Title: ,

*“A Project”*

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

,

Checked by Date \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

,

Approved by Date \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Michael Hamilton, Student Manager 2010

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

Dr Luis Mejias, Project Coordinator

**QUT Avionics**

Queensland University of Technology

CRCSS-EESE, GPO Box 2434

Gardens Point Campus

Brisbane, Australia, 4001.

Telephone (+61 7) 3864 1772

Facsimile (+61 7) 3864 1517

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

web <http://code.google.com/p/ahns10/>

This document is Copyright 2010 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 |  |  |

**Foreword**

This document is a formal representation of the Project Management Plan for the Queensland University of Technology Autonomous Helicopter Navigation System in 2010. The project management plan outlines details for the management structure, document responsibilities, work breakdown structure, work packages and a project timeline. The management structure and document responsibilities outline the roles of each member in the AHNS project. The roles are then divided up into specific tasks outlined in the work breakdown structure and work packages. The work packages describe in detail the work required to be completed. Finally these work packages are then presented on a Gantt chart timeline.

**Table of Contents**

Paragraph Page No.

[1 Introduction 8](#_Toc256078550)

[1.1 Scope 8](#_Toc256078551)

[1.2 Background 8](#_Toc256078552)

[2 Reference Documents 9](#_Toc256078553)

[2.1 QUT Avionics Documents 9](#_Toc256078554)

[2.2 Non-QUT Documents 9](#_Toc256078555)

[3 Project Organisation 10](#_Toc256078556)

[3.1 Management Structure 10](#_Toc256078557)

[3.2 Organisational Structure 10](#_Toc256078558)

[3.2.1 Members Roles 10](#_Toc256078559)

[3.2.2 Documentation Responsibilities 11](#_Toc256078560)

[3.2.3 Documentation Standards 12](#_Toc256078561)

[3.3 Resources 13](#_Toc256078562)

[3.3.1 Financial Resources 13](#_Toc256078563)

[3.3.2 Services and Facilities 14](#_Toc256078564)

[3.3.3 Inherited Equipment and Information 15](#_Toc256078565)

[3.4 Document Numbering 16](#_Toc256078566)

[3.4.1 Project Code and Year 16](#_Toc256078567)

[3.4.2 Sub-System Codes 16](#_Toc256078568)

[3.4.3 Document Code and Number 16](#_Toc256078569)

[4 Work Breakdown 18](#_Toc256078570)

[4.1 Project Stages 18](#_Toc256078571)

[4.2 Work Breakdown Structure 19](#_Toc256078572)

[5 Schedule 20](#_Toc256078573)

[6 Work Packages 21](#_Toc256078574)

[7 Conclusions 22](#_Toc256078575)

[8 Recommendations 23](#_Toc256078576)

**List of Figures**

Figure Page No.

[Figure 1 - Team Management Structure 10](#_Toc256078537)

[Figure 2 - Team Members Sub-Systems 10](#_Toc256078538)

[Figure 3 - Project Stages 18](#_Toc256078539)

[Figure 4 - Work Breakdown Structure 19](#_Toc256078540)

**List of Tables**

Table Page No.

[Table 1 - Documentation Responsibilities 12](#_Toc256078542)

[Table 2 - Documentation Standards 12](#_Toc256078543)

[Table 3 - Germany Planned Purchases 13](#_Toc256078544)

[Table 4 - USA Planned Purchases 14](#_Toc256078545)

[Table 5 - Services and Facilities 14](#_Toc256078546)

[Table 6 - Inherited Hardware 15](#_Toc256078547)

[Table 7 - Sub-System Codes 16](#_Toc256078548)

[Table 8 - Document Codes 17](#_Toc256078549)

**Definitions**

|  |  |
| --- | --- |
| QUT | Queensland University of Technology |
| AHNS | Autonomous Helicopter Navigation System |
| GCS | Ground Control Station |
| HLO | High Level Objective |
| SR | System Requirement |
| PMP | Project Management Plan |
| IMU | Inertial Measurement Unit |
|  |  |

# Introduction

The 2010 AHNS project requires constant planning to ensure that it is has a successful completion by the scheduled delivery date. This document outlines all the project management guidelines, roles, deliverables and due dates.

