AAIB
Air Accidents Investigation Branch

AAIB Bulletin 12/2015

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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.

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

AAIB Bulletins and Reports are available on the Internet
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(ALL TIMES IN THIS BULLETIN ARE UTC)

Summaries of Aircraft Accident Reports

This section contains summaries of Aircraft Accident ('Formal') Reports published since the last AAIB monthly bulletin.

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

Aircraft Accident Report No: 3/2015

This report was published on 23 October 2015 and is available in full on the AAIB Website www.aaib.gov.uk

Report on the accident to Eurocopter (Deutschland) EC135 T2+, G-SPAO Glasgow City Centre, Scotland on 29 November 2013

Registered Owner and Operator:	Bond Air Services Limited
Aircraft Type:	Eurocopter (Deutschland)[1] EC135 T2+
Nationality:	British
Registration:	G-SPAO
Place of Accident:	Glasgow City Centre, Scotland
Date and Time:	29 November 2013 at 2222 hrs All times in this report are UTC

Introduction

The Air Accidents Investigation Branch (AAIB) was notified at 2259 hrs on 29 November 2013 that a helicopter had crashed through the roof of The Clutha Vaults Bar, in the centre of the city of Glasgow. A team of AAIB Inspectors and support staff arrived in Glasgow at 0915 hrs the following morning to commence an investigation.

In accordance with established international arrangements, the Bundesstelle für Flugunfalluntersuchung (BFU) of Germany, representing the State of Design and Manufacture of the helicopter, the Bureau d'Enquêtes et d'Analyses pour la Sécurité de l'Aviation Civile (BEA) of France, representing the State of Design and Manufacture of the engines, and the National Transportation Safety Board (NTSB) of the USA, representing the State of Design and Manufacture of the Full-Authority-Digital-Engine-Controls (FADECs) on the engines, appointed Accredited Representatives to participate in the investigation. They were supported by advisors from the helicopter manufacturer, the BEA and the engine manufacturer. The European Aviation Safety Agency (EASA), the UK Civil Aviation Authority (CAA) and the helicopter operator also assisted the AAIB.

The investigation was conducted under the provisions of *Regulation EU 996/2010* and the UK *Civil Aviation (Investigation of Air Accidents and Incidents) Regulations 1996*.

Summary

The helicopter departed Glasgow City Heliport (GCH) at 2044 hrs on 29 November 2013, in support of Police Scotland operations. On board were the pilot and two Police Observers.

Footnote

[1] Eurocopter (Deutschland) became Airbus Helicopters (Deutschland) in January 2014.

After their initial task, south of Glasgow City Centre, they completed four more tasks; one in Dalkeith, Midlothian, and three others to the east of Glasgow, before routing back towards the heliport. When the helicopter was about 2.7 nm from GCH, the right engine flamed out. Shortly afterwards, the left engine also flamed out. An autorotation[2], flare recovery and landing were not achieved and the helicopter descended at a high rate onto the roof of the Clutha Vaults Bar, which collapsed. The three occupants in the helicopter and seven people in the bar were fatally injured. Eleven others in the bar were seriously injured.

Fuel in the helicopter's main fuel tank is pumped by two transfer pumps into a supply tank, which is divided into two cells. Each cell of the supply tank feeds its respective engine. During subsequent examination of the helicopter, 76 kg of fuel was recovered from the main fuel tank. However, the supply tank was found to have been empty at the time of impact. It was deduced from wreckage examination and testing that both fuel transfer pumps in the main tank had been selected OFF for a sustained period before the accident, leaving the fuel in the main tank, unusable. The LOW FUEL 1 and LOW FUEL 2 warning captions, and their associated audio attention-getters, had been triggered and acknowledged, after which, the flight had continued beyond the 10-minute period specified in the *Pilot's Checklist Emergency and Malfunction Procedures*.

The helicopter was not required to have, and was not fitted with, flight recorders. However, data and recordings were recovered from non-volatile memory (NVM) in systems on board the helicopter, and radar, radio, police equipment and CCTV recordings were also examined.

