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Office of Research and Engineering

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AUTOMATIC DEPENDENT SURVEILLANCE- BROADCAST (ADS-B) AND VIDEO STUDY

Aircraft Performance Study

By

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A. ACCIDENT

Location: Mokuleia, Hawaii
Date: November 5, 2022
Time: 08:11 Hawaiian-Aleutian standard time (HST)
Aircraft: Airborne Windsports Edge XT-912-L, N444EZ

B. SUMMARY

On November 5, 2022, about 0811 Hawaii-Aleutian standard time, an Airborne Windsports Edge XT-912-L weight shift control light sport aircraft, N444EZ, was substantially damaged when it was involved in an accident near Mokuleia, Hawaii. The flight instructor and initial/introductory flight training student were fatally injured. The aircraft was operated as a Title 14 *Code of Federal Regulations* Part 91 instructional flight.

C. PERFORMANCE STUDY

1.0 Aircraft

The aircraft was an Airborne Windsports Edge XT-912-L (Figure 1), a hang glider-style ultralight trike. The aircraft holds two people, has a gross weight of 900 lbs, a cruise speed of 48 kts, and a stall speed of 30 kts. The aircraft is controlled by shifting the weight of the passengers and engine with respect to the high wing. If the pusher bar is pulled back, the weight is shifted forward and the wing angle of attack decreases. If the bar is pushed forward, the weight is shifted aft and the angle of attack increases. Shifting the pusher bar left or right banks the wing and induces a turn.

The hang glider-style wing is shaped by a series of battens that run from the leading edge to the trailing edge. The battens are individually tensioned and can be used to tune the shape of the wing as desired. If the airfoil is overloaded, the battens can "pop" out of the hinged batten fitting located on the trailing edge (Figure 2).



Figure 1. The accident aircraft, an Airborne Windsports Edge XT-912-L, N444EZ. The wing is labeled as an XR-S.

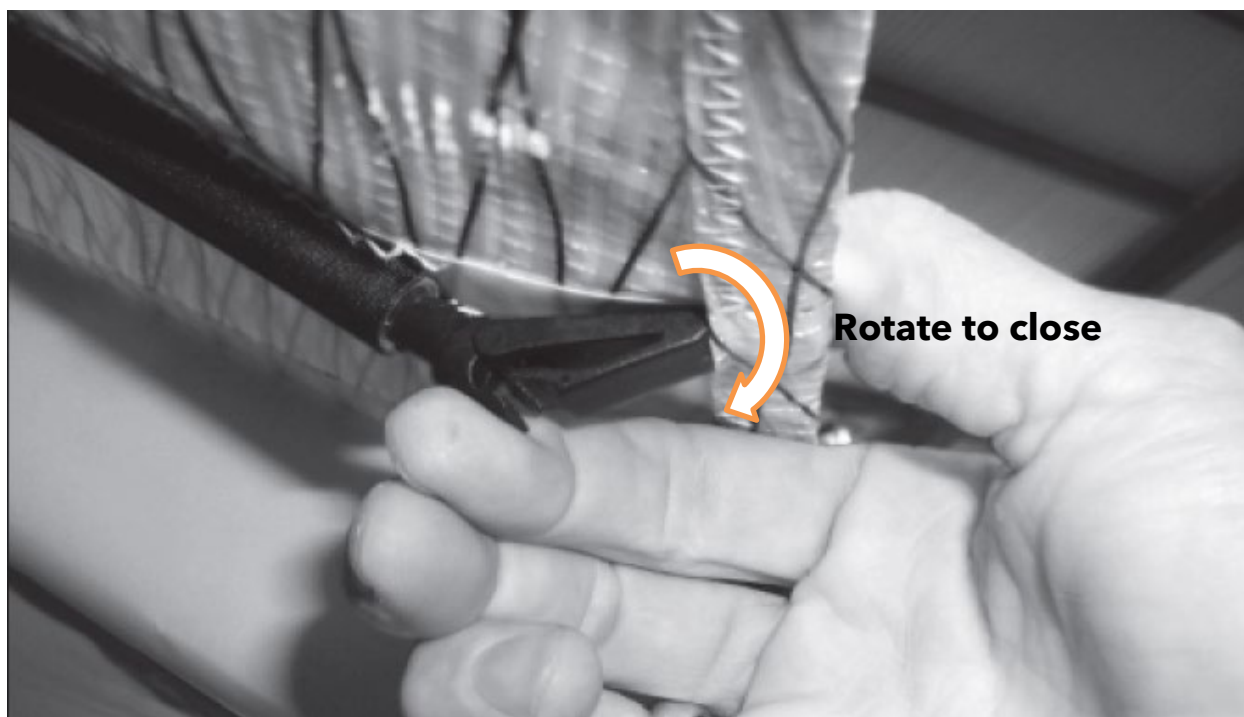


Figure 2. Picture of an open batten trailing edge from Aircraft Operating Instructions [3].

