Air Accident Investigation Unit Ireland

SYNOPTIC REPORT

ACCIDENT

TrikeBuggy Bullet V3.2 (unregistered)
Near Bellharbour, Co. Clare

21 June 2019

An Roinn Iompair
Turasóireachta agus Spóirt
Department of Transport,
Tourism and Sport

Foreword

This safety investigation is exclusively of a technical nature and the Final Report reflects the determination of the AAIU regarding the circumstances of this occurrence and its probable and contributory causes.

In accordance with the provisions of Annex 13[1] to the Convention on International Civil Aviation, Regulation (EU) No 996/2010[2] and Statutory Instrument No. 460 of 2009[3], safety investigations are in no case concerned with apportioning blame or liability. They are independent of, separate from and without prejudice to any judicial or administrative proceedings to apportion blame or liability. The sole objective of this safety investigation and Final Report is the prevention of accidents and incidents.

Accordingly, it is inappropriate that AAIU Reports should be used to assign fault or blame or determine liability, since neither the safety investigation nor the reporting process has been undertaken for that purpose.

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[1] **Annex 13**: International Civil Aviation Organization (ICAO), Annex 13, Aircraft Accident and Incident Investigation.
[2] **Regulation (EU) No 996/2010** of the European Parliament and of the Council of 20 October 2010 on the investigation and prevention of accidents and incidents in civil aviation.
[3] **Statutory Instrument (SI) No. 460 of 2009**: Air Navigation (Notification and Investigation of Accidents, Serious Incidents and Incidents) Regulations 2009.

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In accordance with Annex 13 to the Convention on International Civil Aviation, Regulation (EU) No 996/2010 and the provisions of SI No. 460 of 2009, the Chief Inspector of Air Accidents, on 21 June 2019, appointed John Owens as the Investigator-in-Charge, to carry out an Investigation into this Accident and prepare a Report.

Aircraft Type and Registration:	TrikeBuggy Bullet V3.2 Paramotor (unregistered), paired with a Dudek Nucleon 31 Canopy
No. and Type of Engines:	1 x Vittorazi Moster 185
Aircraft Serial Number:	Nil
Year of Manufacture:	2017
Date and Time (UTC)[4]:	21 June 2019 @ 20.00 hrs
Location:	Bellharbour, Co. Clare
Type of Operation:	General Aviation
Persons on Board:	Crew – 1 Passengers – Nil
Injuries:	Crew – 1 (Serious)
Nature of Damage:	Minor
Commander's Licence:	Club Pilot with Power, issued by the British Hang Gliding and Paragliding Association (BHPA)
Commander's Age:	52 years
Commander's Flying Experience:	20 hours, of which approximately three hours were on type
Notification Source:	An Garda Síochána
Information Source:	AAIU Field Investigation

[4] **UTC**: Co-ordinated Universal Time. All timings in this report are quoted in UTC; Local time is UTC +1 hour.

SYNOPSIS

During an attempted take-off from an agricultural field near Bellharbour, Co. Clare, directional control of the '*TrikeBuggy Bullet*' paramotor was lost, resulting in it colliding with a dry stone wall at the south-western perimeter of the field. The Pilot, who was the sole occupant, sustained fractures to both feet and to one arm. He was removed from the scene by the emergency services and brought to hospital. There was no fire.

NOTIFICATION

The AAIU was notified by An Garda Síochána at approximately 21.45 hrs, shortly after the accident occurred. Two Inspectors of Air Accidents deployed to the scene the following day and commenced an Investigation.

1. FACTUAL INFORMATION

1.1 History of the Flight

As evident in a video recorded by a witness, the Pilot of the TrikeBuggy Bullet (hereafter referred to as the trike) was attempting to take-off in a north-westerly direction from an agricultural field near Bellharbour, Co. Clare. The canopy initially rose directly above the trike, but continued to move towards the right of the centreline of the trike (looking forward). The trike accelerated and veered to the left towards a perimeter wall, located on the south-western side of the field before the left-hand rear wheel of the trike lifted off the ground and the rear of the trike appeared to be dragged to the right by the canopy. This caused the turn to the left to become more pronounced. The engine noise was uniform from the start of the take-off roll until this point. The left-hand wheel then lowered and the engine noise briefly decreased. The left-hand wheel lifted again, followed by the nose wheel lifting and then the right-hand wheel. All three wheels were off the ground for approximately one second and the trike turned further to the left. The engine noise also increased. When the trike returned to the ground, it was travelling towards the perimeter wall, and was almost perpendicular to it. The trike impacted the wall, nose wheel first. The engine noise decreased just before impact.

