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*“A Project”*

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**Abstract**

This document details how the Predictive Flight Management System (PFMS) project will be managed and run throughout its lifecycle. The PFMS project consists of working undergraduate engineer responsible for the completion of the project HLOs with support from the project customer Dr Luis Mejias.

Documents requirements and standards are detailed as well as documents required to be completed over the projects lifecycle. In addition minutes are to be taken during project meetings with the customer Dr Luis Mejias. Each document must be reviewed prior to publication.

This report details safety, schedule, technical and budgetary risks, and puts forward mitigation procedures to minimise each identified risk.

A work breakdown structure outlines how the work for the project will be done. This is decomposed into individual work packages to describe in detail the work required to complete the project. A schedule is created from these work packages in the form of a Gantt chart.

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**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 |
| BEE | Built Environment and Engineering |

# Introduction

The PFMS project requires effective management to ensure its successful completion and achievement of its High Level Objectives (HLOs). This document provides a comprehensive guideline for the lifecycle of the project ensuring cohesive completion of objectives and the quality of the final product.

## Scope

This document details a comprehensive Project Management Plan (PMP) for the 2009 QUT Uninhabited Aerial Vehicle (QUAV) 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 states of the aircraft, weather effects and successive waypoints. A PFMS allows for an Uninhabited 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 Uninhabited Aerial System (QUAS) resulting in the PFMS project. This document outlines the HLOs defined during consultation with the customer Dr Luis Mejias.

# Reference Documents

## QUT Avionics Documents

|  |  |  |
| --- | --- | --- |
| RD/1 | QUAV-PFMS-SYS-HO-0001 | PFMS HLO document |

## Non-QUT Documents

|  |  |  |
| --- | --- | --- |
| RD/3 | SP-601S | NASA Systems Engineering Handbook |

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

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

# Project Organisation

## Management Structure

The reporting structure for the PFMS project is divided into two levels. The first level represents the project advisor and customer, Dr Luis Mejias and the second level represents the working undergraduate engineer Nicholas Rutherford. illustrates the reporting structure for the PFMS project.



Figure - PFMS reporting structure

## Organisational Structure

### Member Roles

The PFMS project consists of working undergraduate engineer responsible for the completion of the project HLOs (RD/1) with support from the project customer Dr Luis Mejias.

### Document Responsibilities

Documentation for the PFMS project is written as required. System documents that define project details and sub-system documents are expected to be completed throughout the project lifecycle. In addition minutes are to be taken during project meetings with the customer Dr Luis Mejias. Each document must be reviewed prior to publication.

#### Documentation Standards

Consistency between all documentation is ensured using predefined documentation standards, which are used according to the QUAV administrative file (RD/1). All documentation produced utilises one or more of the following templates or programs:

* Minutes MoM.dot (reference RD/2)
* Test Reports Avionics\_TR.dot (reference RD/3)
* Other Documents Avionics.dot (reference RD/4)
* Project Timeline Microsoft Project
* Diagrams Microsoft Visio
* Code Notepad ++

## Resources

The PFMS project has been provided with a range of resources for the purposes of this project. These resources include facilities, equipment and services. The following sections outline the resources available to the PFMS team.

### Financial Resources

The PFMS project is provided a $100.00 budget by the Built Environment & Engineering Faculty (BEE) at QUT. However, since the project is ultimately a potential sub-system for the ARCAA QUAS the PFMS project may be subsidised for costs incurred during the design, development, implementation and testing phases where required. This funding will need to be approved by the customer. Regular update of expenditures will be recorded within the project plan.

shows the expenditure of the project. Shipping is included in each cost, and cost reflects total price, not price per unit. Note the table below is subject to change as purchases are made during the project.

|  |  |  |  |
| --- | --- | --- | --- |
| **Product** | **Quantity** | **Cost ($)** | **Purchase Location** |
| No costs incurred | N/A | N/A | N/A |
|  |  |  |  |
| **Total** | N/A | N/A | N/A |

Table - Financial resources

### Services and Facilities

The PFMS team has been provided with services and facilities for the duration of the project, primarily the ability to consult with customer Dr Luis Mejias by request.

The other services available to the group are outlined in below.

|  |  |  |
| --- | --- | --- |
| **Resource** | **Availability** | **Access** |
| Level 11 Avionics Lab | 24 hours/day | Avionics students |

Table - Facility resources

### Human Resources

It is required to commit 10 hours of work time to the project per week. One unit of the QUT Avionics course is ordained one quarter of the 40 hour working week; thereby a minimum of 10 hours on the PFMS project is required per week.

