ACCIDENT

Aircraft Type and Registration:	Aeroprakt A32 Vixxen, G-ENVV	
No & Type of Engines:	1 Rotax 912ULS piston engine	
Year of Manufacture:	2019 (Serial no: LAA 411-15611)	
Date & Time (UTC):	19 July 2022 at 1920 hrs	
Location:	Newtownards Airfield, County Down	
Type of Flight:	Private	
Persons on Board:	Crew - 2	Passengers - None
Injuries:	Crew - 2 (Fatal)	Passengers - N/A
Nature of Damage:	Extensive	
Commander's Licence:	See pilot information section	
Commander's Age:	See pilot information section	
Commander's Flying Experience:	See pilot information section	
Information Source:	AAIB Field Investigation	

Synopsis

On the evening of 19 July 2022, two pilots were flying circuits around Newtownards Airport in G-ENVV an Aeroprakt Vixxen. After approximately 20 mins of circuits they flew a low pass parallel to Runway 03 followed by a steep right turn passing over several people on the ground. Recorded data showed the aircraft passed over the people with 70° angle of bank at 72 ft above the ground. During this turn the aircraft was seen to descend and hit the ground.

The investigation could not determine exactly why the aircraft descended in the turn but no defects could be found with the aircraft or engine. There was evidence that the aircraft's electronic displays lost power before the accident and this could have caused a distraction. However, it was being flown in a manner that exposed the aircraft, the occupants and the people on the ground to a high risk of an accident.

The investigation identified several shortcomings in the build process and the registration of the ballistic parachute recovery system, which did not contribute to the outcome. The LAA and CAA have taken action to address these.

During an inspection carried out immediately before the accident the CAA identified shortcomings in the aerodrome's safety management system, which the CAA stated have now been addressed.

History of the flight

The accident occurred whilst two pilots (one male and one female) were flying circuits around Newtownards Airport (near Belfast) in G-ENVV, an Aeroprakt A32 Vixxen. It is not known who was flying the aircraft; the male pilot was seated in the left seat and the female pilot was seated in the right. The accident occurred after the airport's normal operating hours so there was no air/ground radio service. No other aircraft was flying at or near the airport at the time of the accident flight.

Shortly before the accident flight the two pilots had been flying together in a Van's RV-8A aircraft. They landed from this flight at 1840 hrs. Prior to this flight the male pilot had flown the RV-8A with a different pilot. Another pilot had flown G-ENVV just before the accident flight. He reported that the aircraft had no problems and was flying well.

Figure 1

Newtownards Airport showing the accident and witness locations

Several people, who were at the airport preparing for an open day due to take place the following weekend, saw parts of the accident flight. When the accident occurred, they were stood by a vintage bus on the main apron (Figure 1). Many other people in the local area witnessed parts of the flight.

Data recorded on the aircraft's electronic displays showed the aircraft started to taxi from the apron on the north-west side of the airport at 1859 hrs and took off from Runway 33 at 1901 hrs. Witnesses saw the aircraft taxi out, complete normal power checks then takeoff. The aircraft flew a left-hand circuit to a touch-and-go back on Runway 33 (Figure 2 – Point 1). This was followed by another left-hand circuit to a full stop landing on Runway 26 (Figure 2 – Point 2). The aircraft then backtracked the runway and took off again from Runway 33.

Several witnesses reported the aircraft was flying lower and closer to the aerodrome than they typically saw aircraft flying. It was reported that the aircraft was flying inside Scrabo Hill (Figure 3) during each circuit. Several people reported that the engine sounded as though it was struggling during these circuits. After taking off again, the aircraft made a spiral climb to 1,600 ft above the airport. It then made a spiral descent, completing several orbits to land on Runway 33 (Figure 2 – Point 3). At 1907 hrs one of the people at the airfield, who had a handheld radio, heard the female pilot make a comment about the wind over the radio which the witness thought was referring to the approach and landing the aircraft had just completed. The aircraft took off again and completed another left-hand circuit back to Runway 33 (Figure 2 – Point 4). The recorded data showed the aircraft's angle of bank was around 30° during most of the turns up to this point in the flight, although it reached 47° during one descending turn.

The aircraft then took off again and flew an 'S' turn to approach Runway 03 (Figure 2 – Point 5). During this turn the angle of bank reached 59° with the aircraft at 370 ft agl. The aircraft then flew a low pass parallel to Runway 03 at approximately 70 ft above the ground. At the end of the runway the aircraft made a right turn passing over the people stood next to the vintage bus. Witnesses estimated the aircraft's bank angle was over 60°. One witness described the aircraft "travelling more in the direction of its belly rather than forward". It was reported that the engine sounded "normal" and was at "full power". The last data point, recorded as the aircraft turned right, showed the aircraft was at 72 ft agl, with 71° angle of bank, travelling at an indicated airspeed of 86 kt and a normal acceleration[1] of 1.91 g.

Figure 2

Flight path of accident flight

Footnote

[1] 'Normal Acceleration' is the head to foot acceleration experienced by the pilot.

Seconds after the aircraft passed over the bus it appeared to be out of control and descended rapidly to the ground. Witnesses reported it happened very quickly and accounts of exactly what happened varied. However, witnesses described the aircraft "spiralling", "turning wing over wing" and "tumbling". One witness reported that the aircraft "made a steep bank to its right before it pitched up. The aircraft partially turned over on itself, continued along the trajectory of its initial banking turn but it was losing altitude". Another witness described seeing the aircraft yaw markedly into the turn as it lost control. No one reported any abnormal noises from the aircraft or its engine. Witnesses also confirmed that the aircraft did not collide with any other object.