The video shows that as soon as the canopy attached to the trike started to inflate early in the take-off roll, the Pilot pulled down on the right-hand brake control[5] (his left hand was not visible at this stage). Both canopy brakes appear to have been applied throughout the accident sequence.

The Pilot, who was wearing a helmet, remained restrained within the trike during the impact sequence, but sustained fractures to both feet and to one arm. He was removed from the scene by the emergency services and brought to hospital. There was no fire. At least three persons were present in the field at the time of the accident, one of whom had to step quickly aside to remain clear of the trike as it veered towards the wall.

[5] Paraglider/paramotor canopies are fitted with hand-operated controls, termed '*brakes*'. Pulling a brake control handle deflects a portion of the trailing edge of the canopy downwards on the side that the brake is being pulled, which causes the canopy to turn in that direction.

The trike and the impact site are shown in **Photo No. 1**, which was taken on the day following the accident. The rear-mounted engine/propeller assembly had been separated from the trike to facilitate recovery of the Pilot, as had two of the trike's tubular steel side members. The canopy is visible on the other side of the wall.

Photo No. 1: Trike, engine/propeller and canopy at accident site (on the following day)

1.2 Pilot Interview and Subsequent Report

The Investigation interviewed the Pilot, who advised that he was '*unhappy about the wind*' and didn't feel comfortable attempting a take-off. He said that he felt under pressure to operate, because he had brought along all the equipment. He also said that during the take-off roll, the wind changed and he should have aborted the take-off, and that once the nose of the trike lifted, he lost directional control. He said he thought that by applying full power, he would get over the wall, but that the trike sank.

The Pilot subsequently reported that after he studied a video recorded by a witness, he thought that he may have miscalculated the centre of gravity of the trike during a '*hang test*[6]' that he carried out '*two or three days before the flight*'. However, according to the Pilot, the adjustments made during the '*hang test*' resulted in the front wheel being approximately six inches further off the ground than the rear wheels, i.e. a normal configuration. The Pilot thought that during the accident sequence, the rear wheels of the trike lifted first and that the trike then pivoted on the front wheel and turned towards the wall. He reported that the nose wheel then lifted and prevented a steering correction.

1.3 Injuries to Persons

The Pilot sustained fractures to both feet and to one arm.

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

[6] **Hang Test:** During this test, the trike is suspended from its canopy attachment (hang) points. The hang angle of the trike is set by adjusting the position of the hang-points. Usually, the correct angle is such that when the trike is suspended, the front wheel should be a little higher than the rear wheels.

1.4 Personnel Information

The Pilot was a member of the British Hang Gliding and Paragliding Association (BHPA) and held a Paragliding '*Club Pilot*' rating, with '*Power*', issued by the BHPA on 12 February 2019, which was valid until 31 January 2020. According to the BHPA, this permits a pilot to fly a trike unit in the United Kingdom (UK), provided its empty mass (including fuel) is less than 70 kg. An additional 5 kg is permitted if the trike is equipped with an emergency parachute. In the UK, single seat trikes within this weight limit are exempt from the requirements of the UK Air Navigation Order and therefore a medical certificate is not a requirement in the UK. The Pilot did not hold a medical certificate. The BHPA informed the Investigation that although there is no specific rating requirement to operate a trike in the UK, it now has a training programme, which it recommends pilots complete prior to commencing trike operations.

The Pilot informed the Investigation that he had flown three previous flights in the trike, with a total flight time of approximately three hours. He said that he had received approximately eight hours of training from an experienced trike pilot who was not a qualified instructor. He had also flown approximately 10 hours (total time) in a foot-launched paramotor, and a number of years ago had completed 10 hours under instruction in a fixed-wing ultralight aircraft.