During the investigation, the EC135's fuel sensing, gauging and indication system, and the Caution Advisory Display and Warning Unit were thoroughly examined. This included tests resulting from an incident involving another EC135 T2+.

Despite extensive analysis of the limited evidence available, it was not possible to determine why both fuel transfer pumps in the main tank remained OFF during the latter part of the flight, why the helicopter did not land within the time specified following activation of the low fuel warnings and why a MAYDAY call was not received from the pilot. Also, it was not possible to establish why a more successful autorotation and landing was not achieved, albeit in particularly demanding circumstances.

The investigation identified the following causal factors:

1. 73 kg of usable fuel in the main tank became unusable as a result of the fuel transfer pumps being switched OFF for unknown reasons.

2. It was calculated that the helicopter did not land within the 10-minute period specified in the *Pilot's Checklist Emergency and Malfunction Procedures*, following continuous activation of the LOW FUEL warnings, for unknown reasons.

Footnote

[2] Autorotation in a helicopter is a condition of descending flight where, following the failure of all engines, the rotor blades are driven solely by aerodynamic forces resulting from the airflow up through the rotor.

3. Both engines flamed out sequentially while the helicopter was airborne, as a result of fuel starvation, due to depletion of the supply tank contents.

4. A successful autorotation and landing was not achieved, for unknown reasons.

The investigation identified the following contributory factors:

1. Incorrect management of the fuel system allows useable fuel to remain in the main tank while the contents in the supply tank become depleted.

2. The RADALT and steerable landing light were unpowered after the second engine flamed out, leading to a loss of height information and reduced visual cues.

3. Both engines flamed out when the helicopter was flying over a built-up area.

Seven Safety Recommendations have been made.

Findings

1. The pilot was properly licensed and qualified to conduct the flight, and was well rested.

2. The helicopter was certified, equipped and maintained in accordance with existing regulations and approved procedures.

3. The helicopter was not required to have and was not fitted with flight recorders. However, some recorded evidence was recovered from nonvolatile memory in the helicopter's systems.

4. The helicopter took off with about 400 kg of fuel.

5. The evidence indicated that the main tank forward and aft fuel transfer pumps were OFF from a point on the helicopter's route between Dalkeith and Bothwell.

6. There was no evidence to indicate that the fuel contents display system was operating incorrectly.

7. It is not known when the FUEL caution caption was displayed on the Caution and Advisory Display (CAD).

8. The LOW FUEL warnings were triggered during the flight, and it was estimated that this occurred before the helicopter reached Bothwell.

9. The LOW FUEL warning audio attention-getters were acknowledged five times.

10. It was calculated that the helicopter did not land within 10 minutes of the activation of a continuous LOW FUEL warning, as stipulated in the Pilot's Checklist *Emergency and Malfunction Procedures*.

11. ATC was not advised of any problem with the helicopter.

12. Both engines flamed out due to fuel starvation, about 32 seconds apart, as the helicopter was returning to Glasgow City Heliport.

13. The single engine emergency shutdown checklist was not completed following the first engine flameout.

14. The radio altimeter and the steerable landing light ceased to be powered following the second engine flameout.

15. The SHED BUS switch was not selected to EMERG, to repower the radio altimeter and steerable landing light.

16. The rotor rpm decreased below 97% and recovered twice before it decreased a third and final time.

17. The main rotor blades suffered lead-lag resonance, which, on the EC135 type, occurs between 60 to 70% N_r when a control input is made to change the pitch of the main rotor blades.

18. The transmission system, main rotor blades and Fenestron were not being driven and were not rotating at the point of impact.

19. No significant pre-impact technical defect was identified in any part of the aircraft or its systems.

20. The No 1 and No 2 engine control switches were correctly configured for flight.

21. The No 1 and No 2 fuel shut-off valves were correctly set to OPEN.

22. There was no usable fuel in the supply tank cells when the engines flamed out.

23. There was 76 kg (73 kg usable) of fuel in the main tank when the engines flamed out.

24. When tested, the fuel samples taken from G-SPAO were unadulterated, free from water contamination and within specification.

25. The impact forces were in excess of the design and certification crashworthiness requirements of the EC135 fuselage structure and crew seats.

