FINAL REPORT ON THE ACCIDENT TO DPM MICROLIGHT AQUILAIR SWING 582 REGISTERED OO-F23 IN MOORSELE ON 13 JANUARY 2008

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FOREWORD

This report is a technical document that reflects the views of the investigation team on the circumstances that led to the accident.

In accordance with Annex 13 of the Convention on International Civil Aviation, it is not the purpose of aircraft accident investigation to apportion blame or liability. The sole objective of the investigation and the Final Report is the determination of the causes, and define recommendations in order to prevent future accidents and incidents.

In particular, Article 13 of the Royal Decree of 9 December 1998 stipulates that the safety recommendations made in this report do not constitute any suspicion of guilt or responsibility in the accident.

Unless otherwise indicated, recommendations in this report are addressed to the Regulatory Authorities of the State having responsibility for the matters with which the recommendation is concerned. It is for those Authorities to decide what action is to be taken.

The investigation was conducted by L. Blendeman, chief investigator.

NOTE: For the purpose of this report, time will be indicated in UTC, unless otherwise specified.
Synopsis

Date and hour of the accident

Aircraft
Type: DPM Aquilair Swing 582
Registration: OO-F23

Accident Location:
Airport of Moorsele, EBMO

Aircraft Owner
CIK BVBA and two other persons, amongst which the accidented pilot.

Type of flight
Local

Persons on board
2, both killed on impact.

Cause and contributing factors
The loss of control in flight, followed by tumbling of the airplane was caused by the initiation of a stall manoeuver at high pitch angle that led the airplane to exceed the limits of the flight envelope.

The contributing factors were:

- meteorological conditions do not exclude a possible wind gust at a critical moment, shifting the airplane off-balance.
- pilot had a low recent experience on this aircraft; he did not fly with this aircraft for the last 3 months and had a total of 10 FH for the last 6 months.
1. Factual Information

1.1. Chronology of the events

A celebration party was organized on the airfield of EBMO that day. During the party, a request was made towards the owners of the airplane to perform a demonstration flight. A request was made towards the airfield commander, and granted.

The pilot checked the meteo, and prepared the airplane for the flight.

The airplane made a first flight, with the pilot and a second person on-board. This flight lasted 15min. This flight went uneventfully, and included turn, climb and dive manoeuvres.

Upon landing, a second flight was requested with another passenger – a lady - on-board. The airplane took off at 13.30. The airplane turned around the airfield, some turns were considered `sharp` by witnesses.

The airplane performed an approach on runway 22, then went for a go-around. The airplane climbed to the normal altitude (1000ft). On half downwind position, the airplane made a right turn, coming back to the airfield, with head wind.

The airplane was then flying at a height of approximately 1200ft, and when above the airfield, the pilot initiated a `stall` maneuver. The airplane went to a dive at full throttle, in order to gain speed, followed by a steep climb. At top of climb, the airplane was seen to be vertical.

The airplane went further in a tumbling movement. The airplane was seen performing 3-4 rotations up to the moment that the wing structure broke, and the airplane fell vertically to the ground in a spiraling movement. The pilot and the passenger were killed by the impact on the ground.
1.2. Injuries to persons

<table>
<thead>
<tr>
<th>Injuries</th>
<th>Pilot</th>
<th>Passenger</th>
<th>Others</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fatal</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Serious</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Minor</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>None</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>2</td>
</tr>
</tbody>
</table>

1.3. Damage to aircraft

The airplane was totally destroyed

1.4. Other damage

None

1.5. Personnel information

Pilot.
Sex: Male
Age: 27
Nationality: Belgian
License: Training Authorization, issued on 12 November 2007, valid until 13 November 2008
Medical: Class 3, valid until 13 November 2008

The aircraft log book shows the pilot had accumulated a total of 20.5 FH on OO-F23 since 01 July 2006, and 10.7 FH on OO-F23 since the last 6 months.

The total flight experience of the pilot was 320 FH as pilot in command.

The pilot held a DPM Pilot authorization (Toelating tot besturen) first issued on 4 December 2001.
When this authorization expired, the request for re-validation, dated 12 November 2007, stated that the pilot flew 44.54 FH in the last 24 months, including 10 FH in the last 6 months.