1.5 Accident Site Location

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The accident occurred in a large agricultural field located approximately 1.5 kilometres (km) north-east of Bellharbour, Co. Clare in the west of Ireland and approximately 4 km from the coast. The field was approximately 240 metres (m) long and 80 m wide and was bounded on three sides by walls of dry stone (loose-stone) construction, approximately 1 m in height. The grass surface was firm and reasonably uniform. There was a slight downward slope in the direction of the attempted take-off. A single-colour windsock was fitted to a pole, approximately 2 m in height, at the wall adjacent to the accident site. A video recorded by a witness indicates that the windsock was barely inflated during the attempted take-off, and that any wind present was from the north-west. One of the requirements of S.I. No. 355 of 2008 (Aerodromes and Visual Ground Aids) is that prior to operating an aircraft at a site, permission of the landowner must be obtained. The Pilot was operating at the site with the permission of the land owner.

1.6 Aircraft Information

The TrikeBuggy Bullet V3.2 is a single-seat, steel, tricycle buggy, manufactured by TrikeBuggy Inc. in the United States. The nose wheel is steerable. On each side of the trike, a tubular frame member extends from wheel height at the nose of the trike, to shoulder height at each side of the seat. These frame members are not clearly visible in **Photo No. 1** as they were disconnected following the accident to facilitate the recovery of the Pilot. The subject unit was fitted with a single-cylinder Vittorazi Moster 185 two-stroke engine, which powered a two-blade, fixed pitch, carbon-fibre pusher-propeller, manufactured by Helix. A two-point restraint (lap-belt) was fitted.

A Dudek Nucleon EN[7] Class-C paraglider canopy, size 31 (flat sail area of 31 m^2) with a wing span of 10.37 m (when inflated), was attached to the trike. The specified weight range of the canopy was 120-145 kg. A reserve parachute was also installed. According to the trike Manufacturer, the trike weighs approximately 65 lbs (29.5 kg), without an engine/propeller or canopy attached and a reserve parachute weighs approximately 4 lbs (1.8 kg).

The Pilot estimated that his weight and that of the engine/propeller combined was 110 kg, and that there was 3.5 kg of fuel on board. He estimated that the canopy weighed 7 kg. This results in a total weight of 151.8 kg. However, the Pilot said he obtained a weight of 24 kg (including the reserve parachute) when he weighed the trike. This would result in a total weight of 144.5 kg. The trike and canopy arrangement had been flown by the Pilot and by its previous owner on other occasions.

1.7 Damage to Aircraft

The trike's nose wheel support assembly sustained bending damage.

1.8 Other Damage

A portion of a dry stone wall at the field's south-western perimeter was knocked down due to the impact (**Photo No. 2**). The trike had been travelling parallel to the wall from right to left in the field on the other side of the wall, before it turned left and was almost perpendicular to the wall at impact.

Photo No. 2: Damage to dry stone wall (photo taken the following day)

[7] **EN:** European Norm (EN) paraglider certification is a system whereby paraglider canopies are certified in one of four classes – A, B, C, or D, with 'A' being beginner-friendly and 'D' being intended for highly skilled pilots. At the time (2009), the EN system was used to certify the *Nucleon* wing. Since 2011, another certification process is used to certify paramotor wings.

1.9 Meteorological Information

Met Éireann, the Irish Meteorological service, provided the Investigation with the following meteorological information:

At the time of the occurrence, an anti-cyclone of 1022 hectopascals (hPa) centred near Brittany, France, extended a ridge of high pressure over Ireland. The surface wind was variable at five knots (kts); the wind at 2,000 feet (ft) was south-west at 15 kts; and the winds between the surface and 300 ft were varying between south-east and west in direction, at 5-10 kts. Weather conditions were mainly cloudy, with some clear breaks. The visibility was greater than 20 kilometres (km).

