Date: 8/21/2012
Location: ACRC
Aircraft: Thor
Pilot: Arion Mangio
Flights: 4 Thor

Weather
Sunny day with moderate wind from the south/southwest
METAR (Anoka County)

KANE 211545Z 22006KT 10SM SKC 23/09 A3008
KANE 211745Z 18009KT 10SM SKC 25/08 A3007
KANE 211845Z 20005KT 10SM SKC 26/08 A3006

Andrei, Arion, Peter Bauer and Will arrived at ACRC around 9:30am to test Peter's waypoint tracking algorithm on Thor. There were three different tests planned. The first two tests consisted of four waypoints in a square pattern; one where the points were spaced 150m apart, and one where they were 100m apart. The third test was a parametrized sinusoidal waypoint trajectory. In each case, the initial waypoint always was set where the airplane was located when the pilot turned the controller to automatic mode. This eliminated initial transients. The first test of the day was unsuitable due to a bug in the guidance algorithm. Certain variables were not being reset each time the controller was switched to manual. The next three tests ran smoothly with the new bug fix. After the sinusoidal test, another test was performed with a smaller waypoint radius tolerance (10m rather than 20m for more accuracy). Visually, the airplane seemed to perform as expected; however, there was a data transfer failure, so the data was lost. After this setback, more tests were performed with no avail due to a faulty navigation filter initialization. See the 'Issues' section below for more information.

Software used for this flight was trunk/Software/FlightCode rev 891

Thor flight 65 consisted of tracking four waypoints in a square patter. There were three programmed cases for this flight: a squares with 100m sides, 150m sides, and 200m sides. There were several variables that were not being properly re-initialized after the pilot switched back to manual mode, so the airplane did not perform as expected. Therefore, the data from this flight is not very useful. Software modules used were heading_tracker_BP,EKF_15state,waypoint_guidance

Thor Flight 65
Rx Data: A154, L999, F040, H000

Thor flight 66 consisted of tracking four waypoints in a square configuration spaced 150m apart. Each waypoint has a tolerance radius of 20m around it. There were a few instances where the GPS data was amiss - always in the southern end of the airfield - causing a jagged navigation solution. Besides this, the airplane performed very well. Software modules used were heading_tracker_BP, EKF_15state,waypoint_guidance

Thor Flight 66
Rx Data: A010, L999, F000, H000

Thor flight 67 was conducted in the same manner as flight 66, but with the waypoints spaced 100m apart. The performance for this flight was spot on, with no GPS dropouts. Software modules used were heading_tracker_BP, EKF_15state,waypoint_guidance

Thor Flight 67
Rx Data: A001, L257, F000, H000

Thor flight 68 consisted of visual range test, and a parametrized sinusoidal waypoint tracking pattern. The range test was to determine how far away we can set waypoints while the pilot is still comfortable taking the airplane if something were to go wrong. The sinusoidal test was to test a different kind of waypoint tracking capability. The amplitude of the sinusoids was 20m. The airplane tracked the pattern to +/- 2m, which is actually in the noise of the GPS measurements. Thus, the airplane performed very well. Software modules used were heading_tracker_BP, EKF_15state,path_track

Thor Flight 68
Rx Data: A043, L999, F000, H000

Issues
Faulty Rx data on Thor

After one additional test following flight 68, the navigation filter was never able to initialize correctly. The problem seemed to be GPS related, but we are not sure. Once GPS lock was present, the filter would go unstable. Eventually, the aircraft was not even able to get GPS lock. We ran the exact same software the morning after the flight test, and everything worked normally. Further investigation is required.