26. The flexible fuel tanks exceeded their crashworthiness requirement and remained fuel-tight after impact.

27. The fuel sensors collapsed in accordance with their design during deformation of the fuel tanks.

28. There was no fire.

29. The accident was not survivable.

Safety Recommendations

The following Safety Recommendations have been made:

Safety Recommendation 2015-030

It is recommended that, when the European Aviation Safety Agency requires a radio altimeter to be fitted to a helicopter operating under an Air Operator's Certificate, it also stipulates that the equipment is capable of being powered in all phases of flight, including emergency situations, without intervention by the crew.

Safety Recommendation 2015-031

It is recommended that, when the Civil Aviation Authority require a radio altimeter to be fitted to a helicopter operating under a Police Air Operator's Certificate, it also stipulates that the equipment is capable of being powered in all phases of flight, including emergency situations, without intervention by the crew.

Safety Recommendation 2015-032

It is recommended that the Civil Aviation Authority requires all helicopters operating under a Police Air Operators Certificate, and first issued with an individual Certificate of Airworthiness before 1 January 2018, to be equipped with a recording capability that captures data, audio and images in crashsurvivable memory. They should, as far as reasonably practicable, record at least the parameters specified in The Air Navigation Order, Schedule 4, Scale SS(1) or SS(3) as appropriate. They should be capable of recording at least the last two hours of (a) communications by the crew, including Police Observers carried in support of the helicopter's operation, and (b) images of the cockpit environment. The image recordings should have sufficient coverage, quality and frame rate characteristics to include actions by the crew, control selections and instrument displays that are not captured by the data recorder. The audio and image recorders should be capable of operating for at least 10 minutes after the loss of the normal electrical supply.

Safety Recommendation 2015-033

It is recommended that the Civil Aviation Authority requires all helicopters operating under a Police Air Operators Certificate, and first issued with an individual Certificate of Airworthiness on or after 1 January 2018, to be fitted with flight recorders that record data, audio and images in crash-survivable memory. These should record at least the parameters specified in The Air Navigation Order, Schedule 4, Scale SS(1) or SS(3), as appropriate. They should be capable of recording at least the last two hours of (a) communications by the crew, including Police Observers carried in support of the helicopter's operation, and (b) cockpit image recordings. The image recordings should have sufficient coverage, quality and frame rate characteristics to include control selections and instrument displays that are not captured by the other data recorders. The audio and image recorders should be capable of operating for at least 10 minutes after the loss of the normal electrical supply.

Safety Recommendation 2015-034

It is recommended that the Civil Aviation Authority considers applying the requirements of AAIB Safety Recommendation 2015 - 032 and AAIB Safety Recommendation 2015 - 033 to State aircraft not already covered by these Safety Recommendations.

Safety Recommendation 2015-035

It is recommended that the European Aviation Safety Agency mandate the ICAO Annex 6 flight recorder requirements for all helicopter emergency medical service operations, regardless of aircraft weight. The last two hours of flight crew communications and cockpit area audio should be recorded. The cockpit area audio recording should continue for 10 minutes after the loss of normal electrical power.

Safety Recommendation 2015-036

It is recommended that the European Aviation Safety Agency mandate image flight recorder requirements for all helicopter emergency medical service operations, regardless of aircraft weight. The image recordings should have sufficient coverage, quality and frame rate characteristics to include actions by the crew, control selections and instrument displays that are not captured by a data recorder. The recording should be of the last two hours of operation, including at least 10 minutes after the loss of normal electrical power to the flight recorder.

Summary of safety actions

The operator's fuel policy

On 20 December 2013, the operator issued an amendment to its Operations Manual, Part A, '*8.1.7.3 Fuel Calculations*'. This replaced the Minimum Land on Allowance (MLA) with Final Reserve Fuel (FRF), and increased the VFR and IFR/night FRFs to 90 kg and the unusable fuel to 8 kg. It stated:

> *'An Emergency condition can be considered to exist if the Commander believes that the helicopter will land below Final Reserve Fuel (FRF).*
>
> *8.1.7.3 Fuel Calculations*
>
> *When calculating remaining endurance the following formula is to be used*
>
> $$\frac{\text{Total fuel} - \text{FRF}}{\text{Fuel consumption}} = \text{Endurance}$$
>
> *For normal operations the following nominal figures are to be used*
>
> | | |
> |---|---|
> | *Final Reserve Fuel IFR/ Night / navigating by means other than by reference to visual landmarks (30 minutes)* | *90 kg* |
> | *Unusable fuel (Not indicated)* | *8 kg'* |

These figures were also incorporated in their Operations Manual, Part B, which provides information on the helicopter type and related operational procedures.

