Air Accident Investigation Unit Ireland

FACTUAL REPORT

ACCIDENT

PESZKE S.C. GP-14-SE VELO, OM-M821

Gowran Grange Airfield, Co. Kildare

27 March 2019

An Roinn Iompair
Department of Transport

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 27 March 2019, appointed Kevin O'Ceallaigh as the Investigator-in-Charge, assisted by Clive Byrne, Inspector of Air Accidents, to carry out an Investigation into this accident and prepare a Report.

Aircraft Type and Registration:	**PESZKE S. C. GP-14-SE VELO, OM-M821**
Aircraft Serial Number:	**GP-14-SE-0001**
Year of Manufacture:	**2017**
Date and Time (UTC)[4]:	**27 March 2019 @ 13.08 hrs**
Location:	**Gowran Grange Airfield, Co. Kildare**
Type of Operation:	**General Aviation**
Persons on Board:	**Crew – 1 Passengers – Nil**
Injuries:	**Crew – Nil**
Nature of Damage:	**Substantial**
Commander's Certificate:	**Gold Certificate with Three Diamonds, issued by the Irish Gliding & Soaring Association (IGSA)**
Commander's Age:	**64 years**
Commander's Flying Experience:	**3,140 hours, of which 23 minutes were on type**
Notification Source:	**Pilot**
Information Source:	**AAIU Report Form submitted by the Pilot** **AAIU Field Investigation**

[4] **UTC**: Co-ordinated Universal Time. All times in this Report are quoted in UTC, which was the same as local time on the date of the accident.

SYNOPSIS

During an aerotow take-off from Gowran Grange Airfield, Co. Kildare, a Slovakian registered glider, hit trees at the airfield boundary and subsequently impacted into the ground in the adjoining field. The glider impacted through two sets of post and wire fencing. The glider was substantially damaged. The Pilot, who was the sole occupant of the glider, was uninjured in the accident.

NOTIFICATION

The AAIU was notified by the Pilot of the glider. Two Inspectors of Air Accidents attended the scene and commenced an Investigation.

1. FACTUAL INFORMATION

1.1 History of the Flight

The Pilot arrived at Gowran Grange Airfield, with a Slovakian registered glider (OM-M821) which had been transported in its own bespoke trailer. Prior to the flight, the glider must first be assembled which necessitates, amongst other things, installation and verification of the horizontal tailplane, which incorporates the elevator, and wings. The glider was assembled and checked prior to flight by the Pilot. Ground checks including flight control functional checks were completed with the assistance of another person on the ground.

When the Pilot was satisfied that the glider was ready for flight it was towed by car to the take-off point on Runway (RWY) 03 in preparation for a launch by aerotow. The Pilot reported that weather conditions were good, with light and variable winds and no significant cloud.

The towing aircraft, a Piper PA-18 150 Super Cub, and the glider, commenced the take-off roll at 13.08 hrs. The glider Pilot stated that the glider became airborne during the roll due to bumps on the runway but settled back down on the runway again. The Pilot said that the glider eventually became fully airborne, but that it was too late to clear the top of the hedge. The Pilot stated that the glider '*glanced off the hedge*' and that the towing cable released. The glider climbed momentarily and then '*dived into the ground, slid and went through two electric fences*' before coming to rest (**Photo No. 1**). The Pilot was uninjured.

Photo No. 1: Final position of OM-M821

1.2 Injuries to Persons

No injuries arising from the accident were reported to the Investigation.

1.3 Airfield Information

Gowran Grange Airfield (EIGN) is located one kilometre south-west of Punchestown Racecourse in County Kildare (**Figure No. 1**). The airfield is used exclusively by a local Gliding Club for both recreational and training flights in gliders. The main grass runway is orientated along a magnetic bearing of 030°/210° and is designated as RWY 03/21. RWY 03 is 475 metres (m) in length and has an uphill slope. The runway surface is uneven in areas along its length as illustrated in **Figure No. 2**.