Met Éireann also stated:

> '*At this time of evening as the temperature was cooling with light surface winds and high pressure dominating, a nocturnal inversion was developing near the surface. This would have produced some local eddies and turbulent conditions*'.

1.10 Legislative Information

1.10.1 European Regulation

Annex I of Regulation (EU) 2018/1139 (also known as the '*Basic Regulation*', which supersedes Regulation (EC) 216/2008) on the common rules in the field of civil aviation whose purpose is to '*establish and maintain a high uniform level of civil aviation safety in the Union*' lists the categories of aircraft that are exempt from the Regulation. These categories include powered parachutes having no more than two seats and a maximum take-off mass (MTOM) of no more than 300 kg (when fitted with a single-seat), and any other manned aircraft which has a maximum empty mass, including fuel, of no more than 70 kg.

1.10.2 National Legislation and Guidance Material

1.10.2.1 Introduction

The Irish Aviation Authority (IAA) is responsible for the safety regulation of Irish civil aviation. Revision 01 (dated 14 August 2019) of the IAA's Airworthiness Advisory Memorandum AAM No. 6 '*Flight Permits and Maintenance of Annex I Aircraft (Homebuilt, Classic, Vintage and some Microlights)*' was valid at the time of the accident. It stated that Annex I aircraft [operated in Ireland] are '*subject to Irish national legislation',* rather than EU Regulation.

1.10.2.2 Aircraft Registration

The IAA's Aeronautical Notice, G.13 (Issue 2, dated 20 July 2016), regarding '*Powered Paragliders*' states that:

> '*The Irish Aviation Authority (Nationality and Registration of Aircraft) order, 2015 (SI No. 107 of 2015) requires that all manned aircraft operating within the state shall be properly registered either in this State or in an ICAO contracting state with the exception of the following:*

- *Kites;*
- *Captive balloons not used for carrying passenger;*
- *Piloted balloons used exclusively for meteorological purposes;*
- *Unmanned free balloons without a payload;*
- *Gliders with a maximum empty mass of 80 kilogrammes or less;'*

The Notice also states that:

> '*Where an aircraft comprises a paraglider, parawing, parachute, foil, canopy or other lifting device, and is operated under power, it is not considered a glider and the requirements of the Order* [SI No. 107 of 2015] *apply*'.

And that:

> '*The assigned Nationality and Registration mark shall be affixed to the paraglider, parawing, parachute, foil, canopy or other lifting device* […]'.

In this particular case, neither the trike nor the canopy was registered. The Pilot advised that, at the time, he was awaiting a new canopy and planned to register the new canopy.

1.10.2.3 Airworthiness Certification

Airworthiness Advisory Memorandum AAM No. 6, referred to in **Section 1.10.2.1**, states that '*An Annex I aircraft may not fly without a Certificate of Airworthiness or a Flight Permit*[8]'. 8

'*FLIGHT PERMIT FOR SINGLE SEAT AIRCRAFT*' is the subject of the IAA's Aeronautical Notice A.112 (Issue 04, 6 September 2019). This Notice serves as a Flight Permit for certain aircraft, subject to the criteria specified in the Notice, including the following:

a) the aircraft is registered in the State and,

b) the aircraft is designed to carry no more than one person and,

c) the aircraft has a maximum take-off mass (MTOM) of;

(i) no more than 300 kg for an aeroplane, powered paraglider, parawing, parachute, foil, or canopy; or […].

The Permit is subject to the following conditions:

a) The Registered Owner(s) is responsible for the aircraft's proper maintenance.

b) Prior to each flight, the pilot shall ensure that the aircraft is fit for flight. […].

Because the trike was not registered in Ireland, the provisions of A.112 did not apply.

[8] **Flight Permit**: A Permit which allows an aircraft without a Certificate of Airworthiness to fly within the State. A Flight Permit may only be issued upon the receipt of a recommendation signed by an appropriately approved maintenance organisation, or other approved organisation.

Airworthiness Advisory Memorandum AAM No. 6 has been revised since the accident. Revision 02, dated 22 June 2020, now includes a separate section on '*powered parachutes*' and states that '*Powered parachutes are required to be registered and hold a flight permit. For single seat aircraft, this may be the flight permit issued on IAA Aeronautical Notice A112. Two-seater powered parachutes require a flight permit issued by the Irish Aviation Authority*'.

