

ACCIDENT

Aircraft Type and Registration:	Rollason Druine D.31 Turbulent, G-ARGZ
No & Type of Engines:	1 Volkswagen 1600 piston engine
Year of Manufacture:	1961 (Serial no: PFA 562)
Date & Time (UTC):	16 October 2021 at 1245 hrs
Location:	Damyns Hall Aerodrome, Upminster, Essex
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - 1 (Serious) Passengers - N/A
Nature of Damage:	Aircraft destroyed
Commander's Licence:	Private Pilot's Licence ¹
Commander's Age:	44 years
Commander's Flying Experience:	7,496 hours (of which 10 were on type) ² Last 90 days - 154 hours Last 28 days - 53 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot and further evidence obtained by the AAIB

Synopsis

A display team were training some new pilots to fly a 'limbo' manoeuvre which involved the aircraft flying under a string of bunting suspended between two poles. As one of the new pilots flew the aircraft through the limbo gate the aircraft pitched nose-down and struck the ground with sufficient force to break the main spar. The wings folded upwards and the remains of the aircraft came to rest inverted on the grass. The pilot was taken to hospital having sustained serious injuries.

It is likely that the pilot thought he was slightly high as he approached the limbo gate and instinctively pitched down. The aircraft probably struck the ground before he had time to realise the effect of the pitch input.

History of the flight

The display team were conducting a regular training session at Damyns Hall Aerodrome. Three pilots, who were new to the display team, were completing their introductory training. As the weather was benign, as well as practicing some formation elements, the display leader decided to introduce the new pilots to the 'limbo' element of the display. The limbo

Footnote

¹ The commander also held a Helicopter Airline Transport Pilot's Licence.

² These hours are a combination for rotary and fixed-wing experience.

manoeuvre involves flying the aircraft below a string of bunting suspended approximately 20 ft above the ground between two poles³.

In addition to the normal display briefing and walk through, the display leader separately briefed each pilot on how to fly the limbo manoeuvre. He described that, for this first practice, the aircraft should descend from at least 500 ft aal flying in a straight line towards the limbo gate aiming to achieve approximately 90 kt as the aircraft reaches the gate. Full power should be applied just prior to the gate, if not already applied, ready for the climb. It was emphasised that pilots should not approach the limbo gate at low level over an extended distance. The minimum height of 5 ft should be achieved just short of the gate with sufficient lead-in to achieve stable level flight. Once through the gate, a straight climb was to be initiated back to 500 ft prior to entering the circuit. Guidance on the lateral positioning was given, the aim being to locate the aircraft centrally using an inverted triangle suspended from the limbo cable whilst maintaining 5 ft above the ground. This would ensure there would still be at least 5 ft between the aircraft and the limbo cable. The limbo cable was fitted with a weak link in case an aircraft struck the cable. The practice was conducted parallel to the main runway with the limbo gate set up approximately 50 ft to one side.

To enable the new pilots to experience the limbo procedure each of them observed three existing pilots flying the manoeuvre from the ground. On the first pass they watched from the side of the poles and on the second pass they held the poles. During these passes the display leader re-emphasised how the manoeuvre was flown. Rain then delayed the practice for just over an hour and one of the new pilots had to leave for a prior engagement. The two remaining pilots, the display leaders and a fourth experienced pilot then took off in the four Turbulent aircraft for a practice formation flight away from the airfield. As briefed, when they returned to the airfield, they practiced the limbo manoeuvre. The aircraft were positioned with approximately 200 m between each aircraft to approach the limbo gate. The four aircraft completed two passes through the limbo gate without incident before landing normally.

As planned, they kept the engines running on the four aircraft whilst the fourth pilot swapped with another experienced pilot before they embarked on another flight. The two new pilots switched their formation positions for the second flight. The display leader reported that the weather conditions were settled with a light and variable wind and overcast skies. None of the pilots flying that day reported any significant turbulence.