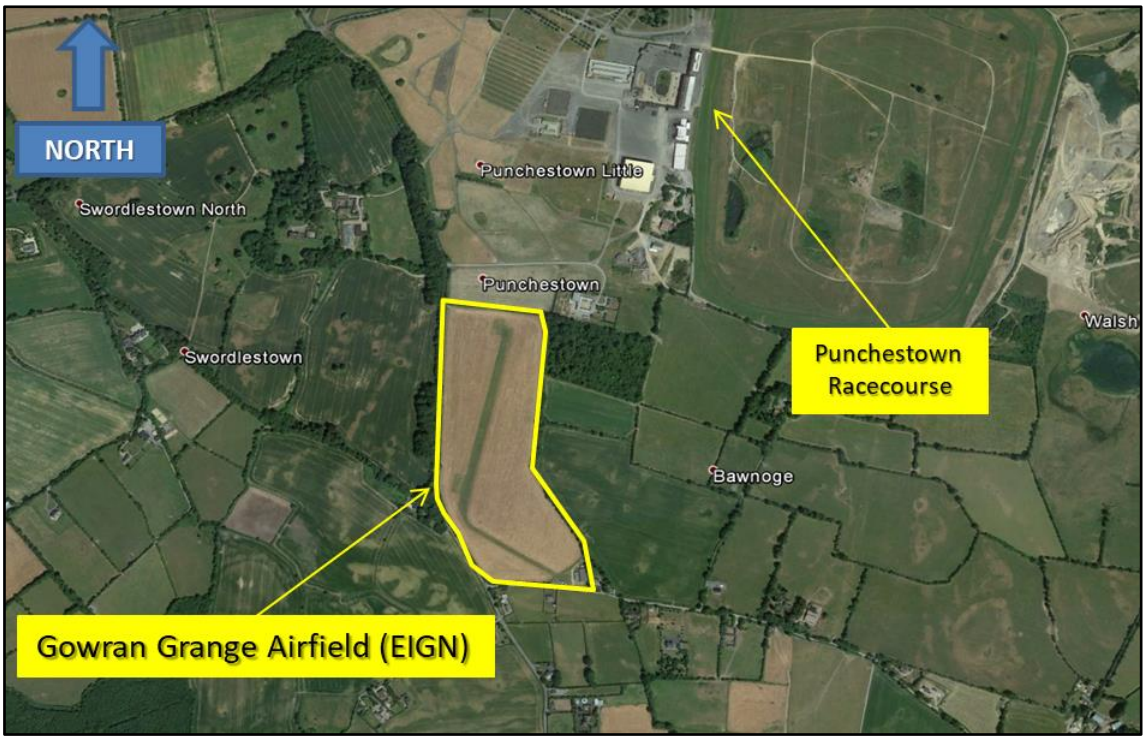

Figure No. 1: Aerial view of Gowran Grange Airfield (*Google*)

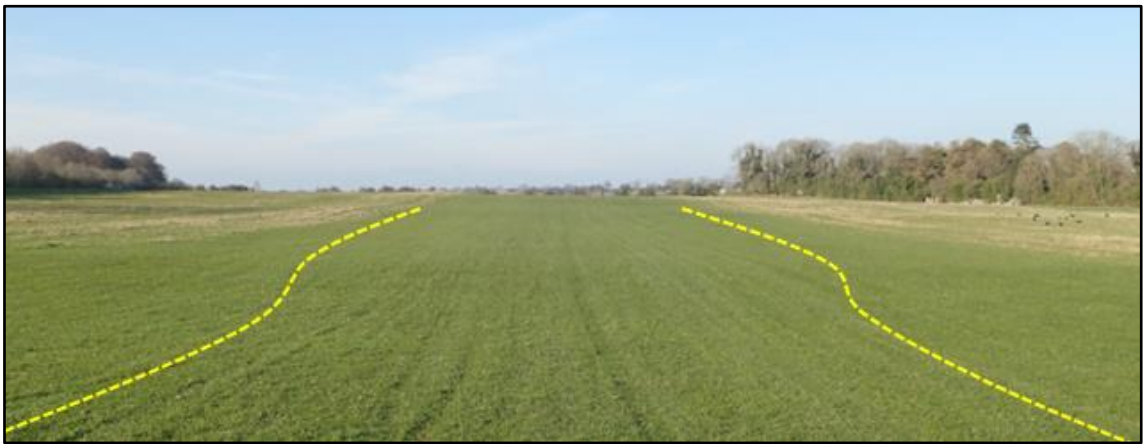

Figure No. 2: Runway surface looking along RWY 03

1.4 Glider Information

1.4.1 General

The subject glider, a GP-14-SE VELO motor glider, is primarily constructed from carbon composite material and was designed and produced in 2017 as a prototype model by the PESZKE S.C Company in Poland. The glider has an empty weight of 245 kilograms and a wing span of 13.5 m. It is fitted with a retractable electric self-launching propeller system to the rear of the cockpit and has a Ballistic Recovery System (BRS) incorporated into the fuselage. The undercarriage arrangement comprises of a single main wheel, located under the cockpit, a tail wheel at the rear of the glider and a wheel on the underside of each wing tip.

The wings and horizontal tailplane of the glider are detachable from the main fuselage and, together with the fuselage, are stored and transported in a bespoke trailer when not in use. Prior to flight, the glider must be reassembled and the horizontal tailplane, which incorporates the elevator, and wings must be correctly installed and checked before flight.

1.4.2 Glider Assembly Instructions

The glider was supplied to the Pilot by the Manufacturer with general documentation for operation. One such document was titled, '*Rigging*[5] *Instructions and Tips'*. The instructions contained a bulleted list of items to check during installation of the *'Wings'* and *'Horizontal Tailplane'.* Instructions referring to the assembly of the horizontal tailplane along with two related figures (FIG. 4 & FIG. 5) are presented in **Figure No. 3** below. For clarity, FIG. 5 -1 relates to item number 1 in the Glider Manufacturer's FIG 5 etc.