2.0 Available Data

This performance study is based on Automatic Dependent Surveillance-Broadcast (ADS-B) data provided by the Federal Aviation Administration (FAA). ADS-B broadcasts an airplane's Global Positioning System (GPS) position and other data to the ground where it is recorded. The GPS position has an accuracy of approximately 20 meters (65 ft) in both the horizontal and vertical dimensions.

The aircraft had a GoPro HERO9, a compact digital camera with a built-in GPS. The camera was mounted on the right wing of the aircraft pointing towards the pilot and passenger and captured the underside of the inboard portions of the wings [1].

The ADS-B record of the flight path was more complete than that captured by the GoPro GPS device so the ADS-B flight path is used for calculations in this report.

3.0 Weather

Weather was recorded for 07:55 at Wheeler Army Airfield, 13 nautical miles southwest of the wreckage location. The temperature was reported as 75°F (24°C), the dew point was 64°F (18°C), and the barometric setting was 30.15 inHg. A scattered cloud layer was reported at 4,900 ft agl (above ground level) and a broken cloud layer at 6,000 ft agl. Winds were 3 kts from 130°. Visibility was 10 statute miles and visual meteorological conditions prevailed.

Additionally, a wind sounding was provided [2] for the area of the accident. For the aircraft's flight levels (between 0 and 6,000 ft above mean sea level (msl)) windspeeds were below 2 kts. The wind sounding was used for airspeed calculations.

4.0 Flight Path

The aircraft took off to the east just after 07:41 from Dillingham Field in Mokuleia, Hawaii. The aircraft climbed initially to an altitude between 550 and 650 ft msl, completing a right then a left 360° turn. During the turns the aircraft's speed increased from 40 kts to 60 kts. After the second turn the aircraft steadily climbed and completed two more 360° right turns and then turned onto a more northerly heading. After 07:58:30 the aircraft completed a right 270° turn and began to fly westward. The aircraft reached a maximum altitude of 5,670 ft and began to descend after 07:59:40. As the aircraft continued its westerly path the airspeed was between 60 and 70 kts. The aircraft descended to 1,200 ft until it began a second climb just after 08:06.



Figure 3. Flight path with selected times and altitudes annotated.

