CHAPTER I
INTRODUCTION

1.1 Background

Aircraft is one of the riskiest transportation that exist, but yet it is the safest transportation, it is called risky because every flying position of the aircraft is critical position and dangerous, also in every critical condition of the aircraft a device that help the pilot to operate the aircraft and minimize any human errors is needed. One of the examples for aircraft critical condition is the time when aircraft approach the runway (landing), in that position the aircraft must on the appropriate distance and altitude, if it is still far from the runway but the aircraft is already dive too low it will be resulting the aircraft to stall error, and if the altitude is too low to the ground it will be very dangerous for the aircraft itself.

The critical condition of the aircraft in every situation makes every devices such as navigation system and communication system on the aircraft are always equipped and connected with radio frequency to know the actual condition of the surrounding area and the condition of the aircraft itself, and one of the device that help the aircraft to approach the runway is Instrument Landing System (ILS) which consist of Marker Beacon, Glide Slope, and Localizer[2], those three devices works with different system as one group of ILS. The ILS system has been already developed since 1928 by the Federal Aviation Administration (FAA) and the first test of ILS was held in 1929 with the first America's civil airlines[15], although this tool has been around for a very long time and has been developed but the function is still not evenly distributed in every airport around the world, seeing the importance of using this tool to reduce human error and also help the pilot to land the aircraft on the bad weather.

ILS marker beacons are used to facilitate the aircraft when landing. The tool used will simulate a marker beacon working system that resembles what is on an actual plane. By drawing lights indicators which indicate the position occur when the indicators lights up is the distance between the plane and the runway.

The Instrument Landing System (ILS) has an important role in navigating the aircraft, namely to help aligning the aircraft against the runway and help the aircraft to landing. ILS is divided into several systems such as marker beacons, glide sloop, localizer[2]. This final project will discuss the process and the system in marker beacons.

Marker beacon consist of receivers and transmitters, Receivers are located on the air planes while transmitters are located on ground or land which have a working principle of receiving signals from the signals emitted from transmitters installed on land and also runways with

signal frequencies of 75 MHz and receiver information output as lights indicators with information frequency such as white 3000 Hz, 1300 Hz amber, and 400 Hz blue[4][5].

The working principle of marker beacon is to emit signals carried out by transmitter antennas placed on land and received by receiver antennas on the aircraft. The antenna that is grounded serves to transmit information in the form of distance from the runway to be addressed in the direction and pattern of the vertical beam and the carrier frequency of 75 MHz. The marker beacon that located on the aircraft works as antenna receivers, data processing, and indicators. The aircraft receives a signal from the transmitter and then processes it by separating the carrier signal from the information signal, after that the output of the information signal will be displayed on the indicator in the form of lights.

Marker Beacon antennas are using a Yagi antenna design and it is a type of a commercial radio or television antenna. This antenna is a directional antenna which is increasing the reinforcement on one side of the antenna, the antenna side behind the reflector has a lower force. the receiver antenna or transmitter antenna in the marker beacon both use the 75 MHz frequency as a carrier signal and have a data signal with a frequency of 400 Hz to 3000 Hz, thus as shown in the table 1.1 the frequency band designation for Marker beacon antenna is Very high frequency (VHF) where the frequency is suitable for air navigation and communication process.

Table 1.1 Frequency band designation[3].

Frequency band	Designation	Typical services
3-30 kHz	Very low frequency (VLF)	Navigation, Sonar
30-300 kHz	Low frequency (LF)	Radio Beacons, navigational aids
300-3000 kHz	Medium frequency (MF)	AM broadcasting, maritime radio, coast guard communication, direction finding.
3-30 MHz	High frequency (HF)	Telephone, telegraph, amateur radio, facsimile, shortwave international

		broadcasting, ship-to-coast and ship-to-aircraft communication
30-300 MHz	Very high frequency (VHF)	Television, FM broadcast, air traffic control, police, taxicab mobile radio, navigational aids
300-3000 MHz	Ultra-high frequency (UHF)	Television, satellite communication, radiosonde, surveillance radar, navigational aids.
3-30 GHz	Super high frequency (SHF)	Airborne radar, microwave links, common-carrier land mobile communication, satellite communication.
30 300 GHz	Extremely high frequency (EHF)	Radar, experimental

1.2 Problems Formulation

ILS Marker Beacons are very complex built and integrated with the Radio Altimeter, and Distance measuring equipment (DME) also the real device needs a long process of work. Therefore, this thesis simplifies the work of the Marker Beacon system without being integrated by the other system so the prototype can be perfectly simulated as the real device in the aircraft.

1.3 Objectives and Benefits

The purpose of this final assignment is to provide a real picture of the system and also how the marker beacon works on the instrument landing system (ILS). The benefit of this marker beacon is to make it easier for pilots to align the aircraft against the runway without only relying on the pilot's visuals.

1.4 Scope of Research

The boundary of problem in this final project is:

1. The marker beacon antenna simulation do not use filters so there is a high probability that noise will occur.
2. The circuit and the system of the antenna is simulated by using CST STUDIO

SUITE

3. The experimental study is conducted by laboratory experiment using Oscilloscope
4. This experiment only discuss technically about the antenna test as telecommunication media or as a transmitter not as an electronics media or circuitry.
5. Expected antenna specification as follow:
    a Frequency : 75 MHz
    b Bandwidth : SSB (Single Side Band)
    c Radiation Pattern : Directional
    d Patch : Aluminum - Copper

1.5 Research Methodology

This thesis deliberates the following methods:

1. Theoretical and Literature Studies

   This step decides references from journals, papers, manuals and books related to instrument landing system, marker beacon, and antenna designing.

2. Antenna Designing

   This step is designing an algorithm to processed the data of marker beacon to obtain range data information.

3. Measurement

   This step is conducted using and oscilloscope to obtain the marker beacon carrier signal data and information signal data.

4. Simulation

   This step is conducted using computer simulation tool for electromagnetic to obtain the marker beacon data by computer.

1.6 Structure of The Proposal

The rest of this proposal is written as follows:

- Chapter 2 BASIC CONCEPTS

  This chapter describes the theories, tools and equipment related in this research.

- Chapter 3 ANTENNA DESIGNING AND SYSTEM MODELLING

  This chapter describes how to design the proposal system based on the problems.

- Chapter 4 RESULT AND SIMULATION ANALYSIS

This chapter describes the analysis of the problems.

- Chapter 5 CONCLUSION AND SUGGESTION

  This chapter describes the conclusion of the problems.