FINAL REPORT

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In accordance with the provisions of SI 205 of 1997, the Chief Inspector of Accidents, on 4 June 2003 appointed Mr. John Hughes as the Investigator-in-Charge to conduct a Formal Investigation of this occurrence.

Operator:	Private
Manufacturer:	AirBorne WindSports
Model:	Climax 13 Hang Glider
Nationality:	Irish
Registration:	No.34
Location:	Pollshone, near Courtown, Co.Wexford
Date/Time (UTC):	25 May 2003 @ 13.40 hrs

SYNOPSIS

The accident happened during the Celtic Cup Hang Gliding Competition which was held over 24 and 25 May 2003 at Mount Leinster on the Carlow / Wexford border. A task was set to fly from the summit of Mount Leinster to a field on the east coast just south of Courtown Harbour – a distance of 37.2km. The pilot arrived over the field and after descending towards the goal area, attempted to perform a loop in his hang glider. The glider failed to complete the loop and slid backwards into a series of reverse loops during which the pilot became detached from the control bar and lost control. He made several attempts to deploy his reserve parachute. When it did deploy, insufficient height remained to recover the situation and the pilot and his hang glider hit the ground simultaneously. The pilot was injured and taken to hospital. He died from his injuries 9 days later.

The Irish Hang Gliding and Paragliding Association (IHPA) conducted an inquiry into this accident. A copy of their Report, dated 2 Sept 2003 was forwarded to the Investigation. The IHPA presented the Investigation with a copy of a video recording taken by a witness to the accident. Having studied the recording, the Investigation agrees with the factual information as detailed in the IHPA report and described below.

FINAL REPORT

1. FACTUAL INFORMATION

1.1 The pilot took off normally at about 12.10 hrs and quickly thermalled to cloudbase. He had on board a Flytec 4020 alti-vario flight instrument and a Garmin 38 GPS (which provided groundspeed). He remained in the vicinity of Mount Leinster for some time before he headed towards goal. He arrived over the goal field which was located at Pollshane near Courtown at about 14.30 hrs at an height of about 2,000 feet AGL (Above Ground Level). He was seen to spend some time losing height in normal controlled flight before he attempted to loop his hang glider from a starting height of between 400 feet and 1,000 feet. The video showed no cause for concern during the dive phase and the hang glider went vertical and then inverted. At this point the glider lost momentum and failed to go through the inverted position. While inverted, the pilot's feet fell onto the back of the sail causing the glider to tail-slide with the pilot still holding the bar. The glider then tumbled forwards with increasing velocity through 1½ rotations from the inverted position. After the first half-rotation the pilot lost his grip on the bottom bar and he was flung backwards around the trailing edge and impacted on to the top of the sail. The pilot's hang-strap then wrapped around the keel as he fell back under the sail and from that point onwards he was suspended from the keel and unable to reach the control frame.

The glider then stopped rotating and entered a steep side-slip. At this point the pilot pulled his emergency reserve parachute release handle and attempted to throw it outwards. In the 4 seconds between pulling his parachute release handle and actually releasing it the pilot made two unsuccessful attempts to deploy the reserve parachute without letting go of the deployment handle. On the third attempt the reserve parachute was successfully thrown clear, the inner bag immediately separated and the canopy started to fill. At this point the keel of the glider, from which the pilot was suspended, broke and the pilot swung forward into the A-frame. The pilot resumed his grip on the bottom bar with both hands but he had no pitch control because the keel was broken forward of the sail tensioning catch. It was no longer possible for the pilot to recover the situation due to the condition of his hang glider. He was now also too low at this point and he impacted the ground before the reserve parachute canopy had time to fully inflate. The right leading edge and bottom bar of the glider impacted the ground simultaneously.

1.2 Injuries To Persons

Injuries	Crew	Passengers	Others
Fatal	1	0	0
Serious	0	0	0
Minor	0	0	0
None	0	0	

1.3 Damage To Aircraft

The keel of the glider was broken in two places – 165cm from the nose (forward of the tensioning catch) and 227cm from the nose. The right upright was broken into two pieces and the left upright was bent outwards by about 15°. The bottom bar was twisted up and splayed at both ends. The trailing edge of the sail was torn close to the keel pocket by the harness hang-strap. There was no other apparent damage to the glider, the harness or the reserve.

