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| Project:  WP Name: Flight Computer Bench Test Report  WP Number:WP-AP-04 | Type of Test:  Inspection and Data Logging | Test Procedure:  Analyse Control Loop Logged Data |
| Test Article:  Flight Control Software | Part Number:  FC and AP | Serial Number:  - |
| Test Specification:  AT-03 | Test Equipment:  Overo and Ubuntu 10.04 Laptop or log data | |
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**Test Summary**

The AHNS flight control subsystem is required to provide control updates to the mode control unit (MCU) at a rate of at least 50Hz as specified in SR-B-03. This is

The test revolves around data transmission and receipt without the need for an entire airborne software system. Data is transmitted. and received from a test application using the same UDP network library as the flight computer software. Received data from the airborne system is logged and displayed by the GCS. Uplink data originating from the GCS includes control system gains and parameters and be inspected from the test program output.

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# Test Objectives

The objective of this test is to perform acceptance testing of the flight control update rate. This includes

* Determining the mean and instantaneous update rates of the control thread to determine if these are greater than the 50Hz required in SR-B-03; and
* Quantifying the overall control delay using a tuned attitude controller and its response to stability augmented radio control commands

# Test Set-up & Equipment

The test can be reproduced using log file data as complete test result generation requires a series flight tests.

## Using Logged Data

The equipment required includes

* Computer with MATLAB installed to review logged data; and
* the files in the docproject/unofficial\_ahns/logs SVN folder including
  + RCRateAttitude.m
  + ControlTester.m

## Using Platform Flight Test

The people and equipment required for a flight test include

* RC Pilot and GCS operator
* Linux Based Computer to run the GCS
* RC Transmitter
* LiPo 11.1v Battery
* Quadrotor platform with installed avionics including
  + IMU
  + Overo Fire with trunk/airborne/flight\_computer/main compiled and running with pre-tuned controller gains.
  + MCU with RC receiver attached and pulse capture/USART communications functioning
* Heliconnect router with GCS and Overo both connected

Note a completed list of flight test equipment and procedures is beyond the scope of this document. Flight test reports should be consulted or the AHNS 2010 Operations brief.

# Procedure

## Using Logged Data

The results of this test report are generated by using MATLAB to analyse four log files; two files collected from the flight computer (mcu.log and control.log) and two files collected from the GCS (a helicopter state log and an autopilot state log).

1. Analysis of the flight computer logs involves reading them into MATLAB with the script ControlTester.m
2. The script will plot the instantaneous control update rates of both the control and MCU flight computer threads and report the average update rate.
3. As the flight test data from the GCS is for an attitude control test using the final attitude controller design the files are analysed with the script RCRateAttiude.m
4. The logged GCS data should provide an indication of the system dynamics, specifically the time difference between the RC pilot command inputs and the response of the system.

## Using Platform Flight Test

A complete list of flight procedures is beyond the scope of this document. For details the flight test reports should be consulted or the AHNS 2010 Operations brief. This test requires only that the control and MCU update logs are saved on the flight computer and that the autopilot and helicopter state log files are saved on the GCS. Once these files are available the logged data procedure can be followed.

# Results



Figure - Control Loop Update Rate



Figure - MCU Loop Update Rate



Figure - Roll Controller Logs



Figure - Pitch Controller Logs

# Analysis

# Conclusions

# Recommendations