## Scope

The purpose of this document is to ensure well-organized and professional operations for the AHNS 2010 project. This document was bounded by the high level objectives and system requirements, RD/1 and RD/2 respectively, and timelines agreed between the client and project manager.

## Background

No Background.

# Reference Documents

## QUT Avionics Documents

|  |  |  |
| --- | --- | --- |
| RD/1 | AHNS-2010-SY-HL-001 | AHNS, High Level Objectives of |
| RD/2 | AHNS-2010-SY-SR-001 | AHNS, System requirements of |

## 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 .

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

# Project Organisation

## Management Structure

The 2010 Autonomous Helicopter Navigation System project team can be divided into three tiers of management structure. Dr Luis Mejias, the project supervisor and client, is at the top tier overlooking the entire project and the group members. On the middle tier is the project manager, Michael Hamilton, whose responsibility in the management structure is to keeps the project supervisor informed of the projects progress. Michael Kincel, Liam O’Sullivan and Tim Molloy make up the bottom tier. Their responsibility, along with Michael Hamilton, is to complete the tasks outlined in this document within the given time frame. The figure below outlines the three tier management structure.



Figure - Team Management Structure

## Organisational Structure

### Members Roles

For any projects success, the duties and roles it in tales must be divided among the team members that are most suited person for the responsibility, based on their backgrounds and knowledge. The four members for AHNS were split into several sub-systems within the major project. Each student is responsible for their assigned sub-system, but all students will contribute to the completion of all tasks. Figure 2 outlines the team member’s assigned sub-systems.



Figure - Team Members Sub-Systems

Michael Hamilton’s major role is the project manager, whose responsibility is to ensure that the high level objectives and system requirements are all met, and that the project is completed within the time schedule. He is also responsible for the communications sub-system, which entails organising all communications between the ground control station, platform and any other auxiliary inputs.

All airframe construction, maintenance and hardware integration tasks will be organised by Michael Kincel. This includes incorporating all physical sub-systems on the platform to enable autonomous flight. Michael’s secondary role is the pilot for the platform for takeoff, landing and emergency manoeuvres while in autonomous testing.

Liam O’Sullivan’s major role is to ensure that the platform is localised under a known co-ordinate system using an array of sensors. Liam is also responsible for determining the state estimation for the platform to determine the underlying behaviour of the system at any point in time with the use of the IMU and other sensor data.

To ensure that the platform can remain stabilised without the aid of the pilot, a control system must be developed and refined. Tim Molloys major responsibility is to determine the control theory for the chosen platform and assign appropriate gains. His secondary role is to develop the GCS from AHNS 2009 to operate with the new platform design.

All members of the 2010 AHNS are responsible for communication between group members, maintenance of equipment and ensuring safety procedures are adhered to for their respective subsystems.

### Documentation Responsibilities

All students in the 2010 AHNS project will be required to submit documents which will outline steps taken in their respective sub-system. Each document produced must be checked by a person other than the author. It is the responsibility of the author of the document to ensure that it is checked by another group member. The document must also be approved by both the project manager and supervisor. Table 1 outlines the major documentation and responsible team members for the AHNS project.

Table - Documentation Responsibilities

|  |  |
| --- | --- |
| Team Member | Document Responsibilities |
| Michael Hamilton | High Level Objectives  System Requirements  Project Management Plan  Risk Management  Traceability Matrix  Initial Design Document  Detail Design Document  Test Reports |
| Michael Kincel | Trade Studies  Initial Design Document  Detail Design Document  Test Reports |
| Liam O’Sullivan | Trade Studies  Initial Design Document  Detail Design Document  Test Reports |
| Tim Molloy | Trade Studies  Initial Design Document  Detail Design Document  Test Reports |

### Documentation Standards

To ensure consistency between all documentation AHNS will adopt the QUAV documentation standards. All documentation produced will utilise the corresponding document template or program:

Table - Documentation Standards

|  |  |
| --- | --- |
| Document Type | Template / Program |
| Minutes | MoM.dot |
| Test Reports | Avionics\_TR.dot |
| Other Documents | Avionics.dot |
| Project Timeline | Microsoft Project |
| Diagrams | Microsoft Visio |
| Circuit Schematics | CADSoft Eagle |

## 

## Resources

The 2010 Autonomous Navigation Helicopter System project has a range of resources at its disposal, including financial resources, QUT services and facilities, inherited past year equipment and knowledge.