The aircraft struck the ground on the airfield boundary just to the south of the flying club and airport cafe buildings. Witnesses ran to the accident site and airport staff collected the airport fire vehicle. They reached the aircraft within a few seconds but there was no sign of life from the occupants. A fire started on the right side of the fuselage but this was extinguished by the airport fire crew and the local fire service, who arrived shortly after the accident.

Accident site

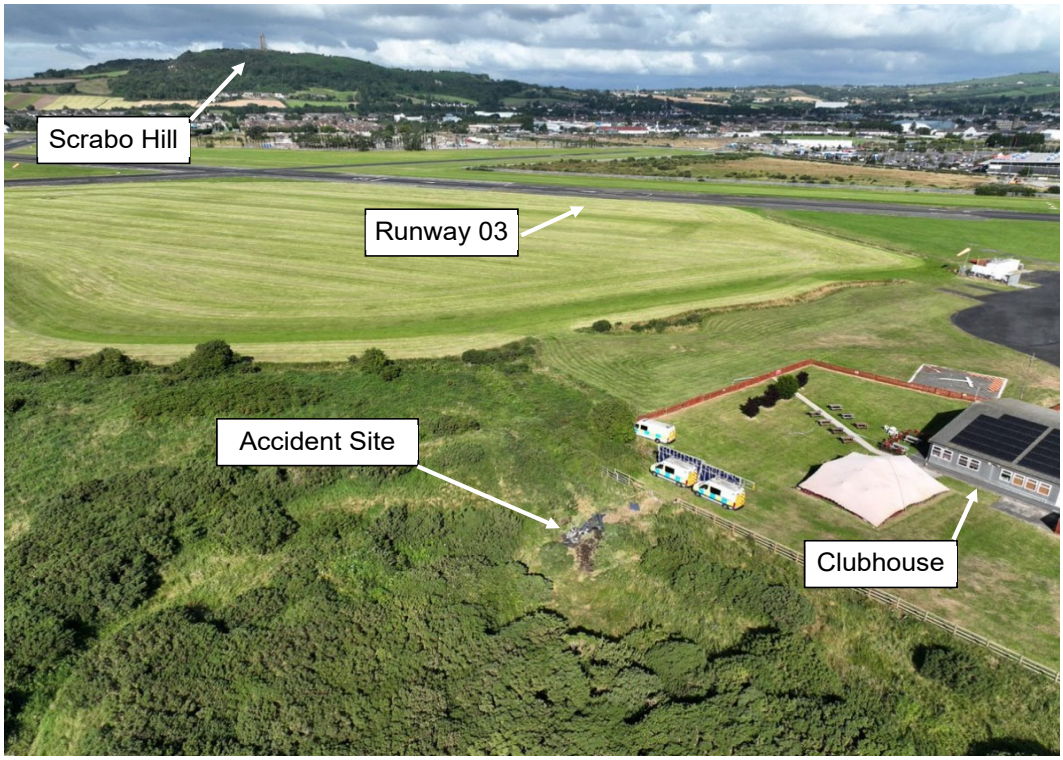

Figure 3

Accident site location

G-ENVV struck a wooden fence on the boundary of the airfield close to the clubhouse and its outside eating area, continuing through the fence before coming to rest, inverted, over a gorse bush (Figure 3). There were no apparent ground marks from impact prior to the fence line.