## Document Numbering

The documentation for this project follows a numbering system to aid traceability. The numbering system is as follows.

QUAV-<PROJECT CODE>-<SUBSYSTEM CODE>-<DOCUMENT CODE>-<DOCUMENT NUMBER>

For example, this document is:

QUAV-PFMS-SYS-PM-0001

### Project Code

The project code is PFMS and this will be on all documents.

### Subsystem Codes

The subsystem codes are:

SYS – whole system

SFW – software system

CUS – customer documents (e.g. customer meeting minutes)

### Document Codes

The document codes are as follows:

TS – Trade Study

PM – Project Management Plan

SA – System Architecture

SR – System Requirements

TR – Test Report

MM – Meeting Minutes

# Risk Management

This section of the document contains a detail risk management plan to ensure that any incident with potential to delay or cause harm can be successfully avoided or properly handled with a detailed mitigation procedure. Risk management is an important consideration for any systems engineering process. It is standard to categorise risks into several groups.

This risk management section utilises methods, and appropriate tables, detailed within the NASA Systems Engineering Handbook as per RD/2.

## Risk Mitigation

Risks within the PFMS project must be identified, and a mitigation procedure must be proposed to minimise potential hazards. Following this risk mitigation procedure will aid in reducing any potential hazard to the safety of individuals, equipment, and the surrounding environment. The following sections detail potential hazards and their mitigation procedures.

## Risk Significance

Each risk has been assigned an appropriate probability of occurring as described in the Probability of Mishap table and a description of the consequences as described in the Severity of Consequences table. The significance of the risk is then calculated by using the Matrix of Judgement of Significance. These three tables are shown below.

### Probability of Mishap

Each risk has been assigned an appropriate probability of occurring as described in the Probability of Mishap table shown below.

|  |  |
| --- | --- |
| Probability of Mishap | |
| Description | **Definition** |
| Frequent | Likely to occur repeatedly in the system life cycle |
| Probable | Likely to occur several times in a system life cycle |
| Occasional | Likely to occur sometime in a system life cycle |
| Remote | Not likely to occur in system life cycle, but possible |
| Improbable | Probability of occurrence cannot be distinguished from zero |

Table - Probability of Mishap table

### Severity of Consequences

A description of consequences as described in the Severity of Consequences in Table 4. Note the .table details severities that should not be expected during the lifecycle of the project, however they are included within this documentation for best systems engineering practices.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Severity of Consequences | | | | | |
| Category / Descriptive Word | **Personnel Illness / Injury** | **Equipment Loss ($)** | **Down Time** | **Product Loss** | **Environmental Effects** |
| I  CATASTROPHIC | Death | More than $1 million | More than 4 weeks | As per equipment loss | Long Term (5 yrs or more) environmental damage or requiring more than $1 million to correct and/or in penalties |
| II  CRITICAL | Severe injury of severe occupational illness | $200000 to $1 million | 2 to 4 weeks | As per equipment loss | Medium Term (1 – 5 yrs) environmental damage or requiring $200000 to $1 million to correct and/or in penalties |
| III  MARGINAL | Minor injury or minor occupational illness | $1000 to $200000 | 1 day to 2 weeks | As per equipment loss | Short Term (less than 1 yr) environmental damage or requiring $1000 to $200000 to correct and/or in penalties |
| IV  NEGLIGIBLE | Less than one day lost | Less than $1000 | Less than 1 day | As per equipment loss | Minor environmental damage, readily repaired and/or requiring less than $1000 to correct and/or in penalties |

Table - Severity of Consequences table

### Matrix of Judgment of Significance

The Matrix for Judgement of Significance is used to qualitatively determine the significance of a particular risk using the Probability of Mishap and Severity of Consequences tables.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Matrix for Judgement of Significance | | | | |
| Probability of Mishap | Severity of Consequences | | | |
| I Catastrophic | II Critical | III Marginal | IV  Negligible |
| A Frequent | Very Significant | Very Significant | Significant | Insignificant |
| B Probable | Very Significant | Very Significant | Significant | Insignificant |
| C Occasional | Very Significant | Significant | Insignificant | Insignificant |
| D Remote | Significant | Insignificant | Insignificant | Insignificant |
| E Improbable | Significant | Insignificant | Insignificant | Insignificant |

Table - Matrix of Judgement of Significance

## Risk Categorisation

The following sections detail the risks involved within four categories for the PFMS projects lifecycle.

