Albatross Flight Test Procedure

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1 Test Considerations

The primary purpose of test flights is for documentation. More than anything, all flights should be logged with descriptive procedures performed, any problems that occurred, if something worked better than expected, etc. See flight log for more info.

1.1 Takeoff

During takeoffs, the team will be looking for takeoff distance, velocity, and flight characteristics during climb out.

1.2 Flight Controls

In studying the flight control characteristics of the Albatross, we will be focused on how effective that the control surfaces respond to manually and automatic inputs. The Albatross is equipped with flaps, ailerons, elevators, and nose wheel controls. We would like to see if these are, firstly, all necessary, if they are effective (Should the ailerons move farther up and down to provide more responsive controls?), and how we can both simplify and improve these surfaces for the OpenUAS. Additionally, the servo connection itself will be questioned: is there a better, more effective or structurally-safer method of attaching the servos to the control surfaces?

The motor controls will also be closely monitored.

1.3 Avionics

We will be testing many aspects of the avionics, with a priority in temperature. We will be testing the Albatross's internal temperature at many different states of flight including zero, full and various in between motor speeds. We want this to be able to compare how well the avionics function at max speed (high motor function) and eventually test methods for internal cooling. Potential testing methods: poke holes in the fuselage, completely take off the

1.4 Landing

During landings, the team will be studying descent quality (with the use of lidar for auto-pilot), the velocity of descent, velocity of touchdown, and how long it takes to land at full stop. The team will be looking for methods in improving landing or changing landing characteristics (for instance without landing gear, how should the UAS land?

1.5 Manual Control

1.6 Auto pilot

1.7 Ground Communication

Ground communication, including telemetry, in-flight data readings, etc.

2 Flight Test 1

This first test flight will be performed completely manually. The primary focus of this first flight test is verifying flight characteristics predicted (such as takeoff velocity, rolloff distance, and such) as well as control characteristics (how sensitive are the controls? Do we need to make adjustments to controls on the OpenUAS?)
We are aiming to answer the following questions in the post-flight de-brief:

- What effect, if any, did the weather conditions have on the flight?
- Where there any difficulties and performing these maneuvers?
- What was the takeoff velocity? How does this compare to the predicted value?
- What was the takeoff distance? How does this compare to Applied Aeronautic's claim of 200 feet?
- How long did it take to climb to 100 feet?
- How far did the Albatross fly while at cruise?
- How long did it take to perform a 180 degree turn?
- How responsive were the controls during the turns?
- How well did ground communications read? Were there any issues? In terms of GPS, altitude, airspeed, ground speed, and vertical speed.
- How did the lidar data read? Were there issues in landing or altitude readings?
- What were the different operating temperatures? (Cruise flight, during takeoff, max power, etc.)
- How long did it take to touchdown from cruise altitude? What altitude did the descent start from?
- How would the input of flaps have changed the descent characteristics?
- Were there any issues in landing? Did the landing gear support the landing?
- What was the velocity at touch down?
- How long did it take to roll to a full stop?
- Do any of the systems appear to be damaged or overheated?
- What could have been done differently to make the flight better?
- What was the batteries' charge before and after the flight?

Team Roles:
We will need one person for each of the following roles:

- Pilot in command
- Alternate Pilot (or overseer)
- Timer/ Documentor
- Rollout and touchdown distance (for runway-length verification) (recommend marking distances on the runway and have someone)
- Safety/ Visual Observer

Flight Test Procedure:

- Complete Pre-Flight checklist, and ensure to record details in weather, runway altitude, and conditions in the Albatross.
- Discuss research questions with the team before flight, ensure that team roles are clear. Discuss safety concerns
- To measure the distance needed to takeoff, mark the predicted takeoff distance 200 feet and have the team member responsible for verifying this distance standing to the side to measure the distance needed).
- Perform one or two taxi-tests, to ensure manual power control is available
- Takeoff with standard power input, rotate at X speed, and maintain a steady climb with no turns (Start the stopwatch when Albatross goes full power. Mark times at takeoff and other identifying steps in the flight.)
- Once 100 ft altitude is reached, level off into steady flight (Mark time)
- Input a slight left turn until a 180 degree turn is reached (Time the turn)
- Input a slight right turn until a 180 degree turn is reached (Time the turn)
- Set a standard cruise speed and fly until the battery is running low
- Align Albatross for final approach
- Descend and land the Albatross to a full stop (strategically so that the motor does not impact the ground!). *Note* this descent is to **not** include flap input (Time the descent, touchdown, and full stop).
- Immediately debrief with the team, answering the questions from above. Discuss what can be tested in the following flight such as stall velocities, airframe characteristics, or ways of changing the internal temperature. Discuss changes in procedures, such as how to determine the range, battery life (Correlate with glide flight test), and such.
- Log this flight in the logbook.
- Complete post-flight checklist.

3 Notes for future Flight Test Procedures

- Performance characteristics: liftoff velocity, stall velocity, takeoff and touchdown velocity, max range and endurance
- Temperature on cruise vs max power, what's happening at different points in the
- In between the battery and main system and motor temperature (two spots to check temperature)
- Check current draw in cruise vs max power...
- Data on ESC after each flight to see how the motor and batteries are performing
- Ways to get internal cooling
- Compare our performance characteristics with Applied Aeronautics'
- Have a run where we're getting longest flight time, top speed, or both
- Replacing batteries at launch site
- Glide flight test
- How to expand flight life (ie glide for some of it? Can we turn off power to the motor and still have controls?)
- OUR UAS: thermometer inside... To see how temp of equip will effect the materials of the structure of the UAS
- Expected fatigue/landing cycles with the airframe (hard landings)
- Max speed the airframe can withstand
- Change servo connectors, and make larger/smaller inputs
- Test with Flap input
- Temperature inside the fuselage
- Breaking the ailerons and actually attaching them in different ways
- Different Landing Gear (3-D printed blocks? Rather than wheels?)
- Redundant power system? What if battery goes out?
- Gliding - turn motor off, maintain power to maintain controls (Applied Aeronautics claims 100 miles at cruise speed for glide
- Flight with autopilot. Test the system's ability to perform standard flight procedures such as takeoff, climb, turns, descent and landing.
- Is the software able to run an entire flight without human input?
- Were there any problems in initially connecting t

4 Lessons Learned