The second flight commenced with formation practice away from the airfield as before. On return to the airfield the team planned to conduct two passes through the limbo gate as they had done on the first flight. The first two aircraft passed through the limbo gate without incident. However, as the third aircraft approached the gate it was seen to pitch down and hit the ground. As the aircraft hit the ground the wings folded upwards and the aircraft came to rest inverted approximately 80 m past the limbo poles (Figure 1 and 2). The pilot was

Footnote

³ The flights were conducted under a CAA Long Term Permission (LTP) issued to Damyns Hall Aerodrome which allowed aircraft to fly below the minimum SERA height for the purpose of display practice (whilst complying with the conditions specified in the LTP).

assisted from the aircraft and taken to hospital. He had suffered a serious head injury and other injuries. He was released from hospital after 72 hours.



Figure 1

G-ARGZ after the accident

After the accident, the pilot remembered setting himself up to fly through the limbo gate. He recalled that he gave himself enough space behind the preceding aircraft and positioned the aircraft centrally, wings level as he approached the poles at approximately 5 ft. However, as he approached the bunting, he had the impression that he was a little too high. He commented that everything happened very quickly and he was not certain what happened but he thought he pitched the nose forward for an instant and then centralised the controls intending to reduce height slightly. He was expecting to see the aircraft in level flight but it struck the ground. He recalled seeing the right wing folding and the landing gear coming into view. He realised he was no longer flying, braced himself and waited for the aircraft to come to rest.