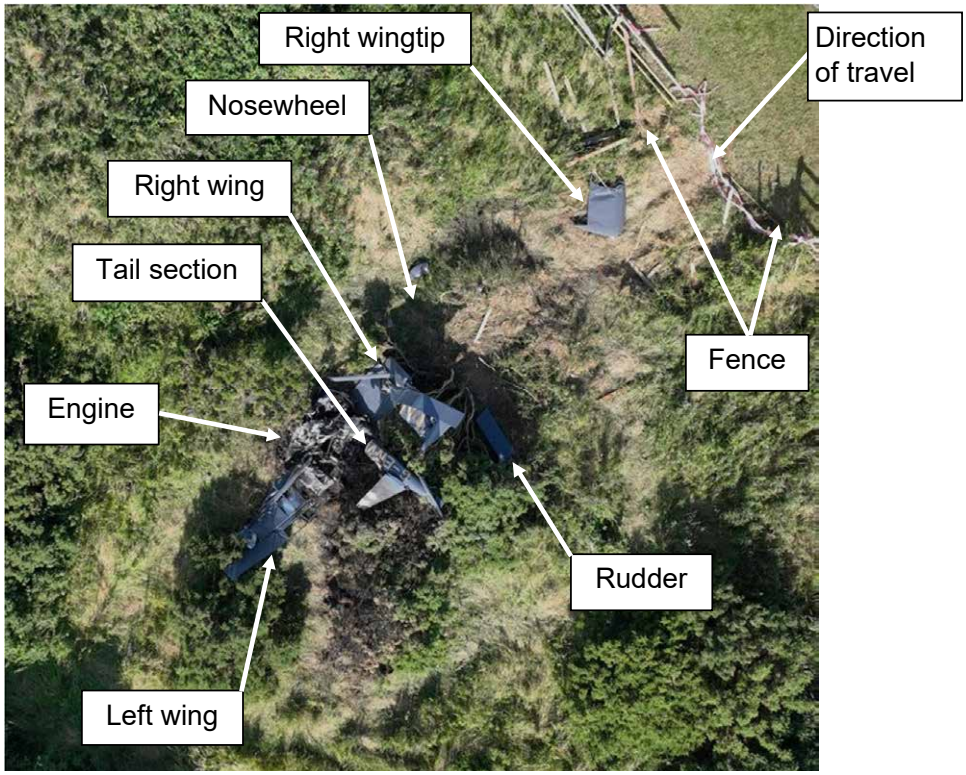

Figure 4
Accident site

Witness marks matching G-ENVV's paint were found on the fence posts. The right wingtip, some glazing from the windows, and the nosewheel were detached at the point of impact with the fence (Figure 4). The rudder became detached at the point of impact with the gorse bush, and was undamaged by the post-impact fire. The remainder of the right wing, left wing, tail section, fuselage, engine and propeller were all located at the final accident site.

Recorded information

The aircraft was fitted with two EFIS avionic units that display and independently record flight, position, engine, and fuel data at a sampling rate of 1 Hz. The recorded data ends about nine seconds before the accident, based on the last recorded speed and estimated ground track (Figure 2).

Figure 5 plots some of the data from both EFIS units, starting from when the aircraft was flying parallel to Runway 03 at about 72 ft (22 m) above the ground, and ending when the recordings stopped. The close alignment of data between the two units, seen in the figure, indicates that each unit was sampling data to within a fraction of a second of the other. The figure also shows that the recording from the left EFIS stopped six seconds before the end of the recording from the right EFIS. The manufacturer of the units stated that the data is buffered for six seconds before being stored in memory, implying that the left EFIS stopped working up to six seconds before the last data point recorded by the right EFIS at time 19:19:32. (The buffer is volatile memory, so its contents are lost when the unit's power is turned off or disrupted.)

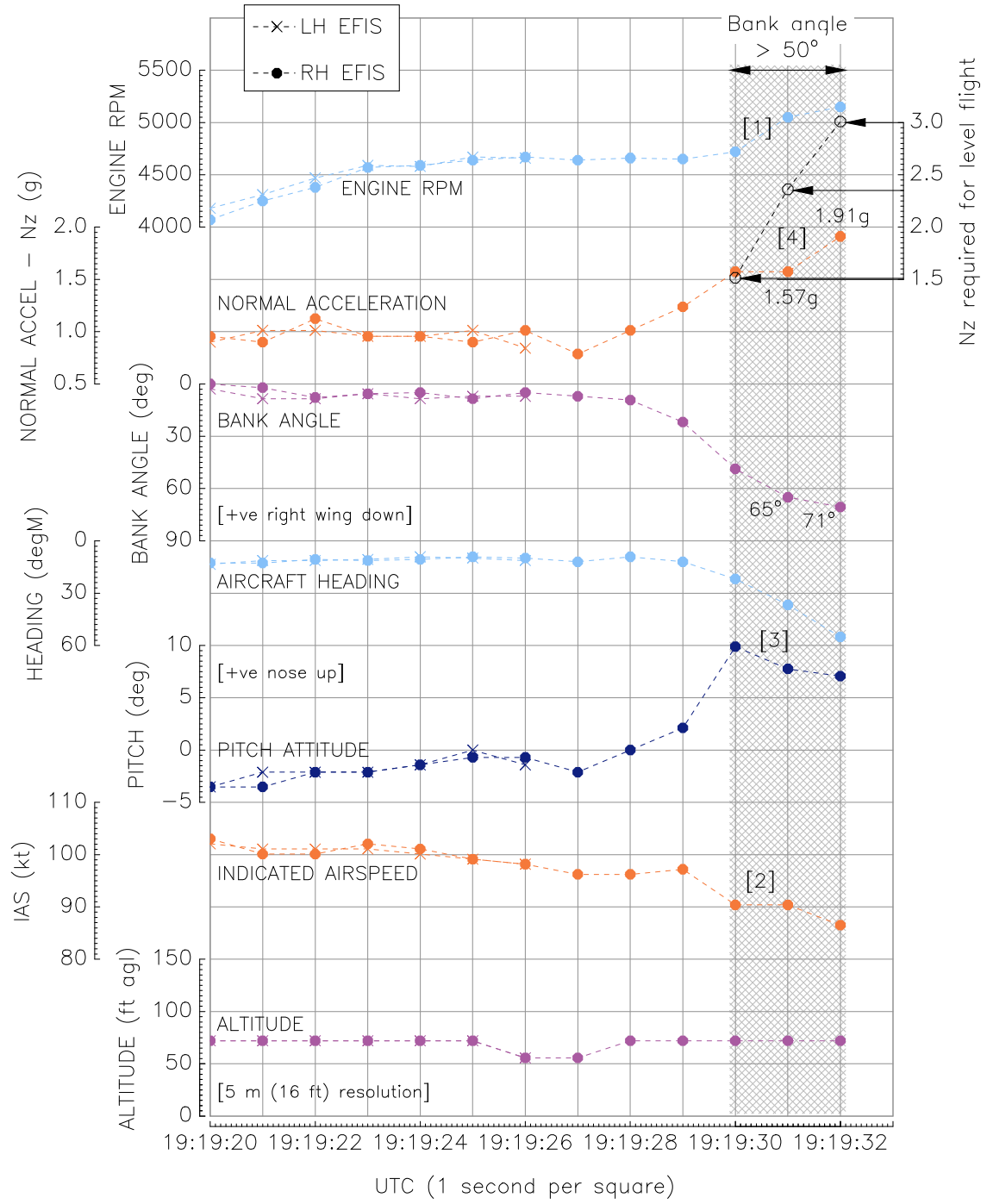

Figure 5

Last 13 seconds of recorded data

This absence of data indicates there may have been a loss of electrical power to the EFIS units before impact.

