AAIB
Air Accidents Investigation Branch

AAIB Bulletin 10/2024

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The sole objective of the investigation of an accident or incident under these Regulations is the prevention of future accidents and incidents. It is not the purpose of such an investigation to apportion blame or liability.

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This bulletin contains facts which have been determined up to the time of compilation.

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AAIB Field Investigation Reports

A Field Investigation is an independent investigation in which AAIB investigators collect, record and analyse evidence.

The process may include, attending the scene of the accident or serious incident; interviewing witnesses; reviewing documents, procedures and practices; examining aircraft wreckage or components; and analysing recorded data.

The investigation, which can take a number of months to complete, will conclude with a published report.

Accident

Aircraft Type and Registration:	Vans RV-6A, G-RVSH	
No & Type of Engines:	1 Lycoming IO-360-A1AD (Modified) piston engine	
Year of Manufacture:	2004 (Serial no: PFA 181A-13026)	
Date & Time (UTC):	3 September 2023 at 1406 hrs	
Location:	Truro Airfield, Cornwall	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - None
Injuries:	Crew - 1 (Fatal)	Passengers - N/A
Nature of Damage:	Aircraft destroyed	
Commander's Licence:	Private Pilot's Licence	
Commander's Age:	60 years	
Commander's Flying Experience:	261 hours (of which 115 hours were on type) Last 90 days - 6 hours Last 28 days - 3 hours	
Information Source:	AAIB Field Investigation	

Synopsis

The pilot of G-RVSH came into land on Runway 14 at Truro airfield but touched down off the side of the runway. The nose wheel was not held off, the nose wheel dug in, and the landing gear strut deformed resulting in the aircraft coming to rest inverted. The guidance from the aircraft manufacturer was that the nosewheel should be held '*off as long as possible*'. The Light Aircraft Association (LAA) provided similar guidance. A combination of the aircraft energy and dynamics of the roll over may have contributed to the pilot sustaining a fatal neck injury.

Safety action has been taken by the airfield owner to provide more information on the Pooley's plate. A helicopter training mound has been removed from the airfield.

History of the flight

The pilot of G-RVSH had decided to fly from White Waltham Airfield to Truro Airfield (Truro), a grass airstrip in an actively farmed field (Figure 1). He called the airfield owner at approximately 1145 hrs, asked for permission to land, and informed him that the flight time would be about 1 hour 15 minutes.

At about 1355 hrs the airfield owner heard the aircraft in the vicinity and, shortly afterwards, saw it on the downwind leg for Runway 14 while he noted the windsock indicated that the wind had shifted in favour of Runway 32.

Figure 1

View of Truro in the direction of Runway 14, taken later on the same day as the accident

Witnesses saw the aircraft approaching to land on Runway 14. As the aircraft touched down it appeared to bounce twice before tipping over its nose and then onto its back adjacent to a mound. The owner went to assist the pilot while the other witness called the emergency services.

Accident site

The aircraft came to rest approximately 20 m to the right side of Runway 14 after a ground roll of approximately 100 m. The first ground marks consisted of three tyre tracks in the grass, which started to the side of and about halfway down the runway length (Figure 2).

Figure 2

Accident site, viewed from the Runway 14 direction

The three tracks were consistent with the three wheels touching down at the same time and were parallel to the runway until adjacent to the north side of the mound (Figure 3). The right landing gear wheel track ended near the periphery of the mound. Approximately 6 m after the right track ended, the partial remains of the nose wheel spat were found. Leading up to the spat was a deep furrow created by the nose landing gear, which started before the point where the right tyre track ended. At the same approximate position there was evidence that the left wing tip was in contact with the grass, and this was further confirmed by light scratches on the left wingtip structure. The nose landing gear furrow extended a further 10 m beyond the remains of the spat with the left tyre track ending approximately halfway along. After a gap of approximately 2 m beyond the nose landing gear furrow, an indentation had been made by the propeller spinner. The aircraft came to rest inverted just beyond this indentation.

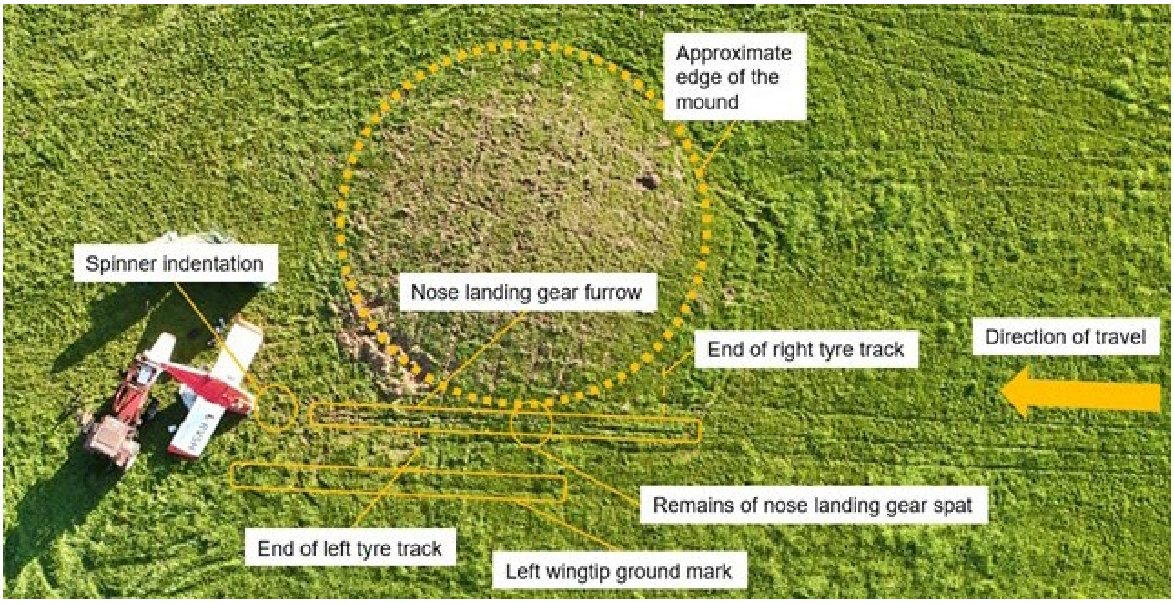


Figure 3

Accident site ground marks

Witness Evidence

Airfield Owner

The airfield owner reported to the AAIB that the pilot called him on the telephone prior to the flight. The owner stated that he confirmed to the pilot that the airfield had two runways, Runway 14 and Runway 32 (which matched entries made by the pilot into a notebook), and that the windsock indicated the wind was about 5 kt, favouring a landing on Runway 14. However, the owner stated that he advised the pilot to check the windsock for indications of the wind direction on arrival and, owing to the downward slope on Runway 14 and since the wind was light, recommended that the pilot should consider landing on Runway 32. He further told the pilot that the circuits were at 800 ft agl to the north, and that there was no dead side.

When the owner heard the aircraft overhead, he moved to a balcony which gave a view of the field in the direction of Runway 32. However, the increasing slope of the field would have obscured his view of the far end of the field, including the first half of Runway 14. The owner stated to the AAIB that at the time he noticed the wind now favoured Runway 32. He reported that the approach seemed normal from his perspective and that the aircraft appeared over the runway. However, he thought it seemed faster than he would have expected for a tailwind and the aircraft appeared to land long.

The owner and another witness, stood beside the airfield owner, stated to the AAIB that the aircraft seemed to bounce twice and seemed out of control before it appeared that the right main wheel contacted the side of a mound as it bounced into the air before landing and rolling over its nose onto its back. The other witness commented to the owner that the aircraft seemed to have landed off the runway.

Farmer

A farmer who was clearing bales on the north-eastern side of the runway saw the aircraft make an approach to Runway 14. He perceived the aircraft was over the runway but faster and deeper than he would have expected.

Recorded information

ATC & flight tracking data

G-RVSH was equipped with a Mode-S transponder. It was first detected by SSR and online flight tracking services as it flew abeam Poole, Dorset. The tracks corroborated GPS tracks downloaded from onboard avionics until G-RVSH descended as it approached Truro. Radar detections of the aircraft's lateral position are usually less accurate than GPS measurements, particularly at low altitudes. The investigation did not find any evidence that the pilot was in contact with ATC at Exeter, Culdrose or Newquay before arriving at Truro.

Onboard data sources

Two digital avionic devices, an EKP-V and an iEFIS, recorded flight parameters to their respective internal memory. The recordings were downloaded with assistance from their manufacturers. Both independently measured heading, acceleration and air data, with the latter being measured from the same air sensors.

The sample rate of iEFIS recordings varied, increasing in dynamic phases of flight and decreasing in steady flight. The EKP-V recorded at a constant 1 Hz sample rate, which recorded air and inertial data as "PFD" parameters, and GPS calculated parameters recorded as "NAV" recordings. In addition to the accident flight, several years of flight recordings were saved in the EKP-V memory.

A comparison of acceleration data from both devices indicated that the iEFIS was less sensitive to g-force changes than the EKP-V, particularly in the vertical axis. The EKP-V also recorded at a more constant rate than the iEFIS, and its acceleration data was more consistent with changes to other parameters, such as attitude and airspeed. Therefore, the investigation did not rely on iEFIS acceleration parameters for its analysis.

A mobile phone and a tablet belonging to the pilot were also recovered from the aircraft. They were undamaged, but the AAIB was unable to download their contents.

Wind speed and direction calculations

The last wind data calculation made by the onboard avionics was recorded as G-RVSH crossed the threshold of Runway 14, and indicated a wind as being from 010 at 6 kt. This is consistent with forecasted wind conditions at the time of the accident and indicates that there was a tailwind component of about 3 kt as G-RVSH landed.

Flight path

The iEFIS and EKP-V received GPS data from their own GPS antennas, which were collocated on top of the cockpit glareshield. The lateral difference between their recorded GPS positions during the final approach and landing was smaller than the typical error in GPS position measurement[1], and indicated that G-RVSH was offset to the right of the Runway 14 edge by about 20 m. This is illustrated in Figure 4, which shows the flight path taken by G-RVSH before landing in the direction of Runway 14. The GPS tracks corroborated the positions of the wheel track marks found on the accident site (Figure 2).

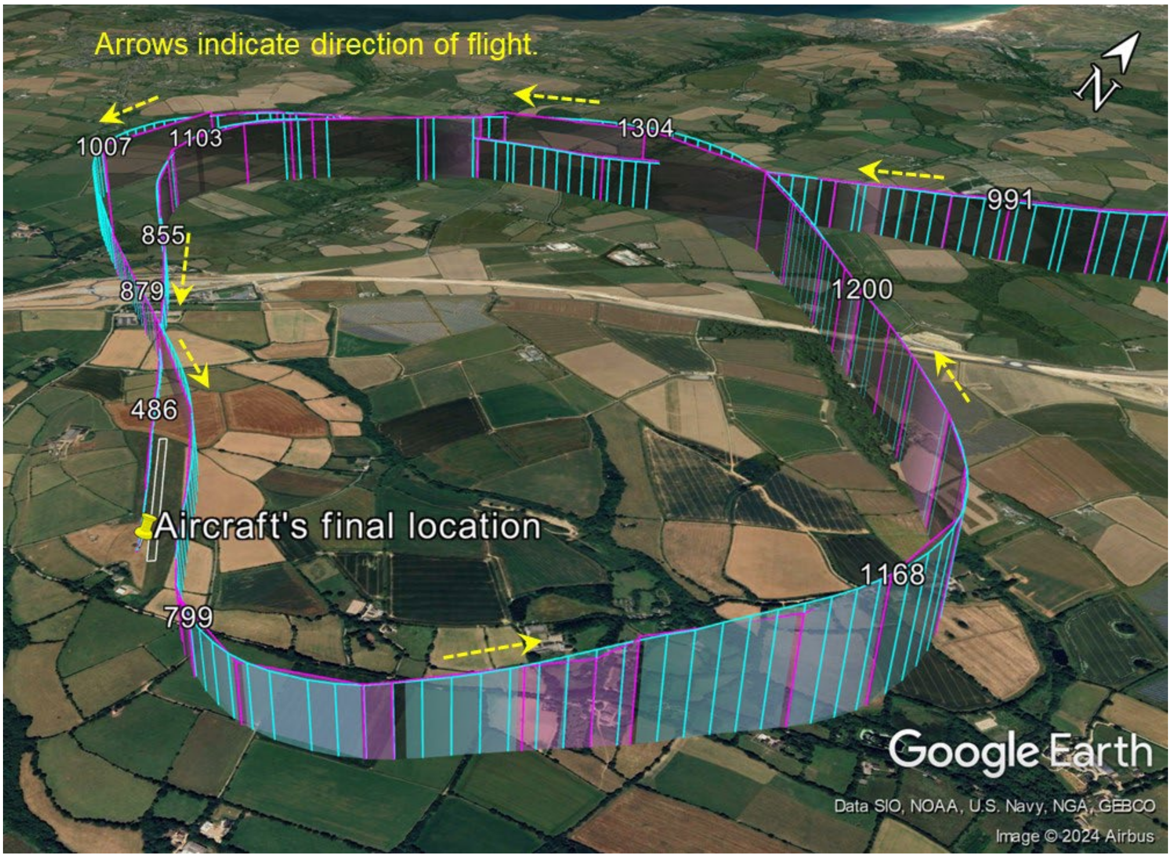


Figure 4

GPS tracks from EKP-V (blue) and iEFIS (purple) recordings, with altitude amsl overlayed
© 2024 Google, Image © Airbus

Figure 5 shows pertinent recorded parameters for the last 60 seconds of the flight. The Flight Path Angle (FPA) was calculated from the recorded data and indicates that the approach was flown at a FPA of between -5° and -7° until the flare. The accuracy of these calculations was limited by sensor measurement and calibration uncertainties, which are not known to the investigation.

Footnote

[1] For further information see: https://www.gps.gov/systems/gps/performance/accuracy/ [accessed January 2024].