1.10.2.4 Pilot Licensing

S.I. No. 333 of 2000 '*Irish Aviation Authority (Personnel Licensing) Order, 2000*', Article 5 (1) (Flight Crew Members to be Licensed) states:

> *'Subject to the provisions of this Order, a person shall not act as a flight crew member of an aircraft registered in the State unless that person is the holder of an appropriate licence issued or validated by the Authority* […]'.

The IAA's Aeronautical Notice, P.21 (Issue 3, 7 April 2017), titled '*ACCEPTANCE OF FLIGHT CREW LICENCES*' states in Section 3:

> '*The holder of an appropriate pilot licence or aviation qualification*[9] *issued by another ICAO signatory state or its national aviation authority or qualified entity, which permits or is accepted as being appropriate to enable the holder to act as pilot-in-command within that state of an aircraft described in Annex II*[10] *of EU Regulation No 216/2008 (as amended), shall be exempt within the territorial limits of the State from the requirements of Article 5 of the Order while acting as a member of the flight crew of an aircraft being operated as a private aircraft*'.

Section 4 states:

> *'This Direction shall apply only provided that the appropriate pilot licence or aviation qualification holder has:-*
>
> *a) given prior notification to the Authority by submitting the appropriate details in the manner published by the Authority on its website;*
>
> *b)* […];.
>
> *c) the valid medical certificate required by the state of issue, but in any case where no such certificate is required or where the certificate required is not an ICAO Class 2 or an EU Part-MED LAPL medical certificate, a minimum of an ICAO Class 2 medical certificate or an EU Part-MED* [Commission Regulation (EU) 1178/2011] *LAPL*[11] *medical certificate;*

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[9] **Aviation Qualification:** According to Aeronautical Notice P. 21, this means a qualification, other than a pilot licence, which certifies or attests that a person has completed a course of flight and theoretical knowledge training according to a syllabus approved or accepted directly or indirectly by another ICAO signatory state according to national rules, and which purports that the holder thereof is deemed to be adequately trained to act as pilot of the relevant subject aircraft.

[10] Annex II of Regulation (EC) 216/2008 has been superseded by Annex I of Regulation (EU) 2018/1139.

[11] **LAPL:** Light Aircraft Pilot's Licence.

d) a minimum flight time experience as follows:-

i. […]

*ii. for weight-shift flex-wing or **powered parachute aircraft** and for helicopters or gyroplanes, not less than 45 hours of flight time, to include at least 10 hours of pilot-in-command time* [emphasis added]*,*

iii. for powered paragliders or powered hang-gliders, not less than 20 hours of flight time, to include at least 10 hours of pilot-in-command time,

iv. […];

e) an appropriate Flight Radiotelephony Operator (Restricted) qualification or a recognised equivalent if an aircraft radio station is required to be operated in controlled airspace, and

f) a minimum of an ICAO Level 4 (Operational level) English Language Proficiency (ELP) licence endorsement or equivalent certification.

The IAA did not receive a notification from the Pilot.

1.10.2.5 Guidance Material

Operations Advisory Memorandum, OAM 11, was published by the IAA on 3 October 2017 in relation to '*Hang-Gliding and Paragliding in Ireland*'. Its stated purpose is to '*promulgate general information to persons intending to fly a "hang-glider" or a "paraglider" in Irish Airspace*'. It contains a summary of the legislative requirements applicable within Ireland regarding the operation of hang-gliders and paragliders (unpowered). It is not applicable to the operation of powered craft, such as the subject trike. In order to assist in raising awareness of the requirements, the Investigation's Draft Report included a proposed Safety Recommendation to the IAA that it should develop a suitable publication which outlines the legislative requirements applicable to the operation of paramotors (powered paragliders) and paramotor trikes within Ireland.