### Personal Injury

The PFMS project poses potential risk of personal injury to members and all who may be exposed to the project. Table 6 details each hazard, and its appropriate mitigation procedure.

|  |  |  |  |
| --- | --- | --- | --- |
| **Risk Item** | **Significance** | **Consequence** | **Mitigation Procedure** |
| **Cuts/ abrasions**  In later stages of the project it may be required to operate mechanical equipment such as tools while working with a UAV. These items can cause small cuts or abrasions. | **Insignificant** | Small cuts or abrasions to personnel in the team will hinder the project development and may cause up to a day’s loss. | Safe operation methods must be known prior to using equipment. |
| **Burns**  Burns might be experienced from equipment such as soldering irons or exposure to the sun. | **Insignificant** | Small burns will hinder the project development and may cause up to a day’s loss. | Safe operation methods must be known prior to using a soldering iron. Risk of sun burn can be reduced with the use of a hat and sun cream. |
| **Electrical**  Small electric shocks might be experienced from battery equipment or when using power tools. | **Insignificant** | Electric shocks will hinder the project development and may cause up to a day’s loss. | The majority of the project will be completed within the QUT engineering laboratories it is therefore a requirement that a safety induction course is completed. |

Table - Personal injury mitigation

### Schedule Risks

Schedule risks must be assessed and controlled to ensure the project is successful in achieving its goals which are outlined in the projects HLOs (RD/1). Table 7 details the schedule risks and their appropriate mitigation procedure.

|  |  |  |  |
| --- | --- | --- | --- |
| **Risk Item** | **Significance** | **Consequence** | **Mitigation Procedure** |
| **Arrival of equipment**  Equipment may be required to be imported from international/national destinations and may experience significant delays. | **Insignificant** | Delays in the arrival of equipment will hinder the project development and may cause several weeks loss. | As some equipment may be ordered from overseas, orders must be made promptly. Delivery failures are beyond control. Alternatives that will require less delivery time must be found; and a preference must be given to Australian products. |
| **Student workload**  Due to commitment to a full time student workload, time must be shared amongst other academic commitments. | **Insignificant** | Unavailability will hinder the project development and may cause up to a day’s loss. | It is expected to complete 10 hours per week on the project. |
| **Failure to achieve HLOs**  A failure to achieve HLOs will negate the success of the PFMS project. | **Significant** | Failure of the project. | To ensure the project’s success the schedule must be strictly adhered to If delays do occur, assistance the project supervisor is to be consulted and further required time scheduled to the project |
| **Software environment training**  The programming environment used during the PFMS project may not be familiar. | **Insignificant** | Software is vital to the HLOs and hence then the project may risk failure if essential code cannot be completed in time. | Lost time is to be recovered with further time scheduled and alternatives discussed with the project supervisor |

Table - Schedule Risks

### Technical Risks

The technical risks and their mitigation techniques are detailed in Table 8.

|  |  |  |  |
| --- | --- | --- | --- |
| **Risk Item** | **Significance** | **Consequence** | **Mitigation Procedure** |
| **Availability of UAV Hardware**  The hardware required for a UAV system cannot be afforded with the given budget. The hardware must be supplied for the completion of UAV integration. | **Significant** | Failure to complete HLOs. | Ensure that hardware is available prior to UAV integration stages and the developed system can be easily integrated. |
| **Inability of Hardware to meet performance requirements**  There are several components of the hardware and inadequate integration may cause a lack of performance. | **Significant** | Failure of hardware to meet performance requirements may cause a degraded result. This will affect the HLOs and the overall project outcome. | Several models of the hardware must be produced, and scheduled to be produced along the project timeline. Each consequent model must take into account the problems of the last and be updated as such. |
| **Design and planning errors**  Unforeseen errors have the possibility to affect the outcomes of any project. | **Significant** | Errors in planning or design of software may risk project failure if a corrected design or plan is unavailable within scheduled time. | All phases of the project have extra time allocated to allow for delays, and the entire project has extra time allocated after its completion before the due date to allow for delays. |
| **Student inexperience**  Limited experience working in a systems engineering project. | **Insignificant** | Having limited previous experience in the systems engineering area more time than scheduled may be required to complete tasks. | Regular meetings with Dr Luis Mejias and advice allow for clarification of queries and issues. |

