

mAEWing2-HuginnFLT01

Project Info	
Project (Class & Team)	mAEWing2
Flight/Test Identifier	HuginnFLT01
Test Objective	First Flight Checkout System ID Approach Landing
Personnel	
Operations Lead / Launcher (OL)	Chris Regan
Pilot (P)	Curt Olson
Observer (O)	Louis Mueller
GCS Operator (GCS)	Leo Heide
Safety-of-Flight / Safety-of-Test Limits	
Airspeed Stall	13 m/s
Airspeed [min max]	Min: 15 m/s, Max: 26 m/s
Bank Limit	45 degrees
Altitude	Max: 100 m AGL
Configuration	
Aircraft	mAEWing2 Huginn
Radio Frequencies and NetID	915 Mhz
Avionics Software Version	SOC v9.2, FMU/Node v8.2_mAEWing2
GCS Software Version	

Test Overview

1. Pre-flight Procedures
 - a. Perform GCS Start-up Procedure
 - b. Perform Range test (Prop Power off)
 - c. Perform Link loss test (Prop Power off)
 - d. Perform Avionics Calibration

SOF/SOM

Joker Power: 3.90 V

Reserve Power for high altitude landing practice + 3x landing attempts

2. Launch

Bingo Power: 3.60 V

3. Test Cards

1. **Pilot Checkout (18 - 22 m/s)**
2. **Auto Checkout (18 - 22 m/s)**
3. **WindCircles (20 m/s)**
4. **Test 20 m/s**
 - a) RTSM
 - b) Aero symmetric set #1
 - c) Aero anti-symmetric set #1
 - d) Aero symmetric set #2
 - e) Aero anti-symmetric set #2
 - f) Aero symmetric set #3

Return to landing

Nominal Low speed mission contains 19 test segments

5. **Approach Practice**

Checkout: 1

Checkout: 1

WindCircles: 2

Test 20 m/s: 6

4. Return

Approach Practice: 1

Landing Go-around: 3

5. Land

Total: 14

6. Post-Flight Procedures

Test Card #1

<p>Pilot Checkout</p> <ol style="list-style-type: none"> 1. (GCS) Verify Altitude, Airspeed, EKF Solution 2. (P) Perform small manual maneuvers 3. (GCS) Call Airspeeds 4. (OL) Complete 	<p>Test Airspeed 18 - 22 m/s</p>
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Test Card #2

<p>Autopilot Engage</p> <ol style="list-style-type: none"> 1. (GCS) Verify Altitude, Airspeed, EKF Solution 2. (P) Engage attitude control autopilot 3. (P) Perform small manual maneuvers 4. (GCS) Call Airspeeds 5. (OL) Complete 	<p>Test Airspeed 18 - 22 m/s</p> <p>Attitude Control, Manual Throttle</p>
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Test Card #3

<p>Wind Circle / Air Calibration</p> <ol style="list-style-type: none"> 1. (OL) "Clear Windcircle" 2. (P) Fly constant bank angle circle, 1 revolution 3. (OL) "Complete, Reverse direction" 4. (P) Fly constant bank angle circle, 1 revolution 5. (OL) "Complete, PUPO" 6. (P) Fly <u>small</u> PUPO 7. (OL) "Complete" 	<p>Test Airspeed 20 m/s</p> <p>Attitude Control, Auto Throttle</p>
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Test Card #4a

<p>Stability ID #1</p> <ol style="list-style-type: none"> (GCS) Verify Altitude, Airspeed (OL) "Clear Engage" (P) Engage Test Fly hands-off, small inputs only (GCS) Call Excitation % (OL) Complete 	<p>Test Airspeed 20 m/s Entry Altitude between 30 and 120 meters</p> <p>Attitude Control, Auto Throttle</p> <p>Engage Reference Excitations (10 s) Roll. Pitch</p>
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Test Card #4b

<p>Aero ID - Symmetric #1</p> <ol style="list-style-type: none"> (GCS) Verify Altitude, Airspeed (OL) "Clear Engage" (P) Engage Test Fly hands-off, small inputs only (GCS) Call Excitation % (OL) Complete 	<p>Test Airspeed 20 m/s Entry Altitude between 30 and 120 meters</p> <p>Attitude Control, Auto Throttle</p> <p>Engage Surface Excitations (10 s) Pitch: TE5, TE3</p>
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Test Card #4c