In response, the IAA published a new Operations Advisory Memorandum – OAM 15, Revision 01, dated 9 July 2020, on '*Powered Paragliding (Paramotoring) in Ireland*'. This contains a summary of the applicable legislative requirements, including those relating to registration, flight permits, pilot licensing and the rules of the air. Links to other applicable documents, including Aeronautical Notice P.21, are also provided. In addition, the General Aviation '*Aircraft Categories*' section of the IAA website has been revised to include a new section on '*Powered Paragliders/Paramotors/Parachutes*', which also contains (or provides links to) the applicable legislative requirements.

1.11 Operating Information

The '*Powered Parachute Flying Handbook*' (2007) published by the Federal Aviation Administration (FAA) of the United States (US), Chapter 7 ('*takeoffs and departure climbs*') states the following:

As the wing starts to rise off the ground and climb, it is acting like a parachute with lots of drag; the cart [trike] *does not move forward much. As soon as the wing passes through the 50^{o} angle to the ground, the drag dramatically decreases as the parachute becomes a wing and the cart will begin to pick up forward speed very rapidly. You must reduce the engine thrust enough at this point to prevent the powered parachute from becoming airborne prematurely.* […].

As the wing is coming up in [the] *back of the cart, one side of the wing may inflate and rise faster than the other side. That higher side should be given a little bit of steering control to allow the other side of the wing to catch up. If you don't make the correction early, the wing will want to fly over to the slower-inflating side. This may create wing oscillations, especially if combined with too slow a takeoff speed.* […].

Some light oscillation is okay, and will merely lift one side of the powered parachute into the air before the other. On the other hand large oscillations will actually change the lift from a straight upward vector to an upward and side-pulling force.

Another publication, '*The Complete Paramotor Pilot's Book of Knowledge*' (Smith, 2020) notes in the section on '*Launching with wheels*' that if during the take-off roll the wing is too far off the wind-line '*you may start to oscillate or lean which can roll the cart* [trike] *over. You will need to abort, as launching like this can end up with you going sideways, and can send you back into the ground hard*'.

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1.12 Tests and Research

In order to more clearly understand the accident, the Investigation sought assistance in analysing the video of the accident from a UK-based subject matter expert with over 20 years' experience investigating paragliding and paramotoring occurrences.

2. ANALYSIS

2.1 The Accident

The Pilot lost directional control of the trike during an attempted take-off, which was performed down a slight incline. The wind sock located adjacent to accident site was barely inflated, but indicated that whatever wind was present was blowing towards the trike as it attempted to take-off, i.e. the trike was operating into wind (in accordance with normal aviation practice). Weather information provided to the Investigation by Met Éireann following the accident, noted that the meteorological situation at the time was conducive to the production of local eddies and turbulent conditions. The Pilot said he was unhappy with the wind conditions, but felt under pressure to take-off because he had brought along all the equipment. He said that the wind changed during the take-off roll. The windsock, as recorded in the video, did not indicate a change of wind. However, the windsock was fitted to a pole that was approximately 2 m in height and therefore may not have accurately reflected the wind conditions at canopy height.

The video recorded by a witness shows the canopy inflating at the start of the take-off roll, but then it moved to the right of the trike's centreline (looking forward). If a trike is not kept directly below its inflated canopy during a take-off roll, the lift vector can change from a straight upward direction to an upward and side-pulling force. The video indicates that this may have occurred in this instance, when, following inflation, the canopy moved towards the right of the centreline of the trike (looking forward). This may have caused the Pilot to instinctively steer the nose wheel to the left to counteract any force pulling the trike to the right. In addition, as indicated by the uniform engine noise, once the canopy rose above the trike, the engine power does not appear to have been reduced, as recommended in the FAA's '*Powered Parachute Flying Handbook*'. This may have made the trike susceptible to becoming airborne early.

The trike veered to the left, before its left-hand wheel lifted and the rear of the trike appeared to be dragged to the right by the canopy, causing the turn to the left to become more pronounced. The left-hand wheel then lowered. The prudent course of action at this stage would have been to reduce the engine power to idle and abort the take-off, and the video indicates that the Pilot did reduce engine power at this point. However, the left-hand wheel then lifted again, followed by the nose wheel and right hand wheel. The engine noise also increased at this stage. Once the nose wheel lifted, it was no longer capable of providing directional control. The Pilot reported that he thought if he increased the engine power he would get over the wall, but that the trike '*sank*'. At this stage, the trike was heading directly towards the wall and all three wheels were back on the ground. The video indicates that the engine noise reduced just before impact.