Table - Technical Risks

### Budgetary Risks

A budget for the PFMS project is defined in 3.3.1. As the PFMS project is a sub-system of the ARCAA Smart Skies project, equipment and budget assistance may be provided. Table 9 details the budget’s risks and the associated mitigation procedures.

|  |  |  |  |
| --- | --- | --- | --- |
| **Risk** | **Significance** | **Consequence** | **Mitigation Procedure** |
| **Cost of parts**  Project components have associated monetary costs and will be allocated from the project budget. | **Insignificant** | The cost of each purchased item will lower the overall project budget. | To mitigate the risk of over expenditure, all purchases comply with the budget. |

Table - Budgetary Risks

# Work Breakdown

The subsequent sections detail the work breakdown of the project during its lifecycle.

## Project Stages

The PFMS project lifestyle consists of six primary stages. Figure 2 details the stages which implement the systems engineering process. The following documentation provides further breakdown of these stages.



Figure - Project Stages

### Stage One: Research and Define

Stage one consists of developing the projects objectives and requirements. This stage requires customer meetings for project definition. Once the project is defined, initial research into PFMS is to be conducted, and subsequently trade studies are to be completed.

### Stage Two: Simulation Development Testing

Stage two consists of investigations of a conceptual design and refinement of system specifications. This stage requires a thorough understanding and discussion of the objectives, possible designs, options and limitations. From the research conducted in Stage One a software and prototype/s is to be implemented, reviewed and validated for 2D and 3D dynamics.

Customer feedback on the realised preliminary design is to be obtained and required modifications realised.

### Stage Tree: Integration Development and Testing

Stage three consists of integrating the PFMS software with hardware components; namely an aircraft and autopilot. During integration testing is to be conducted to refine the operation of the PFMS system onboard the aircraft. In addition software must be developed in the appropriate language for the UAV hardware.

### Stage Four: Operational Testing

This stage consists of operational testing of PFMS onboard an aircraft. It consists of ground testing and in flight testing. Through the operational testing the system is to be refined. The final product is realised at the conclusion of this stage.

### Stage Five: Advanced Concept Integration and Testing

This stage consists of integration of advanced concepts, such as collision avoidance, with subsequent validation through flight testing. This stage is not mandatory and it will only be considered if there is time within the project to realise these concepts.

### Stage Six: Delivery

Stage Six consists of demonstrating the PFMS system meets all the documented System Requirements and High Level Objectives. It involves demonstrating the PFMS system to the project’s customers.

## Work Breakdown Structure

The Work Breakdown Structure (WBS) itemises the work packages required to be completed during the PFMS project to meet the HLOs. The WBS tree is in the figures below.



Figure 3 - WBS for PFMS Project

### Work Packages

The work packages describe each specific task defined in the work breakdown structure trees. They also identify the dates the work package is to be started and completed for the project to be completed on schedule. The allocated time is in days, and represents the entire number of days needed for the work package The start date and due date represent the time allowed for the completion of the package.

#### WP-1

|  |  |
| --- | --- |
| **WP-1** | |
| **Research FMS** | |
| **Allocated Time:** | 2 |
| **Start Date:** | 06/04/09 |
| **Due Date:** | 13/04/09 |
| **Completion Date:** |  |
| **Objective:** | To gain a sufficient understanding of FMS in industry to enable software implementation for appropriate operations required for the PFMS. |
| **Description:** | Perform a literature review and obtain advice for best methods from the project supervisor. |
| **Dependencies:** | None. |
| **Input:** | None. |
| **Outputs:** | None. |
| **Deliverables:** | Trade Study. |

#### WP-2

|  |  |
| --- | --- |
| **WP-2** | |
| **Research Control Methods** | |
| **Allocated Time:** | 2 |
| **Start Date:** | 06/04/09 |
| **Due Date:** | 13/04/09 |
| **Completion Date:** |  |
| **Objective:** | To gain a sufficient understanding of aircraft control methods in industry to enable software implementation for appropriate operations required for the PFMS. |
| **Description:** | Perform a literature review and obtain advice for best methods from the project supervisor. |
| **Dependencies:** | None. |
| **Input:** | None. |
| **Outputs:** | None. |
| **Deliverables:** | Trade Study. |