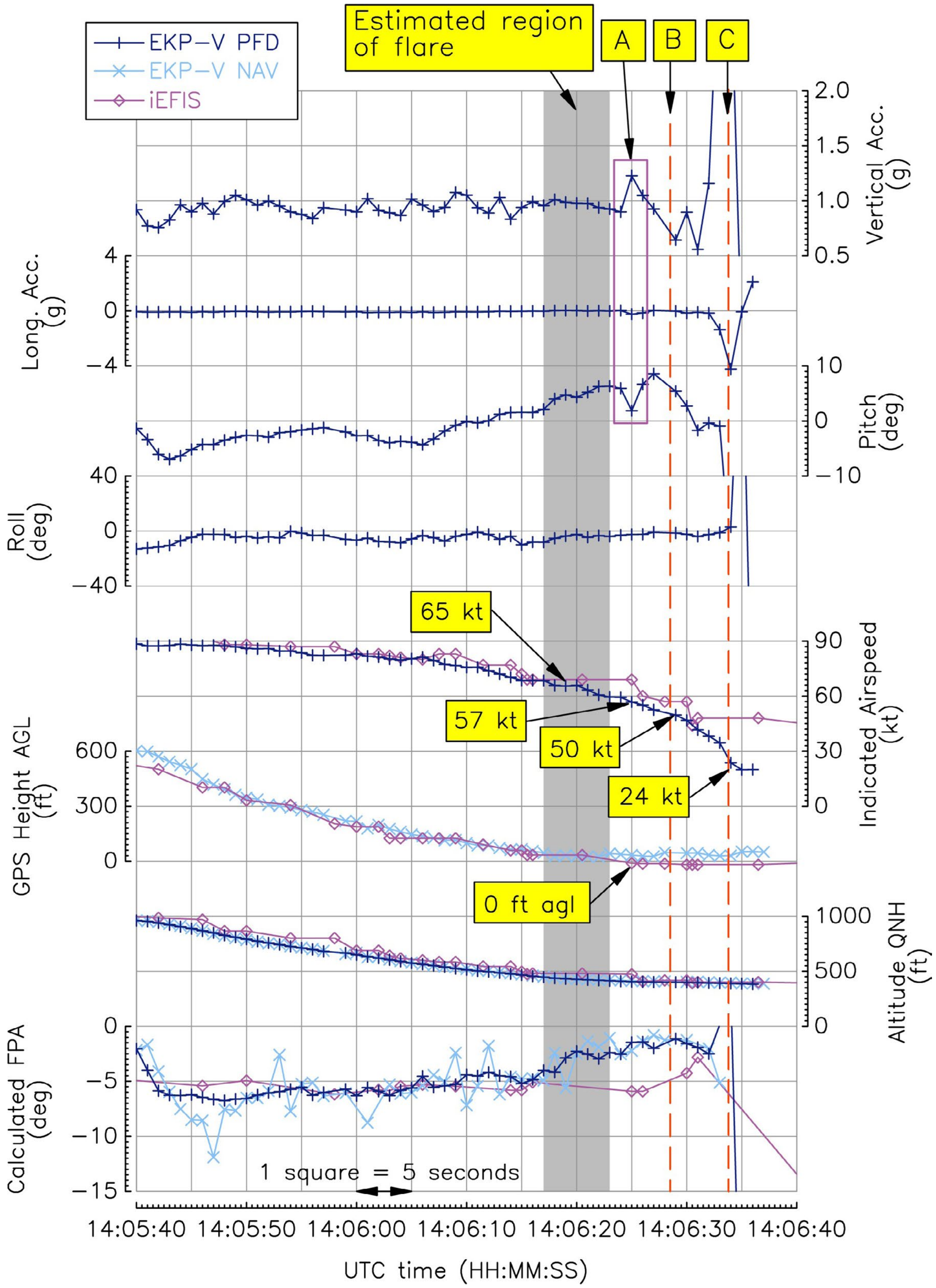


Figure 5

Pertinent recorded parameters for the final 60 seconds of the flight

Interpretation of approach and landing data

The airspeed was about 90 kt at the start of the approach, gradually reducing to about 65 kt where the data indicates G-RVSH began to flare (shown as the shaded region in Figure 5). The recorded GPS position at 1406:20 hrs indicates that G-RVSH was abeam Runway 14 and about a fifth of the length along it when the flare was performed.

A change in vertical and longitudinal acceleration, and temporary reduction in pitch, were recorded shown as point A in Figure 5, and the airspeed was about 57 kt. The sample rate and precision of the altitude and vertical acceleration recordings were not sufficient to determine whether this data indicates a bounce, float or ballooning. Furthermore, similar fluctuations in the recorded vertical acceleration were observed in the data throughout the flight to Truro.

Point B shows the timestamp at which a GPS position was recorded which corresponded with the point where wheel tracks were first visible in the grass. The recorded airspeed at this time was about 50 kt, giving an estimated groundspeed of about 53 kt.

At point C, the variation in acceleration and roll angle parameters indicate the point at which G-RVSH rolled over. When this occurred, the NAV recordings indicated a GPS calculated groundspeed of 35 kt but this parameter varied more than the airspeed, since it is a parameter calculated from differences in GPS positions. The PFD recorded airspeed was 24 kt, giving an estimated groundspeed of 27 kt, which is likely to more accurately reflect the aircraft's speed when it rolled over.

Aerodrome information

Truro Airfield (Figure 6) is located approximately 4 miles north-west of central Truro and has an elevation of 400 ft amsl. It has a single grass runway, 20 m wide, oriented approximately 140°/320°. Runway 14 has a 1.8% slope downhill. It is an unlicenced airstrip and, consequently, there is no requirement for any regulatory oversight.

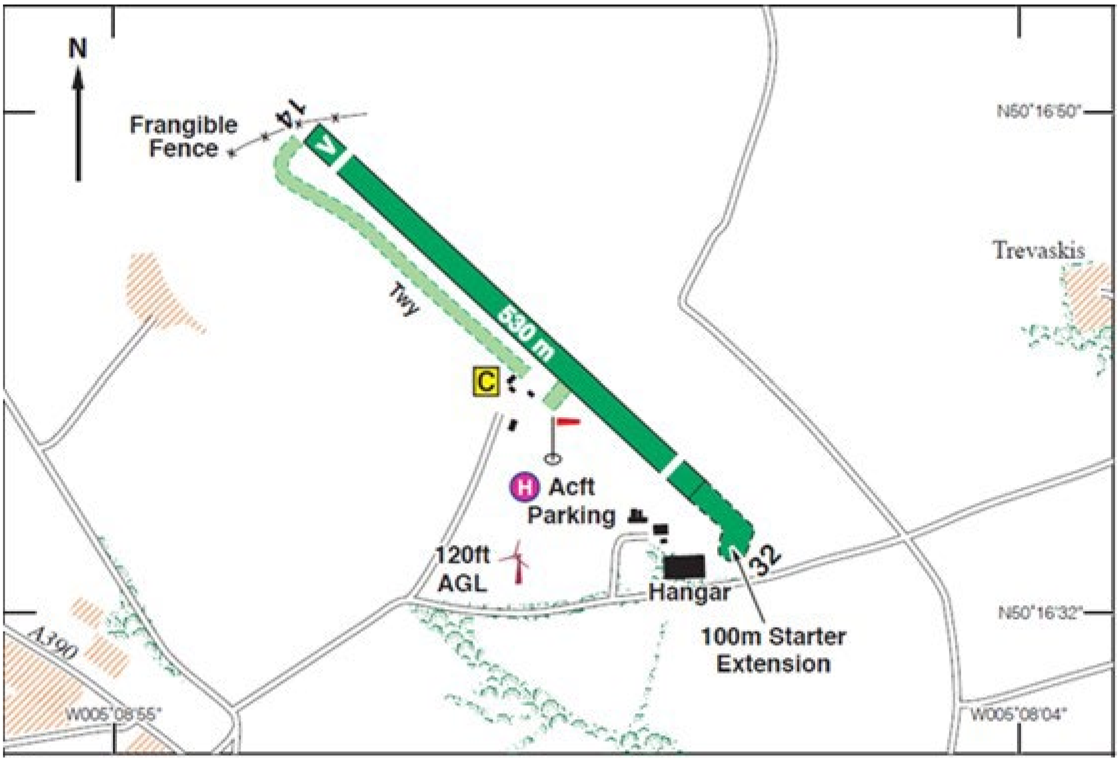


Figure 6

Pooley's Plate of Truro Airfield
2023, Robert Pooley

Truro used to be a licenced airfield, and concrete runway number identifications remain at the threshold of each runway. The numbers used to be painted white but had faded over time. There is a narrow grass taxiway, which runs between a hedgerow defining the airfield boundary and the runway.

The owner stated he had cut the grass on the runway the day before. The surrounding field had been cut for silage during the previous month. Figures 1 and 7 show the contrast between the runway strip and the adjacent grass in the field at the time of the accident.

On the day of the accident flight there were large hay bales to the north of the runway at various locations, some of which were adjacent to the edge of the runway. At the time of the accident, a farmer was collecting bales on the north-eastern side, towards the Runway 14 threshold. Several bales remaining on the north-eastern side of the runway were within 25 m from the centreline (Figure 7).

The airfield was also used as a training location for helicopters to conduct sloping ground landing training and practice. To facilitate this, a mound, about 30 m from the centre of the runway to the south-west between the windsock and the Runway 32 threshold, had been constructed. The base of the circular mound was 18 m in diameter with a 10° slope to a maximum height of 1.5 m. The Pooley's plate made no reference to the mound.

Runway dimensions and obstacles at unlicensed aerodromes

The Civil Aviation Authority publishes a Civil Aviation Publication (CAP)[2] for operations at unlicensed aerodrome. The publication states:

> *'The contents of this CAP are not mandatory, nor do they purport to be exhaustive. However, they do provide what can be considered as sound practice that has been developed in consultation with industry representative bodies.'*

The CAP recommends a minimum runway width of 18 m at unlicensed airfields where light aircraft under 2,730 kg MTWA are intended to operate. It also states that there should be:

> *'No vertical obstacles within 25 m either side of centreline.'*

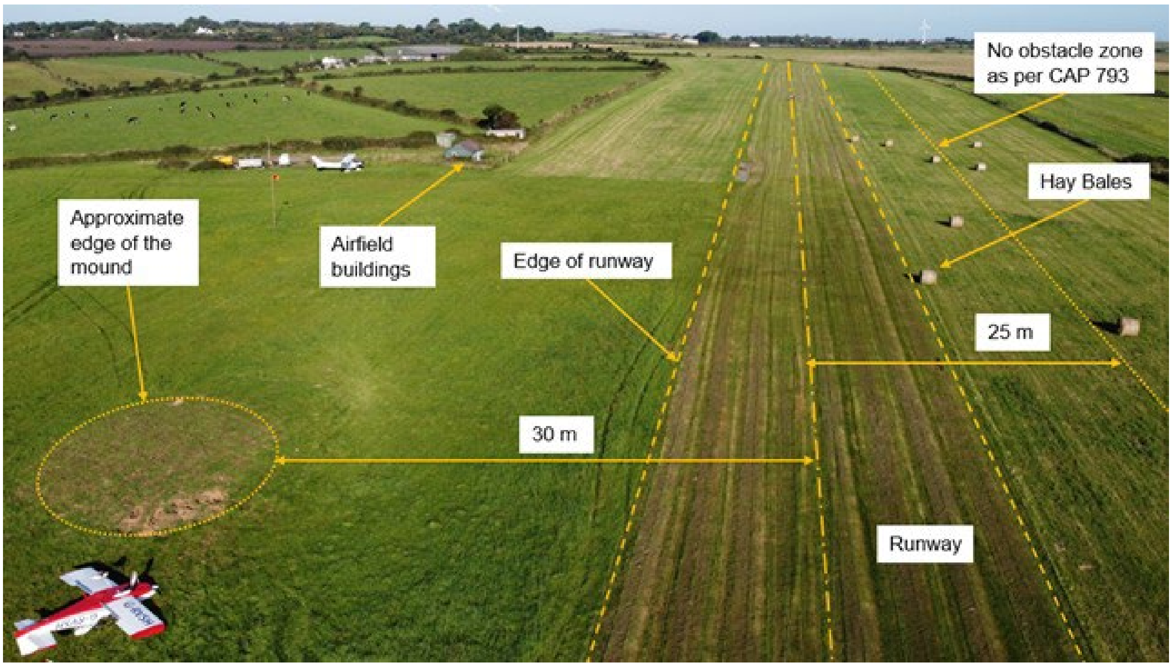


Figure 7

Truro airfield viewed in direction of Runway 32 showing hay bales and the mound

Aircraft information

General

The Vans RV-6A is a two-seat amateur built all metal aircraft powered by a Lycoming IO360A1AD engine and fitted with a constant speed two bladed Hartzell propeller. The two on-board avionic devices were connected to the same pair of static ports, one on each side of the aircraft at the rear of the fuselage which were connected in parallel. Total pressure was also provided to both devices from a single pitot tube located under the left wing.

Footnote

[2] CAA July 2010, CAP 793: Safe Operating Practices at Unlicensed Aerodromes, Edition 1, https://www.caa.co.uk/our-work/publications/documents/content/cap-793/ [accessed March 2024].

G-RVSH was built in 2004 by the previous owner and owned and operated by the accident pilot since 2015. No aircraft logbooks were made available to the investigation however the LAA inspector who performed the last annual inspection confirmed that all the aircraft documentation was in order at the time of the inspection. The aircraft was fitted with the sliding style canopy and the AntiSplatAero nose strut brace.

Landing gear

The landing gear is a tricycle configuration with the struts manufactured from 6150 steel rods and a castoring nose wheel. The nose landing gear strut attached to the engine mounting frame and has a 47° bend at the lower end to align the wheel's castoring axis (Figure 10).

AntiSplatAero nose strut brace

The nose strut brace is an after-market modification to the nose landing gear to prevent it from bending excessively during ground taxiing. It was developed by AntiSplatAero Inc. after reports of multiple nose landing gear failures, some of which resulted in the aircraft becoming inverted. The modification is pre-approved by the LAA for use on the RV-6A.

The modification consists of a high tensile 4130 steel blade which is clamped to the nose landing gear strut but still allows it to bend as a spring providing shock absorption (Figure 10). It prevents the strut from over bending should the forces exceed the capability of the material. It is a popular modification that has been fitted to many aircraft worldwide. The manufacturer states that '*this device could help prevent a costly repair, a propeller strike, engine disassembly for inspection or other damage may be avoided not to mention a dreaded possible flip over*'.