The video shows the canopy's right-hand brake being pulled just as the canopy inflated early in the take-off roll. The Pilot's left hand is obscured from view at this stage, but it appears that both brakes were pulled at the same time, because the canopy initially rose directly above the trike before it moved to the right of the trike's centreline. Both canopy brakes appear to have been applied throughout the accident sequence. Canopy brakes are used to control the canopy once airborne and are normally only sparingly used during a take-off roll. In this case, their apparent use throughout the attempted take-off may have adversely affected the performance of the canopy.

It should be noted that the overall weight of the trike may have been in excess of the upper weight limit of the canopy, if the weight of the trike as provided by the Manufacturer is used in the calculation. This may also have adversely affected its operation. However, the trike and canopy arrangement had been flown by the Pilot and by its previous owner on other occasions.

The Investigation considered the possibility that the canopy hang-points on the trike had been incorrectly adjusted, as suggested by the Pilot. However, based on the video evidence, the loss of control appears to have been initiated by a non-vertical lift vector as a result of the trike not being directly below the canopy early in the take-off roll. This ultimately caused the left-hand rear wheel to lift from the ground and the rear of the trike to be dragged to the right, causing it to veer to the left.

The Investigation notes that although the Pilot held a BHPA Club Pilot with Power rating, he had not completed the BHPA's recommended training prior to operating a trike, although the Pilot did report that he had received some training, albeit from an unqualified instructor.

2.2 Survivability

The trike impacted a wall which was of dry stone construction, causing a portion of it to be knocked down. This would have absorbed some of the trike's energy. Notwithstanding that the only restraint harness fitted to the trike was of a two-point design (lap-belt), the Pilot remained restrained within the trike during the impact sequence. The frame of the trike, members of which extended to shoulder height at either side of the trike's seat, would have assisted in restraining the Pilot. He was also wearing a helmet. These factors, combined with the nature of the wall's dry stone construction, likely lessened the severity of the Pilot's injuries.

2.3 Operational and Legislative Aspects

2.3.1 Operational

The Pilot had very limited experience operating the trike, having only flown it on three previous occasions, and had not received training from a qualified instructor. He had previously only flown 10 hours in a foot-launched paramotor. In addition, the canopy attached to the trike was certified as a Class-C canopy, the handling characteristics of which would be more suitable for an experienced pilot.

2.3.2 Legislative Requirements and Guidance Material

Neither the trike nor its canopy was registered in Ireland or elsewhere. The requirements of S.I. No. 107 of 2015 (*Nationality and Registration of Aircraft*) apply to the trike and therefore the trike/canopy should have been registered.

The IAA's Aeronautical Notice A.112 (*FLIGHT PERMIT FOR SINGLE SEAT AIRCRAFT*) serves as a Flight Permit for certain aircraft, subject to the criteria as specified in the Notice, one of which requires the aircraft to be registered in Ireland. The provisions of A.112 did not apply in this case because the trike was not registered in Ireland; therefore, no Flight Permit was in effect.

The IAA's Aeronautical Notice P.21 relates to the acceptance of Flight Crew Licences. It outlines that the holder of an aviation qualification issued by another state or its national aviation authority or qualified entity, which enables the holder to act as pilot-in-command within that state of an aircraft described in Annex II of EU Regulation No 216/2008 (now Annex I of Regulation (EU) 2018/1139), shall be exempt from Article 5 of S.I. No. 333 of 2000, which requires that a pilot shall be the holder of an appropriate licence issued or validated by the IAA. Aeronautical Notice P.21 states that in order to avail of this exemption, a pilot must give prior notification to the IAA by submitting the appropriate details in the manner published by the IAA. In addition, according to P.21, a pilot of a '*powered parachute aircraft*' must have not less than 45 hours of flight time, to include at least 10 hours of pilot-in-command time, and although a medical certificate is not required to operate a trike in the UK, P.21 requires a pilot to hold a minimum of an ICAO Class 2 medical certificate or an EU Part-MED LAPL medical certificate for operations within Ireland. The IAA did not receive a notification from the Pilot. However, the Pilot did not meet the training, flight experience or medical certificate requirements of P. 21 and therefore his BPHA certification would not likely have been accepted by the IAA for operation within the State had a notification been received.