The operator also issued the following safety notice to all its pilots on the same date:

> *'… we have conducted detailed examinations and tests on our fleet of EC135s. These tests were to evaluate the function and accuracy of the fuel indicator system on the supply tanks. As a result of these test it was deemed necessary to replace the sender units from the supply tanks on a number of our aircraft.*
>
> *Until such a time as we have an approved maintenance program in place to perform functional checks of these units we have deemed*

*it necessary to maintain a **Final Reserve Fuel (FRF) 90Kgs.** When completing fuel calculations as per Reference B [Operations Manual Part A 8.1.7.3], please use 90kgs as the FRF for all flights (VFR & IFR) until further notice.'*

Alert Service Bulletins by the helicopter manufacturer

On 19 December 2013, the helicopter manufacturer issued ASBs EC13528A-018 & EC135-28A-019 (see Appendices D and E). The purpose of the ASBs was to inform operators that the EC135 fuel contents indication system appeared, in some circumstances, to give erroneous fuel quantity indications, and to obtain data as to its extent. Secondly, the LOW FUEL checklist in the Flight Manual was amended.

In addition, the helicopter manufacturer is progressing with a series of changes to the EC135 fuel system. These include:

Fuel sensors

The investigation and test work arising from the G-NWEM incident revealed that, under certain circumstances, water globule contamination can produce erroneous outputs in the present design of fuel contents sensors fitted to the EC135 helicopter. A modification of the mechanical design of the fuel quantity sensor has been initiated, with the supplier, to reduce the susceptibility of the sensor to water contamination.

The target date for the introduction of this EC135 product improvement is scheduled for the fourth quarter in 2016.

Fuel transfer pumps

The helicopter manufacturer will be introducing changes to the fuel transfer pump management logic, for future avionic suites, to reduce pilot workload and simplify the operation of the fuel transfer pumps. The transfer pumps will be switched ON during takeoff and only switched OFF after landing. In addition, the dry-run indication for the fuel transfer pumps will be omitted in the future avionics logic due to the improved dry-run capabilities of the later generation of pumps. This change already applies to the current version of the EC145 and will be included in the next update to the EC135, subject to certification scheduled to take place next year.

However, this change is not proposed for the current EC135 fleet, with CPDS avionics, as the existing fuel pump caution signal does not differentiate between a dry-running pump and pump-blockage.

There are fuel transfer pumps in use in the existing EC135 fleet which do not have the improved dry-run capability and, therefore, must be operated in accordance with the current flight manual.

Timescale

It is anticipated that these improvements will be made available to the existing EC135 fleet at the end of 2015 and will be presented to operators by an optional Service Bulletin.

Further safety actions included:

Compressor wash procedure

Consultations between the operator, engine and aircraft manufacturers identified the need to address the possibility of fuel contamination as a result of the cold chemical engine compressor wash routines. It was found that water and cleaning agent ingress into the fuel tanks via the vent system can only take place during the cold compressor washing process and not following a hot compressor washing process. Accordingly, in July 2014 the engine manufacturer issued an amendment to the cold compressor washing procedure that introduced a process by which operator could measure the quantity of water entering the engine fluid drain and return system. This was followed by a concession to the operator, TMUK/3995/02122014/CON, dated 8 December 2014, to authorise the suspension of the cold compressor washing process but continue with the daily hot washing process, in accordance with the EMM.