According to Art.33 of the Royal Decree of 25 May 1999, a pilot is required to show a minimum of 50 flight hours during the preceding 24 months to have his DPM Pilot Authorization re-validated. In this case, the condition was not met and therefore his license was “de-rated” into a Training Authorization. This would allow the pilot to re-activate his pilot’s license after an evaluation flight with an instructor.
A Training Authorization is basically made to allow a trainee pilot to acquire sufficient flying experience. Art 31 of Royal Decree of 25 May 1999 specifies that the holder of a Training Authorization is only authorized to:

1. Dual controls flights; with the presence of an instructor at the other set of controls for the purpose of training.
2. Flying alone for local flights under the supervision of an instructor.
3. Flying alone with the authorization of an instructor, provided the trainee can justify a minimum experience of 2 dual controls flights.

Flying with a passenger on-board is not allowed.

1.6. Aircraft information

The Aquilair Swing 582 is a two-seat, weight shift controlled flexwing microlight aircraft.
It is constituted by a La Mouette GHOST 14.9 wing and a trike. It is powered by a Rotax 582 engine equipped with a DUC propeller.
The Aquilair Swing 582 was authorized in Belgium under reference 2006/133 – Issue1/12-12-2006, based upon a Type Certification by the Deutscher Ultraleichtflugverband e.V. and Kennblatt-Nr 144/98-1.1 2.

The trike itself is made of a metallic structure on which the engine and its equipment, the fuel tank, the 2 seats and the landing gear are attached. The trike is surrounded by an aerodynamic fairing (not shown on drawings hereunder, for clarity).
The trike is attached to the wing on a hanging bracket by means of a front strut and a rocking mast.
The wing structure consists of a keel, leading edge and cross bars, over which the sail is stretched. The sail is stiffened by a series of battens. Above the wing is a kingpost through which the luff lines are attached.

The pilot controls the airplane through the basebar connected to the wing keel tube by two uprights. The position of the wing is then controlled by the pilot acting on the basebar. This action is then further transmitted to the wing through the flying wires.
The Swing 582 has the following characteristics;

- Wing Area 14.9 m²
- Empty Weight: 197 kg
- Maximum Take-Off Weight: 450 kg
- Never Exceed Speed: 145 km/h
- Cruise speed at MTOW: 120 km/h

The structural integrity of the aircraft has been demonstrated up to an ultimate load factor of +6 / -3 G, without detrimental damage.

The limitations are as follows;
- Max crosswind: 30 km/h (16 kts).
- No aerobatic flights (Max +/- 30° roll and 60° pitch)

**Trike.**
- Manufacturer: Aquilair ULM SARL
- Type: Swing 582
- Serial Number: 116 IM 05K
- Built year: 2006
- Registration: OO-F23
- Certificate of Registration: 6517
- Total Flight Hours: 72 h 50m
- No flights are registered in the aircraft log book after 22 October 2007.

**Engine**
- Manufacturer: ROTAX
- Type: 582 ULDCDI

**Propeller**
- Manufacturer: DUC
- Type: DUCFC
- Serial: 0968

**Weight and balance**
- With the two occupants, and the fuel on-board, the airplane was well under the maximum take-off weight.
1.7. **Meteorological information**

Observed at EBKT
- Wind Direction: 180° - 190°
- Wind Speed: 8-10 kts
- CAVOK
- Pressure: 1009 hPa
- Temperature: 7 °C

Observed at Ostend (EBOS) – 44km NNW 13:50
- Wind Direction: 170°
- Wind Speed: 17 kts, no gusts
- Visibility: more than 10 km
- Clouds: Broken, 4000 ft
- Pressure: 1009 hPa
- Temperature: 8 °C

Note:
The wind speed in Ostend was stable around 14 kts, from 12:00 until 13:50, then it went up to 17 kts, between 13:20 and 13:50 and then later back to 14-15 kts.

In Koksijde (44km NW), this variation was not observed; the average wind speed stayed at 14 kts – 160°. However, winds up to 21 kts were recorded between 13:00 and 14:00.
In Lille (32 km S), the observation showed an average wind speed of 16 kts, with peaks up to 23 knots.
In Semmerzake, (37km E), the wind direction was 180°, with an average speed of 12 kts, and peak values up to 18 knots.

1.8. **Aids to Navigation**

None.

1.9. **Communication**

The airplane was equipped with a radio, but there were no relevant communication between the airplane and the ground at the time of the accident.
1.10. **Airfield information**

The airfield of Moorsele (EBMO) is located at 6 km NW of the Kortrijk airport (EBKT), on the coordinates; 50°51'10"N - 003°08'50" E. The elevation is 60ft asl.

The airfield has a grass bi-directional runway oriented 040°/ 220°. The runway is 670m long and 30m wide.

The airfield is operational on Saturdays, Sundays and during school holidays, from 09.00 until 19.00.