OAM 11, published by the IAA and extant at the time of the accident, contains a summary of the requirements regarding the operation of hang-gliders and paragliders (unpowered). It is not applicable to the operation of powered craft, such as the subject trike and paramotors (powered paragliders). At the time of the accident, there was no similar publication relating to the legislative requirements applicable to the operation of paramotors and trikes within Ireland.

The IAA has since published a new Operations Advisory Memorandum on '*Powered Paragliding (Paramotoring) in Ireland*' (OAM 15, dated 6 Jul 2020), which contains a summary of the applicable legislative requirements and provides links to other applicable documents, including Aeronautical Notice P.21. Furthermore, the IAA website has been revised to include a new section on '*Powered Paragliders/Paramotors/Parachutes',* which also contains (or provides links to) the applicable legislative requirements. The Investigation considers that the measures taken by the IAA will assist in raising awareness of the applicable requirements and therefore, no Safety Recommendation is made in this regard.

3. CONCLUSIONS

3.1 Findings

1. The Pilot was operating at the site with the permission of the land owner.

2. The Pilot had very limited experience operating the trike, having only flown it on three previous occasions, and had not received training from a qualified instructor.

3. Weather information provided to the Investigation by Met Éireann following the accident, noted that the meteorological conditions at the time were conducive to local eddies and turbulence. However, the windsock at the site gave no indication of local eddies or currents at the time of the accident.

4. Directional control of the trike was lost while attempting to take-off.

5. The canopy's brakes appeared to have been used throughout the attempted take-off.

6. The loss of directional control appears to have been initiated by a non-vertical lift vector as a result of the trike not being directly below the canopy as it inflated during the early part of the take-off roll.

7. The Pilot remained restrained within the trike during the impact sequence. This, combined with the nature of the wall's loose-stone construction, likely lessened the severity of the Pilot's injuries.

8. Neither the trike nor its canopy was registered.

9. No Flight Permit was in effect for the trike.

10. The Pilot's BHPA '*Club Pilot*' rating, with '*Power*' was not valid in Ireland, as the requirements outlined in Aeronautical Notice P.21 were not fulfilled.

11. At the time of the accident, there was no single IAA publication which outlined all legislative requirements regarding the operation of paramotors and trikes within Ireland.

12. Since the accident, a new Operation Advisory Memorandum (OAM 15, dated 6 July 2020) has been published which contains a summary of the applicable legislative requirements regarding Powered Paragliding (Paramotoring) in Ireland and provides links to other applicable documents. The IAA website has also been revised to include a new section on '*Powered Paragliders/Paramotors/ Parachutes*', which also contains (or provides links to) the applicable legislative requirements.

3.2 Probable Cause

Loss of directional control during an attempted take-off.

3.3 Contributory Cause(s)

1. A non-vertical lift vector as a result of the trike not being directly below the canopy as it inflated during the early part of the take-off roll.

2. The Pilot's limited training and experience in operating a trike.

3. The use of the canopy's brakes throughout the attempted take-off.

4. SAFETY RECOMMENDATIONS

This Report does not sustain any Safety Recommendations.

- END -

In accordance with Annex 13 to the Convention on International Civil Aviation, Regulation (EU) No 996/2010, and Statutory Instrument No. 460 of 2009, Air Navigation (Notification and Investigation of Accidents, Serious Incidents and Incidents) Regulation, 2009, the sole purpose of this investigation is to prevent aviation accidents and serious incidents. It is not the purpose of any such investigation and the associated investigation report to apportion blame or liability.

A safety recommendation shall in no case create a presumption of blame or liability for an occurrence.

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