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HORIZONTAL TAILPLANE

1. *Make sure the stick is in neutral position*
2. *Slide the bearing on elevator lever (FIG. 5 -1) into hook (FIG. 4 -1) and tongue with bushings (FIG. 5 – 2) onto positioning pins (FIG. 4 -2)*
3. *Make sure the stabilizer is in proper position and control system is correctly connected*
4. *Secure the stabilizer with tightening the bolt from the top (FIG. 4 -3)*
5. *Test the proper function of elevator and other control systems*

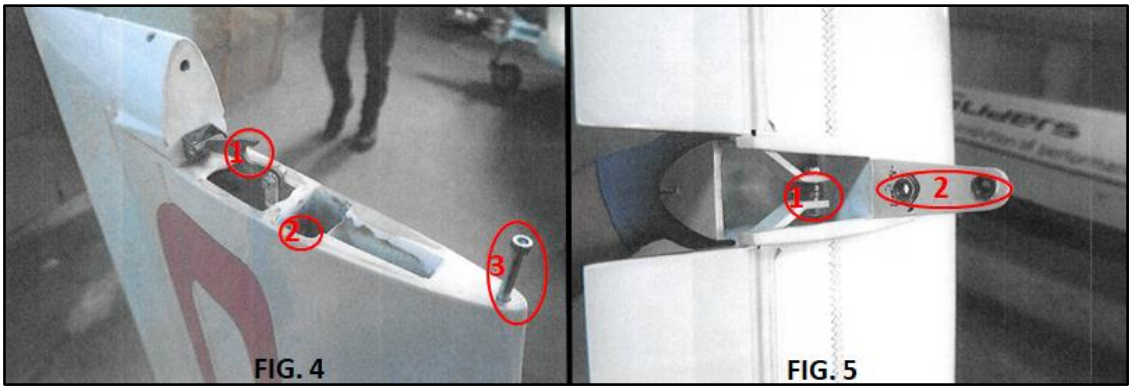

Figure No. 3: 'Rigging Instructions and Tips'
(Source: Adapted from Glider Manufacturer's Document)

[5] The Investigation notes the term '*Rigging*' is used, however, as no adjustment is involved, installation/assembly more accurately describes this process.

1.4.3 Elevator Control System

The Glider Manufacturer informed the Investigation that the elevator control system assembly on the glider is operated '… *via rigid carbon pull-push rods and levers. The carbon tubes are finished with duralumin*[6] *joints with steel swinging bearings and bolts'*. **Figure No. 4** identifies the five main connection points along the elevator control run system.

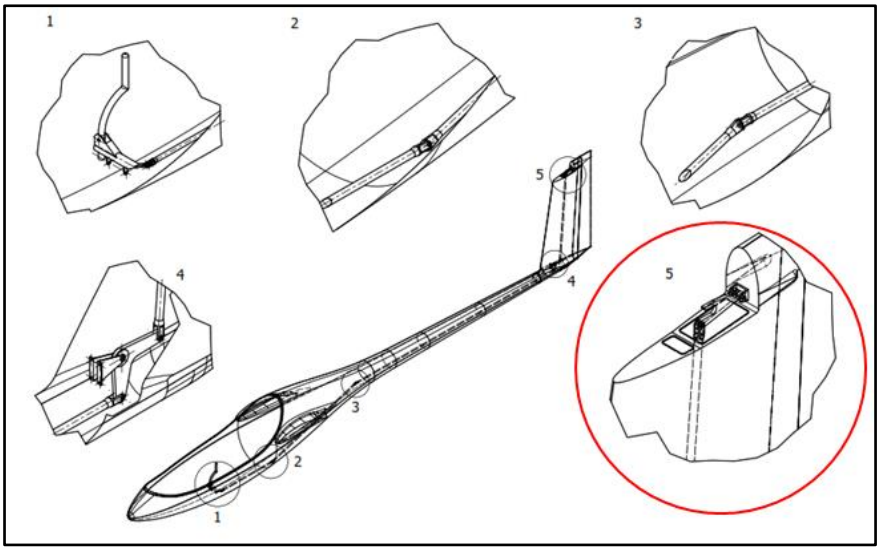

Figure No. 4: Elevator control system assembly
(Source: Adapted from Glider Manufacturer's Construction Drawings)

Item 5, which is circled in **Figure No. 4**, identifies the mating area for the installation of the glider's detachable horizontal tailplane. This area is shown in more detail in **Figure No. 5** where the correct and incorrect installation of the horizontal tailplane, which incorporates the elevator (identified in red), is shown.

