,

TEST REPORT

RC Test

*A Project*

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

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

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

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**Definitions**

|  |  |
| --- | --- |
| AHNS | Autonomous Helicopter Navigation System |
| RC | Remote Control |
| Rx | Receiver |
| MTOW | Maximum Take Off Weight |
| ESC | Electronic Speed Controller |
| CoG | Centre of Gravity |
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# Test Details

Table - Test Details

|  |  |
| --- | --- |
| **TYPE OF TEST** | Flight Test |
| **TEST NUMBER** | FT01 |
| **TEST ARTICLE** | Platform Performance and Behaviour |
| **TEST ENGINEER** | Michael Kincel |
| **TEST OPERATORS** | Michael Kincel, Michael Hamilton |

## Test Summary

This test will be assessing the performance of the platform with anticipated MTOW. The payload will weight a total of 400g. This test will access the performance of the platform with minimum parts installed and with full autopilot installed. It was also access the best position for the battery.

# Reference Documents

## QUT Avionics Documents

|  |  |  |
| --- | --- | --- |
| None |  |  |

## Non-QUT Documents

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

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.

# Objectives

Table - Flight Test Bbjectives

|  |  |  |
| --- | --- | --- |
| Objective | | Criteria |
| 1 | Ensure the platform behaves normally at minimum flying weight with battery mounted below airframe. | The platform performance must behave as expected by the pilot; no unexpected movements are to be produced. |
| 2 | Ensure the platform behaves normally at minimum flying weight with battery mounted above airframe. | The platform performance must behave as expected by the pilot; no unexpected movements are to be produced. |
| 3 | Ensure the platform behaves normally at maximum flying weight with battery mounted below airframe. | The platform performance must behave as expected by the pilot; no unexpected movements are to be produced. |
| 4 | Ensure the platform behaves normally at maximum flying weight with battery mounted above airframe. | The platform performance must behave as expected by the pilot; no unexpected movements are to be produced. |

# Test Set-up and Equipment

The test will be conducted with the following equipment

* Gaui RC Gyro
* Autopilot System
* Transmitter
* Helicopter

## Configurations

### Platform

Table - Platform Configuration

|  |  |  |
| --- | --- | --- |
| Configuration | | RC Rx – Gyro – ESCs (no autopilot) |
| Gyro settings | Orientation | “+” |
| Mode | (RC controlled) |

### Transmitter

Table - Transmitter Configuration

|  |  |  |
| --- | --- | --- |
| Channel directions | Throttle | Normal |
| Roll | Reversed |
| Pitch | Reversed |
| Yaw | Reversed |
| Gear | Normal |
| Aux/Gyro | Normal |
| Travel adjust | All | 100% |
| Gyro Gain | | 30% |
| Dual Rate and Exponential | Throttle | N/A |
| Roll | D/R = 60%; EXPO = 40% |
| Pitch | D/R = 60%; EXPO = 40% |
| Yaw | D/R = 60%; EXPO = 40% |
| Gear | N/A |
| Aux | N/A |
| Throttle Curve | | Linear |

# Procedure

1. Clear room of all non-critical personnel and other obstructions.
2. Ensure all connections between the RC Rx, Gyro and ESCs are correct.
3. Locate battery to balance ‘x’ and ‘y’ axes and below the airframe.
4. Fly platform and record results
5. Relocate battery above airframe and balance in ‘x’ and ‘y’ axes.
6. Fly platform and record results.
7. Attach full electronics payload.
8. Locate battery below the airframe and balance in ‘x’ and ‘y’ axes.
9. Fly platform and record results.
10. Relocate battery above airframe and balance in ‘x’ and ‘y’ axes.
11. Fly airframe and record results.

# Results

Table - Flight Test Results

|  |  |  |  |
| --- | --- | --- | --- |
| Objectives | | Criteria | Results |
| 1 | Ensure the platform behaves normally at minimum flying weight with battery mounted below airframe. | The platform performance must behave as expected by the pilot; no unexpected movements are to be produced. | **FAIL**  (Slow and oscillatory response) |
| 2 | Ensure the platform behaves normally at minimum flying weight with battery mounted above airframe. | The platform performance must behave as expected by the pilot; no unexpected movements are to be produced. | **PASS** |
| 3 | Ensure the platform behaves normally at maximum flying weight with battery mounted below airframe. | The platform performance must behave as expected by the pilot; no unexpected movements are to be produced. | **FAIL**  (Slow and oscillatory response) |
| 4 | Ensure the platform behaves normally at maximum flying weight with battery mounted above airframe. | The platform performance must behave as expected by the pilot; no unexpected movements are to be produced. | **PASS** |

# Analysis

The first and second tests were performed with the minimum take-off weight. This means that only the battery, RC receiver, and gyro are fitted. This was done to form a benchmark for aircraft performance and to test the effect of moving the CoG up and down.

The third and forth tests were performed with the full 400g payload fitted. During this test the effect of moving the CoG up and down was accessed. In addition to this, a comparison was made to the first two tests.

It was apparent that having a low CoG lead to undesirable flight characteristics. A low CoG made the aircraft really slow to respond to commands. In addition to this, a pendulum effect was really clear as the airframe had a tendency to oscillate. The platform was deemed unsuitable to fly with the low CoG configuration.

With the mass of the electronics added, similar results were observed to above. With a low CoG configuration the platform exhibited undesirable flying characteristics. With a high CoG the platform fly as it did with a high CoG with no added weight. The only difference that was noticed between a more weight and less weight was that more throttle was required to sustain flight. This will ultimately lead to a reduction in flying time.

One observation that is consistent with all four flight tests is that the indoor environment makes flying much more difficult due to the wash form the propellers bouncing off the walls. Despite this, the platform is still flyable and can be operated safely.

# Conclusions

The flight test was very successful. It showed that a high CoG is the desirable configuration for flying. The addition mass of a full payload had little adverse effect on the flying characteristics, with only an increase in required thrust being observed.

## Recommendations

* Flight testing should continue with this platform in a high CoG configuration.