Aircraft examination

Initial on-site inspection

The on-site inspection of the aircraft revealed the aircraft had been correctly configured for landing with the flaps fully extended, fuel mixture set RICH and the propeller in HI RPM (fine pitch). One propeller blade was bent rearwards and there was some damage to the leading edge of both blades. Both magnetos were on, along with all the required electrical system switches, but the aircraft key had been removed, presumably by a first responder. Approximately 50 litres of fuel was removed from the aircraft.

The aircraft structure was intact with crush damage to the top of the vertical fin and deformation of the canopy frame and the Perspex shattered. The main landing gear was intact and there was evidence on the tyres of skidding on earth and grass. The nose landing gear strut was bent rearwards, and the front of the spat was damaged with a section missing. The aircraft was recovered to the AAIB facilities for further inspection.

Figure 8
G-RVSH at the accident site

Detailed inspection

The aircraft structure, engine and systems were examined in detail and no pre-existing defects were found that would have contributed to the accident.

The nose landing gear was disassembled to enable inspection of the individual components and measurements to be taken. The landing gear usually has a 47° bend at the lower end and following the accident this had increased to 59°. An additional bend had occurred just before the mounting position of 55° (Figure 9). The blade of the strut brace had also been deformed rearwards.

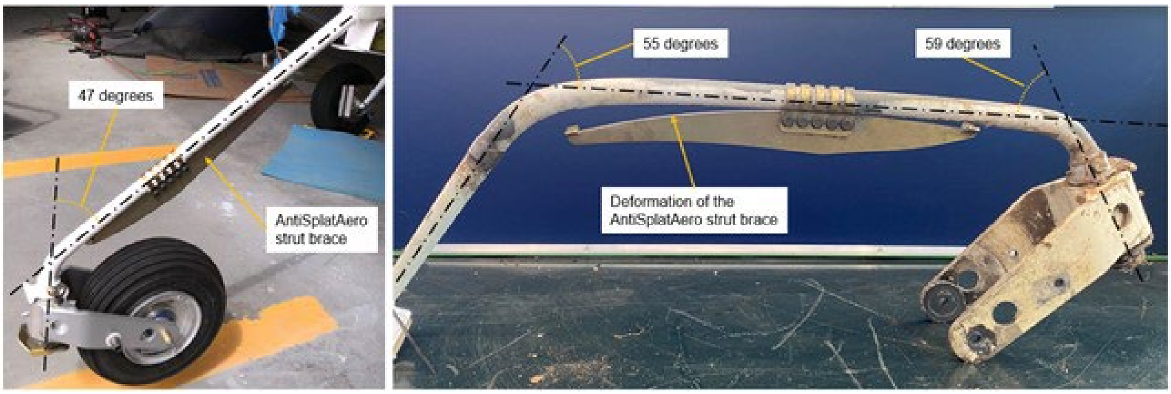


Figure 9
Nose landing gear damage detail

The change in the geometry of the nose landing gear strut resulted in the nose wheel no longer contacting the ground (Figure 10). This is consistent with the furrow that was created just prior to the aircraft becoming inverted. It was noted that despite the deformation of the strut brace, the centre portion of the landing gear strut had remained straight, but that the strut had bent beyond the ends of the brace.

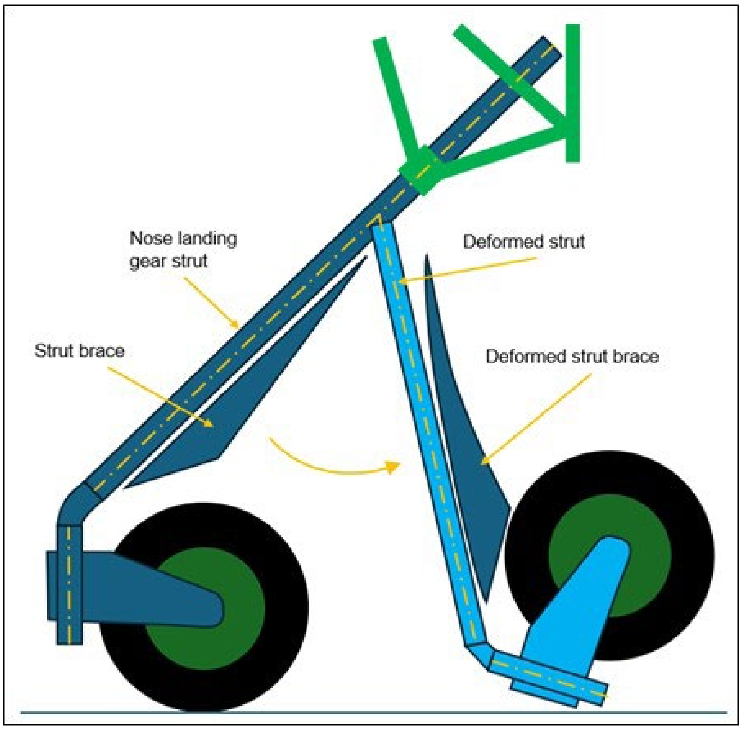


Figure 10
Deformation of the nose landing gear

Survivability

The RV-6A is available with a choice of two canopy types: a forward hinged and a sliding split canopy. G-RVSH was fitted with the sliding canopy with the forward part of the screen fixed and supported by a tubular steel hoop. During the structural inspection of the airframe, the deformation of the airframe and canopy was assessed to understand the change in the survivable volume for the pilot as the aircraft was inverted. When the aircraft was inverted it was resting on the front of the engine cowling and the vertical stabiliser. Analysis of the aircraft geometry showed that the top of the canopy would protrude approximately 35 cm above a line drawn between the engine cowling and the tip of the vertical stabiliser. The tip of the vertical stabiliser was damaged with a loss in height of approximately 5 cm.

Figure 11

Canopy frame deformation – note the pilot had been flying from the left seat

The shape of the steel hoop was examined and it was determined that the hoop had been deformed inwards and laterally to the right (Figure 11). From this it was concluded that as the aircraft became inverted, the left side of the canopy struck the ground first. The canopy continued to deform until the aircraft came to rest on the vertical stabiliser. There was evidence on the left wing tip of light abrasion and faint ground marks in the path of the tip indicating that just prior to the aircraft inverting, the left wing tip was touching the ground.

The pilot's seat belts had been cut by the first responders when he was removed from the aircraft, so it was not possible to determine how tight the shoulder straps had been. Anecdotal evidence suggested that if the shoulder straps were fully tightened it would not be possible for the pilot to reach the right side of the instrument panel and so it is possible that they may not have been tight enough to prevent the pilot moving out of the seat as the aircraft inverted.

The pilot's fatal injury was from a fracture of the cervical spine at the level of C3/4.

Meteorology

On the day of the accident, there was high pressure centred to the east of the country which would typically result in light winds and settled conditions. The actual reports from both Newquay airport to the north-east and RNAS Culdrose to the south gave light north-easterly winds at the time of the accident, with a temperature of 22°C at Newquay and 23°C at Culdrose.

A wind turbine on the airfield recorded a wind speed of about 3.25 m/s, or about 6 kt, at the time of the accident. The turbine did not record any parameters associated with the wind direction or orientation of the turbine nacelle. A video of the aircraft recorded by the airfield owner shortly after the accident showed the blades of wind turbines nearby to the north and north-east. Wind turbines are designed to face into wind and rotate clockwise when viewed from the direction of the wind. The turbines in the video indicated a wind direction from the north/north-east.

Sun position

At the time of the accident, the sun was in the south-west at an elevation of about 40° above the horizon, slightly below its maximum elevation of around 46° for that time of year.

Personnel

The pilot had held a PPL(A) since 1997 and had flown a total of 261 hours. The SEP (Land) rating had been revalidated by experience in March 2022. The pilot had completed a Pilot Medical Declaration (PMD) in May 2023 and 2021, with records indicating he had last seen an AME in 2019.

He had owned G-RVSH since 2015 and his total time on the Vans RV-6A type was 115 hours, with 7 hours flown since February 2023. He originally flew at Blackbushe Airport but had been based at White Waltham, a licensed airfield with grass runways, since 2016. His logbook showed that he had flown to a variety of airfields with both asphalt and grass runways. There was no evidence he had flown to Truro Airfield prior to the accident.

Eyesight

A PMD requires that a pilot meets the minimum DVLA eyesight requirements to drive[3]. This includes the requirement to have a minimum binocular visual acuity of at least 6/12[4]. The pilot would have met the eyesight requirements to make a PMD without the need for the use of corrective lenses.

Medical records from 2019 recorded that the pilot's uncorrected eyesight was 6/7.5 in the right eye and 6/24 in the left eye[5]. A medical examiner advised that his distant and intermediate vision would likely have remained stable, although his near vision may have further deteriorated with age (presbyopia). He assessed that the pilot likely experienced uncorrected binocular vision similar to 6/9; namely at 6 m he could view the same level of detail that a person with eyesight assessed as 6/6 can see at 9 m.

Footnote

[3] https://www.gov.uk/guidance/visual-disorders-assessing-fitness-to-drive#minimum-eyesight-standards--all-drivers [accessed July 2024].

[4] This is the measurement based on the Snellen scale.

[5] 6/6 is considered to be normal vision. With that vision, using only his left eye he would be able to see the same level of detail at 6 m which a person with uncorrected eyesight of 6/6 could see at 7.5 m. In the left eye, the pilot would only be able to see the same level of detail at 6m which a person with 6/6 could see when 24 m away.

Corrective glasses were found amongst the pilot’s personal possessions. It was reported to the AAIB that he had multiple pairs of glasses, including for flying and protection against the sun, and that he would wear glasses for driving at night but not necessarily during the day; he did not use reading glasses.

Figure 12 represents the vision of someone who had 6/9 binocular vision and illustrates the level of visual acuity and detail that the pilot was likely able to see on the approach had he not been wearing corrective glasses. A medical examiner stated that the pilot had mild short-sightedness where he “would not be able to see some small typeface on a PowerPoint presentation from the back of the lecture theatre.” However, the medical examiner stated that the pilot should have been able to identify the airfield, make a circuit and approach, and see the vehicles in the field, but perhaps not any people working on them when he was at the 500 ft agl. His vision would have made identification of the threshold numbers and runway from this point difficult due to the lack of contrast.

Figure 12

View of airfield as per Figure 1, with image refracted to approximate the pilot’s uncorrected eyesight (Note the comparison with Figure 1 might not be valid if viewed with low resolution devices or printed copies)

Other Information

G-RVSH performance data

No pilot operating handbook was found for G-RVSH, but flight test data of G-RVSH from 2016, following the fitting of a Hartzell constant speed propeller, recorded an unstick speed of 65 kt. A clean stall speed of 52 kt was recorded during the flight test for revalidation of the aircraft's permit to fly in April 2022.

RV-6A landing technique

The aircraft manufacturer's Build Manual (applicable to all RVs except RV-12/12iS)[6] provided the following guidance on landing technique:

> *'Make your approach speed 1.5 times the approach to stall speed you noted earlier, usually around 80-90 mph for a typical RV. The 80-90 mph approach is a little faster than ideal approach speed but will be best for the first landing attempt because it will permit more time to execute the landing flare.*
>
> *If you should accidentally hit hard enough to cause a sharp bounce back into the air, apply power and make a go-around for another landing attempt. Unless the runway is very long, it is probably better to start over rather than to try to salvage a bad landing out of an abnormal condition (bouncing back into the air at an unusual attitude or speed.)*
>
> *On tri-gear planes, land on the mains and hold the nose wheel off as long as possible. The nose wheel is taxiing gear, not landing gear. Keep the stick full aft while you taxi.'*

The LAA provide guidance on[7] the landing technique to be used for an RV6-A:

> *'It is also important to land the aircraft on the mainwheels first and hold the nosewheel off the ground during the initial part of the landing roll, rather than landing on all three wheels together which encourages wheelbarrowing and overloading the nosewheel.'*

The NTSB published Structures Study Case No: ANC05LA123 in July 2007 looking at the causes of multiple rollover accidents and incidents with the Vans RV-6A, RV-7A, RV-8A and RV-9A aircraft. In conclusion, they stated '*that the nose gear strut has sufficient strength to perform its intended function*' but there were several factors which could reduce the ground clearance of the wheel fork. This reduction in clearance could cause the strut to bend backwards during landing or taxiing and combined with aerodynamic loads, result in the aircraft nosing over.

Footnote

[6] Section 15: Final Inspection And Flight Test, revision 9 dated 7 December 2023, https://www.vansaircraft.com/service-information-and-revisions/manual-section-15/ [accessed March 2024].

[7] LAA type acceptance data sheet TADS 181A VAN's RV-6 & 6A. Issue 16 dated 2 March 2023.

Other Vans tricycle landing gear aircraft accidents

A review of the AAIB investigation database of all accidents involving Vans aircraft configured with tricycle landing gear was conducted, and the results filtered to only those in which the nose landing gear had been damaged. Further analysis was conducted to determine the landing surface, if the aircraft had bounced on landing, whether the AntiSplatAero mod was fitted and the type of canopy. Several of the AAIB reports refer to other accident reports and the LAA advice regarding holding off the nose landing gear for as long as possible. The list is included in Appendix A to provide a reference point for this type of accident at the time of publication. It is noted that this was the first fatal occurrence of this type of accident in the United Kingdom involving a Vans RV-6A.

Strip Flying

There are various open-source materials on the web or through apps that can assist with the identification of an airstrip and the hazards that may exist. In addition, the CAA has published a Safety Sense Leaflet 12 on Strip Flying[8]. This provides guidance to pilots on planning considerations and how to identify the hazards and manage the threats that may exist or the errors that may occur when landing at an airstrip.

The leaflet emphasises the importance of knowing the slope of a runway and explains how it can be calculated. It also highlights that:

> *'Most normal approaches in light aircraft are flown at around a 4° angle, but some strips may require more than this to land in the available space. Steep approaches and/or 'short field' takeoffs and landings require different techniques from normal and should be practised with an instructor who is familiar with strip operations.'*

It further emphasises that:

> *'The speeds and approach profile need to be very accurately flown. Landing distance required is very sensitive to technique – crossing the threshold too high or a 10 kts increase over the optimal speed may go unnoticed at a normal aerodrome, but at a strip you may not stop in the available distance.'*

The leaflet also provides 'Recommended Performance Factors' to be applied to the landing distance required. These include increases for temperature, long grass, aerodrome elevation, slope and tailwind component. When applied, these factors typically increase the overall landing distance required by affecting the energy at the point of touchdown and the rate in which that energy is dissipated through braking and the effects of the landing surface.