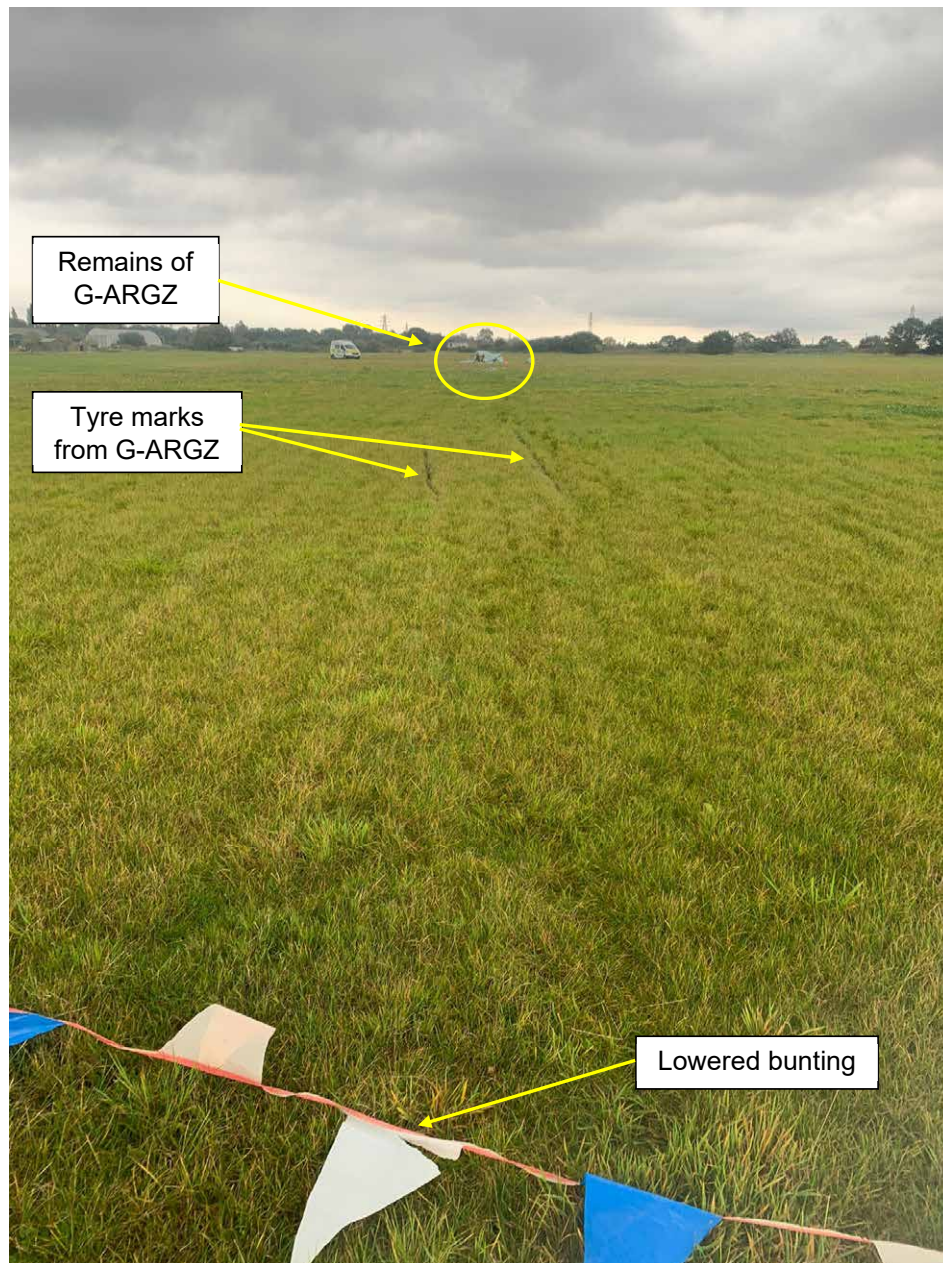


Figure 2

Accident site with the bunting in the fore ground and tyre marks for the accident aircraft

Recorded information

The aircraft was fitted with a cockpit mounted camera but the recording stopped just prior to the accident. The accident was filmed from the ground from two camera positions. The footage shows the aircraft approached the poles with the wings level and in level flight (Figure 3). The video showed that just before it reached the pole the aircraft pitched nose-down (Figure 4). There was no roll or yaw with the pitch change. The aircraft struck the ground on its main wheels in a wings level attitude. As it struck the ground both wings folded upwards (Figure 5). There was less than one second between the pitch change and the aircraft striking the ground.



Figure 3
Accident aircraft approaching the limbo gate



Figure 4
Accident aircraft pitched nose-down

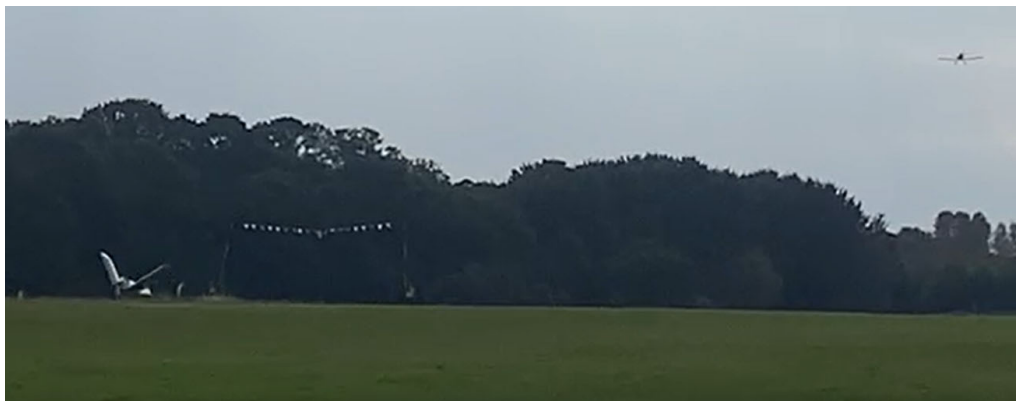


Figure 5
Accident aircraft as it struck the ground and the wings folded upwards

Pilot's background and reflections

The pilot obtained his fixed wing private pilot's licence in 1997. After this he switched to helicopter flying and became a commercial helicopter pilot; he did not fly fixed wing aircraft again for several years. In 2011 he renewed his fixed wing licence and in the following years learnt to fly the de Havilland Chipmunk and obtained a sea plane rating. In 2021 he completed a Tiger Moth conversion course. Following this he was offered the opportunity to fly the Turbulent and undertook a formation flying course in the aircraft. He was then asked if he would like to join the display team. The accident occurred on the pilot's second training day with the display team.