#### WP-3

|  |  |
| --- | --- |
| **WP-3** | |
| **Research Flight Dynamics** | |
| **Allocated Time:** | 2 |
| **Start Date:** | 06/04/09 |
| **Due Date:** | 13/04/09 |
| **Completion Date:** |  |
| **Objective:** | To gain a sufficient understanding of aircraft flight dynamics in industry to enable software implementation for appropriate operations required for the PFMS. |
| **Description:** | Perform a literature review and obtain advice for best methods from the project supervisor. |
| **Dependencies:** | None. |
| **Input:** | None. |
| **Outputs:** | None. |
| **Deliverables:** | Trade Study. |

#### WP-4

|  |  |
| --- | --- |
| **WP-4** | |
| **High Level Objectives Document** | |
| **Allocated Time:** | 2 |
| **Start Date:** | 16/03/09 |
| **Due Date:** | 30/03/09 |
| **Completion Date:** |  |
| **Objective:** | Details the High Level objectives for the PFMS project. |
| **Description:** | Write the HLO document and have it approved by the customer. |
| **Dependencies:** | None. |
| **Input:** | None. |
| **Outputs:** | HLOs |
| **Deliverables:** | HLO document |

#### WP-5

|  |  |
| --- | --- |
| **WP-5** | |
| **Project Management Plan** | |
| **Allocated Time:** | 2 |
| **Start Date:** | 23/03/09 |
| **Due Date:** | 06/04/09 |
| **Completion Date:** |  |
| **Objective:** | Create a project management plan |
| **Description:** | Create a project management plan, and produce a Project Management Plan document. |
| **Dependencies:** | None. |
| **Input:** | None. |
| **Outputs:** | Project management Plan |
| **Deliverables:** | Project Management Plan document. |

#### WP-6

|  |  |
| --- | --- |
| **WP-6** | |
| **System Requirements Document** | |
| **Allocated Time:** | 2 |
| **Start Date:** | 23/03/09 |
| **Due Date:** | 06/04/09 |
| **Completion Date:** |  |
| **Objective:** | Define system requirements |
| **Description:** | Derive the systems requirements from the HLOs and produce System Requirements Document. |
| **Dependencies:** | WP-4 |
| **Input:** | High Level Objectives |
| **Outputs:** | System Requirements |
| **Deliverables:** | System Requirements Document |

#### WP-7

|  |  |
| --- | --- |
| **WP-7** | |
| **Literature Review** | |
| **Allocated Time:** | 4 |
| **Start Date:** | 13/04/09 |
| **Due Date:** | 24/04/09 |
| **Completion Date:** |  |
| **Objective:** | Write a Literature Review |
| **Description:** | Compose a literature review to establish a strong understanding of the mechanics flight management systems, control and aircraft dynamics to assist in the subsequent design of a PFMS in later stages of the project. |
| **Dependencies:** | WP-1 : WP-3 |
| **Input:** | Trade Studies |
| **Outputs:** | Literature Review |
| **Deliverables:** | Literature Review Document |

#### WP-8

|  |  |
| --- | --- |
| **WP-8** | |
| **2D Prototype in Matlab** | |
| **Allocated Time:** | 4 |
| **Start Date:** | 24/04/09 |
| **Due Date:** | 08/05/09 |
| **Completion Date:** |  |
| **Objective:** | Develop a 2D Prototype in Matlab |
| **Description:** | This work package is to apply understanding of a PFMS with application of baseline concepts to derive a simple 2D simulation. In addition the simulation is to be tested and validated. |
| **Dependencies:** | WP-1 : WP-3, WP-7 |
| **Input:** | None. |
| **Outputs:** | Software Design and Validation Document |
| **Deliverables:** | System Requirements Document |

#### WP-9

|  |  |
| --- | --- |
| **WP-9** | |
| **3D Prototype in Matlab** | |
| **Allocated Time:** | 5 |
| **Start Date:** | 08/05/09 |
| **Due Date:** | 05/06/09 |
| **Completion Date:** |  |
| **Objective:** | 3D Prototype in Matlab |
| **Description:** | This work package is to apply understanding of a PFMS with application of baseline concepts to derive a simple 3D simulation. In addition the simulation is to be tested and validated. |
| **Dependencies:** | WP-1 : WP-4, WP-7, WP-8 |
| **Input:** | 2D Prototype in Matlab |
| **Outputs:** | 3D Prototype in Matlab |
| **Deliverables:** | Software Design and Validation Document |

