Title: ,

*“A Project”*

Prepared by Date \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

,

Authorised for use by Date \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

, Project Coordinator

**QUT Avionics**

Queensland University of Technology

S1110

Gardens Point Campus

Brisbane, Australia, 4001.

Telephone (+61 7) 313**8 1411**

e-mail luis.mejias@qut.edu.au

This document is Copyright 2009 by the QUT. The content of this document, except that information which is in the public domain, is the proprietary property of the QUT and shall not be disclosed or reproduced in part or in whole other than for the purpose for which it has been prepared without the express permission of the QUT

**Revision Record**

|  |  |  |  |
| --- | --- | --- | --- |
| Document Issue/Revision Status | **Description of Change** | **Date** | **Approved** |
|  | Initial Issue |  |  |

**Distribution List**

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Affiliation** | **Distribution Date** | **Approved** |
| Avionics Lab File Archive | QUT Avionics |  |  |

**Abstract**

This document details the High Level Objectives (HLOs) for the Predictive Flight Management System (PFMS) project which were defined utilising the provided statement of work and consultation with the project’s supervisor, . The document explicitly details the customer’s requirements in order of preference and details if they are mandatory and desired. The HLOs will be completed in succession as described, with HLO-1 and HLO-2 being mandatory and successive HLOs being desired.

The HLOs are summarised below:

* HLO-1 of the PFMS project is to conduct a literature review in order to identify the relevant information about Flight Management Systems, control and aircraft Dynamics.
* HLO-2 is to design a 3D simulation based system capability with a level of intelligence.
* HLO-3 is to design a PFMS system capability with a level of intelligence and install and test onboard a UAV.
* HLO-4 is to design a advanced PFMS system capability with improved concepts of operation and install and test onboard a UAV.

**Table of Contents**

Paragraph Page No.

[1 Introduction 6](#_Toc228367905)

[1.1 Scope 6](#_Toc228367906)

[1.2 Background 6](#_Toc228367907)

[2 Reference Documents 7](#_Toc228367908)

[2.1 QUT Avionics Documents 7](#_Toc228367909)

[2.2 Non-QUT Documents 7](#_Toc228367910)

[3 High Level Objectives 8](#_Toc228367911)

[3.1 High Level Objectives Overview 8](#_Toc228367912)

[3.1.1 HLO-1 8](#_Toc228367913)

[3.1.2 HLO-2 8](#_Toc228367914)

[3.1.3 HLO-3 9](#_Toc228367915)

[3.1.4 HLO-4 9](#_Toc228367916)

[4 Conclusions 10](#_Toc228367917)

[5 Appendices 11](#_Toc228367918)

**List of Figures**

Figure Page No.

[Figure 1 – PFMS Project’s High Level Objectives 8](#_Toc228367919)

**List of Tables**

Table Page No.

No Tables.

**Definitions**

|  |  |
| --- | --- |
| PFMS | Predictive Flight Management System |
| HLO | High Level Objectives |
| PMP | Project Management Plan |
| QUT | Queensland University of Technology |
| QUAV | QUT Uninhabited Aerial Vehicle |
| UAV | Uninhabited Aerial Vehicle |
| ARCAA | Australian Research Centre for Aerospace Automation |
| QUAS | QUT Uninhabited Aerial System |

# Introduction

This document defines the High Level Objectives (HLOs) of the PFMS project which were defined utilising the provided statement of work and with consultation with the project customer . It serves as a record of defined work to be completed and delivered to the customer. This document contains both mandatory and desired objectives.

## Scope

This document outlines the HLOs for the 2009 Unmanned Aerial Vehicle PFMS project.

## Background

QUT has been developing UAV technology in various forms since 1991. In the past, subsequent to receiving commands from an autonomous traffic controller, flight trajectory prediction has been performed by linear methods which ignore the dynamics of the aircraft, weather effects and successive waypoints. A PFMS allows for an Unmanned Aerial Vehicle (UAV) to have some level of intelligence to determine whether it will be capable of intercepting a demanded waypoint at a given time, whether to ignore waypoints that may/may not be invalid if there is a higher then expected latency in the system, and how to handle the difference between mandatory (mission) waypoints and the demanded waypoints from the traffic controller. In advanced stages of the project the PFMS may include concepts such as autonomous collision avoidance that is independent of the autonomous traffic controller.

This year the Australian Research Centre for Aerospace Automation (ARCAA) requires a PFMS for the Smart Skies QUT Unmanned Aerial System (QUAS) resulting in the PFMS project. This document outlines the HLOs of the PFMS project defined during consultation with .

# Reference Documents

## QUT Avionics Documents

|  |  |  |
| --- | --- | --- |
| RD/1. | SOW-002-SEM1/2-2009 | Statement of Work |
| RD/2 | QUAV-PFMS-CUS-0001 | Customer Minutes |

## Non-QUT Documents

|  |  |  |
| --- | --- | --- |
| None. |  |  |

In the event of any conflict between this document and any RD referenced herein, such conflict shall be notified to .

In the following text, RD/x identifies referenced documents, where "x" denotes the actual document.

# High Level Objectives

The HLOs of this project were defined through the statement of work (RD/1), provided by , and during customer consultation described in meeting minutes (RD/2).The following HLOs are described as either mandatory or desired where all mandatory requirements will be completed before desired functionality is attempted.

## High Level Objectives Overview

The HLOs are summarised as below where they are stated in order of priority.



Figure 1 – PFMS Project’s High Level Objectives

### HLO-1

Conduct a literature review in order to identify the relevant information about Flight Management Systems, control and aircraft Dynamics

This objective is to establish a strong understanding of the mechanics of flight management systems, control and aircraft dynamics to assist in the subsequent design of a PFMS in later stages of the project.

This HLO is mandatory.

### HLO-2

*Develop a 3D simulation based system capability with a level of intelligence.*

This objective is to apply understanding of a PFMS with application complex aircraft dynamics, attitude considerations, to derive a three dimensional model capable of determining a level of prediction with multiple waypoints. In addition the system must be able to determine whether the aircraft will be able to intercept a demanded waypoint at a given time, whether to ignore waypoints that may/may not be invalid if there is a higher than expected latency in the system and how to handle the difference between mandatory (mission) waypoints and demanded waypoint from the autonomous traffic controller. This system will also be capable of handling standard messages which would be relayed by an autonomous air traffic controller. The model is to be implemented in MATLAB.

This HLO is mandatory.

### HLO-3

*Develop a PFMS system capability with a level of intelligence and install and test onboard a UAV.*

This objective is to transfer the PFMS capability to a UAV and its appropriate systems which is capable of operating the PFMS. In addition the system is to be tested and validated. The UAV is to be equipped with an autopilot and suitable hardware to operate the PFMS. The PFMS is to be validated during cruising stages of flight.

This HLO is desired.

### HLO-4

*Design an advanced PFMS system capability with improved concepts of operation and install and test onboard a UAV.*

This objective is to include advanced concepts of operations such as autonomous collision avoidance that is, independent of the autonomous traffic controller instructions. The meaning and technical specification the term advanced PFMS may evolve during later phases of the project.

This HLO is desired.

# Conclusions

The HLOs will be completed in succession as described, with HLO-1 and HLO-2 being mandatory and successive HLOs being desired. All HLOs have been created from the statement of work provided by and from further negotiations. The detailed HLOs will guide the development of the project and are used to derive the system requirements.

# Appendices

None.