The last few seconds of the recorded data are highlighted by the shaded area in Figure 5 and correspond to when the aircraft was in the right turn with a bank angle greater than 50°. During this time, the engine speed increased by about 500 rpm [1]; the aircraft's airspeed

reduced [2]; the pitch attitude reduced from 10° to about 7° [3]; and the normal acceleration was less than that required to maintain level flight at the bank angles flown [4]. No change in altitude was recorded; however, the resolution of the altitude data was 5 m (about 16 ft) so any changes less than this during these few seconds would not be seen in the data.

Aerodrome information

Newtownards Airport is a licensed aerodrome with three asphalt runways. Residential areas are located close to the airport to the west, north and east. Strangford Lough is to the south of the airport.

The airport's operating hours are 0900 hrs to 1700 hrs, during which an air/ground radio service is provided. Aircraft can fly outside the operating hours by prior arrangement.

The published circuit height is 1,000 ft aal.

Aircraft information

The Aeroprakt A32 Vixxen is a high-wing, two seat light aircraft fitted with a Rotax 912 ULS engine and Kiev 3-bladed ground adjustable propeller. It has an all-moving tailplane and flaperon flying controls. The construction is largely metal, with a mixture of metal and fabric-covered surfaces.

Figure 6

G-ENVV at Newtownards (image used with permission)

Build history

The A32 is supplied as a fast-build kit from the manufacturer to the UK importer, within the 51% owner-builder amateur requirements for a LAA Permit to Fly[2]. The fast-build kit is

Footnote

[2] At least 51% of the physical aircraft build must be completed by the amateur builder.
British Civil Airworthiness Requirements (BCAR) Chapter A3-7 '*Permit to fly Aircraft - Initial and Continuing Airworthiness*'.
Civil Aviation Publication (CAP) 659 '*Amateur Built Aircraft*'.
Light Aircraft Association LAA Technical Leaflet (TL) 1.02, section 18 '*Amateur Building Rules*'.

close to 49% complete in its supplied state, which precludes significant further work being completed by anyone other than the amateur owner-builder. G-ENVV was issued with a Permit to Fly in October 2019.

The aircraft arrived at Newtownards by road, requiring final assembly and avionic systems installation. Work, including fabric covering and external paint, had been done prior to its arrival. There was evidence of remunerated subcontracted work towards build completion having occurred at Newtownards. The address listed for build was not where the aircraft was finally assembled[3]. There were three interested parties in the aircraft's ownership at the point of build, of which one (the male accident pilot) was registered as the owner for the initial build. The investigation did not find evidence to substantiate that the owner was physically involved in the build of G-ENVV to qualify the build within the 51% owner-builder amateur requirements.

Maintenance history

The aircraft's airframe and engine logbooks were retrieved from the aircraft but neither had been updated since the last Permit to Fly revalidation inspection in October 2021, at 451 flying hours.

The A32 has a manufacturer's maintenance schedule published within its Aircraft Maintenance Manual, detailing the required maintenance at 50, 100 and 200-hour intervals. The LAA provides generic maintenance schedules for use when a manufacturer's schedule is either not available or is not mandated by the aircraft's Permit to Fly Operating Limitations. The LAA stated that the manufacturer's maintenance schedule was not mandated for G-ENVV, and the *'owner's tailored maintenance schedule'* was declared within the Certificate of Clearance form. It was stated by those carrying out maintenance on G-ENVV that a generic LAA schedule was followed. There were no workcards or maintenance documents to support airframe or engine logbook entries made before October 2021. There were no logbook entries or maintenance history to verify the status of the airframe or engine after October 2021.

Data subsequently retrieved from on board flight display systems logged 587 engine hours at the time of the accident.

Aircraft examination

Structure

The fuselage structure surrounding the passenger compartment was destroyed in the post-impact fire.

The aft section of the tail was mainly intact, had separated from the fuselage and suffered fire damage. There was some fire damage to the left all-moving tailplane but both left and

Footnote

[3] Light Aircraft Association LAA Technical Leaflet (TL) 1.02, section 4 *'Workshop and Storage Facilities'* specifies that the LAA inspector will check the suitability of where the aircraft will be built. Section 7 *'Frequency of Inspections'* details the in-person main inspection stages required for the project. Both require knowledge of where the aircraft is to be built.

right tailplanes were present and attached. The rudder had detached at final impact and was largely undamaged. The rudder at its uppermost attachment point to the tail structure showed evidence of having travelled beyond full deflection to both left and right sides before detaching from its base plate.

The right wing exhibited impact damage to the leading edge and internal structure corresponding to contact with the boundary fence. The right flaperon was partially attached to the wing, but damaged from impact with the gorse bush. The left wing had suffered significant disruption at its point of attachment with the fuselage and had become detached during impact with the gorse bush. The left flaperon was still attached. Both wings had considerable fire damage in the region of the internal fuel tanks.

The nosewheel had detached at the joint with the shock absorber, also corresponding to impact with the fence.

Flying controls

Flying control surfaces were activated via cable and pulley systems, from a central control stick located between the seats. Continuity was established between the rudder pedals to the rudder base plate, and control stick to the tailplane and left flaperon, with the cables free from restriction and intact after impact. The right flaperon cable was found to have broken in overload in the area of the wing to fuselage attachment point, consistent with damage sustained in this area during impact.