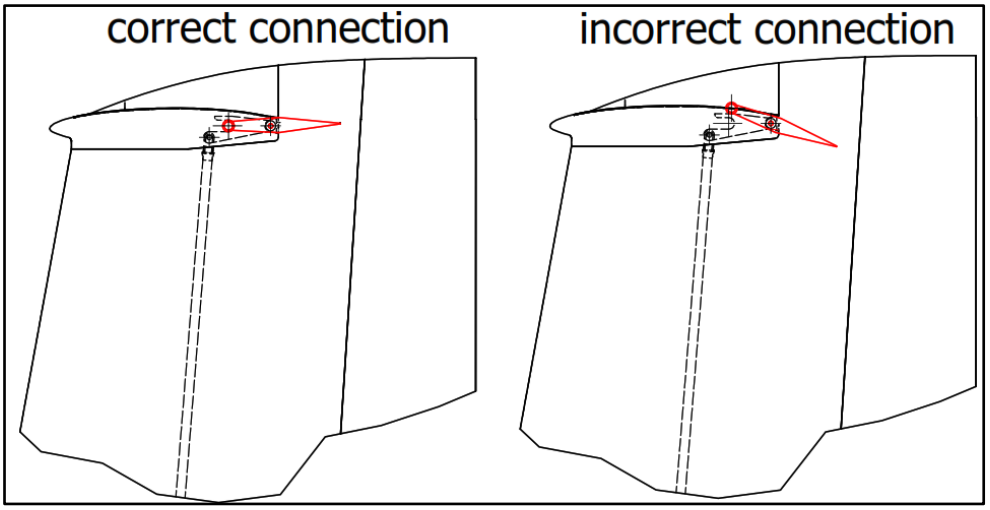

Figure No. 5: Elevator control system, horizontal tailplane installed
(Source: Adapted from Glider Manufacturer's Construction Drawings)

The Pilot stated that the glider was assembled and checked just prior to flight, and that a control check was completed.

[6] **Duralumin:** A lightweight aluminium alloy which has a higher tensile strength than aluminium.

1.4.4 Elevator Installation and Ground Checks

During discussions with the Glider Manufacturer, the Investigation established that when the elevator is incorrectly installed, as illustrated in the image on the right of in **Figure No. 5**, movement of the control stick in the cockpit would still provide movement to the elevator.

The Glider Manufacturer was asked the following question:

> *Can you advise* […] *if when the elevator is* ***incorrectly*** *rigged* [installed] *on this aircraft type* […]:
>
> *a) Is the elevator control run mechanically locked due to lack of available travel?*
>
> *Or*
>
> *b) Would movement of the control stick in the cockpit provide positive movement to the elevator during ground checks?*

The Glider Manufacturer responded as follows:

> *'The movement of the control stick in the cockpit would have ca. 80% travel of the system correctly rigged* [installed] *and natural forces on the stick due to the spring loaded elevator trim system. However the elevator itself would deflect only about 50% in the range from neutral position or close to neutral position to lower position'.*

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1.5 Damage to Glider

The cockpit area of the glider sustained a number of fractures as a result of the impact with the ground. A significant fracture to the cockpit structure was evident on the left side of the glider as shown in **Photo No. 2**. The fracture penetrated to the internal surface as shown in **Photo No. 3**.

Photo No. 2: Cockpit fracture (external) **Photo No. 3:** Cockpit fracture (internal)

As a result of the impact with the wooden fence posts and associated electric wires, both wings sustained significant impact and splitting damage, in particular to the leading edge area.

Transfer marks from the wooden posts were observed at a number of areas on the wings in addition to scuff markings from the electric wire fence.

Both wings, but most notably the right wing, were pushed rearward due to the impact with the fixed fence poles causing displacement damage at the wing root attachment point and flaperon area as shown in **Photo No. 4** and **Photo No. 5**. Impact marks on the canopy from the fence poles were also observed.

Photo No. 4: Leading edge damage

Photo No. 5: Flaperon area damage

During control surface continuity checks performed by the AAIU at the accident site, it was noted that there was no elevator control continuity present. The elevator on the glider is operated via forward and rearward movement of the glider's control stick. The control stick is directly linked to a carbon fibre torque tube located under the cockpit floor, as illustrated previously in **Figure No. 4**, which converts the linear motion of the control stick to rotational motion of the torque tube. This rotational motion of the torque tube is transmitted to the elevator via a control system which is comprised of a combination of carbon fibre and metallic linkages.

Further examination of the elevator control system, which involved the removal of some panels in the cockpit area to gain access, found that the control linkage located between the control stick and the elevator had failed at two points as shown in **Photo No. 6**.