1.4 Other Damage

There was no other reported damage.

1.5 Personnel Information

1.5.1 The pilot had 20 years experience with more than 1,400 hours total airtime. He had 200 hours on type. The pilot was a founder member and flying instructor with his club. The pilot had won numerous international and domestic flying competitions during his flying career. The IHPA reported that he was also a certified sailplane pilot and a microlight pilot. He was highly experienced and had an injury-free flying career going back over two decades. He had purchased the accident glider directly from the manufacturer in Australia in December 2001. He took out a Short Term Membership with the Hang Gliding Association of Australia (HGFA) in January 2002, which was valid for 4 months. During this time, he took part in competitions around Australia.

In their Report on the accident the IHPA said that the pilot was seen to be working towards achieving a loop on his hang glider in recent months and had successfully looped the hang glider twice already in 2003.

1.6 Aircraft Information

1.6.1 Leading Particulars

Aircraft type:	Hang Glider
Manufacturer:	AirBorne WindSports Ltd.
Constructor's number:	CL13-84
Date of manufacture (assembly):	14 July 2001
Certificate of registration:	Not Applicable

1.16.2 General Information

The Climax is a topless high performance hang glider. A topless glider does not incorporate a kingpost attached to the top of the keel from which the wires are suspended to support the sail as used in the intermediate performance glider. The Climax has carbon cross spars with wire braced washout tubes. It also incorporates a VG (Variable Geometry) system. The VG system is designed to increase the nose angle of the glider in flight. The increase in nose angle causes more tension along the trailing edge, which results in less washout (better glide performance). The VG (operated by the rope on the control frame) is operated when the pilot wishes to glide at higher speed between thermals. Normally the VG is off (lower nose angle and more twist) when thermalling or during general manoeuvres. The VG rope actuates a pulley system, which increases the nose angle and thus reducing twist in the wing. The VG is normally off when thermaling and on (less twist) for gliding at higher speeds. Wire braced washout tubes are used in the Climax. The centre tube has a compensating system, which causes the tube to raise approximately 120 mm when the VG is released.

The sail is constructed of PX 20 leading edge. The main sail is made from "Matrix" Polyester laminate with a 13-degree warp oriented X-Ply Polyester yarn. A light weight Taffeta is laminated to the cloth for extra durability.

Although manufactured in Australia, the type Climax 13 was tested and certified in the USA. The glider specifications are stated in **Appendix A**. In common with all hang gliders, this glider is not certified for aerobatic manoeuvres.

The hang glider is designed and placarded for an advanced pilot as follows:

"*Flight operations should be limited to non-aerobatic manoeuvres where the pitch angle does not exceed 30 degrees up or down to the horizon and where the bank angle does not exceed 60 degrees"*

The Owner Manual, delivered with the glider, states:

"Never stall the glider with the nose pitched up too high. This is a dangerous manoeuvre and can result in a tail slide and severe tumble."

A warning is also given in the "Operating Limitations" section of the manual and this is reproduced in **Appendix B.** It includes the recommendation that the hang glider be flown with an airspeed indicator.

On this occasion the pilot had an alti-vario instrument (measuring climb and descent) and a Global Positioning System (GPS) which provided ground speed indication to the pilot. The pilot did not fly with an airspeed indicator.

1.7 Meteorological Information

1.7.1 The club indicated that conditions on the day of the accident were light, west-north-west winds (approximately 10 to 15mph) and thermic. Cloudbase was at about 4,500 feet.

1.7.2 Met Éireann, the Irish Meteorological Service, provided the following information after the accident:

General: The area was under the influence of an anticyclone associated with a high pressure area off the west coast of Spain, the general gradient flow was west to north-west.

Wind: 2000 FT 29018KT
SFC 240-260/10-12KT

Visibility: 10+KM

Weather: Nil

Cloud: FEW/SCT 2500FT SCT/BKN 4000FT

Temperature: 15 deg C

DewPoint: 17 deg C

Pressure: 1018 hPa

A straight linear interpolation would suggest that the wind at 400 ft was about 25012KT. An analysis of the tephigram for Valentia at 1200 UTC, which should be representative for the area in question, indicates intense absolute instability in the surface layer, absolute instability to about 900 millibars, conditional instability to 820 millibars, capped with a shallow inversion at this level. The temperature at 400ft would have been 1° C below that at the surface.