Footnote

[8] CAA Safety Sense leaflet 12, Strip Flying, Safety Sense 12 - Strip Flying (caa.co.uk) [accessed March 2024].

Effect of Slope on pilot perception

A slope on the runway will alter the pilot's visual perception of the aircraft's approach path angle. A downhill slope has the effect to make the approach appear flatter than the actual flight path flown. This can be interpreted by the pilot that the aircraft is lower than it actually is; as a result, there is a tendency to fly a steeper approach and land long.

Analysis

Overview

The pilot of G-RVSH made an approach to Runway 14 at Truro airfield offset by about 20 m to the right of the edge of the runway. The aircraft landed deep and off the runway. There was evidence that at, or shortly after touchdown, the nose landing gear wheel was in contact with the ground. Ground marks indicated that the nose wheel fork dug into the ground, causing the nose landing gear strut to bend and resulting in the aircraft coming to rest inverted. There was some evidence that the left wingtip contacted the ground which either coincided with the right landing gear wheel running over the edge of a small mound or when the nose landing gear deformed. The canopy struck the ground when the aircraft rolled over and was significantly deformed above where the pilot was seated, causing the pilot to sustain a fatal neck injury.

Strip flying

The CAA has published guidance to pilots for operating to or from landing strips in Safety Sense Leaflet 12. The appearance of grass runways and the contrast between them and the surrounding field will vary depending upon the time of year and can be influenced by how recently the grass has been cut. This can present a challenge for the correct identification of the location of the grass runway. Furthermore, any obstacles in adjacent fields may be temporary.

Whilst the pilot had operated routinely from White Waltham, and to other grass airfields, each grass airstrip presents their own unique challenges. These demand appropriate planning and continued risk assessment by the pilot to determine whether it is appropriate and safe to land, especially if the pilot is landing at a strip for the first time.

The investigation could not establish the degree of pre-flight planning the pilot had conducted to land at Truro, apart from the phone call with the airfield owner.

Choice of runway

The choice of runway seems to have been in contradiction to the recommendation given over the phone by the airfield owner. However, it has not been possible to determine why the pilot elected to land in the direction of Runway 14.

There may have been an expectation that the wind favoured a landing on Runway 14, set by the earlier phone call made by the pilot to the airfield owner. While the pilot flew past the airfield to the left of Runway 14, his view of the runway and the windsock may have been limited since he was in the left seat. It is possible that, had the pilot been able to see the windsock clearly, he would have interpreted that the wind was mainly a cross wind from the left. However, he may not have recognised that there was also probably a slight tail wind. This likely difference of interpretation between the pilot and the airfield owner would have been due to the differing perspectives from which each viewed the windsock. Consequently, the recce may have confirmed the pilot's expectation and contributed to his decision to land on Runway 14.

It could not be ascertained whether the pilot had consulted a guide providing airfield information. While the slope at the threshold end of the Runway 32 was likely to have been obvious to the pilot, the downward slope on Runway 14 may not have been discernible to him from the air. It is, therefore, possible that he had not considered slope in his decision to land on Runway 14.

Alignment with the runway

Whilst the investigation could not determine if the pilot had been wearing corrective glasses at the time of the accident, it concluded that it was reasonable to presume that he was. However, the investigation explored whether his eyesight may have been a factor which contributed to landing off the runway had he not been wearing glasses at the time of the accident.

Figure 12 indicates that his uncorrected vision would not likely have affected his ability to discern the airfield. However, it would likely have made identification of the threshold numbers and runway difficult due to the lack of contrast seen from the 500 ft point.

The loss of colour and texture from the mowing of the grass of the runway and the harvesting of the field, along with tramlines formed when harvesting, would have reduced the clarity of the cues available to discern the actual runway. This may have led to confusion by the pilot. The hay bales to the left of the runway may also have influenced the pilot to align to the right of the actual strip and for him to believe he was landing on the actual runway.

The AAIB also considered whether the sun position may have had an influence on the ability for the pilot to discern the actual runway strip. However, the sun was to the right as the pilot made the approach and just passed its zenith in the sky. It is not considered that the sun and light levels at the time of the accident would have resulted in glare or diminished the contrast between the runway strip and the field in which it was situated.

Touchdown point

The approach data indicates the pilot started his approach at about 90 kt and gradually reduced it to about 65 kt at the start of the flare. The higher speed at the start of the approach would have required an increased rate of descent to be able to commence the flare at the threshold of the runway. The higher speed probably contributed to the pilot starting the flare approximately a fifth of the way down the runway.

The Flight Path Angle (FPA) is a correlation of approach speed and rate of descent. Throughout the approach the FPA was steeper than the 4° that is normally flown by light aircraft. The downslope of the runway likely contributed to the steeper approach, although it would have looked normal to the pilot. The result would have been extra energy at the start of the flare. The presence of a light tailwind would also have added to this extra energy. At the point of the flare, this extra energy probably resulted in float or ballooning and, consequently, the aircraft landing further along the runway length than normal.

Whilst the witnesses stated they saw the aircraft bounce, it was unlikely they would have been able to actually see the aircraft's wheels touch the ground from their position, and they may have interpreted a float, or even a ballooning of the aircraft, as a bounce. The absence of ground marks prior to the touchdown point suggests the aircraft did not bounce, although it could not be determined from the data whether the aircraft floated, ballooned or bounced. The data shows an unstable flare with a decrease in vertical g associated with a pitch down suggesting a "bunt" (Figure 5, point A), followed by a pitch up and further pitch down just prior to touch down. This corresponds with the evidence of the start of the tyre tracks.

If a pilot is faced with an unstable approach or landing, the advice is to go-around. The manufacturer states:

> *'…it is probably better to start over rather than to try to salvage a bad landing out of an abnormal condition…'*

Nose over

Both the aircraft manufacturer and the LAA documentation for this aircraft type highlight the need to keep the nosewheel off the ground on landing. The aircraft manufacturer's documentation emphasised *'the nose wheel is taxiing gear, not landing gear'*, while the LAA documentation highlights the risk of wheelbarrowing and overloading the nosewheel. There was strong evidence that all three wheels were in contact with the ground at the point of landing and throughout the ground roll. This would have increased the load on the nose gear and increased the risk of the aircraft becoming inverted.

At the point that the aircraft began to nose over, it would not have decelerated to the same extent as it would have if it landed on the runway. In addition, there were other performance factors present due to the slope and tailwind, as well as the airfield elevation and temperature. These would not only have likely affected the energy of the aircraft at the start of the flare but also reduced the rate of deceleration of the aircraft during the landing roll.

Nose over events of this aircraft type have not typically resulted in a fatal outcome. Tight shoulder harnesses reduce movement of the occupant and possible contact with the canopy or other areas within the cockpit. The combination of the level of energy at the point that G-RVSH nosed over, and the deformation of the canopy's steel hoop likely contributed to the fatal outcome. The degree to which the shoulder harnesses were fully tightened could not be determined.

Conclusion

The aircraft landed deep and 20 m to the right side of Runway 14, and the evidence indicated that it touched down on all three wheels. As a consequence, the nose wheel dug in, the strut deformed, and the aircraft rolled over onto its canopy.

The investigation did not determine why the aircraft landed deep and off the runway to the right. There were a number of factors that led to the aircraft's energy being sufficient for the aircraft to nose over, and the canopy being significantly deformed.

Safety Actions

Following the accident, the following safety actions have been taken:

- The airfield owner has instructed the farmers to remove the hay from the airfield as soon as it is baled and not to store it on the airfield.
- The airfield owner has provided additional guidance in the Pooley's Plate on which runway to use depending upon the wind conditions.
- The airfield owner has removed the training mound.

Appendix A

AAIB investigations of Vans aircraft with tricycle landing gear which damaged the nose landing gear

Aircraft Reg	Type	Location	Event Date	Event description	Surface	Inverted	Bounce	Speed	Nose strut brace fitted	AAIB safety comment
G-RUSL	RV-6A	Westonzoyland Airfield, Glastonbury	03/09/2023	Made a heavy landing, bent the nosewheel which dug into the ground and the aircraft flipped over.	Grass	Yes	Yes	Roll out	Yes	No
G-RVSH	RV-6A	Truro Airfield, Cornwall	03/09/2023	Aircraft turned over on landing – see above.	Grass	Yes	Yes	Landing	Yes	Yes
G-RVCE	RV-6A	Rendcomb airfield, Gloucestershire	13/08/2023	After landing nose wheel dug in and aircraft flipped over	Grass	Yes	Yes	Landing	Unknown	No
G-RVEE	RV-6A	Eshott Airfield, Northumberland	09/07/2022	Aircraft flipped on landing.	Grass	Yes	No	Landing	Unknown	No
G-CKTF	RV-6A	Holmbeck Farm, Leighton Buzzard, Bedfordshire	08/08/2020	Aircraft turned over on landing.	Grass	Yes	Yes	Landing	Unknown	No
G-CKTF	RV-6A	Stapleford Aerodrome, Essex	31/03/2019	Taxiing on soft ground the nose wheel collapsed causing aircraft to tip forward.	Grass	No	No	Taxi	No	No
G-CCVS	RV-6A	Old Sarum Airfield, Wiltshire	15/08/2017	Nosewheel collapsed on landing, dug in and aircraft became inverted.	Grass	Yes	Yes	Landing	Yes	Yes
G-CCVS	RV-6A	Sywell, Northampton Airfield, Northamptonshire	02/09/2011	Aircraft appeared to touch down heavily and bounced before coming to a halt.	Grass	No	Yes	Landing	Yes	No
G-RVSA	RV-6A	Fishburn Airstrip, Co. Durham	30/08/2008	Nose wheel hit ground and aircraft flipped over on landing.	Grass	Yes	Yes	10 kt	Yes	No
G-RVPW	RV-6A	Netherthorpe Airfield	07/06/2008	Nose gear collapse on landing.	Grass	No	No	25 kt	Yes	No
G-EDRV	RV-6A	Northampton (Sywell) Aerodrome	29/10/2006	Nose gear collapse on landing.	Grass	No	Yes	25 kt	Yes	Yes
G-RVCG	RV-6A	Wellesbourne Mountford	01/09/2004	Nose gear collapse on landing.	Hard	No	No	Touch and go	Unknown	Yes
G-BVRE	RV-6A	Barton - Manchester Rwy 32	21/04/2001	Nose gear collapse on landing.	Grass	No	No	Roll out	Unknown	No
G-HOPY	RV-6A	Dunkeswell Airfield Nr Honerton, Devon EX14	04/09/1999	Nose gear collapse on landing.	Hard	No	Yes	Landing	Unknown	No

Appendix A cont

Aircraft Reg	Type	Location	Event Date	Event description	Surface	Inverted	Bounce	Speed	Nose strut brace fitted	AAIB safety comment
G-ELVN	RV-7A	Drayton St Leonard Farm Strip, Oxfordshire	21/05/2019	Nose gear collapsed on landing.	Grass	No	Yes	Landing	Yes	No
G-ELVN	RV-7A	Sywell Aerodrome, Northamptonshire	12/08/2017	Nose gear collapsed on landing.	Grass	No	Yes	Landing	Yes	Yes
G-IIRV	RV-7A	Goodwood Aerodrome (Chichester), West Sussex	31/05/2014	Nose gear collapsed on landing.	Grass	No	No	Landing	Unknown	No
G-MROD	RV-7A	Sittles Farm Strip, Lichfield, Staffordshire	08/11/2009	Aircraft probably stalled on landing, nose gear dug into soft ground and gear leg bent.	Grass	No	No	Landing	Yes	No
G-CDRM	RV-7A	Crofts Farm, 10 miles north of Gloucester	09/06/2007	Nose gear dug in during landing and aircraft flipped over.	Grass	Yes	Yes	Roll out	Unknown	No
G-HCCF	RV-8A	Old Sarum Airfield, Wiltshire	21/02/2018	Aircraft flipped over on landing.	Grass	Yes	Yes	Roll out	Unknown	Yes
G-RVCH	RV-8A	Cranfield Airfield, Bedfordshire	08/09/2012	Nose gear leg collapsed on landing.	Hard	No	Yes	Roll out	No	No
G-CGXR	RV-9A	Kirkbride Airfield, Cumbria	15/08/2020	Nose gear collapsed on landing.	Hard	No	Unknown	Landing	Unknown	No
G-CFMC	RV-9A	Yeatsall Farm Strip, Abbots Bromley, Staffordshire	29/07/2019	On rollout aircraft suffered collapsed nose gear leg.	Grass	No	Unknown	Roll out	Unknown	No
G-RPRV	RV-9A	Nympsfield Airfield, Gloucestershire	23/08/2016	Nose gear collapse on landing and the aircraft inverted.	Grass	Yes	Yes	20 kt	Yes	Yes
G-XSAM	RV-9A	Old Sarum Airfield, Wiltshire	18/09/2015	Nose gear collapsed on landing.	Grass	No	No	Roll out	Yes	Yes
G-CGXR	RV-9A	Carlisle Airport, Cumbria	24/07/2013	Nose gear collapsed on landing.	Hard	No	Yes	Landing	Unknown	No
G-HUMH	RV-9A	Runway 25, Shoreham Airport	22/05/2009	Nose gear collapsed on landing.	Grass	No	Yes	Landing	Unknown	No
G-CDMF	RV-9A	Oaksey Park Airfield, Wiltshire	02/09/2007	Aircraft bounced on landing, nose gear dug in and aircraft tipped over.	Grass	Yes	Yes	Landing	Unknown	No
G-CCZY	RV-9A	Caernarfon Airfield	24/02/2007	Nose gear collapsed on landing.	Hard	No	Yes	Landing	Unknown	No
G-CCZT	RV-9A	Bicester Airfield, Oxfordshire	14/04/2005	Nose gear damaged on landing.	Grass	No	Yes	Roll out	Unknown	No

Published: 22 August 2024.