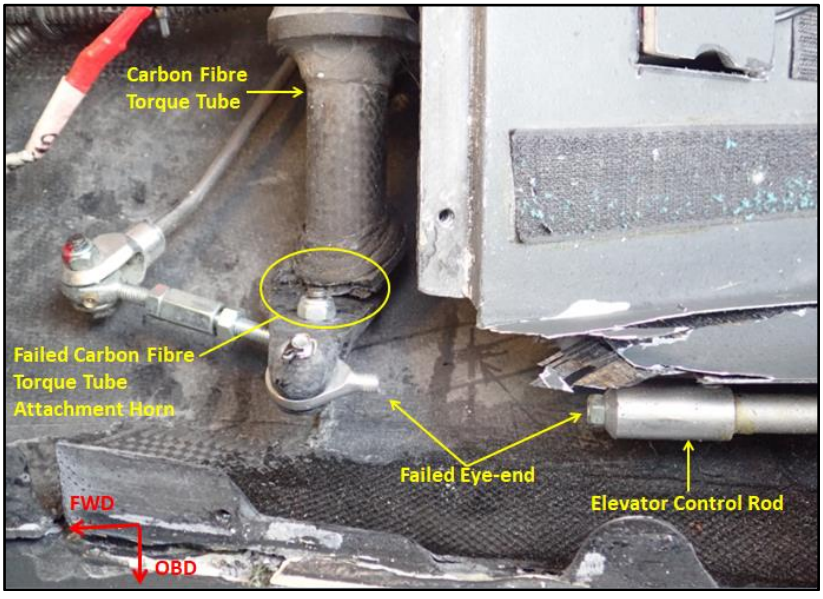

Photo No. 6: Failure of elevator control linkage

An elevator control rod (Refer to **Figure No.4**, Connection Points 1-2), which runs along the left side of the cockpit under some panelling, was found to be fractured at the carbon fibre torque tube attachment horn area. The point of failure was observed as the threaded portion of an eye-end, which connects the control rod to the carbon fibre attachment horn. In addition, the carbon fibre attachment horn itself was also found to have failed at its root area.

During examination of the glider at the accident site it was noted that the elevator was resting in a downward deflected position (**Photo No. 7**).

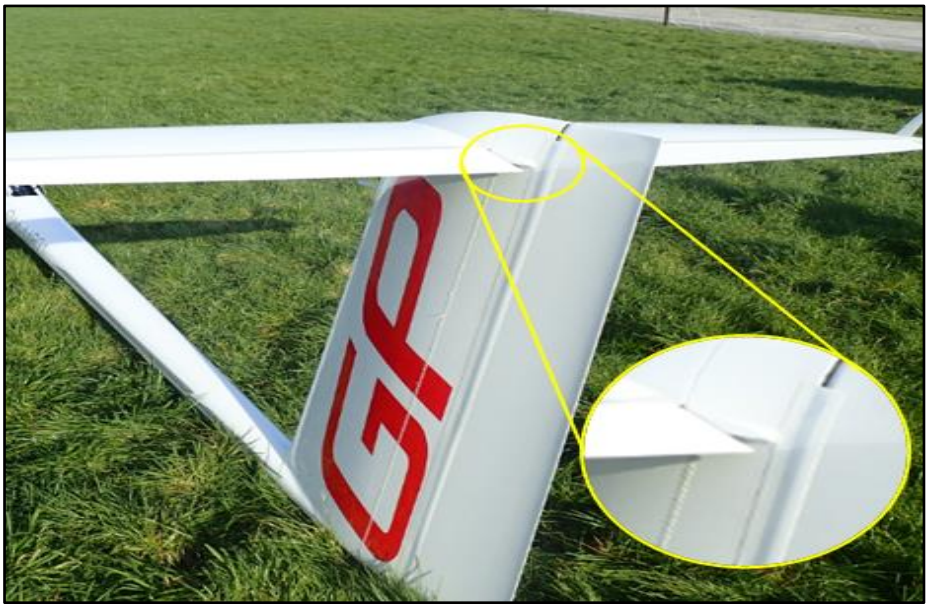

Photo No. 7: Elevator position at accident site

In discussions with the Glider Manufacturer, the Investigation established that when the horizontal tailplane is correctly installed as per the '*Rigging Instructions and Tips*' document, **Section 1.4.2,** (elevator lever, hook and tongue correctly positioned and secured), and the control linkage is fractured in the area shown in **Photo No. 6**, the natural resting position of the elevator would be in a slightly upwards deflected position and not the slightly downward position shown in **Photo No. 7**.

1.6 Other Damage

A double row of electric wire fencing and associated fence poles were displaced during the accident sequence. The grass surface was firm and as a result there was only a small amount of ground scarring noted.

1.7 Glider Pilot Information

Age:	64 years
Certificate:	IGSA Gold Certificate with Three Diamonds
Total All Types	3,140 hours (gliders)
Last 90 Days:	1 hours 48 minutes
Last 28 Days:	1 hour 48 minutes
Last 24 Hours:	0 hour 0 minutes
Total On Accident Type:	23 minutes

1.8 Sailplane (Glider) Licensing

According to the Irish Aviation Authority (IAA) website extant at the time of the accident, gliding in Ireland has been self-regulated since its inception. The introduction of EU Commission Regulation 1178/2011 (The Aircrew Regulation) in November 2011 included Sailplane licensing under EASA's remit.

The IAA had availed of a derogation from this Regulation, which was in place at the time of the accident. Accordingly, the IGSA continued to oversee all aspects of gliding (sailplane) operations conducted in Ireland at the time of the accident.

At the time of the accident the glider had a valid Certificate of Airworthiness and valid Certificate of Registration, both of which were issued by the Slovak Federation of Ultralights (SFUL) in accordance with the authorisation as issued by the Civil Aviation Authority of the Slovak Republic.