The flap lever was found in the 'UP' position. The lever is held in place with a locking pin, which is released by pulling the lever laterally to free the pin from its locating hole. There are three locating holes for each position of flap. Due to the force required to move the lever, it is likely that the flaps were 'UP' during flight immediately prior to impact.

The trim control was located between the seats at floor level. Control cable continuity and free movement from the control lever to the trim tab was established.

Avionics

The aircraft was equipped with flat-screen primary flight display systems. They were an additional item to the kit purchased by the owner and were installed during the initial build, except for an Attitude Heading and Reference System (AHRS) which was a later modification. The AHRS can display information including an artificial horizon, pitch and roll attitude, airspeed, and altitude. The flat-screen display system is customisable and capable of displaying comprehensive flight, engine, and navigation information, and is coupled to a data acquisition unit. Flight logs and aircraft parameters from those flights are stored within the system, and data from the accident flight was retrieved.

Two battery back-up supply units were installed; one for the flat-screen display system and one for the AHRS unit. The purpose of the battery back-up is to give up to 40 mins usage of the instrumentation if aircraft main power fails. The power supplies for the flat-screen display system were controlled by two toggle switches added to an existing row of switches on the centre console. Both switches were required to be ON for the screens to function.

The AHRS power was controlled from a single toggle switch at the top centre of the same console. None of the switches were labelled as to their function.

At the accident site, both flat-screen display system switches were found in the ON position and the AHRS switch was found in the OFF position, however, due to the disruption to the cockpit area that occurred upon impact, these switch positions cannot be confirmed to have been the same during flight.

An examination of the electrical system was conducted, but it was too badly damaged by the post-impact fire to determine system integrity or continuity.

Fuel

G-ENVV was fitted with optional larger fuel tanks, with total capacity of 114 l, 112 of which is usable. The A32 can be used with fuel meeting three different specifications[4]. It was not possible to determine the type of fuel used during the accident flight although witness accounts refer to the pilot purchasing UL91 fuel in drums that were stored in the aircraft's hangar.

It could not be determined how much fuel was on board at the start of the accident flight. The pilot who flew the aircraft on the previous flight estimated there was 20 litres remaining after his flight. However, it was not possible to determine if the aircraft had been refuelled immediately prior to the accident flight. It was reported that the aircraft typically consumed 15-20 l/hr. The length of pipework between the fuel tanks and engine could contain enough fuel for approximately 40 seconds of flight once the usable fuel had been consumed. Fuel quantity is displayed on two analogue dials in the central console, each with its own low fuel warning light. The electronic flight displays did not record fuel quantity.

Fire damage concentrated in the locations of the fuel tanks and fuselage indicated that the system contained fuel at impact. The A32 has two fuel supply handles, one for each wing tank. One of the fuel supply handles was retrieved and was in the 'open' position, but its position during flight could not be verified.

There was no fuel remaining for sampling or quantity analysis.

Engine

The Rotax 912 ULS had suffered significant fire damage, and it was not possible to determine if fuel remained within the carburettors or fuel manifold although recorded engine data showed it running at approximately 5,100 rpm immediately prior to the accident. The throttle levers remained connected to the carburettors after the accident.

The spark plug electrode gaps and colouration were within manufacturer limits. Two plugs were lightly coated with oil, but the engine was found inverted with an accumulation of oil

Footnote

[4] Motor gasoline (Mogas), Aviation gasoline (Avgas 100LL), or a fuel that meets a minimum octane of 95 and has an Anti-Knock Index of 91. The latter specification includes fuel type UL91.

within this cylinder, which probably occurred post-impact. Borescope examination of the cylinders did not show any areas of excessive wear or build-up of combustion products for the engine's estimated hours.

Propeller

All three blades were found at the engine impact point. One blade was still attached to the propeller hub but cracked at its base, the second was partially attached and the third had completely detached. The blade damage was consistent with the propeller stopping within a single revolution upon impact. The Rotax 912 ULS engine is fitted with a clutch to protect the engine from damage caused by a propeller strike. It is possible that the clutch disconnecting the propeller from the engine, followed by multiple strikes with the fence and gorse before hitting the ground, could have slowed the propeller's rotation. Therefore, the power of the engine at impact could not be clearly determined.

Ballistic parachute recovery system

A ballistic parachute recovery system (BPRS) is a rocket-deployed parachute, used to recover a whole aircraft including occupants to the ground in an emergency situation.

G-ENVV was fitted with a Magnum 601 S-LSA BPRS located aft of the luggage compartment behind the seats. The system comprises a parachute packed into a soft case, launched by a separate rocket canister. The parachute exits the aircraft through a frangible hatch on the upper fuselage surface. The system is activated by a pull-handle cable located between the aircraft's seats. The pull-handle has a safety pin inserted into it to prevent unintended operation on the ground, which is required by the manufacturer to be removed before flight. The BPRS had not been activated by either occupant, and the safety pin was found inserted in the handle. It is not known if the occupants had inadvertently left the pin in place or if they routinely flew with the activation pin installed. CAA and LAA guidance[5,6] specifies a two-stage release control for BPRS to avoid inadvertent operation. BPRS installation approval for the A32 was based on that for the A22 Foxbat, where a 2.5 mm cable tie is used for the secondary release, not the activation pin. It is possible that the occupants regarded the activation pin as the secondary release mechanism or were not familiar with the two-stage release guidance for this aircraft type.