<p>Aero ID - Anti-Symmetric #1</p> <ol style="list-style-type: none"> (GCS) Verify Altitude, Airspeed (OL) "Clear Engage" (P) Engage Test Fly hands-off, small inputs only (GCS) Call Excitation % (OL) Complete 	<p>Test Airspeed 20 m/s Entry Altitude between 30 and 120 meters</p> <p>Attitude Control, Auto Throttle</p> <p>Engage Surface Excitations (10 s) Roll: TE5, TE3</p>
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Test Card #4d

<p>Aero ID - Symmetric #2</p> <ol style="list-style-type: none"> (GCS) Verify Altitude, Airspeed (OL) "Clear Engage" (P) Engage Test Fly hands-off, small inputs only (GCS) Call Excitation % (OL) Complete 	<p>Test Airspeed 20 m/s Entry Altitude between 30 and 120 meters</p> <p>Attitude Control, Auto Throttle</p> <p>Engage Surface Excitations (10 s) Pitch: TE4, TE2</p>
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Test Card #4e

<p>Aero ID - Anti-Symmetric #2</p> <ol style="list-style-type: none"> 1. (GCS) Verify Altitude, Airspeed 2. (OL) "Clear Engage" 3. (P) Engage Test 4. Fly hands-off, small inputs only 5. (GCS) Call Excitation % 6. (OL) Complete 	<p>Test Airspeed 20 m/s Entry Altitude between 30 and 120 meters</p> <p>Attitude Control, Auto Throttle</p> <p>Engage Surface Excitations (10 s) Roll: TE4, TE2</p>
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Test Card #4f

<p>Aero ID - Symmetric #3</p> <ol style="list-style-type: none"> 1. (GCS) Verify Altitude, Airspeed 2. (OL) "Clear Engage" 3. (P) Engage Test 4. Fly hands-off, small inputs only 5. (GCS) Call Excitation % 6. (OL) Complete 	<p>Test Airspeed 20 m/s Entry Altitude between 30 and 120 meters</p> <p>Attitude Control, Auto Throttle</p> <p>Engage Surface Excitations (10 s) Pitch: TE1, LE1</p>
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Test Card #5

<p>High Alt Landing Practice</p> <ol style="list-style-type: none"> 1. (OL) "Approach and Recovery" 2. (GCS) Call airspeeds 3. (P) Line-up approach 4. (OL) "Clear for landing" 5. (P) Demonstrate airspeed/pitch control 6. (P) Maintain Wings level 7. (P) Slow to 15 m/s 8. (P) Recover 	<p>Attitude Control, Manual Throttle</p> <p>Predicted Approach Speed is 18 m/s Predicted Touchdown Speed is 14 m/s Predicted Stall Speed is 13 m/s</p>
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Day-Before-Flight Checklist

1. Check and charge batteries
 - a. Propulsion
 - b. Avionics
 - c. Transmitter
 - d. Ground Control Station
 - e. Walkie-Talkies
2. Prepare ground control station laptop
 - a. Verify flight software is operational
 - b. Verify GCS software is operational
3. Verify Firmware and Settings
 - a. FMU firmware
 - b. FCC software
4. Packing List
 - a. Maintenance
 - i. Aircraft specific tools
 - ii. Velcro
 - iii. Zip-ties
 - b. Battery bag
 - c. Electronics components
 - i. Radio Modem
 - ii. USB Cables
 - iii. microSD cards
 - d. Battery chargers
 - e. RC transmitter(s)
 - f. RC transmitter hand warmer, if applicable
 - g. Laptop computer and charger
 - h. Bungee launch system
5. Verify CG location
6. Verify pitot cover is secured on
7. Inspect bungee launcher condition