1.9 Meteorological Information

Met Éireann, the Irish Meteorological service, provided the Investigation with the following aftercast for the Gowran Grange Gliding Club, Co. Kildare, for 13.00 hrs on 27 March 2019:

Meteorological Situation:		A high pressure system of 1038 hectoPascals (hPa) was centred to the south-east of the country, giving a light west to north-west flow.
Wind:	**(At surface)**	West, 5 knots (kts).
	(At 2,000 ft (feet))	West 10-15 kts.
	(Surface to 3,000 ft)	There was a very slack pressure gradient, which would have resulted in little or no change in wind speed and direction between the surface and 300 ft.
Visibility:		35 km.
Weather:		Fair weather cloud and sunny spells.
Cloud:		Few (1-2/8th of sky) fair weather cumulus with bases 2,500 ft and scattered (3-4/8th of sky) stratocumulus cloud with bases 3,000 ft.
Surface Temp/Dew Pt:		11 °C, 5 °C.
Mean Sea Level Pressure:		1036 hPa.
Freezing level:		8,000 ft.

1.10 Flight Recorders

1.10.1 General

The glider was not required to have either a Cockpit Voice Recorder or a Flight Data Recorder installed. The Glider did have an LX-9000 cockpit navigation system, which included an integrated flight recorder. It recorded some limited parameters from the flight. The purpose of this flight recorder is to provide independent evidence of certain flight parameters to the *Fédération Aéronautique Internationale Gliding Commission* (FAI IGC)[7]. This data is then used in the conferral of competition placings, records, medals, diplomas and other awards achieved under the FAI IGC's rules.

As part of the digital security process, the data is recorded by the system into a proprietary file format *(.igc*), and can be saved to a Secure Data memory card or USB memory stick. The *FAI Sporting Code Section 7H – Flight Recorder Specification* states that;

> ***3.1.1 Flight recorder***
> *The recorder must be a device capable of producing a digitally signed IGC flight data file, from positional data obtained from internal GNSS* [Global Navigation Satellite Systems] *and pressure sensor modules. There are no specific requirements regarding the physical security of the instrument, other than to take all practicable measures to ensure that:*
>
> - *False data cannot be injected or recorded.*
> - *Internal data cannot be modified.*
> - *The security key cannot be read from the device*.
>
> […]
>
> ***3.1.3 IGC file creation***
> *The IGC file must be created when the end of the flight is detected or notified by the user, or when the instrument is powered off, and digitally signed using the G record mechanism. The file must be written to user-accessible storage so that it can be easily transferred to an external location.'*

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The Pilot provided the Investigation with a copy of the *.igc* file for the flight, and also the file for a previous flight for comparative purposes. The *.igc* file was then decoded at the AAIU recorders laboratory.

1.10.2 Recorded Data

The data (shown in **Figure No. 6**) indicated that the glider, which was being towed by a powered aircraft, commenced the take-off roll at 13.08:20 hrs. During the roll, the glider lifted off the grass, and maintained a height of between 5 ft and 23 ft above the runway as it accelerated.

[7] **FAI IGC:** The FAI IGC is an international organisation with the basic aim of promoting air sports and recreational flying activities worldwide, ratifying world and continental records and coordinating the organisation of international competitions. It is recognised by the International Olympic Committee (IOC). The FAI's activities include gliding, parachuting, microlight flying and ballooning.

The frequency of the height data recording (once per second) does not preclude the possibility that the glider touched down again momentarily on the runway between data points during the take-off roll. The data indicated that at 13.08:41 hrs the glider climbed to a maximum height of 39 ft above the ground, at a groundspeed of 65 kts. Neither the control surface deflection nor the status of the glider's towing mechanism was a recorded parameter.

At 13.08:43 hrs, the LX-9000 cockpit navigation system recorded a substantial deceleration coincident with the location of the treeline at the end of the runway, and within the subsequent four seconds, the glider's groundspeed reduced and a descent was recorded. At 13.08:47 hrs, the data indicated that the glider touched down in a field adjacent to the runway, and came to a stop at 13.08:50 hrs. A number of additional pertinent parameters from the flight are shown in **Appendix A**.