Accident

Aircraft Type and Registration:	UAS Malloy Aeronautics T150	
No & Type of Engines:	8 Electric motors	
Year of Manufacture:	2023 (Serial no: 120)	
Date & Time (UTC):	27 June 2023 at 1443 hrs	
Location:	Field in South Scarle, Lincoln	
Type of Flight:	Training	
Persons on Board:	Crew - None	Passengers - None
Injuries:	Crew - N/A	Passengers - N/A
Nature of Damage:	Destroyed	
Commander's Licence:	General Visual line of sight Certificate (GVC)	
Commander's Age:	45 years	
Commander's Flying Experience:	150 hours (of which 2 were on type) Last 90 days - 5 hours Last 28 days - 5 hours	
Information Source:	AAIB Field Investigation	

Synopsis

Whilst being operated in a manual flight mode, the unmanned aircraft breached the geofence and changed to an automated flight mode. In response, the remote pilot reduced the throttle and changed back to the manual mode. Control of the aircraft was lost because the mode was changed at a low throttle setting and the subsequent actions to regain control were unsuccessful. The aircraft struck the ground and was destroyed.

The operator no longer uses the manual mode and has promoted the use of standardised phraseology between the ground control station operator and the remote pilot. Further action has been taken to consider and apply a suitably sized geofence for each operational flight.

The Operation Safety Case on which the Civil Aviation Authority (CAA) granted a Specific Category Operational Authorisation were missing definitions and procedures for the use of geofences and actions to be taken in the event of a breach. A Safety Recommendation has been made to the CAA as these omissions have further effect as the use of a geofence is widely used as a mitigation for several other operational risks.

History of the flight

The Remote Pilot (RP) was undertaking a skills currency flight using a Malloy Aeronautics T150 unmanned aircraft and was assisted by a Ground Control Station (GCS) operator. The RP and GCS operator were in two-way communication via radio. The RP was flying circuits in Stabilised flight mode (STAB mode) at a training ground. It is a remote site on farmland used by the organisation he was contracted to fly with as an R&D and training pilot. The geofence for the flight was 40 m high by 300 m radius with the centre on the takeoff point (Figure 2). The dimensions of the geofence were not considered by the RP and GCS operator prior to the flight but accepted as a standard training envelope.

The GCS operator noticed the aircraft was approaching the upper limit of the flight geography zone within the geofence and he informed the RP using terminology not immediately understood by the RP. The RP was aware that the aircraft was turning to the right and climbing quicker than he had expected. Shortly afterwards the aircraft breached the upper limit of the geofence and reverted to an automated Return to Launch (RTL) flight mode. The RTL automation initially commanded the aircraft to climb, which the RP instinctively counteracted by reducing the throttle. The GCS operator informed him that RTL mode was engaged, and the RP changed the flight mode, by cycling the three-way flight mode selector switch on the handheld transmitter, to LOITER and then back to STAB mode.

The aircraft diverged from level flight and was seen to follow an erratic flight path unfamiliar to the RP, during which it achieved a maximum pitch of -41° and -60.9° of roll. To regain control the RP increased the throttle to 100% which caused the aircraft to overcorrect, and it then pitched to 85.3° with 60° of roll before descending rapidly from a height of 37 m. The RP realised he could not regain control and switched to an automated mode (LOITER mode) but by this time the aircraft was heading towards the RP's ground position and he decided to close the throttle, bringing it to the ground (Figure 1). Twelve seconds had passed from the geofence breach before the aircraft struck the ground approximately 50 m from the RP's position and within the horizontal boundary of the geofence (Figure 2).

Figure 1

Malloy T150 unmanned aircraft at the accident site

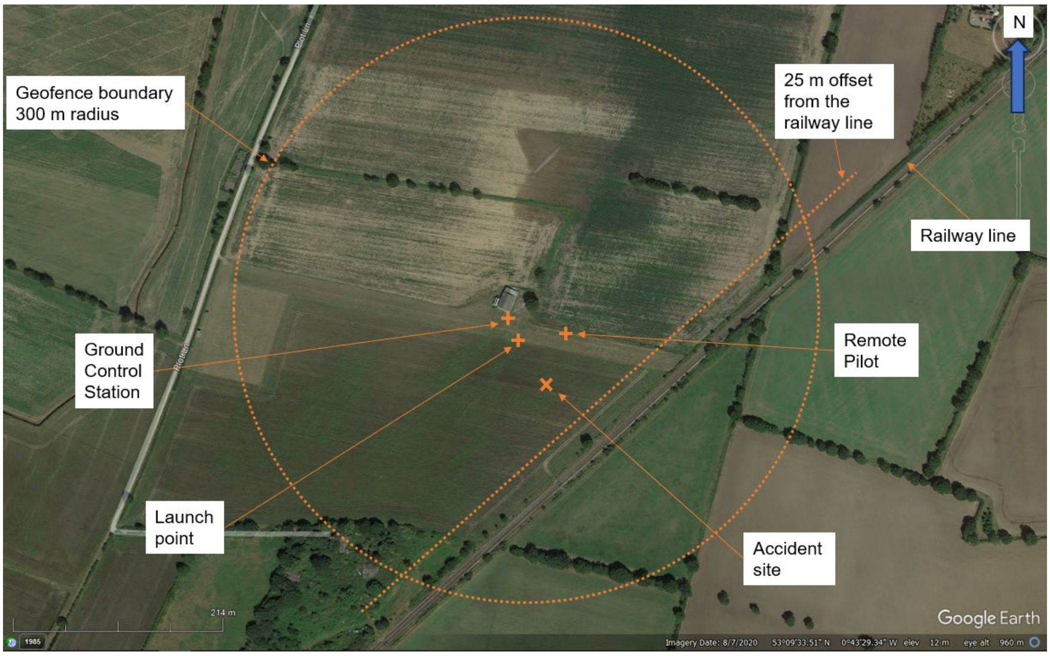


Figure 2

Accident site and geofence

Recorded information

Data downloaded from the UA showed that at 1445:56 hrs (local) the aircraft entered RTL mode (Figure 3) and the throttle input was recorded as having reduced to 2.6% from an RP input; this had no effect in RTL mode. The mode then changed to LOITER for approximately 600 ms before going back to STAB where the throttle increased to 100% in less than 1 sec. A large roll input was recorded after which the mode was changed to LOITER. The aircraft deviated from normal flight attitude and was not under control. The throttle was recorded as reducing to zero. The aircraft then pitched up but as it was inverted, it struck the ground.

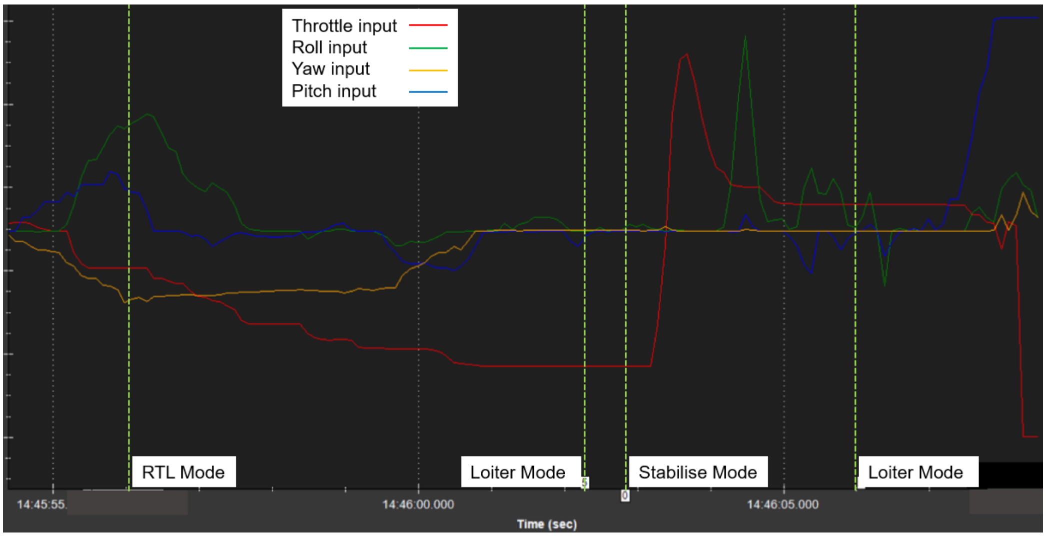


Figure 3

Pilot inputs

Aircraft information

The Malloy Aeronautics T150 is a military standard, cargo carrying unmanned aircraft capable of lifting a payload of 68 kg, has a maximum takeoff mass of 123 kg and produces 240 kg of thrust from its eight electric motors. The aircraft can be operated in various flight modes from manual flying with little automated assistance to fully automated pre-planned missions with minimal RP input required.

RP transmitter

On the accident flight the RP operated the aircraft with a FrSky Taranis X9D plus transmitter (Figure 4) and was supported by a GCS operator. The transmitter operates on 2.4 GHz and has a variety of customisable switches and features. The left stick controlled the throttle and yaw with the right stick for pitch and roll. It is possible to adjust the length of the sticks to suit individual operators. The transmitter is fitted with a three-way toggle switch which enabled the RP to manually change between a selection of the pre-programmed flight modes. There are 20 different automated flight modes available within the aircraft firmware which can be combined with the automated mission flight profiles. On the accident flight the selectable flight modes were Altitude Hold (ALT HOLD), STAB and LOITER mode.

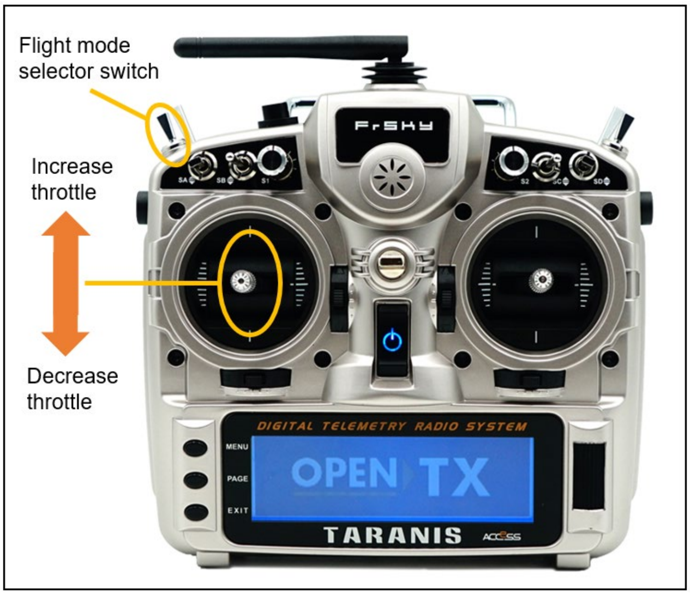


Figure 4

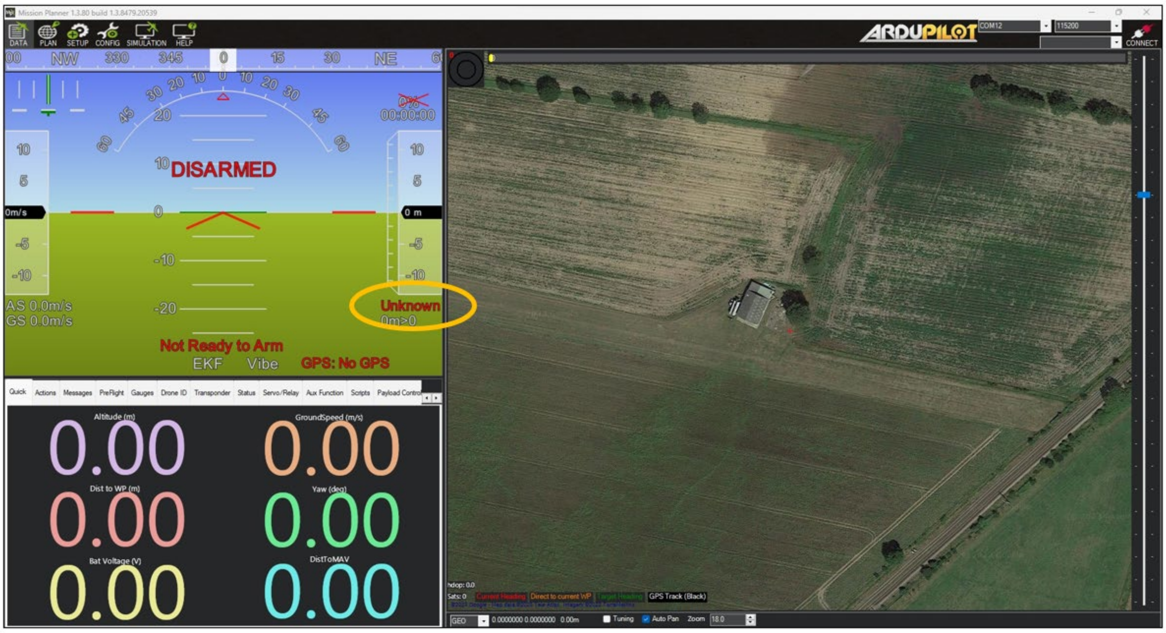
FrSky Taranis X9D plus transmitter

Flight modes

LOITER mode is a highly automated flight mode with the vertical and horizontal position of the aircraft controlled by the software. All the onboard sensors and GNSS receivers are operational. ALT HOLD mode allows manual commands in roll and pitch and is commonly used when the GNSS signal is lost. Translational speeds are higher than in LOITER mode but vertical speeds are limited. STAB mode is a reversion mode when multiple sensors (lidar, barometers) and both GNSS units are not functioning. The RP has full authority in all directions and access to the full 240 kg of available thrust. The probability of the aircraft entering this mode is remote due to inbuilt redundancy. The operator's RPs frequently flew in this mode to retain a high manual skill level and in case of an emergency during the R&D work they were undertaking. RTL mode is a fully automated mode which is engaged when the geofence is breached. The initial command is to climb 2 m then transition in a straight line to the launch point before landing. In this mode the RP inputs on the transmitter (Roll, pitch, yaw and throttle) have no effect.

Ground Control Station

To assist the RP a GCS operator is employed to monitor the continuous data feed from the aircraft and provide warnings, information and updates via radio headsets. The GCS laptop uses the open source ARDU Pilot Mission Planner software and the user interface is shown in Figure 5.