External warning placards are required[7] to be applied to aircraft fitted with a BPRS, to alert occupants upon entering the aircraft and emergency responders in the case of an accident. The presence of a BPRS must also be notified to the CAA (in this case via the LAA) for inclusion in the central aircraft register to provide safety information to those attending in an emergency. The requirement to notify the CAA at initial aircraft registration was introduced at the beginning of 2022 in response to an accident where BPRS was fitted but the CAA

Footnote

5 Civil Aviation Authority (CAA) CAP 482 *British Civil Airworthiness Requirements (BCAR) Section S – Small Light Aeroplanes, Sub-Section K, Issue 7. 'AMC S 2003 (Interpretive Material)*'.

6 Light Aircraft Association (LAA) *Technical Leaflet (TL) 3.27 Ballistic Parachutes, Issue 1, 27 March 2020 Section 4.3 'Miscellaneous Points*'.

7 Civil Aviation Authority (CAA) CAP 482 *British Civil Airworthiness Requirements (BCAR) Section S – Small Light Aeroplanes, Sub-Section K, Issue 7. S 2041 'Markings and Placards*'

was not informed[8]. There was no evidence of placards on the aircraft and the presence of a BPRS was not shown in G-ENVV's CAA database record. The only reference found to a BPRS fitted to G-ENVV was within the weight and balance record completed at initial permit application. No entries were found within the aircraft's build record, modification record or Permit to Fly application paperwork, nor subsequent annual Permit to Fly revalidations. LAA members and inspectors associated with G-ENVV's build and maintenance did not appear to have a good understanding of the relevant requirements.

Survivability

The manufacturer of the BPRS specifies a minimum deployment altitude for safe rescue of 200 m, with some documented rescues down to 80 m. This allows sufficient time for safe parachute opening and aircraft stabilisation during which altitude is lost. G-ENVV was flying at an altitude of approximately 80 ft (24 m) at the point where departure from controlled flight occurred. If the BPRS had been activated at this moment, there would not have been enough time for the parachute to deploy and effectively arrest the aircraft's descent.

G-ENVV was fitted with four-point harnesses at both seats. There was extensive fire damage to the harness webbing but the buckles from both seats were found fastened. A lack of heat and smoke damage to the interior of the buckles indicated that they were both fastened correctly prior to impact.

Weight and balance

The aircraft had two occupants on board, a partial fuel load and no luggage, and would have been within its maximum takeoff weight of 600 kg and centre of gravity limits.

Aircraft performance

The Pilot's Operating Handbook (POH) gives the aircraft's 1g stall speed at maximum takeoff weight, with flaps up, as 32 KIAS. The POH does not give the stall speed for level flight with different bank angles. However, based on data supplied by the manufacturer, the stall speed in level flight at 70° angle of bank would be approximately 68 KIAS[9]. A load factor of 2.92 g is required to maintain level flight with 70° angle of bank.

The aircraft is certified as non-aerobatic and its operating handbook specifies a maximum bank angle of 60°. It has a maximum positive load factor of +4.0g.

Meteorology

Weather reports are not recorded at Newtownards Airport outside aerodrome hours. Belfast City Airport (7 nm west-north-west) reported, at the time of the accident, a surface wind from 350° at 6 kt varying between 300° and 020°, visibility greater than 10 km, cloud overcast at 3,200 ft, temperature 16°C and a sea level pressure of 1022 hPa.

Footnote

[8] AAIB investigation to Silent 2 Electro, G-CIRK, 23 April 2021 https://www.gov.uk/aaib-reports/aaib-investigation-to-silent-2-electro-g-cirk [Accessed February 2023]

[9] The indicated stall speed at this angle of bank is higher than might be estimated from increased load factor alone, due to indication errors at increased angle of attack.

A pilot who took off from Newtownards approximately 40 minutes before the accident estimated the wind at the airfield was from the north-west at 8 - 12 kt but he commented that the wind increased markedly in the climb.

Pilot information

The female pilot was 44 years old and held a Private Pilot's Licence which was issued in October 2020. She held a Single Engine Piston rating which was valid until 31 October 2022 and also held a night rating. She had a valid Class 2 medical.

She had been undertaking training for a restricted instrument rating (IR(R)) and it was reported that she had been studying to take the ATPL ground exams.

The last entry in her logbook was on 21 October 2021 which was an IR(R) training flight in a Cessna 172. Her last flight as pilot in command in G-ENVV was recorded on 13 October 2021. The logbook gave a total flight time of 204.6 hours. Flying club technical log dockets were found relating to 14 further flights between 23 October 2021 and 19 February 2022 totalling 12.1 hours but these were not recorded in her logbook. A notepad was also found containing notes about three flights on 7, 14 and 20 May 2022.

An instructor commented that she had been a "competent and knowledgeable student" who flew with "caution and diligence". However, he had noticed a change in her flying in the months preceding the accident. After observing several tight approaches with sharp turns onto final approach he felt compelled to speak to her about the risks involved in manoeuvring close to the ground. He spoke to her informally, advising her to be more cautious.

The male pilot was 50 years old and held a National Private Pilot's Licence which was issued in June 2018. He had held Microlight and Simple Single Engine Aeroplane (SSEA) ratings but the Microlight rating lapsed on 31 May 2022 and the SSEA rating lapsed on 31 October 2021. There was no evidence that either rating had been renewed. He had a valid self-declared medical.