Engine fuel drain system

The investigation highlighted a number of issues regarding the way in which contaminants can enter the fuel supply system. Both the engine and the airframe manufacturers examined the interface between the airframe and the discharge and removal of excess or unwanted fluids from the engines. It was found that the engine fuel drain system can in some case be overwhelmed and unwanted fluids can find their way back into the fuel tank vent system. To address this, the aircraft manufacturer issued Service Bulletin (SB EC135-71-047, dated 14 April 2014, recommending the retrofitting of vent hoses to the high pressure (HP) fuel pump drain lines. This modification prevents unwanted fluids held in the drain bottles being sucked through the HP fuel pumps during engine start-up and shut-down procedures.

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:	Gulfstream III (G-1159A), N103CD	
No & Type of Engines:	2 Rolls-Royce Spey Mk511-8 turbofan engines	
Year of Manufacture:	1984 (Serial no: 418)	
Date & Time (UTC):	24 November 2014 at 2030 hrs	
Location:	Biggin Hill Airport, Kent	
Type of Flight:	Private	
Persons on Board:	Crew - 2	Passengers - 5
Injuries:	Crew - None	Passengers - None
Nature of Damage:	Aircraft damaged beyond economic repair	
Commander's Licence:	Airline Transport Pilot's Licence	
Commander's Age:	36 years	
Commander's Flying Experience:	4,120 hours (of which 3,650 hours were on type) Last 90 days - 60 hours Last 28 days - 19 hours	
Information Source:	AAIB Field Investigation	

Synopsis

The aircraft lined up for takeoff in conditions of reduced visibility. The crew believed that the lights they could see ahead were runway centreline lights when they were actually runway edge lights. The aircraft began its takeoff run but ran off the paved surface and onto grass. The commander closed the thrust levers to reject the takeoff.

Information available to the pilots allowed them to develop an incorrect mental model of their route from the holding point to the runway. Environmental cues indicating that the aircraft was in the wrong position for takeoff were not strong enough to alert the pilots to the fact that they had lost situational awareness.

One Safety Recommendation has been made.

History of the flight

On 24 November 2014 the crew of Gulfstream III N103CD planned for a private flight from Biggin Hill Airport to Gander International Airport in Canada. The weather reported at the airport at 2020 hrs was wind 'calm', greater than 10 km visibility with fog patches, no significant cloud, temperature 5°C, dew point 4°C and QNH 1027 hPa. At 2024 hrs, the crew was cleared to taxi to Holding Point J1 for a departure from Runway 03. After the crew read back the taxi clearance, the controller transmitted:

"WE ARE GIVING LOW LEVEL FOG PATCHES ON THE AIRFIELD, GENERAL VISIBILITY IN EXCESS OF 10 KM BUT VISIBILITY NOT MEASURED IN THE FOG PATCHES. IT SEEMS TO BE VERY LOW, VERY THIN FOG FROM THE ZERO THREE THRESHOLD TO APPROXIMATELY HALF WAY DOWN THE RUNWAY THEN IT LOOKS COMPLETELY CLEAR".

The crew acknowledged the information.

At 2028 hrs, the aircraft was at the holding point and was cleared for takeoff by the controller. The aircraft taxied towards the runway from J1 but lined up with the runway edge lights, which were positioned 3 m to the right of the edge of the runway. The aircraft began its takeoff run at 2030 hrs, passing over paved surface for approximately 248 m before running onto grass which lay beyond. The commander, who was the handling pilot, closed the thrust levers to reject the takeoff when he realised what had happened and the aircraft came to a halt on the grass having suffered major structural damage. The crew shut down the engines but were unable to contact ATC on the radio to tell the controller what had happened.

The co-pilot moved from the flight deck into the passenger cabin and saw that no one had been injured. He vacated the aircraft through the rear baggage compartment and then helped the commander, who was still inside, to open the main exit door. The commander and the five passengers used the main exit to vacate the aircraft.

The controller saw that the aircraft had stopped but did not realise that it was not on the runway. He attempted to contact the crew on the radio but, when he saw the lights of the aircraft switch off, he activated the crash alarm, at 2032 hrs, declaring an aircraft ground incident. At 2034 hrs the airport fire service reached the aircraft and declared an aircraft accident, after which the airport emergency plan was activated.