1.8 Aids to Navigation

Not Applicable

1.9 Communications

Not Applicable

1.10 Airfield Information

The goal field was located about 500 metres from the Pollshone shoreline in an area known as Glen Richards. The target was a red flag placed at random in the field. The owners of the field told the Investigation that they were not aware that their field was to be used as a landing area.

1.11 Recorders

A witness in the goal field recorded this accident on his DV camera. This recording has been invaluable to the Investigation.

1.12 Wreckage and Impact Information

Two experienced hang glider pilots examined the glider on behalf of the IHPA and found no evidence of equipment failure. The examiners believe that the forward break in the keel occurred in the air and de-tensioned the sail thus preventing any possibility of recovery. They said that the rearmost break probably occurred on impact with the ground.

1.13 Medical and pathological Information

There was no evidence that the pilot suffered from any pre-existing physical or mental condition that would have contributed to this accident**.** Death was due to multiple organ failure secondary to hepatic (liver) trauma.

1.14 Fire

There was no fire.

1.15 Survival Aspects

Two unsuccessful attempts were made to deploy the emergency reserve parachute without letting go of the deployment handle. On the third attempt, the reserve was successfully thrown clear, the inner bag immediately separated and the canopy started to fill. The pilot was then too low and he impacted the ground before the emergency reserve canopy was fully inflated. Immediate First Aid was rendered at the site and a doctor attended the pilot within ten minutes. He was moved by ambulance to Wexford County Hospital and arrived there at 14.27 hrs. The pilot was transferred to St.Vincent's Hospital, Dublin on 26 May and died on 3 June 2003.

Although the emergency reserve parachute was about 20 years old and had not been re-packed recently, the parachute was in good condition and it did start to open when properly deployed.

1.16 Tests and Research

The hang glider was brought to the AAIU facility at Gormanston where it was examined by a metallurgical consultant. His report includes the following:

One of the uprights of the "A Frame" had fractured about mid way along its length. In addition, there was tearing/splitting of one end of the component. The keel tube had fractured at two locations and each of the fractures was associated with significant deformation. Examination of the fractured surfaces revealed features indicative of single event overload in all cases. There was no indication of any material or manufacturing defect, or any pre-existing defect (such as fatigue cracking), associated with any of the fractures.

1.17 Organizational and Management Information

The pilot was a founder member of the Mount Leinster Hang Gliding Club. The club was founded as a non-profit organisation dedicated to the training of novice pilots. The club is affiliated to the Irish Hang Gliding and Paragliding Association (IHPA), which in turn is affiliated to the Irish Aviation Council (IAC). It is through the IAC that the IHPA is linked to the Commission International Vol Libre (CIVL) and its main body the Federation Aeronautique Internationale (FAI).

Until a few years ago the standards were arbitrarily awarded based on airtime and general flying competence as dictated by the few instructors then available.

The Constitution of the IHPA states that the Association will "*issue pilot ratings to members under the terms of the SafePro systems set by FAI/CIVL."* Incremental awards are made as the student progresses in flying ability from elementary pilot to advanced pilot. Last year the IHPA implemented a system whereby existing ratings were recognised but all new ratings were only available through the schools system. They implemented a structured syllabus and logbook system with the school instructors rating the student pilots.

The IHPA is particularly involved in promoting high safety standards and also advises students to enrol in nationally recognised first aid courses. Members are encouraged to report all accidents and incidents and these are logged on the IHPA website so that guidance can be offered towards the prevention of a reoccurrence by other pilots. The Committee consists of a chairman, secretary, treasurer, training officer and two competition officers. All are elected annually.

The IHPA commenced their own "Tribunal of Inquiry" into this accident on18 August 2003 and published their Report on 4 September 2003.