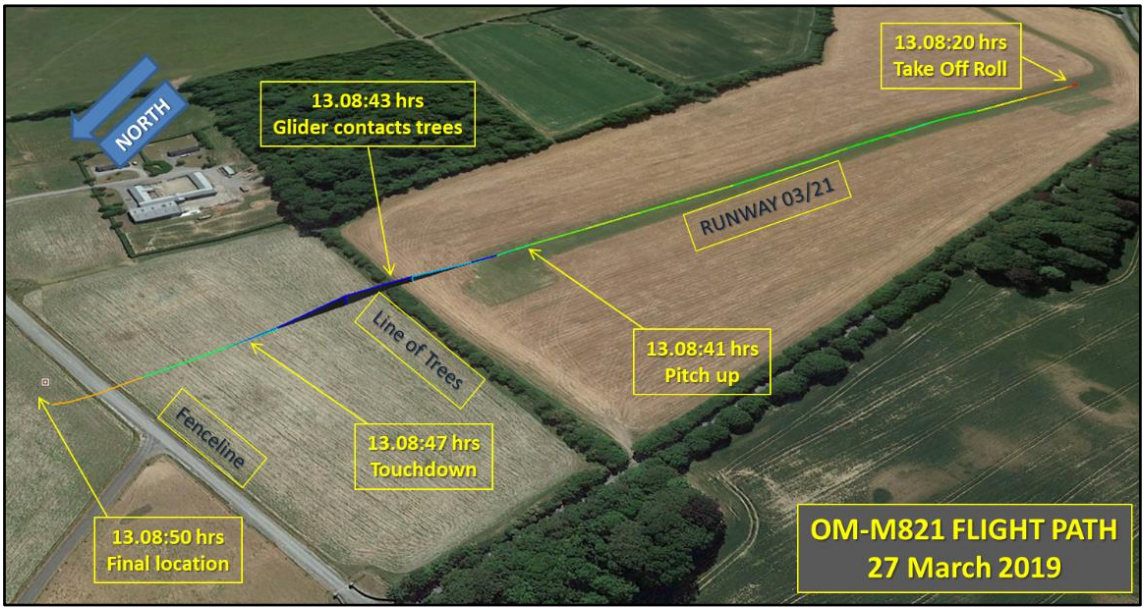


Figure No.6: OM-M821 Flightpath based on recorded data (Google)

1.11 Safety Action from Glider Manufacturer

The Investigation contacted the Glider Manufacturer after the accident in relation to the elevator hook mechanism. The manufacturer informed the Investigation that:

> '… *we have immediately* [following] *the incident redesigned the elevator hook to eliminate the risk of incorrect rigging* [installation] *and recalled and replaced it on all other gliders.'*

Figure No. 7 illustrates the design change showing redesign of the hook mechanism. The old design is shown on the left and the new redesigned mechanism is shown on the right. The Glider Manufacturer stated that this new design has *'completely eliminated the risk of incorrect rigging* [installation] *during elevator installation'*.

Figure No. 7: Old (left) and new (right) redesigned hook mechanism

The wings on the accident glider were arranged so that both may also be routinely removed and reinstalled prior to flight. For completeness, the Investigation asked the Glider Manufacturer if a similar design consideration to that of the elevator installation was employed with the installation of the wings.

The Glider Manufacturer responded as follows:

> *'… the system* [wings] *does not allow the assembler to execute the action incorrectly. It is only possible to install the main and rear pins when the wings and controls are in their correct positions.*

2.13 AAIU Comment

The Pilot was an experienced glider Pilot holding a Gold Certificate with Three Diamonds. However, he had limited experience with the subject glider.

The glider, which was transported to the airfield in a bespoke trailer, was assembled by the Pilot. Ground checks including flight control functional checks were completed with the assistance of another person on the ground.

The towing aircraft and glider commenced the take-off roll at 13.08:20 hrs. The Pilot said that during the take-off roll the glider momentarily became airborne, which was most likely due to the uneven surface on sections of RWY 03, after which the glider eventually became fully airborne. Data indicated that the glider climbed to a maximum height of 39 ft above the ground, at a groundspeed of 65 kts. Neither the control surface deflection nor the status of the glider's towing mechanism was a recorded parameter on the installed LX-9000 unit and it could not be determined if the climb was associated with control inputs by the glider Pilot, a force applied by the towing aircraft, or a combination of the two.

Approximately two seconds later, the LX-9000 cockpit navigation system on the glider recorded a substantial deceleration coincident with the location of a line of trees, most likely associated with an impact with the trees as reported by the Pilot. Within the subsequent four seconds, the glider's groundspeed reduced and a descent into the adjacent field was recorded. The glider came to a stop three seconds later following impact with wooden fence posts and electric wire fencing.

At the accident site, continuity checks completed on the glider's elevator control system by the AAIU revealed that the elevator did not move in response to movement of the cockpit control stick. Further examination identified that there was a double failure of the control linkage under the floor in the cockpit area of the glider. Detachment of either one of these points individually would result in complete loss of elevator control. This double failure corresponded with the main impact area of the glider with the ground.

Further examination of the elevator's position at the accident site found that the elevator was resting in a downward deflected position. The Glider Manufacturer confirmed that in the subject glider when the elevator is correctly installed, and the control linkage is separated at the area where the double failure in the elevator control run was located, the elevator would deflect slightly upwards. The downwards deflection of the elevator at the accident site indicates that the elevator was most likely incorrectly installed prior to flight.

