Measurement of magnetometer readings with brushless motor running

Date: 11th Oct 2006, 0730hrs, RM 15.

1. Experiment Setup

Figure 1 shows the setup for the experiments. The configuration is as follows:

1. Slow stick plane
2. Hi-Max Outrunner motor HC2812-0650
3. APC 12 x 3.8 SF propeller
4. 3 cell Li-Po battery
5. MNAV sensor serial no: 05013264
6. Mean distance between motor and MNAV: 15 cm

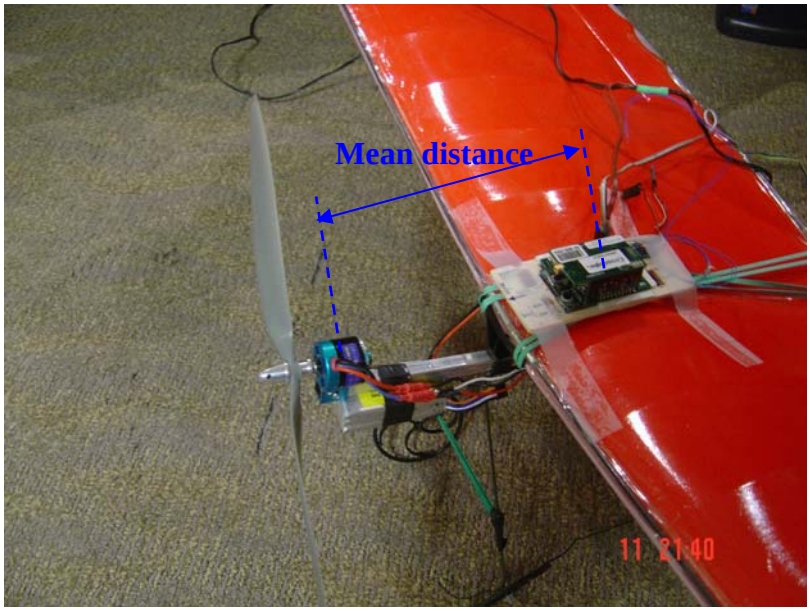

Figure 1. Experimental setup

2. Procedure

(a) The MNAV is first power on before the motor is being powered on.

(b) A sequence of motion is done to perturb the sensor from neutral position:

- Roll right of approx. 90 degrees and back to neutral and roll left of approx. 90 degrees and back to neutral.
- Pitch down of approx. 90 degrees and back to neutral and pitch up of approx. 90 degrees and back to neutral.
- Yaw right of approx. 90 degrees and back to neutral and yaw left of approx. 90 degrees and back to neutral.

(c) 3 cycles of throttle input are applied to the motor. In each of the cycle, the motor starts from 0 rpm and it is being spin up till the throttle is slight more than half stick position and then the throttle control input is slowly reduced till the motor stop spinning.

3. Result

Figure 1 shows the result of the time history of the whole test. The disturbance of the magnetometer to the 3 cycles of throttle input are very small and a zoom in are shown in figure 2 & 3.