1.18 Additional Information

1.18.1 Regulations

In the U.S., hang glider flights are conducted under Federal Aviation Regulation FAR Part 103. FAR Part 103 prescribes rules governing the operation of Ultralight Vehicles in the United States. They are not required to meet the Airworthiness Certification standards specified for aircraft or to have Certificates of Airworthiness. The pilots are not required to have medical or pilot licences. Hang gliders are not required to be registered or to bear markings of any type. The US Hang Gliding Association (USHGA) has a set of Safety Recommendations for hang glider operations set out in USHGA Part 100. The USHGA is self-regulated with their own bylaws and have developed a complete program of proficiency ratings in their USHGA Part 104.

Likewise in Australia the Civil Aviation Safety Authority (CASA) have issued Civil Aviation Order Part 95, Section 95.8, detailing regulations for hang glider operations.

Transport Canada's Air Navigation Order, Series V, No.24 covers hang glider operation in Canada. Hang glider operations and equipment requirements will be found in Transport Canada CAR 603.77 and 605.114. The Hang Gliding and Paragliding Association of Canada (HPAC/ACVL) have produced a suggested Safety Officers Guide for the guidance of club safety officers.

In the UK, the CAA is responsible, under the terms of the Civil Aviation Act and the Air Navigation Order (ANO), for generally regulating the safety of all aviation activities. Overall responsibility for the safe regulation of the flying activity remains with the CAA. However the CAA recognises the important role played by governing bodies of sport such as the British Hang Gliding Association (BHGA). It allows the BHGA to issue a Type Certificate of Airworthiness (C of A) when a glider has passed extensive tests for structural integrity and demonstrated vice-free handling in the air. The Association issue their own *Safety Notices* to instructors and clubs. The UK Air Accident Investigation Branch (AAIB) normaly carries out an investigation only where there is an accident involving a fatality.

In Ireland the provisions of the IAA Nationality and Registration of Aircraft Order 2001 and the Airworthiness of Aircraft Order 1996 do not specifically refer to the operation of hang gliders. However, the inspection and operation of hang gliders is covered under U.S. FAR Part 103 (Ultralight Vehicles), which Part is applicable within the State. This Part covers the operation of the vehicle within Class A to Class G airspace, flight visibility and cloud clearance requirements.

1.18.2 Type Certification

The four main design, testing and certification standards are provided by:

- Deutscher Hangegleiter Verband (DHV) (Germany).
- Schweizerischer Hangegleiter Verband (SHV) and Federation Suisse de VolLibre (FSVL) (Swiss).
- British Hang Gliding and Paragliding Association (BHPA) (UK)
- The United States Hang Gliding Association (USHGA) delegates the whole certification process to a manufacturers association (U.S.H.G.M.A)

The IHPA do not certify gliders but rely on Certificates of Airworthiness from international bodies such as the BHPA and DHV.

2. ANALYSIS

The weather conditions in the area were favourable for the sport of hang gliding.

Although possible to complete a vertical loop, in common with all hang gliders, the Airborne Climax glider is not certified for such aerobatic manoeuvres.

A witness said that he had seen the pilot conduct this manoeuvre on a previous occasion. The Investigation believes that the pilot made known his intention to loop his glider on this occasion and from the sound track of the DV recording it was apparent that a number of club members were aware of this.

The Investigation is of the opinion that the IHPA should advocate the appointment of a Safety Officer who would oversee the implementation of a continuous flight safety programme. In this way, all pilots would be made aware of flight safety issues as they affect themselves and other club members with whom they fly. This should eventually lead to a flight safety culture among club members.

Other countries particularly Australia and Canada have Regulations or Orders issued by their respective government aviation authorities to control the safe operation of hang gliders. For instance, most of the Canadian Aviation Regulations (CARs) about airspace apply to hang gliders and paragliders.

The IHPA are well placed to regulate this sport in Ireland and to produce a Training/Operations Manual, to be approved by the IAA, containing the procedures and instructions necessary to ensure an acceptable level of pilot training and proficiency and the safe conduct of hang gliding operations within the State.

3. CONCLUSIONS

3.1 Findings

3.1.1 The hang glider had insufficient airspeed at the top of the loop to complete the manoeuvre. The resulting lack of centrifugal forces causing the pilot to fall vertically on to the underneath surface of the wing, from whence the pilot and glider tail slid and tumbled into a reverse loop.

3.1.2 After the tumble, control of the glider was not possible because the pilot was entangled in the keel, rearward of the trailing edge, and unable to reach the control frame.