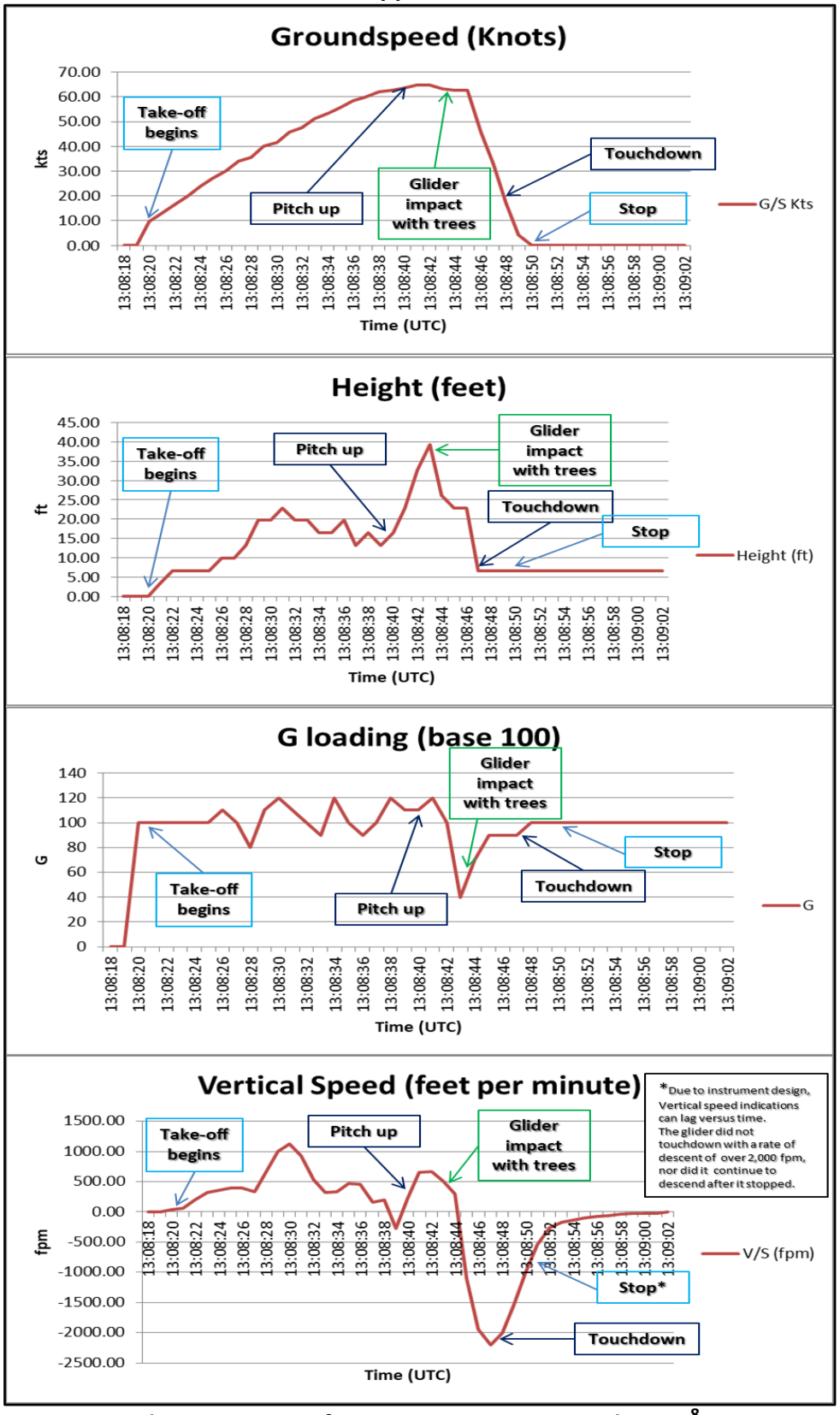
During physical installation of the horizontal tailplane, which incorporates the elevator, the configuration and design of the elevator hook mechanism was such that the elevator lever may be installed incorrectly without it being visually obvious to the installer. Bullet Point 3, from the *'Rigging Instructions and Tips'* document supplied with the glider, highlights this potential hazard. The Pilot confirmed that prior to the flight a flight control functional check was completed, with the assistance of an observer on the ground.

The Glider Manufacturer confirmed to the Investigation that even when the elevator was incorrectly installed, movement of the control stick in the cockpit during functional checks would translate to positive, although limited, movement of the elevator. The control stick would have had approximately 80% travel of a correctly installed system; however, the elevator would only deflect approximately 50% from close to the elevators neutral position to the lower deflection position. This would account for the ground checks giving the impression that the elevator had been installed correctly. When the elevator was incorrectly installed, upward deflection of the elevator would not have been possible therefore effective elevator control of the glider by the Pilot was not possible.

It is therefore probable that during the functional test of the elevator on the ground, where approximately 80% of expected control stick travel was achieved without any mechanical binding noted by the Pilot, combined with the elevator deflection noted by the observer, and with limited currency with the glider type, it was mistakenly considered by the Pilot that the glider had been assembled correctly and was therefore fit for flight.

The Glider Manufacturer provided the Investigation with details surrounding the redesign of the hook mechanism. This redesign was completed by the Glider Manufacturer in order to mitigate the possibility of future incorrect installation. In response to questions regarding the redesign in the elevator area, the Glider Manufacturer now considers that the redesign has eliminated the risk of incorrect installation on their aircraft. In addition, the Investigation was informed by the Glider Manufacturer that the original design was recalled and replaced on all their other gliders which were affected.

Appendix A



Recorder Parameters from OM-M821 - 27 March 2019[8]

- END -

[8] **G Loading (base 100):** This parameter is recorded in base 100, which means that 100 = 1 g.

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.

Produced by the Air Accident Investigation Unit

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