Information from the crew

The crew had reported at 1840 hrs for a 2030 hrs departure and noticed that there was moisture from the mist on the aircraft windshield. As they taxied they were aware that there was some patchy ground fog and, as the aircraft turned onto the runway heading, they noticed that the runway lights had a "glow" around them as did more distant lighting. They did not consider the conditions to represent a hazard and there was "nothing widespread or thick".

Both crew members were expecting the runway to have centreline lighting.

The crew stated that the aircraft was normally operated under Part 91 of US Federal Aviation Regulations which leaves takeoff visibility requirements to the discretion of the aircraft commander. The commander stated that he preferred visibility at takeoff to be equivalent to between one quarter and one half of the runway length and he had believed he had sufficient visibility for this takeoff.

Information from the ATC controller

The ATC controller stated that the weather had been CAVOK during the afternoon. Subsequently, the wind dropped and some low level thin mist, which "appeared like

steam", could be seen drifting across the airfield. Later, there were some patches of fog approximately "waist deep" from abeam the control tower towards the southern end of the runway but it was clear to the north. At 2005 hrs, a fire command vehicle had driven along the runway for a wildlife inspection and had reported the visibility as being "good". The controller reported that, after the aircraft came to a halt, he could see only the top of the fuselage and tail above the layer of fog.

The controller stated that the airport was unable to measure and report runway visual range (RVR) in respect of the departure end of Runway 03.

Accident site

Biggin Hill was originally a military airfield and at the beginning of Runway 03 is a 250 m long and 36 m wide paved surface, with a 30º slant to the runway, called an Operational Readiness Platform (ORP). While there are no markings at the start of the ORP to indicate that aircraft should not enter this area[1], a section of the ORP between the runway and Taxiway C has been painted with yellow hatching (Figure 1). Grass and weeds have grown in the gaps between the concrete segments in the ORP. Four surface-mounted red runway edge lights, evenly spaced 61 m apart, were positioned approximately 3 m from the white