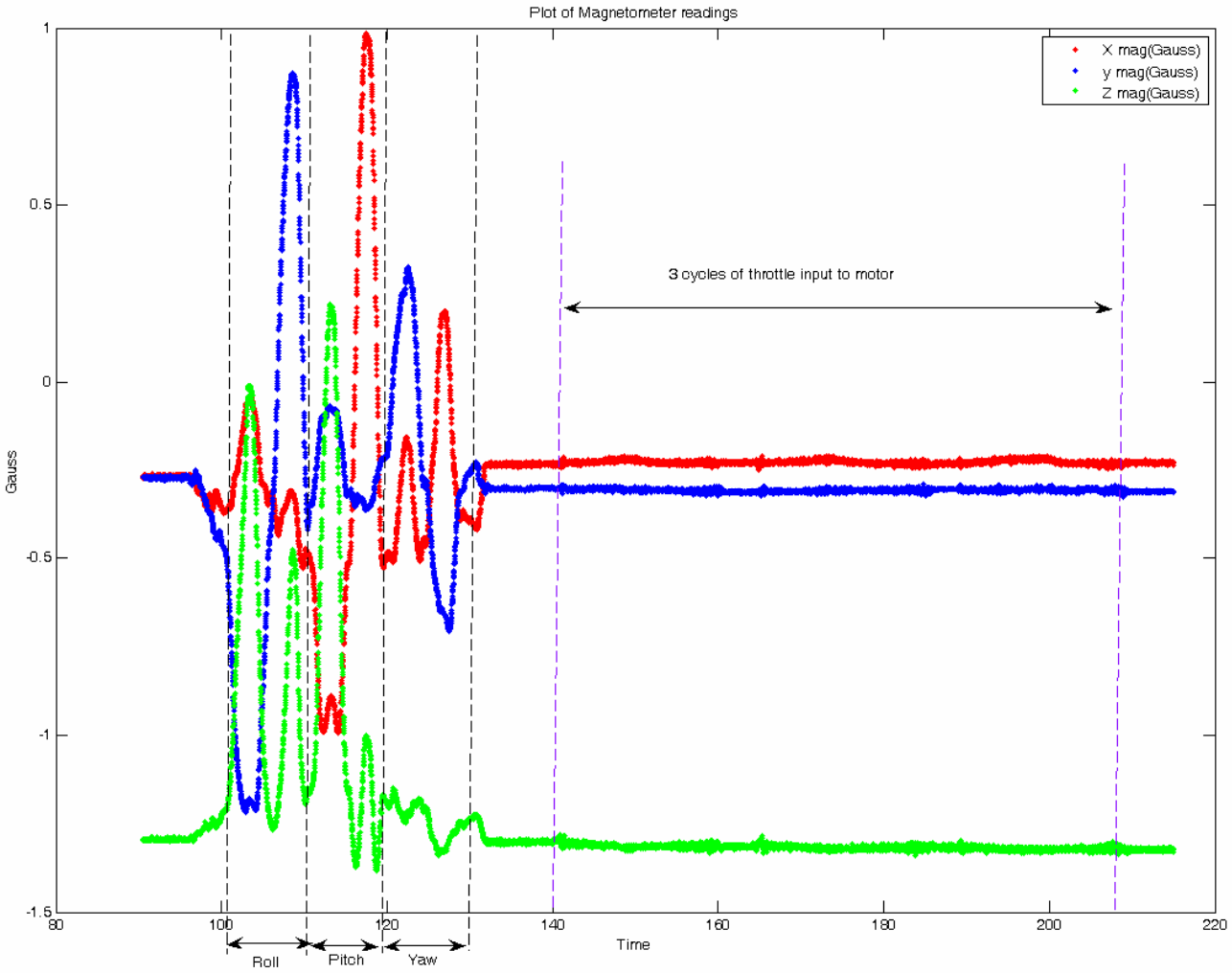

Figure 1. Time history of the magnetometer data

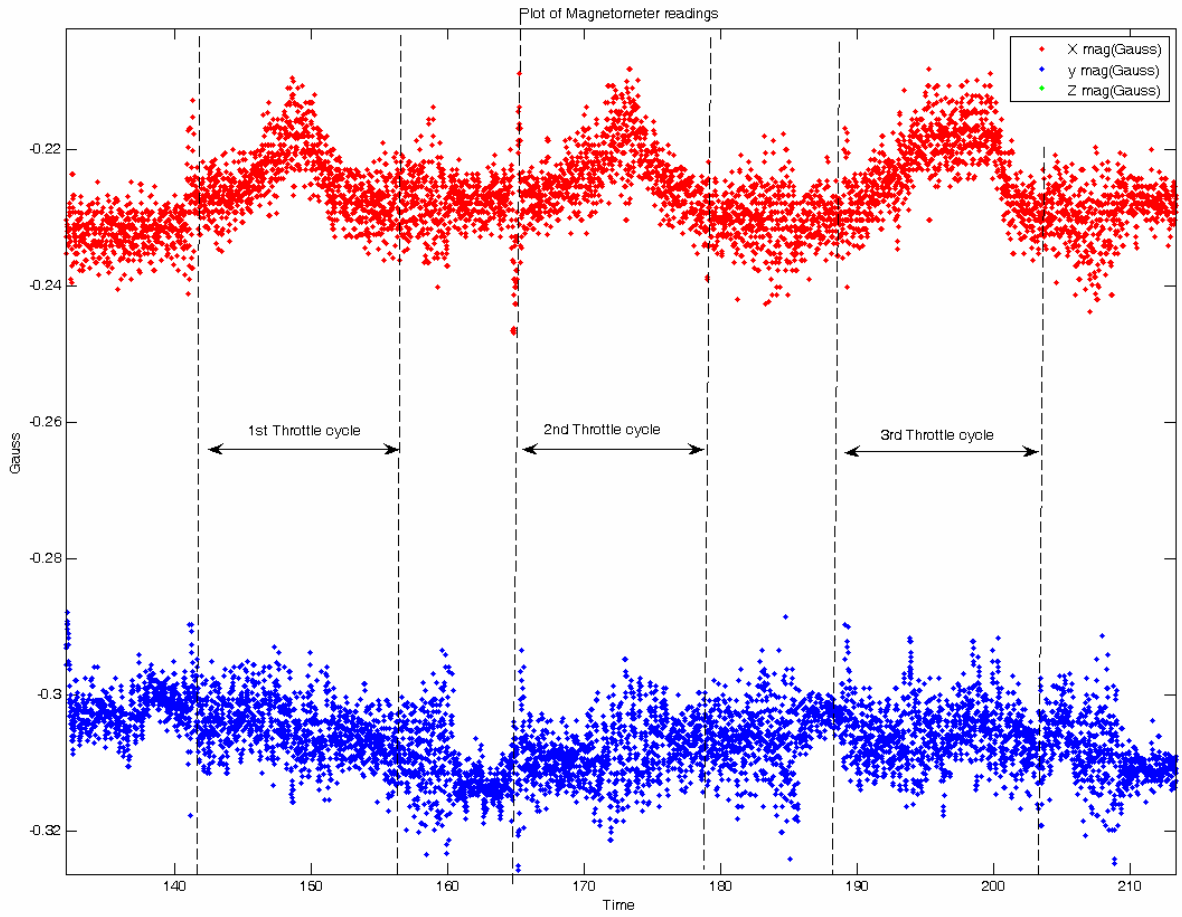

Figure 2. Zoom in on the data for the throttle cycle on X and Y mag

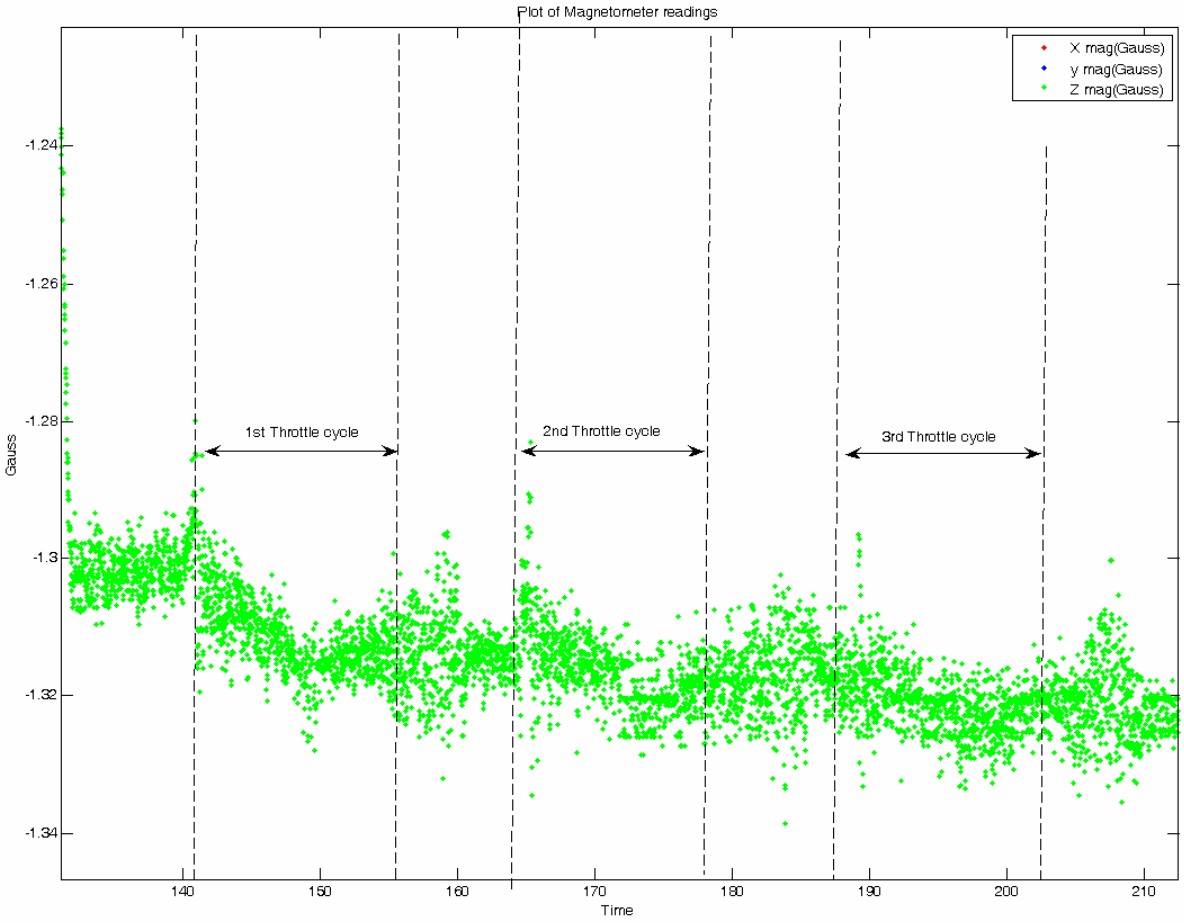

Figure 3. Zoom in on the data for the throttle cycle on Z mag

From the plot of the zoom in, we can see a very obvious interference that the motor has on the X axis Mag reading. From 0 to max throttle input, it causes a change of 0.02 Gauss. (I have yet to figure out how this will correspond to the AHRS algorithms for the error that we will have in terms of angle). However, this interference trend is not really obvious in the Y and Z axis.