Day-of-Flight Checklist

1. Setup Ground Control Station
 - a. Power-on laptop
 - b. Connect radio modem
 - c. Start GCS software
2. Assemble aircraft
 - a. Attach wings, torque to spec
 - b. Attach winglets
3. Setup Bungee Launch System
 - a. Measure out anchor locations
 - b. Install two base anchors (~20 ft apart)
 - c. Install safety/release anchor
4. Perform Range test (Prop Power OFF)
 - a. Verify RC and TM links
 - b. Verify RSSI on GCS
 - c. Transmitter to range mode
 - d. Rotate aircraft
5. Perform Link loss test (Prop Power OFF)
 - a. (OL) Secure aircraft, "Aircraft Secure"
 - b. (P) Switch to Autopilot mode
 - c. (P) Observe throttle up, surfaces pos
 - d. (P) Turn transmitter off
 - e. (P) Verify: throttle cut, surfaces to spiral, manual mode
 - f. (P) "Link loss test complete"
6. Perform Avionics Calibration

The Day-of-Flight Checklist is performed at the flight field. The complete checklist is performed once prior to any flights, and all or portions may be performed following any in-field modification to the aircraft. Stale batteries can be used for the procedure.

Bungee Setup:

57 ft of stretch
28 lbs of total stretch

With $\frac{1}{2}$ Thrust, this is predicted to give 15 m/s
(@ full relax, ~2 seconds of acceleration)

Pre-Flight Checklist

1. Check battery voltages
2. Arm Bungee Launch System
 - a. Stretch each bungee, verify tension, attach to safety strap (2 person)
3. Turn on transmitter, switch user if required
4. Connect and secure Avionics battery
5. Verify flight mode via GCS
 - a. Verify TM Link
 - b. Verify GPS Satellite
 - c. Hold for Nav Filter init

The Pre-flight Checklist is Performed only prior to launch. Fresh batteries should be used.

Note Starting Battery Voltages: _____

Note Bungee Distance and Tension: _____

Notes:

Launch Checklist

1. Perform Pre-flight checklist
2. Transition aircraft to launch start
3. Secure Aircraft
4. Power-on cameras, start recording
5. Install and secure Propulsion batteries
6. Ensure non-essential personnel are clear of the operation area
7. Attach bungee launcher
8. Power-on Propulsion
9. (GCS) Verify Nav Solution
10. Verify GCS is ready
11. (GCS) "Pilot, Stick Left... Right... Up... Down..."
12. (GCS) "Pilot, Throttle runup"
13. Remove launch safety strap
14. Check runway is clear
15. Verify Pilot is ready
16. Verify Launcher is ready
17. (OL) "Ready for Takeoff"
- 18. (P) Half stick aft, Half throttle**
19. (P) "Launch, Launch, Launch"
20. (L) Pull launch release pin
21. (GCS) Confirm Launch and Data Quality
- 22. (P) Gear Up**

Manual Control, Manual Throttle

Abort straight ahead, reduce throttle

Return Checklist

<ol style="list-style-type: none"> 1. (OL) "Approach and Recovery" 2. Check that runway is clear and everyone has left the area other than the Pilot and Operations Lead 3. Check wind 4. (P) Line-up approach 5. (P) Initiate approach mode 6. (P) Verify Gear Down 7. (GCS) Verify Approach mode, "Approach" 	<p>Approach mode: Attitude Control, Manual Throttle</p>
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Landing Checklist

<ol style="list-style-type: none"> 1. (OL) "Clear for landing" 2. (OL/P) Call "Flare" at 20 ft AGL 3. (P) Initiate Flare 4. (GCS) Verify Flare Mode 5. Land and come to a complete stop 6. (P) "Throttle cut, hands off" 	<p>Predicted Approach Speed is 18 m/s Predicted Touchdown Speed is 14 m/s Predicted Stall Speed is 13 m/s</p> <p>Flare Mode: Bank, attitude, and airspeed automated</p> <p>Flare Bypass Mode: Bank and Attitude pilot control Airspeed hold (16 m/s)</p>
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Post-flight Checklist

<ol style="list-style-type: none"> 1. (P) Power-Off Prop, "Prop Safe" 2. (OL) Power-Off Avionics 3. Transition aircraft back to setup location 4. (OL) Retrieve logs, archive, clear 5. Remove and store batteries 6. Inspect aircraft 	<p>Note any Squawks:</p>
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