The pilot had approximately 7,200 hours of helicopter flying time and approximately 300 hours of fixed wing flying.

The pilot reported that he was fit and well rested on the day of the accident. He stated that the formation flying had been a good challenge, and that he did not feel any external pressure on the day to complete the task.

After the accident the pilot felt there were three factors which contributed to the accident:

- He thought he made an instinctive decision to attempt to reduce height as the aircraft approached the bunting. However, afterwards he realised his height was probably acceptable and even if the aircraft was too high it would have been better to accept it as the bunting had a weak link and would break if the aircraft caught it.
- The controls are light and effective, meaning that only a small movement generates a significant pitch change.
- He had more experience flying helicopters than fixed wing aircraft. He thought that perhaps in that instant he had made a control input that would have made a small height change in a helicopter, returning it to a level attitude, but in the Turbulent resulted in a significant rate of descent.

Aircraft information

The Druine Turbulent is a light-weight low-wing single-seat aircraft constructed from wood with a fabric covering. The maximum authorised weight is 620 lbs. The maximum authorised airspeed (V_{NE}) is 109 kt. Typically approach and landing is made at 55 – 60 kt.

Aircraft examination

A pilot who flew G-ARGZ earlier in the day reported that the aircraft had been flying well with no problems. Members of the flying club examined the aircraft after the accident, paying particular attention to the flying controls, but did not find any evidence of any pre-existing defects. It was evident from the wreckage that the main wing spar had broken as the aircraft struck the ground.

Previous accident

The AAIB reported on a similar accident which occurred in the same aircraft type at Headcorn Aerodrome on 15 March 2008⁴. On that occasion it was concluded that the aircraft probably encountered a disturbed air mass that resulted in an uncommanded change of flight path.

Analysis

Whilst flying under the limbo gate the aircraft pitched nose-down and collided with the ground. The aircraft struck the ground with sufficient force to break the wing spar, causing both wings to fold up.

There was no evidence to suggest there was any defect with the aircraft which could have contributed to the accident.

The video showed the aircraft was in stable flight as it approached the limbo gate and there was no roll or yaw as the pitch changed. This suggests the aircraft was not affected by turbulence or wake from another aircraft. The other pilots flying at the same time also did not report any turbulence.

The flying club reported that they conducted an extensive briefing before the flight, including allowing the trainees to watch the manoeuvre flown by experience pilots prior to their own flights. The club reported that the weather conditions were suitable for conducting the flights.

The pilot reported that he was fit and well on the day and felt well prepared and briefed for the flight.

Whilst the pilot was not certain what happened during the accident, he thought that as he approached the limbo gate, he had felt the aircraft was too high and had instinctively pitched forward. The video recording showed that the aircraft struck the ground less than one second after the pitch change. It is unlikely the pilot had sufficient time to realise the effect of the pitch change prior to the impact. He considered that his considerable experience on helicopters may have caused him to make a control input more suitable for a helicopter rather than the Turbulent.

The flying club conducted an internal review following the accident and decided that in future new pilots will be required to practice flying along the runway at 5 ft and 90 kt to become familiar with flying the aircraft at low level and high speed prior to flying under the limbo gate. It intends to place an additional marker on the ground immediately beneath the central triangle to give pilots an additional reference point to help position the aircraft. It also intends to film all future limbo transits to inform pilots about their positioning. The flying club considered these measures would help to prevent a similar accident occurring again.

Footnote

⁴ G-APTZ reported in AAIB Bulletin 11/2008, available at <https://www.gov.uk/aaib-reports/durine-d-31-turbulent-g-aptz-15-march-2008> [accessed December 2021].

Conclusion

Whilst learning to fly a limbo manoeuvre, it is likely that the pilot thought he was slightly too high when passing under the cable and made an instinctive nose-down pitch input. The aircraft struck the ground before he had time to realise the effect of the pitch input.

The flying club have added some additional training which they intend will prevent a similar accident occurred again.