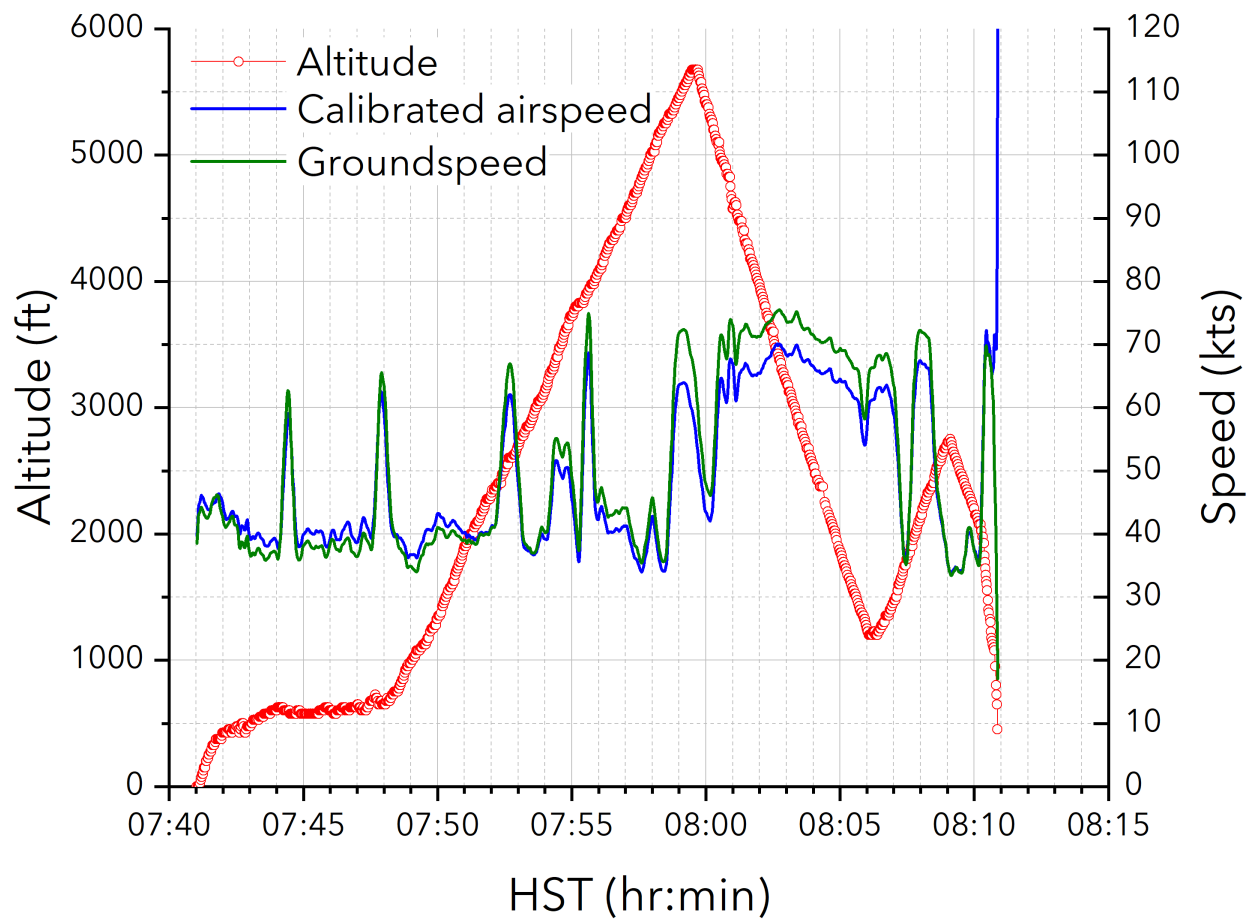


Figure 4. ADS-B recorded altitude and calculated ground and calibrated airspeed.

Near the end of flight, the aircraft completed a left 360° turn between 08:07 and 08:08 (Figure 5 and Figure 6) while continuing to climb. It made a large-radius 180° left turn and after 08:09:06 started to descend from 2,700 ft. The aircraft's speed remained between 35 and 40 kts. The aircraft turned left to the north just after 08:09:30 and then right at 08:10:00.

