UNIVERSITI TEKNOLOGI MARA

DESIGN FOR MODULARITY OF BLENDED WING BODY (BWB) BASELINE II-E2 UNMANNED AERIAL VEHICLE (UAV)

MATZAINI BIN KATON

Thesis submitted in fulfillment
of the requirements for the degree of
Master of Science

Faculty of Mechanical Engineering

July 2014

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.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

Name of Student	:	Matzaini Bin Katon
Student I.D. No.	:	2008331575
Programme	:	Master of Science
Faculty	:	Faculty of Mechanical Engineering
Title	:	Design for Modularity of Blended Wing Body (BWB) Baseline II-E2 Unmanned Aerial Vehicle (UAV)
Signature of Student	:	....
Date	:	July 2014

ABSTRACT

This thesis describes the strategy used for designing the structural modular layout for the Blended Wing Body (BWB) Baseline II-E2 Unmanned Aerial Vehicle (UAV) airplane. In order to give UAV more flexibility in terms of availability of flight mission, there was a need for a quick and ease of assembly and disassembly's process for the airframe. The goal of this research was to design a BWB modular airframe, focusing on the ease of airframe assembly and disassembly. Morphological Method and Pugh Method were used as the concept generation and evaluation tools in designing the BWB airframe. The BWB was divided into 5 main modules: wing-body module, starboard and portside module and, right-side and left-side canards module. CATIA, a Computational Aided Design (CAD) software was used to build the three dimensional (3-D) model of the airframe. MSC Patran/Nastran was used as the finite element (FE) analysis tool to analyze the BWB airframe static strength. Analysis was done focusing on the stress and deflections results. FE models for the airframe were developed in MSC Patran. CQUAD4, CTRIA3, CBEAM and CBAR elements were used to represent the individual components of the airframe such as spar and frames. Validation of FE static analysis was done using the static theoretical analysis in the form of stress calculations using simple beam theory. The airframe design was based on the +3.8 g flight load. Sizing of joints between modules was done through the use of empirical analysis. Internal forces induced in the connector between modules were used to size the joints. Approach using the CAD and Computational Aided Engineering (CAE) platform for designing the modular BWB airplane has been shown in this research. Design of the airframe proposed here had been analytically proven to be safe.

TABLE OF CONTENTS