



IOWA STATE UNIVERSITY

MAKE TO INNOVATE:
BOEING EXPERIMENTAL FLIGHT
FLIGHT REPORT

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12/04/2021

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1 Project Statement

The goal of Boeing Experimental Flight (BEF) is to determine the viability of novel technologies that will aid in the future development of electric aircraft through research and testing.

2 Abstract

The Freewing AL37 is an RC aircraft sold by MotionRC. The aircraft is modeled after the Boeing 737 MAX. Boeing Experimental Flight ordered this aircraft through Make To Innovate for the purpose of data testing. This aircraft will be used to gather aerodynamic performance data for comparison with the Boeing 737 MAX. The aircraft will collect energy consumption data and can be reconfigured to collect other variables. The first flight of this aircraft was conducted on December 4th, 2021. After the flight analysis was conducted to determine what aspects need worked on further for future flights.



Figure 1: Freewing AL37

3 Methodology

The aircraft was assembled following manual instructions. The aircraft is powered by a 22.2V 5000 mAh 6S 30C Spektrum battery. The engines are two 70 mm, 12-blade Electric Ducted Fans (EDFs). The aircraft features flaps, flaperons, and ailerons on the wings as well as a retractable landing gear. These, along with the elevators and rudder, are controlled by a Spektrum transmitter. The aircraft was configured with a pitot tube for pressure data and a Pixhawk 4 capable of measuring pressure, altitude, and GPS data. However, due to issues with powering the Pixhawk 4 it was not ran during this initial flight.

We transported the aircraft to Central Iowa Aeromodelers AMA Field, in Cambridge, IA. The flight was conducted with 8 mph winds to the Northeast. The temperature was 40 degrees Fahrenheit. The transmitter was controlled by a pilot in command with certified Part 107 licensure who is a member of the Central Iowa Aeromodelers club. The center of gravity was directly behind the engine.

4 Results

The aircraft took off successfully from the runway and flew for a total of 5 minutes, 40 seconds. The airplane was controlled with the engines at 50% throttle and was able to fly with no issues. The aircraft landed with no concerns, and the battery cut power soon after. The battery's remaining voltage per cell was measured as 3.1 V/cell.

5 Discussion

The aircraft's performance during the flight was as desired for the project. It was able to handle multiple flight maneuvers with no concern. The team gained valuable insight for the battery system. For future flights we will invest in utilizing a parallel circuit to connect two batteries. We will also utilize a smaller battery to power the Pixhawk rather than attempt to connect it to the main power source of the aircraft.

6 Conclusion

Boeing Experimental Flight conducted its first successful flight in the project's history. There were difficulties with gathering sufficient data from the flight, but the project gained experience and knowledge with RC flight. Prospective student pilots were able to watch the flight and learned how to use the transmitter by a licensed pilot. This knowledge will be used when those students work on ground study and

getting their own licenses in the Spring semester. The project also provided valuable results and input in regards to the power system and how it can be improved on.

In Spring 2022 the project will order another Freewing AL37 for the purpose of constructing a truss-braced wing design from previous semesters while keeping the fuselage and retractable landing gear systems constant. The current model will be used for data collection tests and will be flown multiple times next semester. This will allow the project to gather more data and configure data collection on a flight-by-flight process.

7 Acknowledgements

Boeing Experimental Flight is a part of the Make To Innovate (M:2:I) class. We would like to thank and acknowledge ISU professors Matthew Nelson, Christine Nelson, and Travis Grager for their help and guidance throughout the semester and helping make this project possible. We would like to thank and acknowledge the help and guidance from Rohan Sharma and Ryan Engel, employees of the Boeing Company and technical advisors of the project. We would also like to thank the project's Teaching Assistant (TA) Riley Thomas and student advisor Matthew Nord for their assistance throughout the semester.