

Date: 07/26/11  
Location: Tri Valley  
Aircraft: Thor  
Pilot: Arion Mangio & James Rosenthal  
Flights: 4 Thor

## Weather

Sunny, moderate easterly winds with some gusts, temps around 80F.  
METAR KLVN 261450Z AUTO 09007KT 10SM CLR 23/17 A2991 RMK AO2=

## [Link to Flight Data](#)

We took Thor to Tri Valley to fly Garrison's waypoint tracker, a fault injection sequence, and some open loop doublets.

Onboard video was taken for 3 of 4 flights. In addition, motor data (from the ESC) was recorded, as well as R/C receiver performance data. Takeoff and landing was done from the gravel strip leftover from the old runway. We cleared most of the larger rocks. This seemed a better alternative than mowing the grass. Takeoff was no problem, but landings were a little more challenging due to gusty winds and a relatively small landing area.

R/C Receiver Performance: Using a 'flight log', we downloaded the receiver data. [See mfg manual](#). This data includes 'fades' for each antenna, frame losses, and holds. Fades represent when one antenna loses a bit of information. 50 to 100 fades are normal; remedial action is suggested at 500. Frame loss is when all antennas have a simultaneous fade. A hold occurs when there are 45 consecutive frame losses (about 1 sec). On Thor, the two antennas are noted as "A" and "L". Frame loss is "F", and holds are "H".

The controller used for all flights was a composite student controller, with the following gains: pitch\_gain[3] ={-0.6, -0.09, 0.08}; group 1, v1  
roll\_gain[3] ={-0.45, -0.022, 0.05}; group 3, v1

Software used was /trunk/Software/FlightCode/ rev 484 for flights 19-21, rev 486 for flight 22.

**Thor Flight 19:** Waypoint tracker; Engaged multiple times, but the tracker appeared to have difficulty reaching waypoints. Lots of circling and figure 8 patterns. Winds aloft appeared significant. The aircraft didn't hold altitude well due to excessive turning. R/C Rx: A=3,L=6,F=0,H=0.

**Thor Flight 20:** Open loop pitch-yaw-roll doublet. Wings level for 4 sec; then open loop (hold controller commands). 3 degree elevator doublet at 5 sec (1 sec period), 1.5 degree rudder doublet at 8 sec (1.5 sec period), 4 degree roll doublet at 12 sec (1 sec period). Purpose for this test was to compare the doublet response of the alpha-beta sensor to the simulation. The aircraft did not hold wings level very well due to the turbulence. Multiple repeats were done, and a few runs were completed successfully. R/C Rx: A=2,L=2,F=0,H=0.

**Thor Flight 21:** Fault injection sequence (8 different profiles), repeated twice for a total of 16 runs. Wings level for 2 sec; 20 degree roll (phi) doublet (4 sec period). Fault injected at 8 sec. Two more roll doublets at 10 and 16 sec (4 sec period). Ramp faults were 12 sec in duration. The faults were:

1. 5 deg ramp, non-additive
2. 10 deg ramp, non-additive
3. 5 deg step, non-additive
4. 10 deg step, non-additive
5. 5 deg ramp, additive
6. 10 deg ramp, additive
7. 5 deg step, additive
8. 10 deg step, additive

R/C Rx: A=214,L=55,F=0,H=0.

**Thor Flight 22:** Open loop pitch-yaw doublet, same as Flight 20, but without the roll doublet. Aileron controller was left on to help the aircraft maintain wings level. R/C Rx: A=19,L=4,F=0,H=0.

Issues:

1. Alpha and beta did not get saved in the flight data packet. The pressures did, so this can be computed after the fact. CORRECTION: alpha and beta were in fact saved. There was an error in the data conversion script that resulted in alpha and beta being zero in the matlab data file.
2. Comparing alpha and beta to simulation data shows that the alpha dynamic pressure is reversed. This was fixed by swapping the tubes on the pressure sensor.
3. There was a large bias on the yaw rate ( $\sim 42$  deg/s) for all of the flights. This bias was not present in the flight data from June 6. RESOLVED, see ticket [#40](#)

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