The result presented here is just an initial sensitivity study on the effect the motor propulsion can have on the MNAV magnetometer sensing.

Others:

In addition to this test, we will be conducting a test to check on the roll, pitch and yaw angles that MNAV output using the AHRS algorithms from crossbow. The test jig is done (shown in figure 4) and once the coding has been ported into the MPC 555, we will be able to do the test.

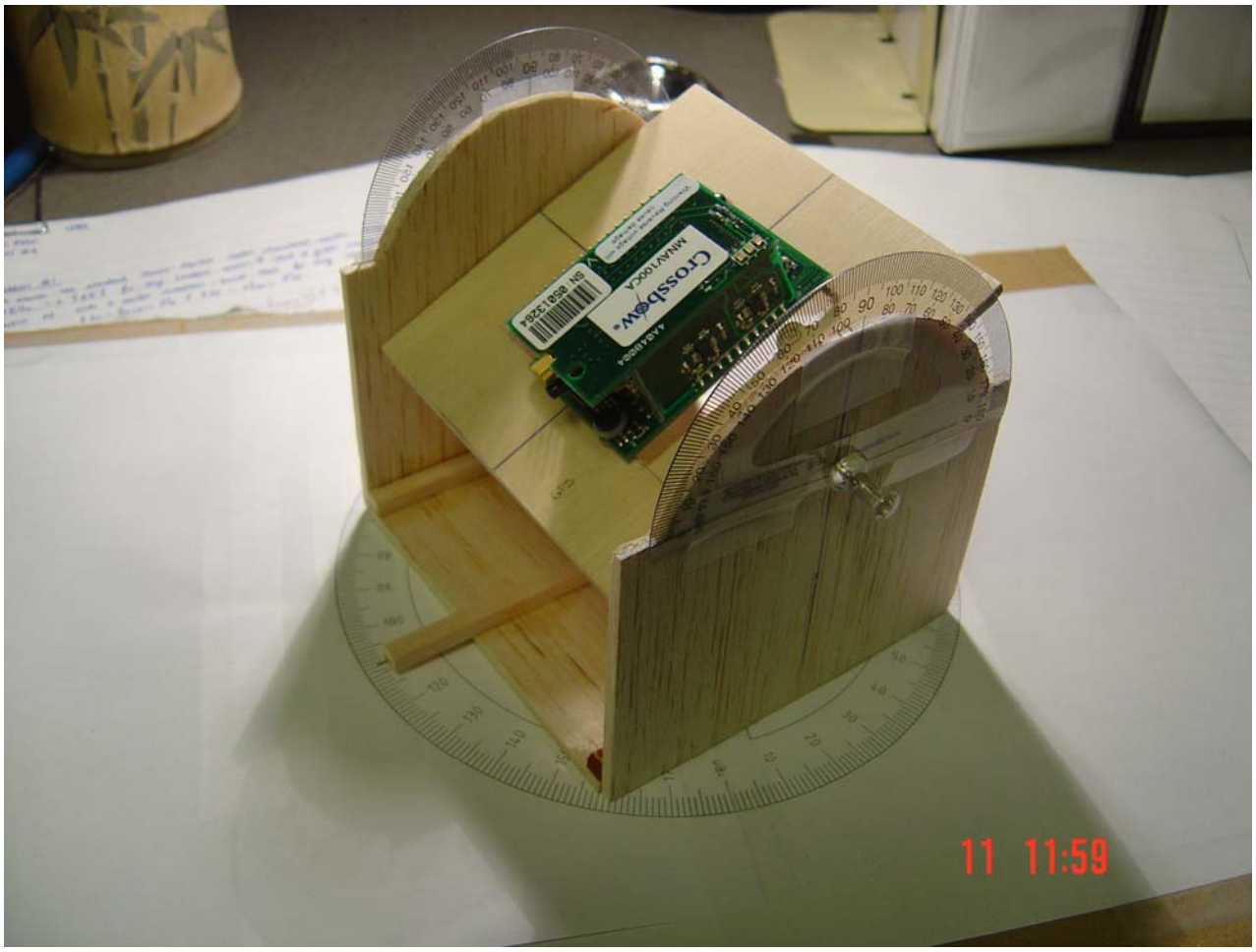

Figure 4. 2-DOF test jig to check the roll, pitch and yaw angle from MNAV