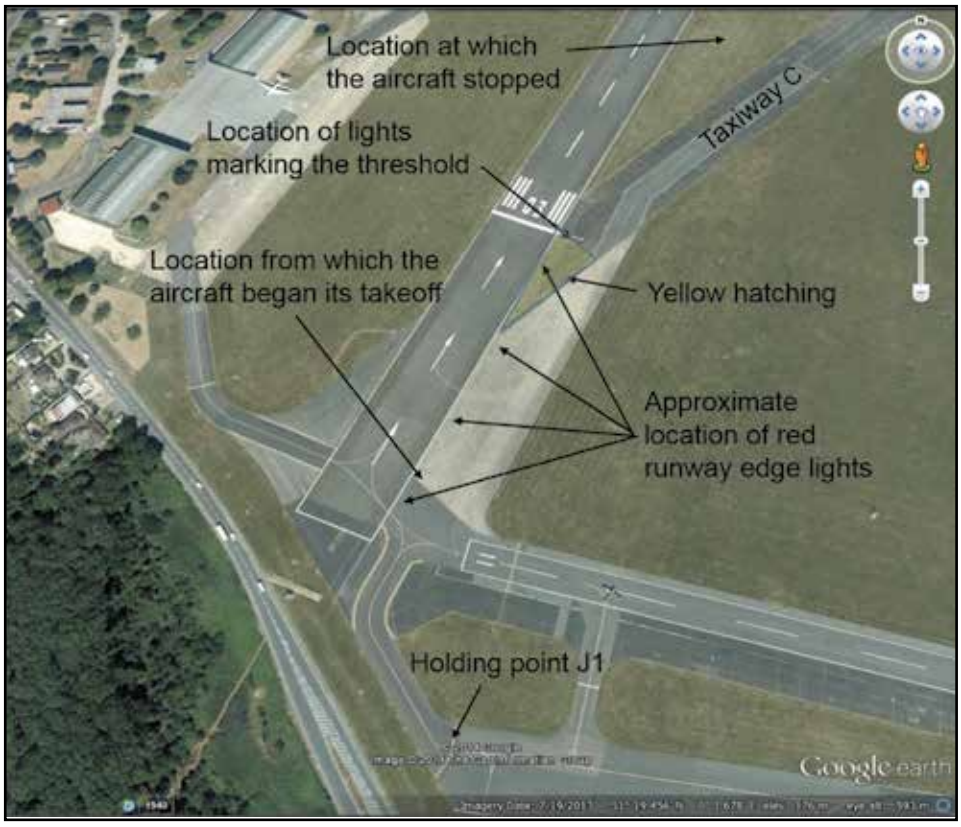

Figure 1

The area near the threshold of Runway 03

Footnote

[1] See later section, *Taxiway markings.*

line that marked the edge of the runway. The most northerly light was located 30 m from the threshold of Runway 03 (Figure 2). Beyond the lights marking the runway threshold, white runway edge lights were mounted on poles located in the grass.

Marks made by the aircraft tyres showed that on exiting Taxiway J the aircraft entered the ORP with the left main wheels in line with the red runway edge lights. When the aircraft began its takeoff run, it had passed the first red runway edge light and the next edge light ahead of the aircraft was approximately 46 m away. The aircraft track continued parallel to the runway and 248 m from the start of the ORP the aircraft left the paved area and ran onto the grass. All the wheels sank approximately 0.25 m into the soft ground; however, the depth of the furrow made by the nosewheel varied, indicating that the aircraft was oscillating about the main landing gear. After travelling 120 m across the grass the nose landing gear and radome detached. The aircraft eventually came to a halt 424 m from the start of the ORP, in line with the PAPI. After passing the threshold lights, the left main wheel damaged two of the three white edge lights.

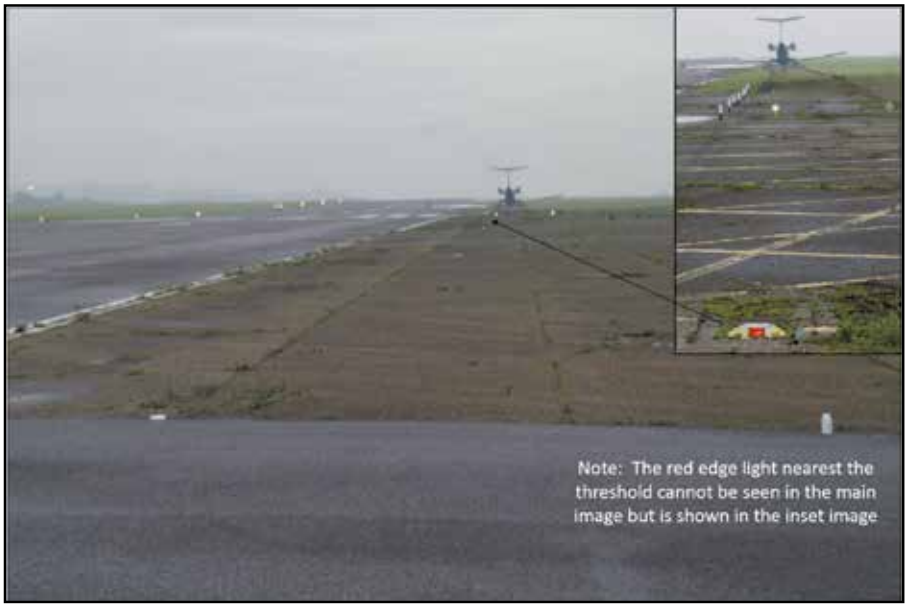

Figure 2

Red lighting on the ORP and the ORP's boundary with the taxiway

Damage to the aircraft

After the nose landing gear separated from the aircraft, it struck the lower fuselage approximately 0.3 m aft of the nose landing gear bay, tearing a hole in the skin 6.5 m long. A number of frames in this area were damaged and all the aerials mounted on the forward lower section of the fuselage were found detached. There was also a crease and rupture in the skin over the top of the fuselage, just aft of the second window in the cabin (Figure 3). The aircraft was assessed as being beyond economic repair.

Figure 3

The aircraft as it came to rest, showing area of skin crease and rupture

Recorded data

Flight recorders

The aircraft was fitted with a 30-minute CVR and a 25-hour FDR. The CVR was a tape-based recorder but the mechanism drive motor had failed, so there was no recording relevant to this accident. The CVR was due to be checked on 30 November 2014.