### Financial Resources

The financial resources will be used for purchasing equipment that the 2010 AHNS team require to complete the projects objectives. All purchases will be conducted by the project manager once authorisation from the project supervisor has been granted. It is the project managers responsibility to monitor the budget as purchases are made.

Every student within the subject is provided $100 Australian dollars to put towards their project, supplied by Built Environment & Engineering Faculty at QUT. Additional funding was also acquired from Boeing Australia, to the sum of $2000 Australian dollar. This adds to $2400 dollars total for the 2010 AHNS project. Table 3, Table 4 outlines the planned purchases that will be made initially to acquire necessary parts from Germany and USA respectively.

Table - Germany Planned Purchases

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ****Item Name**** |  | ****Quantity**** | ****Price**** | ****Total Price**** |
| MK40 - Frameset |  | 1 | 54.95 EU | 54.95 EU |
| BL-Ctrl V1.2 (SMD preassembled) |  | 4 | 39.95 EU | 159.80 EU |
| Robbe ROXXY BL-Outrunner 2824-34 |  | 4 | 31.90 EU | 127.60 EU |
| MK Propeller Mount 1045 |  | 4 | 7.95 EU | 31.80 EU |
| Propeller pair EPP1045 |  | 10 | 3.89 EU | 38.90 EU |
| Vibration dampeners M3x15 |  | 2 | 5.95 EU | 11.90 EU |
| Vibration dampeners M3x8 |  | 1 | 5.89 EU | 5.89 EU |
| MK FlexLander L |  | 2 | 37.95 EU | 75.90 EU |
| Postage |  | 1 | 33.00 EU | 33.00 EU |
|  |  |  | **TOTAL:** | **539.74 EU** |

Table - USA Planned Purchases

|  |  |  |  |
| --- | --- | --- | --- |
| ****Item Name**** | ****Quantity**** | ****Price**** | ****Total Price**** |
| Overo Fire COM | 1 | 219.00 US | 219.00 US |
| Pinto- TH | 1 | 27.50 US | 27.50 US |
| Summit | 1 | 49.00 US | 49.00 US |
| Gumstix Postage | 1 | 62.82 US | 62.82 US |
| SRV-1 Blackfin Camera | 1 | 175.50 US | 175.50 US |
| Blackfin Postage | 1 | 60.00 US | 60.00 US |
|  |  | **TOTAL:** | **593.82 US** |

### Services and Facilities

The 2010 AHNS team have several services and facilities at their disposal, which provide a range of benefits for the project. Table 5 outlines the available services and facilities located in QUT’s garden point campus.

Table - Services and Facilities

|  |  |  |  |
| --- | --- | --- | --- |
| **Location** | **Availability** | **Access** | **Resources** |
| S-Block Level 11 Avionics Lab | 24 hours/day | Avionics students | Tools, Soldering Iron, electronic parts, computers, storage, electronic measuring equipment. |
| S-Block  Level 11  Computer Lab | 24 hours/day | Electrical and Avionics Students | Computers. |
| S-Block Level 9 Shop | Business hours  (Monday – Friday) | Electrical and Avionics Students | Tools, electronic parts, PCB manufacturing. |
| S-Block Level 9 Lab | Business hours  (Monday – Friday) | Electrical and Avionics Students | Soldering Iron, electronic parts, computers, electronic measuring equipment. |
| J-Block | Business hours  (Monday – Friday) | Engineering Students | Laser Cutter. |

### Inherited Equipment and Information

The AHNS 2010 team has inherited several items from previous year’s helicopter projects, including both documentation and hardware. The table below lists the description and quantity of all inherited hardware.

