UNIVERSITI TEKNOLOGI MARA

AERODYNAMIC DESIGN IMPROVEMENT OF THE KENYALANG FUEL CELL *POWERED UNMANNED AIR VEHICLE (UAV)*

NOOR IDAYU BT MOHD TAHIR

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ABSTRACT

The research started with Kenyalang-1 as a fuel cell technology demonstrator back in year 2009. Kenyalang-1 UAV had flown successfully. However, detail calculations of the flight performance are yet to be done. It is necessary to have flight performance behavior in this project since there are a lot of rooms for future improvement. The previous Kenyalang-1 fuselage design is fabricated with a large, rectangular-shaped. The huge fuselage is used to fit propulsion system, hydrogen tank and avionics system. Nevertheless, this large fuselage increases the overall weight, which degrades the performance of the Kenyalang-1. Several alternatives and designs must be studied in order to improve the flight performance of Kenyalang-1.

The objectives of this project are to create alternative, improved aircraft aerodynamic designs, analyzing the best design's flight performance, and assess which design would be best for a new Kenyalang-2 fuel cell powered UAV.

The steps started with preliminary design, aerodynamic analysis using computational fluid dynamic (CFD) and aircraft performance analysis which are maximum speed, take off distance and rate of climb. Kenyalang-1 design used as the datum named model 1. Then the alternative designs have been created which are model 2, model 3 and model 4. The research continues with CFD analysis for model 1, model 2, model 3 and model 4. The CFD analysis results for all 3 models will compare with model 1 and ANSYS simulation data from other work [7] and also theoretical calculations. The comparison result between theoretical data and CFD analysis model 1 proved that the CFD data is valid. The next step is selecting best aerodynamic model based on C_L/C_D maximum. The best C_L/C_D maximum will proceed with flight performance analysis which are take off distance, stall speed, rate of climb and maximum altitude. The flight performance for best design will be the character for Kenyalang-2 model.

As a result, the maximum speed of alternative UAV Kenyalang-2 is 26 meter per second, and stall speed is 18.28 meter per second, take off distance is 178.19 meter while rate of climb is 4.16 m/s. The research objective has been achieved and the outcome is beneficial to the alternative energy, economy, society and knowledge.

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