UNIVERSITI TEKNOLOGI MARA

DESIGN AND ANALYSIS OF YAW STABILITY AND CONTROL SURFACES FOR UiTM'S BWB UAV BASELINE-II E-4

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of the requirements for the degree of
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AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the result of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

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ABSTRACT

UiTM is currently developing a blended wing body aircraft known as UiTM's BWB UAV Baseline-II. There are a few revolutions made since 2009. The one which concerned with directional control is known as UiTM's BWB UAV Baseline-II E-4. This aircraft is categorized as a tailless aircraft. Hence, it is unequipped with any vertical tail to perform the directional motion. This report presents the design process of alternative yaw control surfaces. The alternative yaw control surfaces are designed in order to provide the restoring or rectifying effect to the BWB aircraft. Trade-off study is performed in order to select the best yaw control surfaces for UiTM's BWB aircraft. From the study, split drag flaps are selected as yaw control surfaces. These control surfaces are selected depending upon the criteria such as the aspect ratio and wing sweep angle. Deflection of the split drag flaps on the one side of the wing will produce asymmetric drag force and as a consequence, yawing moment will be generated. The selected yaw control surfaces will be analyzed using the Computational Fluid Dynamics (CFD) software in order to obtain the aerodynamics data such as drag coefficients (C_D), side force coefficients (C_Y), lift coefficients (C_L) and yawing moment coefficients (C_n). The simulation is executed at various sideslip angles (β) up to 30° and split drag flaps total deflection (δ_T) angles up to 60°. From the results, it is noticed that the UiTM's BWB aircraft can perform the directional motion using the split drag flaps. However, lower deflection of split drag flaps is still inadequate to provide restoring yawing moment for the aircraft. This can be seen when negative yawing moment are still generated at the certain sideslip angles. Meanwhile, higher split drag flaps deflection (δ_T>30°) will produce positive yawing moments throughout the sideslip angles.

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