Table - Inherited Hardware

|  |  |
| --- | --- |
| Hardware Description | Quantity |
| TREX450 (Nancy) | 1 |
| Blade400 (Emily) | 1 |
| TREX450s kit box | 1 |
| Tracking antenna PCB | 1 |
| Sensor dynamics IMU (1 working) | 2 |
| XBEE ground station  box | 1 |
| 325mm wood main rotor blade | 4 |
| Metal tail rod | 1 |
| Stereo camera | 1 |
| Spektrum DX6i | 1 |
| Easy radio | 4 |
| Eflite landing gear strut set | 1 |
| Servo extensions (400 mm) | 5 |
| 6v 2000mAH NiMH | 1 |
| 6v Intellect NiMH | 1 |
| Dean connectors | 2 |
| Eflite 7.4V 800mA | 1 |
| 3-cell 12V 2200 mAH LiPO damaged | 1 |
| 3-cell 12V 2200 mAH LiPO | 3 |
| 7.4V 800mA Li | 1 |
| USB-Serial connector | 1 |
| Twister 2 cell LiPO charger | 1 |
| Eflite O ring set | 11 |
| USB -> blackbox -> Stereo jack | 1 |
| BNC to alligator clips | 1 |
| Zippy ties | 10 |
| Swann webcam | 1 |

## Document Numbering

All documentation within the AHNS project must follow strict naming convention to ensure that system identification and traceability can be maintained. The naming convention for all official AHNS documentation is as follows.

*<Project Name>-<Project Year>-<Subsystem Code>-<Document Code>-<Document Number>*

An example for this is the project management plan, under the system level sub-system, AHNS-2010-SY-PM-001

### Project Code and Year

The project code and year for all official documents will be AHNS 2010. This code allows external readers to indentify the project and year of development.

### Sub-System Codes

To differentiate between each sub-system within the AHNS project, a code is assigned to indentify the document to belonging to that system. Table 7 outlines the corresponding codes for each sub-system.

Table - Sub-System Codes

|  |  |
| --- | --- |
| Subsystem | Code |
| System Level | SY |
| Platform | PL |
| Autopilot | AP |
| Localisation | LO |
| State Estimation | SE |
| Ground Control Station | GC |
| Communication | CO |

### Document Code and Number

All sub-systems will have many different types of documents associated with them. An additional document code will also be included into the name to aid in categorising the reports. Table 8 outlines the all the codes against the type of document that is within the report. Also attached to each document code is a three digit ascending number, which differentiates between multiple documents of the same document code.

Table - Document Codes

|  |  |
| --- | --- |
| Document | Code |
| High Level Objectives | HL |
| System Requirements | SR |
| Project Management Plan | PM |
| Trade Study | TS |
| Design Document | DD |
| Test Report | TR |
| Detailed Drawing | DR |
| Traceability Matrix | TM |
| Lessons Learnt | LL |
| Minutes of Meeting | MM |

# Work Breakdown

## Project Stages

Large engineering projects are broken down into five primary stages of development, which are outlined in figure X RD/3. Stage one consists of Defining the objectives and system requirements for the project. Initial research is also carried out within each sub-system which can including overview of previous years documents and performing trade studies. Stage two outlines the chosen design that will achieve the HLO’s SR’s prepared in a preliminary design document. Once the design has been finalised, the individual components are acquired and constructed.

Stage three outlines the individual components testing, which ensures that each component achieves its own purpose before integration with the system. Stage four consists of integration of all the individual components into the whole system. The system is then tested to ensure that it achieves the HLO’s and SR’s.

Finally stage five involved the delivery of the product to the customer, which in tales demonstration and presentations. Figure X illustrates the work breakdown structure for the 2010 AHNS project utilising the five primary stages as a guideline.



Figure - Project Stages

## Work Breakdown Structure

The work breakdown structure is managed using bottom side up approach, which conforms to NASA’s guidelines for systems engineering RD/3.



Figure - Work Breakdown Structure

# Schedule

# Work Packages

# Conclusions

# Recommendations