1.11. **Flight Recorders**

Not applicable
1.12. Wreckage and Impact information

The airplane impacted the ground at 80m from the center of the runway axis, and at mid length.

The impact of the airplane with the ground was vertical. The airplane remained at the place where it impacted the ground, there was no rebound.

The helmet of the pilot and the seat cushion of the passenger were found at a great distance (50m) of the impact, indicating a in-flight rotating movement of the airplane.
1.13. **Medical and Pathological information**

The occupants of the airplane suffered fatal injuries consequent with the impact shock.
1.14. Fire

There was no fire.

1.15. Survival Aspects

The tumbling invariably leads to the loss of the aircraft once initiated; the survival rate is very low.

1.16. Test and Research; inspection of the wreckage.

The controls

The basebar was found bent, and one upright was found broken at mid length; one part still attached to the base bar, but the other part was disconnected from the hanging bracket. The other upright was found disconnected from the basebar but it was still connected to the hanging bracket.

One cable of the flight lines, connected to the rear side of the keel was torn. This occurred probably during the last phase when the wing folded.
The Wing

The Leading Edge tubes were found fractured in three places. The keel tube was also fractured. On the impact zone, the wing was found separated in 2 parts and folded.

All fractures were made under stress – flexion. There was no sign of rupture prior to the accident.

Wing structure.
Rupture of the cross-tube central connection

Rupture of the cross-tube connection to the wing

Most of the battens of the upper surface were found deformed, and many were ruptured.
The trike.

The trike was still attached to the wing on the hanging bracket.

The rocking arm was found intact and still attached to the structure of the trike.

The damages to the trike were found to be consequent with the shock of the trike hitting the ground. Mainly, the RH aft landing gear, and the front landing gear structure collapsed due to the shock.
The engine.

From the damage to the propeller, we can assume that the engine was not operating at the moment of impact. The engine stopped probably during the tumbling phase.
2. Analysis.

Tumbling: General
The tumble is a departure from controlled flight whereby the angular momentum of the aircraft causes the microlight to rotate about its pitch axis with a very high angular velocity and acceleration; angular velocities of one revolution per second and transient accelerations of 8g are not unknown. During the tumble the forces are so great that the basebar normally hits the front strut with sufficient force to cause either the basebar or front strut to fail. A tumble normally results in the break up of the aircraft and the occupants to be fatally injured.

For a microlight to tumble the trike must swing with sufficient momentum to overcome the aerodynamic damping forces from the wing and allow the establishment of a pitch autorotation. This is possible if the pilot mishandles the aircraft, severe turbulence is encountered at low speed, or the microlight enters a stall from a high climb angle. Mishandling or a steep stall normally result in the microlight tumbling nose down.

The flight
From the damage found on the wreckage, we can conclude that the airplane was caught in a tumbling movement. The tumble generate forces well above the resistance of the structure. The stress was sufficient to explain all the ruptures and deformation found on the controls and structure of the wing.

According to some witnesses, the position of the aircraft while attempting the stall manoeuver was 'closed to the vertical position', and this was followed by a steep dive. This movement almost certainly caused the swing of the trike, and generated the tumbling of the airplane.

However, it is not clear whether this movement was the result of the input of the pilot alone. A wind gust may have occurred at a critical moment, during the stall manoeuver, shifting the airplane off-balance. Wind gusts were not felt by the witnesses on the ground during the flight, but the situation at 1200ft high may have been different. At the time of the flight, the meteo stations of Lille, Semmerzake and Koksijde recorded wind peaks around 20knots (see page 10).
3. Conclusions.

3.1. Findings

- The pilot had a valid Training Authorization for DPM and medical certificate.
- There was a passenger on board, although not allowed according to the privileges of the Training Authorization for DPM.
- The type of aircraft was authorized to fly in Belgium, as found complying with the Belgian requirements.
- The aircraft manual prohibits acrobatic manoeuvres, pitch angle greater than 60°.
- The airplane was loaded within its limits for weight and balance.
- There was no sign of in-flight structural failure.

3.2. Cause and contributing factors.

The loss of control in flight, followed by tumbling of the airplane was caused by the initiation of a stall manoeuvre at high pitch angle that led the airplane to exceed the limits of the flight envelope.

The contributing factors were:

- meteorological conditions do not exclude a possible wind gust at a critical moment, shifting the airplane off-balance.
- pilot had a low recent experience on this aircraft; he did not fly with this aircraft for the last 3 months and had a total of 10 FH for the last 6 months.

4. Safety recommendations.

There are no safety recommendations issued for this accident.