His logbook was in the aircraft when the accident occurred and was significantly fire damaged. A photograph was found of a page of his logbook which showed that in November 2021 he had accumulated 421 flying hours. His logbook contained five further completed pages (55 flights) but the logbook was too damaged to read the details of these flights.

Several qualified pilots who knew him well commented that "he liked to push the boundaries" and "he enjoyed the more exciting side of flying". It was reported that he was "a very capable pilot" but he enjoyed "flying low approaches and very tight circuits". A commercial pilot who had recently flown with him in G-ENVV commented that he felt "uncomfortable" with the tight circuit the pilot had flown. He had recently purchased a Van's RV-8A aircraft and had been flying aerobatic manoeuvres, although he had no formal training or qualification in aerobatics.

Organisational information

The airfield is operated by a flying club. The flying club incorporates a Declared Training Organisation (DTO). Flying club members can fly the club aircraft but some members also hangar their own aircraft at the airfield. The flying club is managed by a committee of volunteers.

The accident flight occurred in a privately owned aircraft being flown by two qualified pilots[10]. It was therefore outside the oversight of the DTO. It also occurred outside the aerodrome's published hours, which limited oversight by the flying club.

The Aeronautical Information Publication entry for the airfield states that flying outside the licensed hours is allowed '*by arrangement*'. The club website refers to an out-of-hours indemnity form which should be completed to fly outside licensed hours but the investigation found that no such form existed. The investigation did not find any record of who was authorised to fly outside hours or any arrangements by which this was managed.

Some committee members reported that there had been previous reports of low flying and excessively tight circuits being flown by other pilots outside licensed hours. They reported that during licensed hours, with a duty instructor on duty and with considerable flight training activity taking place, there was sufficient oversight, but that outside hours there was no oversight. Several years previously, the committee had tried to report to the CAA another pilot who was observed low flying, but they had not been able to provide sufficient robust evidence, so the CAA was unable to take any action. This resulted in the committee feeling they were unable to tackle future similar issues.

The flying club standard operating procedures set out the requirement for all incidents to be reported in writing and posted in the reporting box in the flying club. Despite several previous incidents being mentioned to the AAIB during this investigation, no evidence was found of any previous incident reports being made to the flying club. The aerodrome manual describes the club safety management system (SMS). It states that '*an aerodrome safety committee meets a minimum of twice per year to review any safety related issues, accident and incident reports'*. The investigation did not find any evidence that these meetings had ever happened.

On the day of the accident and the previous day the CAA was conducting an oversight audit at the airport. The audit finished before the accident and made five Level 2 findings[11]. One of these related to the SMS and stated:

Footnote

[10] The male pilot's flying licence was not valid at the time of the accident.

[11] A Level 2 finding means it been identified that the Aerodrome is not in full compliance with the aerodrome licensing requirements set out in either the Air Navigation Order, the Aerodrome Licence, ICAO Annex 14, Civil Aviation Publication (CAP) 168 or the Aerodrome Manual. Rectifying action must be taken within the agreed timescales.

'The safety management system was found not to be operating as described in the aerodrome manual:

1) *Current records could not be found for the committee monthly meeting or the 6 monthly Airport Safety Group meeting,*
2) *No evidence of internal audits could be found,*
3) *The SMS should include reference to "just culture",*
4) *Current monthly reports could not be found'.*

The auditor also observed a runway incursion during the audit and made the following finding:

'The aerodrome does not have effective procedures to prevent runway incursions. An incursion was witnessed during the audit when an individual riding a motorbike entered the aerodrome and crossed runways 03/21 and 15/33 to access hangars across the airfield but without making radio calls. An MOR needs to be filed for this event and adequate procedures implemented (covering access, driving rules and procedures and RTF procedures) to enable this activity to be completed safely.'

When asked about the safety culture at the flying club several people reported to the AAIB that it was poor. It was reported that there was a small group of pilots who often operated outside normal aviation convention, but this had not been addressed by the committee.

Analysis

Accident flight

The accident occurred whilst the aircraft was making a low altitude steep turn, which occurred above people and buildings.

There was no evidence of any construction anomaly, failure or malfunction in the airframe or flying controls that could have contributed to the accident. Data recovered from the aircraft's avionics suggested the engine was performing normally during the accident flight. The exact fuel quantity on board could not be determined. However, the previous pilot reported there was at least 20 litres remaining after his flight and, if that were the case, there would have been sufficient fuel onboard for the 20 minutes flight. It is possible that the steep angle of bank could have caused the fuel supply to the engine to be interrupted but the fuel pipework was of sufficient capacity that had it contained fuel it could have sustained the engine for approximately 40 seconds.

An absence of recorded data from the EFIS units indicates they may have lost power before impact, although it could not be determined why this occurred as battery back-up systems were installed. Had such a failure occurred, it is possible that it captured the pilot's attention and briefly distracted the pilot from the primary task of flying the aircraft.

The aircraft exceeded its 60° bank angle limit in the last 1.5 seconds of recorded flight. It was not possible to determine if this was intentional.

It was not possible to determine the exact sequence of events which led to the aircraft losing height and striking the ground. The last recorded data point showed the aircraft had a normal acceleration of 1.91 g. If sustained, this would be insufficient to maintain level flight with a 70° bank. It is possible that the accident was caused by over banking and descending in the turn with insufficient altitude for the pilot to recover, but witness accounts are more consistent with a departure from controlled flight. The stall speed with 70° bank and level flight is approximately 68 KIAS. At the last data point the aircraft was flying at 86 KIAS, but the speed was reducing and the application of nose-up elevator intended to arrest a descent might cause a stalling angle of attack.