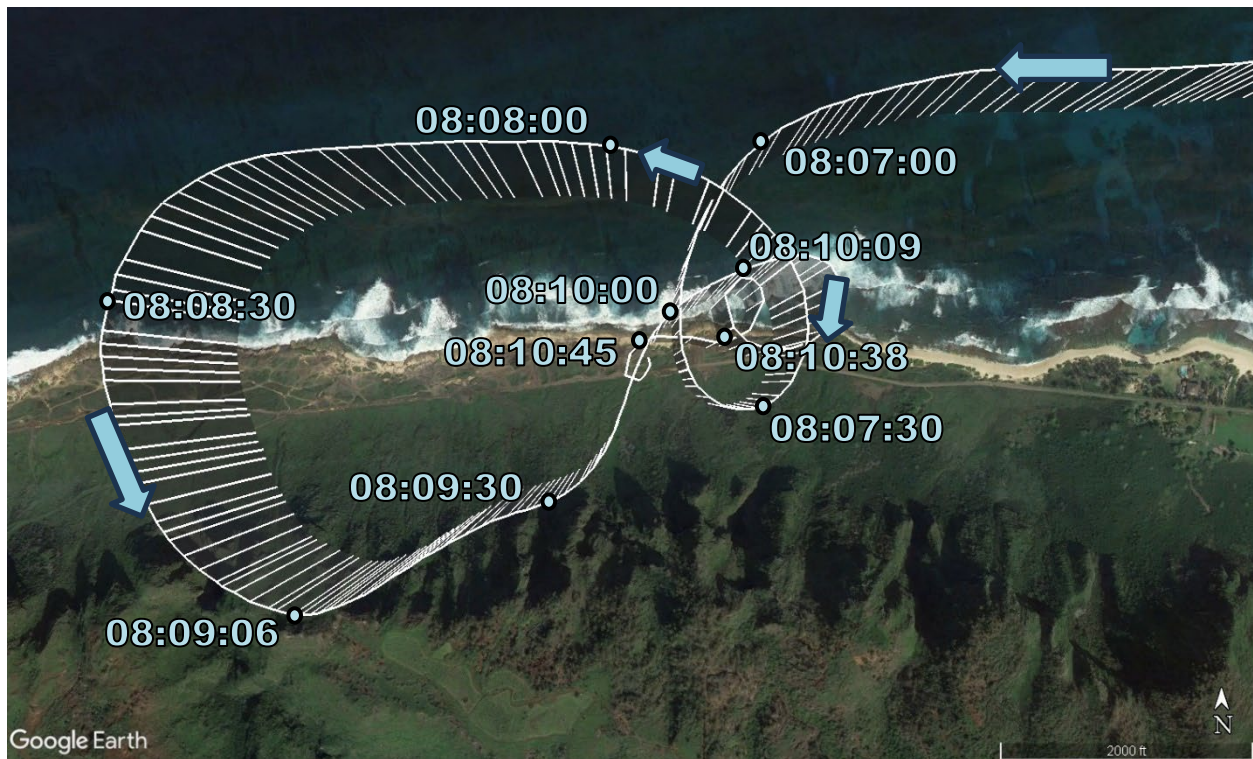


Figure 5. Flight path with selected times and altitudes annotated for final five minutes of flight.

Starting at 08:10:09, the onboard video recorded a comment related to performing a 360-degree spiral turn to lose altitude rapidly. The aircraft's initial altitude was 2,100 ft and its airspeed was 36 kts. At 08:10:15 the descent rate and airspeed rapidly increased and it entered a tight right turn (Figure 6).

A simplified aerodynamic model of the aircraft was used to calculate roll angles and the aircraft held a right wing down roll angle near or exceeding 60° from 08:10:23 to 08:10:33 (Figure 6 and Figure 7). The Aircraft Operating Instructions advise not to exceed 60° [3]. Additionally, the maneuvering speed, V_A , for the aircraft with the XR-S wing is listed as 73 kts, indicated airspeed. The calculated calibrated airspeed, based on the wind sounding, during the turn was above 70 kts. Indicated airspeed is specific to an aircraft's pitot-static system, but is usually within a few knots of the calibrated airspeed. For about 10 seconds of the right turn the aircraft was near the maximum recommended bank angle and V_A .

At 08:10:38 the descent rate was arrested at 2,000 fpm and the aircraft was rolling back towards wings level. At the same time, the video showed three of the left

battens released at the trailing edge and the left wing began to flutter. At the loss of lift on the left side, the aircraft rapidly rolled left. At 08:10:45 the descent increased to over 5,000 fpm and it entered a tight left turn. The video showed the aircraft in a spiral dive after 08:10:50. The final ADS-B return was at 08:10:52 when the aircraft was at an altitude of 451 ft.