Altitude (m) 0.00
GroundSpeed (m/s) 0.00
Dist to WP (m) 0.00
Yaw (deg) 0.00
Bat Voltage (V) 0.00
DistToMAV 0.00

Figure 5

ARDU Pilot Mission Planner interface

The display in the top left shows the primary flight display similar to a manned aircraft and the highlighted text: 'UNKNOWN', is the flight mode caption. The software has an audible alert when the flight mode changes and the text flashes to white before returning to red. It was reported that these audible alerts were disabled for the accident flight. The lower left part of the interface contains 'Control and Status' values for various flight parameters such as battery level, altitude etc. The right side of the screen can be configured for either a map view or video feed.

Personnel

The RP was an experienced unmanned aircraft pilot who had been flying for many years. He was a member of the British Model Flying Association and the Large Model Association and had been flying the T150 for two years. He was subcontracted to the operator as an instructor and R&D pilot and held an A2 Certificate of Competency (CofC) and a General Visual line of sight Certificate (GVC).

The Ground Control Station (GCS) operator was also a qualified UA pilot with an A2 CofC and a GVC certificate and was experienced on multiple UA types. He held a company authorisation to be a mission commander and a GCS operator.

There were four other involved people at the operating site, but none were actively engaged with the aircraft operation on the accident flight.

Operating Safety Case

The aircraft was being operated in the Specific Category[1] under a CAA Operational Authorisation (OA) granted on 30 May 2023. The OA referenced the Operating Safety Case (OSC) document which included an Operations Manual (Volume 1 version 1.3), a Technical Ability document for the T150 (Volume 2 version 1.3) and Safety Risk Assessments (Volume 3 version 1.5). The OSC covered all aspects of the operation of the aircraft within the boundaries of the pre-defined work package that the prime contractor was engaged to provide. The operator on the accident flight was subcontracted to a prime contractor to provide training and test pilots for a development programme.

Volume 1 section 6 details the integrated organisational structure of the prime contractor and the operator for the purposes of the development programme. The contact details, licenses and types flown for many RPs but not the subcontract RPs details and skills. The section does not mention the use of subcontract RPs and only the Chief Pilot has the Malloy T150 listed in '*Types*'.

Volume 1 section 9 Competency and Qualification Requirements defines the overall training plan for an RP to convert to the T150 from another type. Ground and flight training is covered and specifically includes flight modes (LOITER, ALT HOLD & STAB) and emergency handling. It refers to an additional training annex – *'Disparate Remote Autonomous System Training Plan'* in which ground and flight school syllabi are detailed. RTL logic and safety settings are listed although there is no specific reference to operating within a geofence.

Volume 1 section 9.3 is specific to maintaining currency of flying skills for RPs and is defined as two hours every 90 days on any UA (not necessarily a T150). There are no other specific requirements and '*training should be focussed in areas of self-identified weakness*'.

Footnote

[1] Unmanned Aircraft System Operations in UK Airspace - Guidance (caa.co.uk) – CAP 722 section 2.2.2. [Accessed June 2023].

Volume 1 section 14.1 details the area of operation at the South Scarle site. Currency and competency flying are listed but '*no flights within 25m of railway on E-side*' are allowed. No vertical or over flight restrictions are defined.

Volume 1 section 25.5 describes the software functionality of programming geofences and the interaction between the ADRU Pilot software and the Special Mission Computer. Figure 6 taken from the OSC, is the Safe Airspace Volume (SAV) diagram that RPs and mission commanders '*must understand*' during flight planning. The origin of the diagram is from the graphical representation of the Joint Authorities for Rulemaking of Unmanned Systems (JARUS) Specific Operations Risk Assessment (SORA) Semantic Model to ensure a common usage of terminology for risk assessments. There are no specific requirements or information on how to define a suitable size related to the flight purpose, nor any RP procedures in the event of a geofence breach despite the statement that a '*breach of the Operational volume will require emergency action*'. The operators understanding of the contingency volume is the maximum operating volume allowed under their OA which was 400 ft (120 m) above surface level and 500 m from the RP. The geofence on the accident flight was considered to be the flight geography volume.

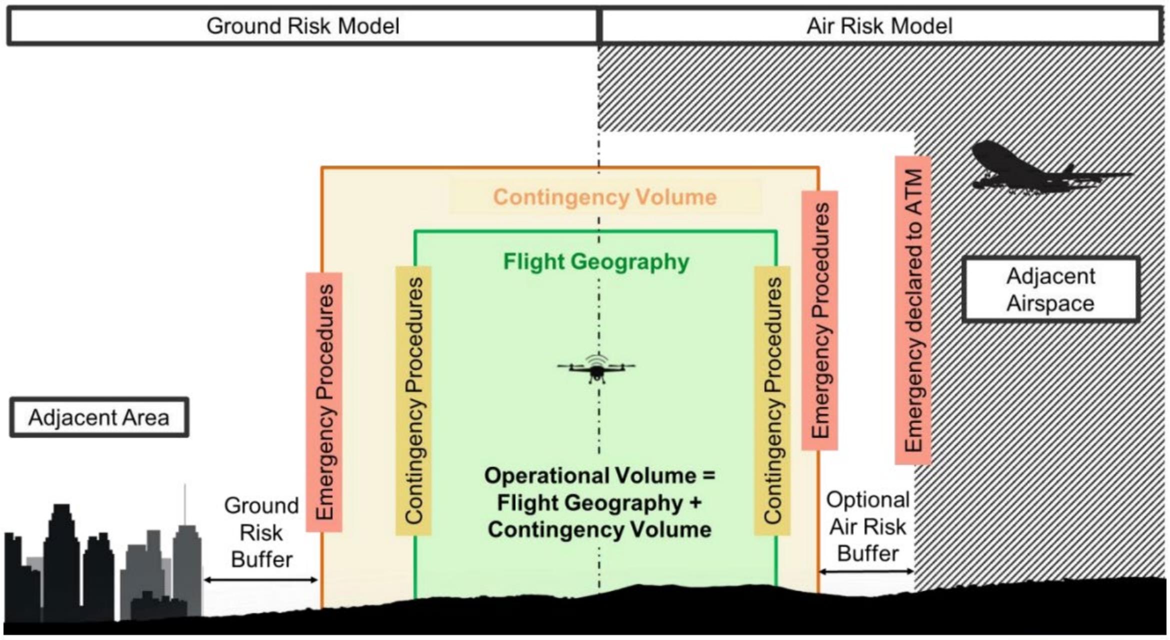


Figure 6

SAV model / JARUS SORA Semantic Model

Volume 1 appendix B are the applicable checklists to be used before, during and after a flight. A search of the checklists for items related to the geofence returned the only result in the '*Power On and Safety Checks*' in which the geofence is to be ENABLED and '*set appropriately*'. No parameter is included to qualify the appropriateness of the geofence set.

Volume 1 appendix B also includes all the Emergency Checklists and these were reviewed to identify if any could have been appropriate during the accident flight because a breach of the operational volume of the geofence will require '*emergency action*'. No Emergency Checklist could be found that was applicable for a geofence breach.

Volume 2 section 5.5 T150 Positioning, Navigation and Guidance states that in the event of a geofence breach the aircraft can be configured for the following actions:

- Land and report to GCS.
- RTL and report to GCS.
- Report to GCS only.

The geofence setup procedure refers to Volume 1 section 4.10 but Volume 1 section 4 is the Safety Statement from the Accountable Manager. No geofence setup procedure was found elsewhere in the OSC.

Volume 2 section 7 details the Emergency Recovery or Safety Systems and that the geofence is to be used for every flight to ensure the aircraft does not stray beyond the planned flight area including the maximum permissible altitude. In the event of a breach, the aircraft will be instructed to RTL or land at the RPs discretion.

Volume 3 of the OSC contains all the risk assessments and their mitigations for the specific operations that the operator planned to undertake. There are no risk assessments for a geofence breach or for a loss of control inflight. The most applicable risk assessment for the accident flight was Risk 4.9 'Flyaway – Air' and is described as '*an undesired flight trajectory and/or uncontrolled descent* [that] *could cause the aircraft to potentially exit segregated airspace and collide with another UAS or a manned aircraft or impact property causing damage, impact a person or animal causing serious injury or fatality*.' The '*During Operations*' mitigations for this risk is that the geofence will prevent the flyaway and that the flightpath is to be monitored by direct visual contact.

There are six risk assessments in which the use of a geofence is used to mitigate the impact[2]. In all cases the geofence is to be used to either maintain the aircraft within the designated airspace or to initiate the automated RTL mode.

Analysis

The accident flight

The RP, with the support of a GCS operator, was conducting a skills currency flight and flying circuits in a manual flight mode when he penetrated the vertical limit of the geofence. The STAB flight mode did not use any of the automated systems to aid the pilot and gave him full authority over throttle and speed in all the flight axis. The size of the geofence was 40 m high and 300 m radius centred on the takeoff point which was a standard size for training and no action was taken prior to the flight to consider if it was appropriate.

Footnote

[2] See Appendix - Risk assessments using a Geofence to mitigate the impact.

The GCS operator verbally warned the RP over the two-way radio just before the geofence was penetrated but did not use terminology the RP instantly recognised. The audible alerts on the GCS ground station had been disabled which the RP could have heard directly over the radio. The operator acknowledged that in the future the audible alerts must be enabled on the GCS ground station and that standardised phraseology should be used between the GCS operator and the RP. When the aircraft penetrated the geofence the flight mode automatically changed to RTL and commenced an initial climb of 2 m.

As the aircraft approached 40 m agl the RP was already reducing the throttle and as the aircraft climbed further in RTL mode it was reduced to a minimum of 2.6% to counteract the climb. The GCS operator alerted the RP of the mode change to RTL and the RP cycled the flight mode switch on the transmitter from STAB to LOITER and back to STAB. This cancelled the RTL mode and returned the aircraft to the manual STAB mode but with only 2.6% throttle applied. The RP stated that as he was aware that the aircraft had penetrated the geofence and he saw no need to allow the aircraft to RTL. By cycling the mode switch, he could regain control of the aircraft and continue with the flight.

The aircraft was not able to maintain stable level flight with such a low throttle setting and immediately descended with roll which the RP countered by applying full throttle. This was followed by a large roll input. The aircraft is capable of 240 kg of thrust but only weighed 55 kg as there was no payload attached for the training flight. This abundance of thrust resulted in the RP over correcting the roll attitude and the aircraft further departing controlled flight. Upon reflection the RP considered that it was unusual that he had applied so much throttle in such an uncoordinated manner. It is possible to adjust the length of the control sticks of the transmitter and on the accident flight he recalled that they were at their shortest setting. He was used to flying with much longer sticks where the distance from neutral to full deflection would have been further. It is his opinion this is why he applied full throttle instead of an intermediate amount of throttle to correct the descent.

The RP switched to LOITER mode and returned the sticks to the neutral position to allow the automation to regain control. However, the aircraft was too far out of the flight envelope for the automation to recover and was travelling towards the RP and GCS operator, so the RP closed the throttle and allowed the aircraft to impact the field.

Operator actions

An internal review by the operator after this event highlighted that a larger geofence could have been set as there were no airspace restrictions at the training site and their OA allowed them to operate with an operational volume of 120 m high by 500 m radius.

The review also considered the appropriateness of using STAB mode. The aircraft manufacturer did not think it should be used as it is a reversionary mode which would only be used in the event of multiple sensor failures. The operator concluded that they would no longer use it and flying should be conducted in either ALT HOLD or LOITER mode. In addition, the review concluded that the use of standard phraseology is to be adopted to accurately relay information between the RP and the GCS Operator. In conjunction with enabling the audio alerts from the GCS, which can be heard over the two-way radio, it was felt that this would prevent situations from occurring, such as a geofence breach.

Operating Safety Case

The investigation reviewed the OSC documents, and several findings were identified relating to operating with a geofence which may have contributed to the accident.

Definition of a geofence

The maximum operational volume allowed is defined in the OA as 400 ft above the surface and 500 m from the RP. Volume 1 section 25.5 Geofence defines the SAV model that RPs and mission commanders '*must understand*'. The '*Power On and Safety Checks*' checklist states that the geofence is to be ENABLED and '*set appropriately*'. The geofence for the accident flight was 40 m (131 ft) by 300 m and was a standard training envelope but neither the RP nor the GCS operator recalled a discussion whether this size was appropriate. The height of the geofence was a causal factor in the accident.

Geofence procedures

It was considered by the operator that all the RPs were experienced and therefore there was no requirement to detail the actions to be taken in the event of a geofence breach. The geofence diagram in the OSC states that when the aircraft crosses from the flight geography volume to the contingency volume there are '*Contingency procedures*' and '*Emergency procedures*' when the aircraft leaves the operational volume. The investigation could not find either contingency or emergency procedures for either case.

The practise of cancelling the RTL in the event of the geofence breach was normalised behaviour to save time. The RP was aware that he breached the top of the geofence and felt comfortable cycling the flight mode switch on the handset to restore the aircraft to the manual flight mode. This action was carried out spontaneously without conscious awareness of the throttle setting and therefore the aircraft entered the manual mode with the throttle almost fully closed which resulted in the loss of control. Following this accident the operator will train RPs, when cancelling an automated flight mode, to revert to LOITER mode thereby excluding the controller throttle setting.

Training

Recurrent flight training relied only on '*self-identified*' weaknesses to be practiced as opposed to a structured training plan which would have defined regular practise of normal and non-normal procedures. There was no requirement for an objective assessment of flying skills and the identification of any specific skills that needed practise. The repetition of non-normal procedures in a training environment can result in a more consistent application of defined procedures in times of high workload. This informality may have led to the RP being comfortable with cancelling the RTL and continuing with the flight after the breach rather than to follow the OSC which stated that "emergency action" should be taken.

The size of the geofence used for the accident flight was considered a "standard training geofence". It was not clear to the investigation whether that was applicable to the recurrent training of the operators RPs or student RPs being trained by the operator. Had the height of the geofence been set higher the initiating event would not have occurred. The lack of a definition of what is an '*appropriate*' geofence contributed to this. The investigation also noted that the 300 m radius geofence encompassed a railway line despite the OSC stating that flights should not come with 25 m of the railway line. The operator relied on the RP to ensure overflights did not occur, but the OSC stated that a '*Geofence will be used to maintain the aircraft within designated airspace*'.