3.1.3 The pilot was observed to make two unsuccessful attempts to throw the emergency reserve parachute without releasing the handle.

3.1.4 The third attempt was successful and the emergency reserve parachute started to deploy. At this point the keel broke, causing structural failure and rendering the hang glider uncontrollable.

3.1.5 The emergency reserve parachute had insufficient height to fully deploy and the pilot and hang glider hit the ground simultaneously.

3.2 Causes

3.2.1 The attempt by the pilot to carry out a manoeuvre for which neither the aircraft or the pilot were qualified to perform.

4. SAFETY RECOMMENDATIONS

4.1 The IHPA should issue a "Safety Notice" to all pilots stating that they should not attempt to perform manoeuvres outside the manufacturer's specified flying parameters**.** **(SR 20 of 2004)**

4.2 The IHPA should ensure that pilots attend regular emergency reserve parachute deployment clinics (at least annually) at which their reserve parachute systems are test-deployed and re-packed. This attendance should be recorded and the IHPA should ensure that pilots replace their reserve parachutes before they are ten years old. *(Recommended in the IHPA Report)* **(SR 21 of 2004)**

4.3 An officer of the IHPA Committee should carry the role of Flight Safety Officer in addition to his existing duties. **(SR 22 of 2004)**

4.4 The IHPA should advocate the nomination of a Flight Safety Officer in each school. **(SR 23 of 2004)**

4.5 The IHPA should secure the property owners permission prior to establishing a goal field. **(SR 24 of 2004)**

4.6 The IAA should nominate the IHPA to regulate the operation of hang gliding and paragliding within the State, to approve an IHPA *Training/Operations Manual* and to initiate a review of the operation of hang gliders with reference to the equipment and instrumentation to be carried on board. **(SR 25 of 2004)**

APPENDIX A

SAIL AREA	**13.1 m^2**
WING SPAN	**9.6 m**
ASPECT RATIO	**7.0**
NOSE ANGLE	**128-133°**
DOUBLE SURFACE	**92%**
BATTENS	**22+ 6**
GLIDER WEIGHT	**33 kg**
ASSEMBLY TIME	**10 min**
PACK UP LENGTH	**4.9 m**
SHORT PACK LENGTH	**3.8 m**
RECOMMENDED PILOT HOOK IN WEIGHT RANGE	**55-90 kg**
VNE (Recommended Maximum Speed)	**85 km/h**
VA (Recommended Maximum Rough Air Manoeuvring Speed)	**74 km/h**
VD (Recommended Steady State Speed)	**115 km/h**

Note: VD is the Maximum Steady State Velocity. This is the maximum speed the aircraft is capable of achieving.

APPENDIX B

Section 3 OPERATING LIMITATIONS

WARNING

Hang Gliding is a high-risk sport. The safe operation of this hang glider ultimately rests with you, the pilot. We believe that in order to fly safely you must maturely practice the sport of hang gliding. You should never fly this hang glider beyond the placard limits. The velocity never to exceed (VNE) for your glider is given in Section 2, as is the maximum speed for manoeuvres or flying in rough air (VA). The indicated airspeeds given are for calibrated instruments mounted on, or near, the base bar of the control frame. It is recommended that you fly your Climax with an airspeed indicator, as it is relatively easy in the VG on configuration to exceed the placard limitations. Flight operations should be limited to non-aerobatic manoeuvres where the pitch angle does not exceed 30 degrees up or down to the horizon and where the bank angle does not exceed 60 degrees. Aggressive stalls and spins should not be attempted. Operations outside the recommended flight envelope, such as aerobatic manoeuvres or erratic pilot technique may ultimately produce equipment failure. Your glider was designed for foot launched soaring and should not be flown by more than one person at a time. It should not be flown backwards or inverted. The setting up and breaking down of a hang glider, transportation on cars and flying itself will have an effect over time on its structural integrity. The glider will require maintenance as outlined in the maintenance section of this manual. Like any aircraft safety depends on a combination of careful maintenance and your ability to fly intelligently and conservatively. The owner and operator must understand that due to inherent risks involved in flying a hang glider, no warranty of any kind is made or implied against accidents, bodily injury and death, other than those that cannot by law be excluded. We hope that your new glider will provide you with many hours of safe flying.