|  |  |  |
| --- | --- | --- |
| Project:  WP Name: Augmented Flight Test Report  WP Number: WP-SY-05 | Type of Test:  Verification | Test Procedure:  Flight test platform to verify attitude hold. |
| Test Article:  Attitude Stabilisation | Part Number:  None | Serial Number:  None |
| Test Specification:  Achieve attitude hold with gyro. | Test Equipment:  Quadrotor platform with payload  Laptop (running GCS) | |
| Test Operators:  All AHNS Members | Test Engineer:  All AHNS Members | |
| WP Group Manager:  Michael Hamilton | WP Supervisor:  Dr. Luis Mejias | |

**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

**Test Summary**

The initial attitude test was undertaken to observe the stabilisation of the platform utilising an off the shelf quad copter RC gyro. The gyro was integrated into the platform electronics and mixing of the pilot’s RC commands was implemented. It was found that the platform stabilised its attitude using the gyro after some minor gain tuning. Throughout the flight-testing stage the landing gear would sway the gyro during take-off and landing, which resulted in rapid unnecessary attitude changes. It is recommended that the pilot takes off and lands in a short period of time to reduce this added noise.

**Table of Contents**

Paragraph Page No.

1 Test Objectives 3

2 Test Set-up & Equipment 4

3 Procedure 5

4 Results 6

5 Conclusions 7

6 Recommendations 8

**List of Figures**

Figure Page No.

No Figures.

**List of Tables**

No Tables.

# Test Objectives

The test report has the following test objectives:

* Achieve stable attitude during flight using the RC gyro by changing the gain.
* Observe flight characteristics of platform using ground control station, including IMU, compass and ultrasonic sensor data.

# Test Set-up & Equipment

The following test setup and equipment was used to conduct the test report:

* PC with a Linux based operating system installed.
* Ground control station software installed to Linux PC.
* Quadrotor platform with payload attached (including the RC gyro, IMU, Arduino and compass sensors).
* 2.4 Ghz ‘heliconnect’ wireless modem.
* Open area clear of obstructions to flight-test.
* Spare batteries and battery charging station.
* Spare hardware mounting platters to replace in the event of a crash.
* Tools and equipment to make on the spot modifications/repairs to the platform if necessary.
* Safety glasses for all group members.
* Fire extinguisher and first aid equipment.
* Printed copy of risk management plan.
* Working bench for ground control station and tools.

# Procedure

The test report utilised the following procedure:

1. Ensure all connections on the AHNS platform are correct before powering the system.
2. Turn on the main power switch and wait until the wireless on the Overo is initialised.
3. Connect to the platform through ‘heliconnect’ and ensure that all systems are working correctly.
4. Open the ground control station and open the connection to display and record the data transmitted from the on-board sensors.
5. Initialise the Electronic Speed Controllers (ESC) and engines and to observe each engine start.
6. Preform a small input engine test under RC control to observe that all engines are working and rotating the correct way.
7. Place platform in the centre of the testing area and trim the control inputs.
8. After the pilot and project members are satisfied the system is safe to fly, commence the flight testing.
9. Record the flights data from the ground control system and observe any anomalies during flight.

# Results

The results for the test report were by investigation, and are shown below:

* The platform vibrated on the landing gear during take-off and landing, which saturated the gyro. This resulted in quick unwanted movements from the platform during these periods. It was found that by applying a lot of thrust during take-off and cutting the engine power when the platform is just off the ground reduces this effect.
* The platform had a tendency to oscillate during flight tests. After each flight test the gain of the gyro was altered, using a screwdriver, with improved results.
* At the end of the gain tuning stage the helicopter became very sable and easy to fly. When no input was given to the RC controller, the platform returned to a stable attitude.
* The platform experienced large position error in which the pilot had to counter. This is to be expected, and position hold loops will account for this.

# Conclusions

The RC gyro is a useful tool to allow quick stabilisation of the airframe in RC mode. The hardware component was implemented into the system for verification against the IMU data. After tuning the gain of the RC gyro, the platform was found to be very stable in flight.

# Recommendations

It is recommended that the RC gyro be used for future flight test prior to the IMU, state estimation and loop controls.