Use of geofences as a risk mitigation

The use of a geofence (followed by an automated RTL) was the mitigation identified in the OSC to reduce the impact of several risks to as low as reasonably practicable. These risks are applicable to all flights conducted under the OA. For the mitigation to be effective the geofence needs to be adequately defined so that when the automation takes control it is sufficient to reduce the impact[3] of the risk. As part of the OA review process the granting authority should ensure that the OSC contains sufficient detail regarding the definition of the safety feature and the procedures by which it is implemented. Without these, the safety feature cannot be effective to mitigate the risk.

Therefore, the following Safety Recommendation is made:

Safety Recommendation 2024-106

It is recommended that the UK Civil Aviation Authority, when granting Operational Authorisations for Unmanned Aircraft Systems in the specific category, ensure that any safety feature that is used to mitigate risks, is adequately defined in the Operational Safety Case and includes the necessary operational procedures.

The contract between the prime contractor and operator has now been completed so it is not expected that any update to the OSC for this operation will be made.

Conclusion

Control was lost of an unmanned aircraft during a training flight following a geofence breach. The height of the geofence was not evaluated prior to the flight to determine its appropriateness. The lack of a structured training programme and the normalisation of cancelling the RTL by cycling the flight mode switch resulted in the aircraft leaving an automated mode with low throttle applied. This throttle setting was insufficient to maintain controlled flight and the subsequent actions to regain control were unsuccessful.

The OSC, on which the CAA granted an authorisation for Specific Category flying, was missing definitions and procedures specific to the use of geofences and actions to be taken in the event of a breach. These omissions have a further effect as the use of a geofence is widely used as a mitigation for many other operational risks.

Footnote

[3] The use of a geofence will mitigate the impact of a risk and not the probability of occurrence.

Appendix – Risk assessments using a Geofence to mitigate the impact

Hazard	Mitigation	Argument	Evidence
FrSky Transmitter, Receiver or Link Failure	During Operations: ● Ground power options ● Geofence ● Automation ● Visual and audio warnings ● Spare battery	During operations: Geofence will be used to maintain the aircraft within designated airspace.	Volume 1 25.5 - Geofence
GCS Failure and/or Link Degradation	Design: ● Ardupilot native geofence ● SMC logic ● FrSky pathway ● Remains in safe airspace ● Robust Change Management process	Technical Mitigation: The UAS is programmed with an Ardupilot circular Geofence in which it must remain. If the aircraft attempts to exit the Geofence, either horizontally or vertically, the system will automatically limit the flight path.	Volume 1 25.5 - Geofence
GNSS Degradation	Design: ● GNSS redundancy ● Still airworthy without GNSS ● Regain GNSS data, geofence ● Robust Change Management process	Technical Mitigation: If the aircraft departs VLOS and regains GPS, the UAS is programmed with a Geofence. If the UAS attempts to exit the Geofence either horizontally or vertically, the system will automatically intervene.	Volume 1 24.1.3 - Geofence [sic – does not exist]
Flyaway - Air	Unmitigated failure: ● Geofence failure During Operations: ● After take-off checks ● Wind direction noted ● Telemetry noted for faults ● Geofence ● VLOS	During operations: Geofence will be used to maintain the aircraft within designated airspace.	Volume 1 25.5 - Geofence

Hazard	Mitigation	Argument	Evidence
Flyaway - Ground	Unmitigated failure: ● Geofence failure Technical malfunction: ● Software error During Operations: ● After take-off checks ● Wind direction noted ● Telemetry noted for faults ● Geofence ● VLOS	During operations: Geofence will be used to maintain the aircraft within designated airspace.	Volume 1 25.5 - Geofence Volume 2 1.9 - Pos, Nav & Guidance 1.13 - Safety Systems
Small Mission Computer (SMC) negatively influences the functionality of RPAS flight control	Design: ● Comprehensive Change Management process to document configuration control activity ● Geofence function integrated and enabled ● RTH function integrated and enabled ● Software changes are evidenced and practiced in simulation and live flying on proxy aircraft prior to live flight on T150	Technical Mitigation: Geofence is enabled on T150, and SMC is unable to over-ride.	Volume 1 1.13 - Safety Systems Volume 2 25.5 - Geofence

Published: 5 September 2024.

AAIB Correspondence Reports

These are reports on accidents and incidents which were not subject to a Field Investigation.

They are wholly, or largely, based on information provided by the aircraft commander in an Aircraft Accident Report Form (AARF) and in some cases additional information from other sources.

The accuracy of the information provided cannot be assured.

Accident

Aircraft Type and Registration:	Spitfire IXT, G-LFIX
No & Type of Engines:	1 Rolls-Royce Merlin 25 piston engine
Year of Manufacture:	1944 (Serial no: ML407)
Date & Time (UTC):	6 May 2024 at 1400 hrs
Location:	Pitsford Airfield, Near Sywell, Northants
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 1
Injuries:	Crew - None Passengers - None
Nature of Damage:	Propeller damaged, left wing rear spar buckled
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	62 years
Commander's Flying Experience:	23,000 hours (of which 90 were on type) Last 90 days - 25 hours Last 28 days - 17 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot and further enquiries by the AAIB

Synopsis

The engine cut out due to fuel starvation shortly after the pilot had transferred fuel supply from the wing tanks to the fuselage tank in preparation for landing. This resulted in a forced landing at Pitsford Airfield, a private grass airstrip, to the west of Sywell. During the landing the aircraft pitched onto its nose, damaging the propeller and left wing.

On a previous flight the pilot had inadvertently left the engine being supplied from the fuselage tank for the whole flight, rather than changing to the wing tanks once airborne, unknowingly reducing the fuel level in that tank.

As a result of the event the operator has implemented changes to the operating procedures to minimise the possibility of a reoccurrence.

History of the flight

The aircraft was on its third flight of the day and had not been re-fuelled since before the first flight. It was being operated as a private flight with a friend of the owner as passenger in the rear seat. The flight had been uneventful and as the pilot approached Sywell from the west, using the normal operating procedures, he transferred the fuel supply from the wing tanks to the fuselage tank. Approximately 30 seconds after changing to the fuselage tank, the engine 'surged' and ran down. The pilot re-selected the wing tanks and attempted to induce flow into the engine by yawing the aircraft, however he was unable to re-start the engine. At this point the aircraft was approximately 2,000 ft agl. The pilot realised he did not have sufficient height to land at his intended destination, so opted to land at Pitsford Airfield, a private grass airstrip to the west of Sywell. The pilot transmitted a MAYDAY call on the Sywell frequency and then briefed the passenger to prepare for the landing by opening his canopy and unlocking the side door, as explained in the pre-flight briefing.

The pilot reported that he arrived in the vicinity of the landing site with some excess energy, so 'S-turned' on the approach and lowered the landing gear and flaps to slow down. He recalled that he touched down approximately a quarter of the way down the 500 m strip. He also recalled that he had lowered the tail and started to brake close to the eastern end of the mown area. With a pronounced downslope the deceleration was slower than he had hoped and as he was approaching the field boundary he turned to the right to avoid a hedge. In doing so the right landing gear dug into soft ground, pitching the aircraft onto its nose and left wing. The propeller and left wingtip were damaged. Subsequent assessment of the left wing found that the inboard end of the rear spar had buckled. The rear canopy was also released when the aircraft pitched forward.

Approximately 60 imperial gallons (imp gal) of fuel were drained from the wing tanks, however the fuselage tank was found to be empty.

Aircraft information

G-LFIX is a Spitfire Mk IX that after service in the Second World War was converted to be a two-seat trainer for the Irish Air Corps. The aircraft was retired from service and had not flown for some years until restoration began in 1979. As part of the restoration the wing fuel tanks were converted from the original 13 imp gal bladder tanks into two 60 imp gal integral tanks positioned between the spars in the wings. The fuselage tank was retained and stores 39 imp gal.

The fuel system was re-configured to supply fuel to the engine from either the fuselage tank via an electric pump that was originally used to supply the engine from a blister tank or gravity fed from both wing tanks. An engine driven mechanical fuel pump is located downstream of the fuel selection valve.

The wing tanks do not have a quantity gauge, however the fuselage tank does. The quantity of fuel is displayed on a gauge on the lower right of the instrument panel when a button is depressed by the pilot (Figure 1). Prolonged depression or removal of the button to make the gauge read permanently would cause the measuring element to fail.

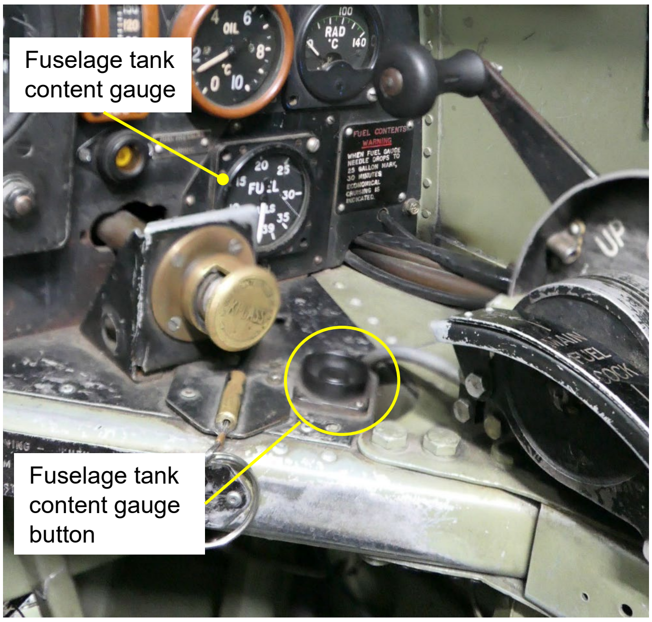


Figure 1

Spitfire G-LFIX fuselage fuel tank content indication gauge

Other information

Nature of operation

At the time of the accident the aircraft was being operated as a private flight with a friend of the owner as a passenger, however the aircraft is often used for Safety Standards Acknowledgement and Consent (SSA&C) passenger flights.

Fuel management

The aircraft had been fuelled to around 120 imp gal, approximately 40 imp gal in each wing tank and 39 in the fuselage tank. The operator had recorded the fuel consumption over several years and operated on a conservative consumption for a normal flight profile of 60 imp gal per hour, allowing for three 25 minute flights with a 30 minute reserve.

The operator's procedures are to takeoff and land using the fuselage fuel tank as the gravity fed wing tanks are less reliable during ground manoeuvring. There is also redundancy from the electrical fuel pump when fuel is supplied from the fuselage tank during operations close to the ground. Once away from the airfield, the wing tanks are selected.

Previous flights

The first flight of the day was a training sortie with the accident pilot seated in the rear seat and another pilot operating as pilot in command. After this flight the accident pilot moved to the front seat and a friend of the owner boarded the aircraft as a passenger.

During the pre-flight checks the pilot confirmed the fuselage tank contents by using the fuel quantity gauge. The quantity was as expected and sufficient for the planned flights that were to follow. The aircraft then departed the airfield. Although the flight was considered to have been completed normally, in hindsight, the pilot believes he may have been distracted and after takeoff failed to transfer the fuel supply to the wing tanks. On return to the aerodrome, he intended to complete a straight in approach, however once in the vicinity of the airfield found that the runway in use had changed. The pilot altered his approach and when he completed pre-landing checks found the fuel tank selector set to the fuselage tank, but with the altered approach, he assumed he had already configured for landing by changing to the fuselage tank during the initial approach and did not consider anything to be abnormal.

Once the aircraft had landed the passenger was disembarked and another friend of the owner boarded as a passenger. The pilot completed the pre-start checks, however during the checks he was interrupted so that he did not check the fuselage tank contents. When returning to complete the checks he omitted to check the fuel level. The flight continued normally until the aircraft approached Sywell and the pilot transferred back to the fuselage tank and subsequently depleted the fuselage tank's contents.

Analysis

The loss of engine power was attributed to fuel starvation due to depletion of fuel in the fuselage tank supplying the engine. When the fuel was depleted, the electrical pump continued to pump air, creating an air lock in the fuel inlet. When the pilot returned the fuel supply to being from the wing tanks the gravity feed was unable to overcome the airlock and with the engine not turning the engine driven pump was unable to draw fuel into the engine to re-start.

The initiating factor arose when the pilot did not transfer the supply to the wing tanks after takeoff for the second flight. There were, however, two opportunities to identify the issue, but circumstances prevented the opportunities from being realised. The first was on approach into the airfield at the end of the second flight. Had the runway in use not changed, the pilot may have realised the fuel had been supplied from the fuselage tank for the whole flight and not dismissed the position of the selector as having been positioned during the initial approach.

The second opportunity was when the pre-flight checks were being completed prior to the third flight. If the pilot had not been distracted during the checks, he would have identified that the contents of the fuselage tank were below that expected and taken action to rectify the issue.

With the passengers for both the second and third flight being friends of the owner, there may have been a slightly more relaxed approach to the flight, which may have been a factor in causing the distraction on both counts. It is also possible that distraction of this nature could occur during an SSA&C flight.

Had the pilot checked the contents of the fuselage tank prior to changing it during either flight he may have identified that the contents were below that expected and taken mitigating action to maintain fuel flow to the engine.

Safety action

As a result of this event, the operator has introduced a requirement in their operating procedures for pilots to confirm the contents of the fuselage tank before changing to it.

AAIB Comment

Distraction and interruption are unavoidable aspects of flying, no matter which phase of flight or flight preparation they occur. The effects can be immediate or masked for some time, as was the case in this accident. The UK Civil Aviation Authority have produced Safety Sense leaflet SS31 'Distraction and interruption in General Aviation Operations'[1] which provides guidance, case studies and lessons related to distraction and interruption to improve awareness of the dangers and promote strategies to help mitigate the effects.

Footnote

[1] https://www.caa.co.uk/our-work/publications/documents/content/safety-sense-leaflet-31/ [Accessed 10 July 2024].

AAIB Record-Only Investigations

This section provides details of accidents and incidents which were not subject to a Field or full Correspondence Investigation.

They are wholly, or largely, based on information provided by the aircraft commander at the time of reporting and in some cases additional information from other sources.

The accuracy of the information provided cannot be assured.