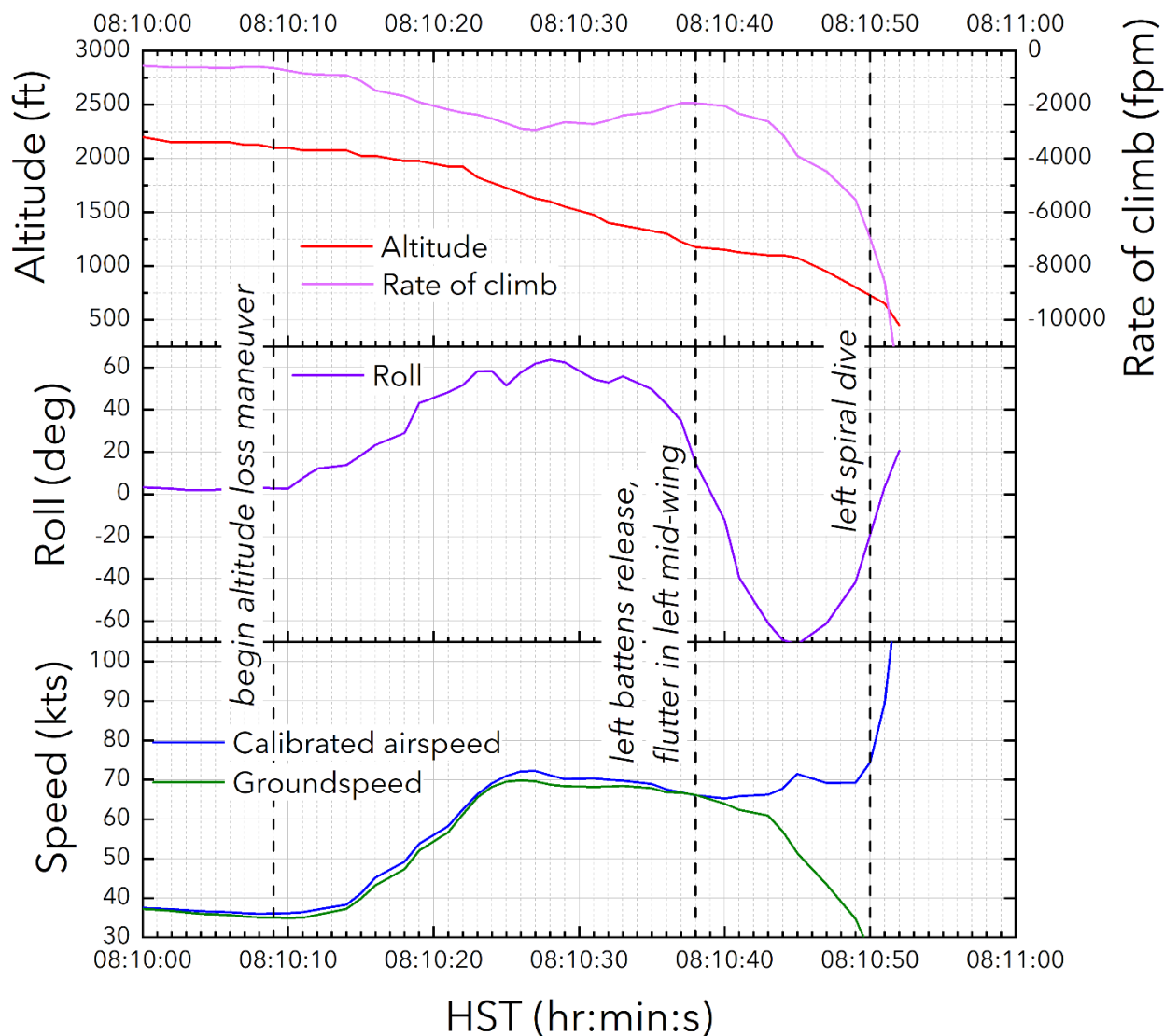


Figure 6. ADS-B recorded altitude, calculated rate of climb, groundspeed and calibrated airspeed, and roll angle for the final five minutes of flight.