The aircraft was flown at 72 ft above people and buildings. The rules of the air[12] state that the pilot in command should '*not fly in a manner that would endanger either people or property*' and should '*not fly closer than 500 ft to any person, vessel, vehicle or structure unless necessary for taking off or landing'*. It is likely the pilot in command was breaching both rules.

It is not known which pilot was flying the aircraft when the accident occurred. Both pilots had previously been seen flying steep turns at low altitude. The male pilot had recently purchased a Van's RV-8A aircraft and it was reported that he had been flying aerobatic manoeuvres in that aircraft. The investigation did not find any evidence that either pilot had been trained in aerobatic flight.

Choosing to fly excessive manoeuvres close to the ground increases the opportunity for error and reduces the room for recovery, placing occupants and the public at unnecessary risk.

Pilot's licence

The male pilot did not have a valid flying licence. His Microlight and SSEA ratings had expired. It is likely that he would have had sufficient flying hours to revalidate by experience but he had not had his licence signed by an examiner[13]. Once the ratings had lapsed he would have needed to complete a proficiency test to renew the ratings.

It is possible that he was not aware that his ratings had lapsed. The CAA does not provide a reminder service for when ratings and licenses lapse. However, all pilots must ensure their licence is valid before flying. If unsure about the requirements advice can be sought from an instructor, examiner, flying club or the CAA.

Footnote

[12] Guidance on the Rules of the Air can be found in the Skyway Code (CAP1535) available at The Skyway Code | Civil Aviation Authority (caa.co.uk) (accessed 22 November 2022).

[13] It could not be determined if he had completed a flight with an instructor which is required to revalidate by experience but the 55 flights in his logbook suggests he would have achieved the 12 hours required.

Aircraft build and maintenance

It was not possible to ascertain the exact build and maintenance status of G-ENVV due to a lack of detail within the aircraft's build, maintenance and logbook paperwork. This is likely, in part, due to the low level of owner involvement during build completion compared to third party assistance, regarding the 51% amateur builder requirements. It is possible that as a result the aircraft did not conform to the requirements to qualify for a Permit to Fly, indicating this aspect of the process for fast-build kits that would benefit from a higher level of oversight. The LAA is exploring ways to improve oversight of the build process relating to the 51% rule, looking to include, but not limited to, more frequent and better targeted auditing of build projects.

There was nothing to indicate to those attending the accident site that G-ENVV was fitted with a BPRS. CAA registration of G-ENVV occurred in 2019, before the introduction in 2022 of a point in the registration process to verify that BPRS and compliant placarding was fitted. There was no point within the LAA Permit to Fly issue or annual Permit to Fly revalidation process to verify that BPRS and relevant compliant placarding had been fitted, other than by relying on inclusion in the aircraft's modification record during the build process. It also appears there was no reliable way to ensure this information was included in the CAA's central aircraft register. Permit to Fly issue and annual revalidations presented three opportunities at which this could have been identified for G-ENVV. To ensure future visibility of BPRS installations the following safety actions have been taken:

The CAA has amended form CA1 *Application for Aircraft Registration or Change of Ownership*, introducing a field to indicate whether an emergency ballistic device such as BPRS is fitted.

The LAA has amended form CA3 *Permit to Fly Application*, introducing a field to indicate whether an emergency ballistic device is fitted, which is flagged to the CAA Aircraft Registration Team to subsequently update the GINFO database.

Retrospective installations of BPRS must be notified to the LAA by an application to install BPRS as a new modification to the aircraft type, or notification that BPRS has been installed as a manufacturer's standard option. The LAA will then notify the CAA of the installation.

There was a lack of knowledge regarding regulations for BPRS installation, placarding and notification to the appropriate authorities amongst LAA inspectors and members. It is becoming increasingly popular amongst the general aviation community to fit BPRS, which are offered as an option or retrofit on many microlight and general aviation aircraft. To improve awareness among LAA inspectors and members, the following safety actions have been taken:

The LAA has included the requirements for BPRS markings and notification of installation to the CAA for inclusion on G-INFO register in articles within the *'Engineering Matters'* section of the member publication *Light Aviation*.

New LAA Inspector induction briefings given by the LAA Chief Inspector now include a specific topic explaining BPRS installations and associated aircraft marking requirements.

Organisation

Members of the flying club committee were aware that low flying was taking place outside the aerodromes licensed hours in the months before the accident, but no action had been taken to prevent it. It was reported that the committee had not found an effective way to manage flying outside licensed hours.

The CAA conducted an audit at the airfield just before the accident which found that the SMS was not functioning as described in the aerodrome manual. During the investigation of this accident the AAIB found a lack of safety reporting within the club and received several reports of a poor safety culture. The CAA audit made several findings which the CAA stated the aerodrome operator has now addressed.

Conclusion

The accident occurred when the aircraft was flown at low altitude and a high angle of bank over people and buildings. There was insufficient evidence to determine the precise cause. No defects were found with the aircraft or engine which could have contributed to the accident. There was evidence that the electronic displays in the aircraft lost power before impact and it is possible that this caused a distraction. However, the aircraft was being flown in a manner which exposed it, the occupants and the people on the ground to a high risk of an accident.

The investigation identified several shortcomings in the build process and the registration of the BPRS system. The LAA and CAA have taken action intended to address the registration of BPRS systems. The LAA is exploring ways to improve oversight of the build process within the 51% amateur building rules.

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