CHAPTER 1

INTRODUCTION

1.1 GENERAL DESCRIPTION

An unmanned aerial vehicle (UAV) is an aircraft that operating without the presence of a pilot and is controlled by remotely and others fly autonomously using pre-programmed flight plans. UAV can be classifying into four different groups which is large, medium, small and micro. The examples of large UAVs are Global Hawk (20m wingspan) and Predator (14.8m wingspan) (Bowman, 2004). The representative for mid-size and small UAVs are Malat Hunter (8.8m wingspan) (Rocky, 2004) and Raven (1.28m wingspan) respectively. The micro air vehicle (MAV) is miniature aircraft with a maximum wingspan of 15mm.

Early used of unmanned aerial vehicle (UAV) was to replace the manned aircraft in the military operations. The advantages of using UAV instead of manned aircraft are that the UAV can reduce the exposure risk of the operating pilot in the war zone and capable to perform the large variety of dangerous missions including providing a ground and aerial gunnery a target that may simulates an enemy aircraft and also can attack the enemy territories using the missiles weapon.

Nowadays, the development and interest of small unmanned aerial vehicles (UAV) are slowing finding their way into civil and commercial applications. UAVs are finding use in the following industrial fields such as agriculture industry, crop
monitoring, weather research, air traffic control and many more (Wong et al., 1997) and easily handled by human without expertise in aviation industry.

1.2 PROJECT BACKGROUND

The purpose of this project is to design a small Unmanned Aerial Vehicle (UAV) which can be used for the reconnaissance missions. This included the process estimating weight of the UAV, wing area and the power used to generate the mini-UAV. The project focused on the evaluating and designs the chosen empennage configuration including the vertical stabilizers, horizontal stabilizers and also the control surface sizing for the mini-UAV. Finally, the suitable airfoils were analyzed where the best airfoil based on suitable requirements is selected.

1.3 PROBLEM STATEMENT / TECHNICAL TASK

1.3.1 Introduction

A small UAV is selected to use in the civil reconnaissance applications because it is less expensive, more portable than the large UAV and easily to operate by the human. Generally, design requirements for a typical low-altitude small UAV flew at speeds between 20 and 100 km/h (12 to 62 mile/h), cruise altitudes of 3 to 300 m (10 to 1000 ft), light weight, and all-weather capabilities. The vehicles has the wing spans less than approximately 6 m (20 ft) and masses less than 25 kg (55 lb) are usually considered as a small UAV (Mueller, 2003). The technical task needed to determine first before the design process of the UAV took place. Developing a new UAV, desired the designer to decide the technical task for the small UAV such as the cruise speed, cruising altitude, range, endurance, take-off distance and landing distance based on assumption with good justification.

The mini-UAV is build to do the civil surveillance and reconnaissance missions. The type of civil surveillance and reconnaissance missions such as:
a. Scenery snapshot / Aerial Photography  
b. Wildlife and ecological monitoring  
c. Deforestation Vigilance  
d. Agriculture Industry  
e. Traffic monitoring  
f. Monitoring disaster areas.  

1.3.2 Standard Requirements  

As the UAV is used for civilian missions, it must conform to international standards and follow the Federal Aviation Regulations, or FARs (Epps et al, 2008). The UAV will follow the FAR 23 specifications that contain airworthiness standards for airplanes in the normal, utility, acrobatic, and commuter categories.  

1.3.3 Performance Parameters  

Cruise speed -60 km/h  

The higher cruise speed ensures the aircraft to reach the mission area quickly, hence it will increase the efficiency of the mission’s flight. But if the aircraft is travelling too fast it will weakened the camera performance where the picture will become unclear or blurry. Therefore, a suitable cruise speed needs to determine to satisfy all the missions’ requirement. Hence, for this project it is suggested the cruise speed for the aircraft is 60 km/h.  

Loiter Speed – 40 km/h  

Aircraft loiter speed is lower than cruise speed where the smaller loiter speed able to increase focused point monitoring and resolution during the mission. For the successfully reconnaissance mission, the aircraft should be able to provide the clear