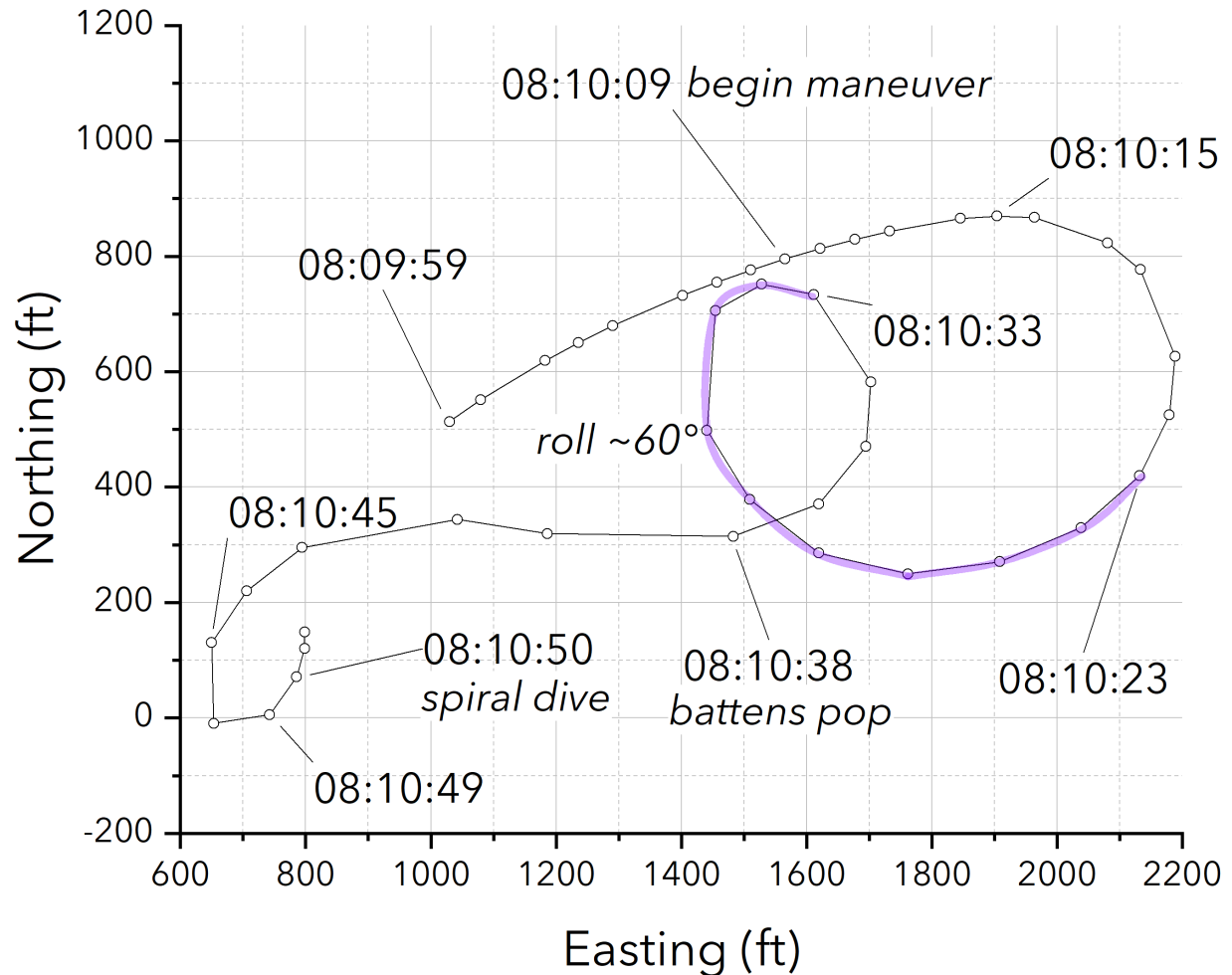


Figure 7. ADS-B end of flight path with selected times and events noted. The purple line highlights the portion of the flight path when the aircraft was near 60° right wing down.

Three hinged batten fittings released during flight. An Airborne Service Instruction [4] listed three different factors that can cause the hinged batten to unload. They were 1) damage to the latch from incorrect loading of the fitting, 2) over tension of the batten within the pocket, and 3) operation outside the placarded limitation of the aircraft. While 1 and 2 cannot be determined by this Performance Study, in the right turn beginning at 08:10:23 the aircraft was banked near its maximum recommended bank angle of 60° and near its maneuvering speed V_A of 73 kts.

When the battens released, the wing no longer held the airfoil shape and lift was rapidly lost on the left side causing the aircraft to enter the left spiral dive.

D. SUMMARY

The aircraft began a steep descending turn near the end of flight. The aircraft rapidly gained speed to near its maneuvering speed V_A while in a bank near its maximum recommended bank angle of 60°. For about 10 seconds of the right turn the

aircraft was near the maximum recommended bank angle and V_A . Shortly after, three left batten hinges released causing the left wing to flutter. The left wing lost lift and precipitated an eventual left spiral dive.

E. REFERENCES

1. Onboard Image Recorder, Group Chairman's Factual Report, ANC23FA003, National Transportation Safety Board, 2023.
2. Meteorology Specialist's Factual Report, ANC23FA003, National Transportation Safety Board, 2023.
3. Aircraft Operating Instructions, Light Sport Aircraft, EDGE XT MK4 L - XRM/XRK/XRS Microlight. AirBorne WindSports Pty Ltd, 2018.
4. Service Information, Hinge Batten Fitting Security, AirBorne Service Instruction SB-019 Issue 1, 2015.