Drone	
Dimensions	Length	2.7 m
	Height	1.3 m
	Rotor Diameter	3.2 m
Weight	Empty Weight	113 Kg
	Payload	57 Kg
Performance	Speed	190 Km/h
	Endurance	3.2 hr
	Service Ceiling	4900 m
	Mission Radius	100 Km

Table 1: Proposed Specifications.

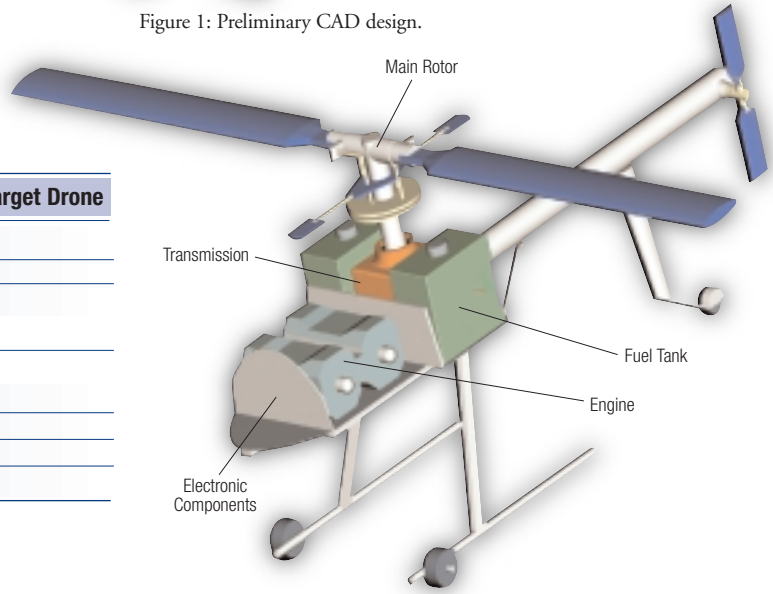

Figure 2: VTOL main components.

The preliminary CAD design and components are shown in **Figures 1 and 2**. The main frame will be of aluminum alloy (2014-T6) rods welded together. The engine is proposed to be the LIMBACH L550 E (two cylinder-two stroke, 548, max performance of 50 HP at 7500 rpm, torque: 60 Nm, weight: 21 Kg, electric starter). The transmission will be placed on the center of gravity of the vehicle, producing the required torque for main and tail rotors with a constant gear ratio and estimated weight of 9 Kg. The main rotor is placed above the transmission, composed of two blades with characteristics following mainly the 23012 NACA series, with a chord length of 15 cm, carbon fiber construction material for added flexibility, and vibration absorbance during rotation, and a rotor diameter of 3.2 m.

The tail rotor is composed of two blades with the same NACA characteristics and the same material. Two fuel tanks will be positioned on the transmission sides, supplying fuel simultaneously to the engine.

Preliminary crash tests have yielded very satisfactory results. We are currently in the process of optimizing the design and performing additional crash tests for better overall performance, before proceeding to the next phase.

For details, please correspond with ***nikost@dpem.tuc.gr***, or ***kvalavan@csee.usf.edu***.