Record-only investigations reviewed: July - August 2024

3 Mar 2024 **Cessna 150M** **G-BSYV** Sandtoft Airfield, North Lincolnshire

On a student's first solo flight, the aircraft landed to the left of the runway centre line and then veered off onto the grass. The aircraft came to rest inverted and the nose wheel, propeller and vertical fin were damaged. The student suffered minor injuries but was able to evacuate unassisted.

29 Apr 2024 **Piper PA-28RT-201T** **G-BYKP** Thruxton Aerodrome, Hampshire

The aircraft's nose landing gear collapsed during a normal touchdown, causing damage to the lower cowling, landing gear doors, propeller and shock-loading the engine. The cause of the nose landing gear collapse was not conclusively determined.

24 May 2024 **EV-97 TeamEurostar UK** **G-CDJR** Sandown Airport, Isle of Wight

After an uneventful touchdown and rollout on grass Runway 23, the right landing gear leg collapsed during taxiing.

27 May 2024 **Pioneer 200-M** **G-CGLI** Wottons Farm, near Hempston, Devon

Control was lost after touching down during the third attempt to land. The pilot stated that he had become fixated on landing in the same direction as the takeoff, and should have considered alternative options after the second aborted landing.

20 Jun 2024 **Robinson R22 Beta** **G-JKAT** Gloucestershire Airport

The student was undertaking initial hover training on a designated helicopter site on the airfield. The student's control inputs were causing the helicopter to drift to the right and backwards during each attempt. The instructor stated that he adjusted the helicopter's position each time he took control but did not realise that the helicopter had moved closer to a building housing the airfield's NDB equipment. On the final hover attempt, the student's input caused the helicopter to move rapidly backwards. Before the instructor could intervene, the main rotor struck a DME antenna on the building causing the helicopter to roll over. The occupants were uninjured and able to exit unaided.

22 Jun 2024 **Piper PA 34 200** **F-BXLZ** 11 miles north-west Turks & Caicos

The aircraft had suffered a fuel leak on a previous flight, which the pilot stated had been corrected by a maintenance organisation. A fuel gauge was also changed, because of erratic readings, before the aircraft undertook this flight from Florida to the Turks and Caicos Islands. Both engines stopped approximately 11 miles north of the Islands, most likely due to fuel exhaustion. The two occupants were rescued by the United States Coastguard, one of whom suffered minor injuries.

Record-only investigations reviewed: July - August 2024 cont

22 Jun 2024 **Skyranger Swift 912S(1)** **G-CMFE** Newnham Airstrip, Hertfordshire

The pilot advised that, during the approach to land on a grass strip with a 10 kt headwind, the aircraft became too low and too slow. Power was applied too late to prevent the aircraft's impact with a hangar located in the area before the runway threshold.

25 Jun 2024 **Rans S6-ESD XL (Modified)** **G-MZJI** Sherburn-in-Elmet Airfield, North Yorkshire

When flying downwind, doing practice circuits, the pilot went to change fuel tank, but found that the fuel tank selector lever was missing. The pilot continued the circuit, but, distracted by the missing selector lever, allowed the aircraft to slow and stall prior to touchdown. This resulted in the aircraft landing on its nose wheel causing the nose landing gear to buckle. The missing fuel tank selection lever was not found in the aircraft, and the cause of it detaching could not be determined.

29 Jun 2024 **Piper PA28-181** **N65JF** Beccles Airfield, Suffolk

On final approach to Runway 09 at Beccles airfield, the pilot became distracted and on short finals noticed the airspeed was approximately 20 kt fast. The pilot decided to continue the approach and the aircraft landed faster and deeper down the runway than intended. The pilot could not stop the aircraft before reaching the runway end and the aircraft continued into a hedgerow before coming to a complete stop. There were no significant injuries sustained by the four occupants but the aircraft was damaged beyond repair. The pilot commented that he had taken away a number of learning points from the event, including to avoid distraction during a critical phase of flight and that executing a go-around in this case may have resulted in a safer outcome.

29 Jun 2024 **Cessna F177RG** **G-AYPG** Wellesbourne Mountford Airfield, Warwickshire

After completing two touch-and-go landings at Wellesbourne, the pilot forgot to lower the landing gear for the third landing. The aircraft slid along the runway for approximately 50 m damaging the underside of the aircraft and the propeller.

1 Jul 2024 **Zenair CH 750** **G-TMRL** North Coates Airfield, Lincolnshire

As the aircraft was slowing down after landing control was lost when the aircraft was caught by a crosswind gust. The aircraft departed the grass strip and ran into a water ditch.

Record-only investigations reviewed: July - August 2024 cont

1 Jul 2024 **Rans S6-116** **G-BWYR** Swanborough Farm Airstrip, East Sussex

The aircraft touched down, bounced, became airborne and drifted to the left side of the runway. After touching down again the aircraft drifted further to the left coming to rest in a ditch.

3 Jul 2024 **Rans S6-ES** **G-CBTO** Woottons Farm, near Totnes, Devon

Following a go-around from a first attempt to land on a short grass strip in a headwind that the pilot described as "stronger than expected", the second approach, albeit "bumpy", progressed as normal until the aircraft was very close to the ground. At that point, the rate of descent increased and the aircraft landed heavily at the planned touchdown point, bending the nose leg and breaking the propeller.

6 Jul 2024 **Pioneer 300 Hawk** **G-CGHK** Sherlowe Airfield, Shropshire

During takeoff the aircraft experienced a significant crosswind gust which caused the pilot to lose directional control and the aircraft suffered a runway excursion. The aircraft came to rest at a hedge line on the airfield's perimeter.

11 Jul 2024 **Thruster T600N 450** **G-CGFZ** Near Portaferry, County Down

Whilst conducting a low-level training flight the pilot heard a "sudden bang" from the engine, followed by heavy vibrations, after which the engine came to a complete stop. At 600 ft agl the pilot selected a suitable field and made a MAYDAY call. As the aircraft touched down the nose wheel dug in and the aircraft tipped over. Both pilots were able to exit the aircraft unaided with no injuries.

19 Jul 2024 **Pitts S-2A Special** **N80035** Near Croxton, Cambridgeshire

Just prior to performing a loop the engine oil pressure dropped slightly before recovering; this was captured by a cockpit camera. During a second loop, the pressure dropped from 60 to 25 psi and the engine lost power. The oil pressure continued to fall gradually until the engine stopped. The pilot landed the aircraft in a field of crops and the aircraft inverted. The pilot released himself from the cockpit and was uninjured.

26 Jul 2024 **EC120 B** **G-EIZO** Crewe, Cheshire

Whilst hovering away from the 40 cm high helipad, the right rear skid contacted the lip of the pad and, as the pilot applied more power, the helicopter rolled over onto the ground.

Record-only investigations reviewed: July - August 2024 cont

26 Jul 2024 **Mooney M20J** **G-FLYA** Full Sutton Airfield, Yorkshire

During a go-around, the aircraft clipped some crops to the side of the runway. The aircraft then landed with damage to the landing gear and wing.

17 Aug 2024 **Fournier RF3** **G-BNHT** Top Farm Airfield, Cambridgeshire

The pilot misjudged the flare and the aircraft landed to the right of the touchdown zone. The leading edge of the wing clipped a traffic cone that was marking earth works, causing cracking to the wing's D box. A go-around was initiated and the aircraft landed safely on the next attempt.

21 Aug 2024 **SIPA S91** **G-BDAO** Hunters Airstrip, near Wells, Somerset

The aircraft experienced a sudden drop in airspeed caused by the wind blanking effect of trees alongside the runway and landed heavily. The pilot commented that landing deeper into the strip where there were fewer trees and a consistent headwind may have had a better outcome. CAA safety sense leaflet SS12 offers advice for strip flying.

30 Aug 2024 **Piper PA-28-181** **G-TSGJ** Fishburn Airfield, County Durham

The aircraft was being manoeuvred to the fuel pumps for refuelling. The instructor had left the aircraft to prepare the fuel pump. The pilot under instruction then opened the throttle to move the aircraft towards the fuel pumps but it accelerated and struck an outbuilding, destroying the building and damaging the aircraft.

Miscellaneous

This section contains Addenda, Corrections and a list of the ten most recent Aircraft Accident ('Formal') Reports published by the AAIB.

The complete reports can be downloaded from the AAIB website (www.aaib.gov.uk).

TEN MOST RECENTLY PUBLISHED FORMAL REPORTS ISSUED BY THE AIR ACCIDENTS INVESTIGATION BRANCH

3/2015	Eurocopter (Deutschland) EC135 T2+, G-SPAO Glasgow City Centre, Scotland on 29 November 2013. Published October 2015.
1/2016	AS332 L2 Super Puma, G-WNSB on approach to Sumburgh Airport on 23 August 2013. Published March 2016.
2/2016	Saab 2000, G-LGNO approximately 7 nm east of Sumburgh Airport, Shetland on 15 December 2014. Published September 2016.
1/2017	Hawker Hunter T7, G-BXFI near Shoreham Airport on 22 August 2015. Published March 2017.
1/2018	Sikorsky S-92A, G-WNSR West Franklin wellhead platform, North Sea on 28 December 2016. Published March 2018.
2/2018	Boeing 737-86J, C-FWGH Belfast International Airport on 21 July 2017. Published November 2018.
1/2020	Piper PA-46-310P Malibu, N264DB 22 nm north-north-west of Guernsey on 21 January 2019. Published March 2020.
1/2021	Airbus A321-211, G-POWN London Gatwick Airport on 26 February 2020. Published May 2021.
1/2023	Leonardo AW169, G-VSKP King Power Stadium, Leicester on 27 October 2018. Published September 2023.
2/2023	Sikorsky S-92A, G-MCGY Derriford Hospital, Plymouth, Devon on 4 March 2022. Published November 2023.

Unabridged versions of all AAIB Formal Reports, published back to and including 1971, are available in full on the AAIB Website

http://www.aaib.gov.uk

GLOSSARY OF ABBREVIATIONS

aal	above airfield level
ACAS	Airborne Collision Avoidance System
ACARS	Automatic Communications And Reporting System
ADF	Automatic Direction Finding equipment
AFIS(O)	Aerodrome Flight Information Service (Officer)
agl	above ground level
AIC	Aeronautical Information Circular
amsl	above mean sea level
AOM	Aerodrome Operating Minima
APU	Auxiliary Power Unit
ASI	airspeed indicator
ATC(C)(O)	Air Traffic Control (Centre)(Officer)
ATIS	Automatic Terminal Information Service
ATPL	Airline Transport Pilot's Licence
BMAA	British Microlight Aircraft Association
BGA	British Gliding Association
BBAC	British Balloon and Airship Club
BHPA	British Hang Gliding & Paragliding Association
CAA	Civil Aviation Authority
CAVOK	Ceiling And Visibility OK (for VFR flight)
CAS	calibrated airspeed
cc	cubic centimetres
CG	Centre of Gravity
cm	centimetre(s)
CPL	Commercial Pilot's Licence
°C,F,M,T	Celsius, Fahrenheit, magnetic, true
CVR	Cockpit Voice Recorder
DME	Distance Measuring Equipment
EAS	equivalent airspeed
EASA	European Union Aviation Safety Agency
ECAM	Electronic Centralised Aircraft Monitoring
EGPWS	Enhanced GPWS
EGT	Exhaust Gas Temperature
EICAS	Engine Indication and Crew Alerting System
EPR	Engine Pressure Ratio
ETA	Estimated Time of Arrival
ETD	Estimated Time of Departure
FAA	Federal Aviation Administration (USA)
FDR	Flight Data Recorder
FIR	Flight Information Region
FL	Flight Level
ft	feet
ft/min	feet per minute
g	acceleration due to Earth's gravity
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
GPWS	Ground Proximity Warning System
hrs	hours (clock time as in 1200 hrs)
HP	high pressure
hPa	hectopascal (equivalent unit to mb)
IAS	indicated airspeed
IFR	Instrument Flight Rules
ILS	Instrument Landing System
IMC	Instrument Meteorological Conditions
IP	Intermediate Pressure
IR	Instrument Rating
ISA	International Standard Atmosphere
kg	kilogram(s)
KCAS	knots calibrated airspeed
KIAS	knots indicated airspeed
KTAS	knots true airspeed
km	kilometre(s)
kt	knot(s)
lb	pound(s)
LP	low pressure
LAA	Light Aircraft Association
LDA	Landing Distance Available
LPC	Licence Proficiency Check
m	metre(s)
mb	millibar(s)
MDA	Minimum Descent Altitude
METAR	a timed aerodrome meteorological report
min	minutes
mm	millimetre(s)
mph	miles per hour
MTWA	Maximum Total Weight Authorised
N	Newtons
N_R	Main rotor rotation speed (rotorcraft)
N_g	Gas generator rotation speed (rotorcraft)
N_1	engine fan or LP compressor speed
NDB	Non-Directional radio Beacon
nm	nautical mile(s)
NOTAM	Notice to Airmen
OAT	Outside Air Temperature
OPC	Operator Proficiency Check
PAPI	Precision Approach Path Indicator
PF	Pilot Flying
PIC	Pilot in Command
PM	Pilot Monitoring
POH	Pilot's Operating Handbook
PPL	Private Pilot's Licence
psi	pounds per square inch
QFE	altimeter pressure setting to indicate height above aerodrome
QNH	altimeter pressure setting to indicate elevation amsl
RA	Resolution Advisory
RFFS	Rescue and Fire Fighting Service
rpm	revolutions per minute
RTF	radiotelephony
RVR	Runway Visual Range
SAR	Search and Rescue
SB	Service Bulletin
SSR	Secondary Surveillance Radar
TA	Traffic Advisory
TAF	Terminal Aerodrome Forecast
TAS	true airspeed
TAWS	Terrain Awareness and Warning System
TCAS	Traffic Collision Avoidance System
TODA	Takeoff Distance Available
UA	Unmanned Aircraft
UAS	Unmanned Aircraft System
USG	US gallons
UTC	Co-ordinated Universal Time (GMT)
V	Volt(s)
V_1	Takeoff decision speed
V_2	Takeoff safety speed
V_R	Rotation speed
V_{REF}	Reference airspeed (approach)
V_{NE}	Never Exceed airspeed
VASI	Visual Approach Slope Indicator
VFR	Visual Flight Rules
VHF	Very High Frequency
VMC	Visual Meteorological Conditions
VOR	VHF Omnidirectional radio Range

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Air Accidents Investigation Branch