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*“A Project”*

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**Revision Record**

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

**Distribution List**

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**Abstract**

This document outlines a preliminary system architecture for a Predictive Flight Management System (PFMS). The document utilises the recommendations from the previous literature survey in RD/1.

The document explicitly outlines the system architecture for preliminary phases of the project as defined in RD/2. The fundamental architecture is defined by a control model, vehicle dynamics model, inputs of vehicle constraints and initial conditions and outputs of trajectory prediction.

In later phases of the project a system architecture including inputs of meteorology and control with intelligence to perform independent collision avoidance of the autonomous air traffic controller. The system architecture will be developed for these stages in later documentation.

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**Definitions**

|  |  |
| --- | --- |
| PFMS | Predictive Flight Management System |
| UAV | Unmanned Aerial Vehicle |
| ARCAA | Australian Research Centre for Aerospace Automation |
| QUAS | QUT Unmanned Aerial System |
| DOF | Degree of Freedom |
| ECEF | Earth Centred Earth Fi |

# Introduction

This document details the preliminary system architecture of the PFMS utilising the previous literature survey.

## Scope

This document outlines the preliminary system architecture of the PFMS.

## 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 states 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 preliminary system architecture for successive phases of the project.

# Reference Documents

## QUT Avionics Documents

|  |  |  |
| --- | --- | --- |
| RD/1 | QUAV-PFMS-SYS-TS-0001 | PFMS TS document |
| RD/2 | QUAV-PFMS-SYS-SR-0001 | PFMS SR document |
| RD/3 | QUAV-PFMS-SYS-HO-0001 | PFMS HLO document |

## 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.

# Preliminary System Architecture

The preliminary system architecture for the PFMS is detailed in .



Figure - Preliminary System Architecture

Each section of the above figure and its method of implementation, as per recommendations in RD/2, is detailed in the sections below.

## Aircraft Control Model

The aircraft control model will be implemented within Matlab utilising the MPC toolbox. The control model will consider attitude constraints provide 3 dimensional trajectory predictions as per HLO-2 (RD/3)

## Vehicle Dynamics Model

The vehicle dynamics model will be implemented as a 6 Degree of Freedom (DOF) model in Matlab utilising the Aerosim blockset.

## Aircraft Intent

The aircraft intent data will 3 dimensional guidance data provided by the Air Traffic Controller (ATCo). In addition it will provide the current setting of control power of the UAS. The aircraft intent will be simulated for the Matlab implementation.

## Initial Aircraft State

The sensor data required for a 6 DOF model will be provided by the UAS. The aircraft initial state will be simulated for the Matlab implementation.

## Advance Considerations

In later phases of the project a system architecture including inputs of meteorology and control with intelligence to perform independent collision avoidance of the autonomous air traffic controller. The system architecture will be developed for these stages in later documentation.

## Trajectory Prediction

The predicted trajectory at the required time will be detailed in the Simulink workspace. The predicted location will be given in the Earth Centred Earth Fixed (ECEF) reference frame.

# Conclusions

The preliminary system architecture will be implemented as detailed.

# Appendices

None.