#### WP-10

|  |  |
| --- | --- |
| **WP-10** | |
| **Implement PFMS Prototype for a UAV** | |
| **Allocated Time:** | 6 |
| **Start Date:** | 05/06/09 |
| **Due Date:** | 10/07/09 |
| **Completion Date:** |  |
| **Objective:** | Develop a PFMS prototype for a UAV |
| **Description:** | This work package is to implement the PFMS simulation in a suitable programming language for operation onboard a UAV. In addition the PFMS implementation is to be tested and validated. |
| **Dependencies:** | WP-1 : WP-4, WP-7 : WP-9 |
| **Input:** | 3D Prototype in Matlab |
| **Outputs:** | Software Design and Validation Document |
| **Deliverables:** | Software Design and Validation Document |

#### WP-11

|  |  |
| --- | --- |
| **WP-11** | |
| **Integrate PFMS Prototype with a UAV** | |
| **Allocated Time:** | 6 |
| **Start Date:** | 19/06/09 |
| **Due Date:** | 24/07/09 |
| **Completion Date:** |  |
| **Objective:** | Integrate PFMS Prototype in a UAV |
| **Description:** | This work package is to integrate the developed PFMS with a UAV. This step requires loading the software on the appropriate hardware of the UAV. |
| **Dependencies:** | WP-1 : WP-4, WP-7 : WP-10 |
| **Input:** | Implemented PFMS prototype for a UAV |
| **Outputs:** | PFMS onboard a UAV |
| **Deliverables:** | Integration Document |

#### WP-12

|  |  |
| --- | --- |
| **WP-12** | |
| **Test and Validate PFMS** | |
| **Allocated Time:** | 4 |
| **Start Date:** | 24/07/09 |
| **Due Date:** | 14/08/09 |
| **Completion Date:** |  |
| **Objective:** | Validate PFMS |
| **Description:** | This work package is the operational testing of the PFMS onboard an aircraft. It consists of ground testing and in flight testing. Through the operational testing the system is to be refined. The final product is realised at the conclusion of this stage. |
| **Dependencies:** | WP-1 : WP-4, WP-7 : WP-11 |
| **Input:** | PFMS onboard a UAV |
| **Outputs:** | None. |
| **Deliverables:** | Validation Document |

#### WP-13

|  |  |
| --- | --- |
| **WP-13** | |
| **Implement Advanced Concepts** | |
| **Allocated Time:** | 4 |
| **Start Date:** | 14/08/09 |
| **Due Date:** | 04/09/09 |
| **Completion Date:** |  |
| **Objective:** | Implement Advanced Concepts |
| **Description:** | This stage consists of integration of advanced concepts with the PFMS. |
| **Dependencies:** | WP-1 : WP-4, WP-7 : WP-12 |
| **Input:** | PFMS onboard a UAV |
| **Outputs:** | Advanced PFMS onboard an UAV |
| **Deliverables:** | Software Design and Validation Document |

#### WP-14

|  |  |
| --- | --- |
| **WP-14** | |
| **Test and Validate Advanced PFMS** | |
| **Allocated Time:** | 4 |
| **Start Date:** | 04/09/09 |
| **Due Date:** | 25/09/09 |
| **Completion Date:** |  |
| **Objective:** | Test and Validate Advanced PFMS |
| **Description:** | This work package is the operational testing of the advanced PFMS onboard an aircraft. It consists of ground testing and in flight testing. Through the operational testing the system is to be refined. The final product is realised at the conclusion of this stage. |
| **Dependencies:** | WP-1 : WP-4, WP-7 : WP-13 |
| **Input:** | Advanced PFMS onboard an UAV |
| **Outputs:** | None. |
| **Deliverables:** | Validation Document |

#### WP-15

|  |  |
| --- | --- |
| **WP-15** | |
| **Deliver Final Product** | |
| **Allocated Time:** | 4 |
| **Start Date:** | 05/10/09 |
| **Due Date:** | 26/10/09 |
| **Completion Date:** |  |
| **Objective:** | To deliver the final product. |
| **Description:** | This work package is to deliver and present the final working PFMS. |
| **Dependencies:** | WP-1 : WP-4, WP-7 : WP-12 (Possible WP-13, WP-14) |
| **Input:** | PFMS System working successfully |
| **Outputs:** | None. |
| **Deliverables:** | Finalised PFMS |

# Schedule

The following schedule is based on the work packages described above for the PFMS’s project life cycle. The schedule is updated as the project progresses and packages are completed, reflecting the current progress of the project.

PFMS Schedule.tif

Figure - PFMS Schedule

# Conclusion

Adhering to the comprehensive plan and mitigation procedures for the PFMS project will enable cohesive completion of HLOs and the quality of the final product.

# Appendices

None.