An FDR was fitted although there was no requirement to do so. It only had a basic parameter set and the data was not sufficiently reliable to be used in this report. The only FDR-related scheduled maintenance was associated with the underwater locator beacon attached to the FDR.

iPad tablets

Three iPad tablets were recovered from the aircraft and the path of the aircraft during the attempted takeoff was recorded by 'apps' installed on two of them. These tablets use built-in GPS receivers as part of their positioning capability, which are less effective when used within an aircraft. However, whilst the accuracy of the recorded tracks is not known, the two recordings were largely consistent with each other. One of the recordings started at 1956 hrs but no motion was recorded until 2025 hrs and the motion stopped at the final location of the aircraft at 2030 hrs. The recorded ground speed reached a maximum of approximately 70 kt during this period. The path recorded by the iPads is shown in Figure 4.

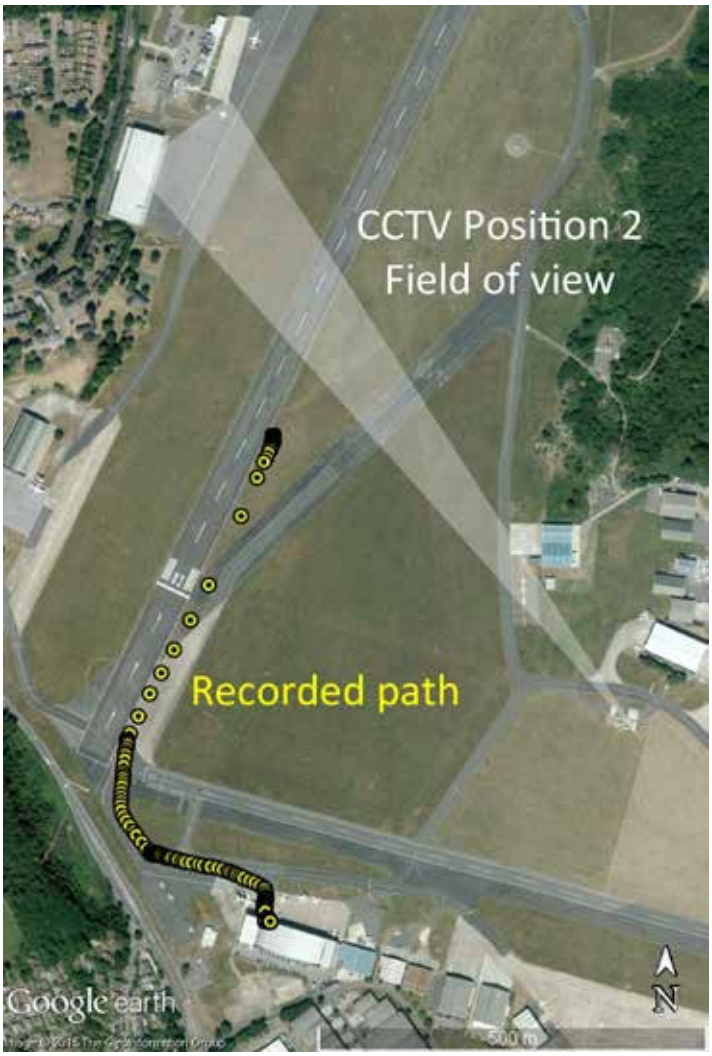

Figure 4

Recorded path of the aircraft and relevant CCTV image coverage

CCTV

A CCTV camera was installed to the east of the runway. The camera can be panned in a complete circle and zoomed. At the time of the accident it was stepping through a sequence of direction/zoom combinations, known as 'Positions', which repeated every 1 minute and 25 seconds. The field of view whilst at Position 2 is shown in Figure 4 and snapshot images whilst in this position are shown in Figure 5.

Figure 5 illustrates the low-level fog patches drifting across the airfield during the accident period, and the patches are also prevalent in the rest of the recording, in which their movement is seen more clearly. The CCTV snapshots were taken from the side of the runway, so only the low-intensity omnidirectional components of the runway edge lights were captured, and not the high-intensity directional component as viewed when looking along the runway.

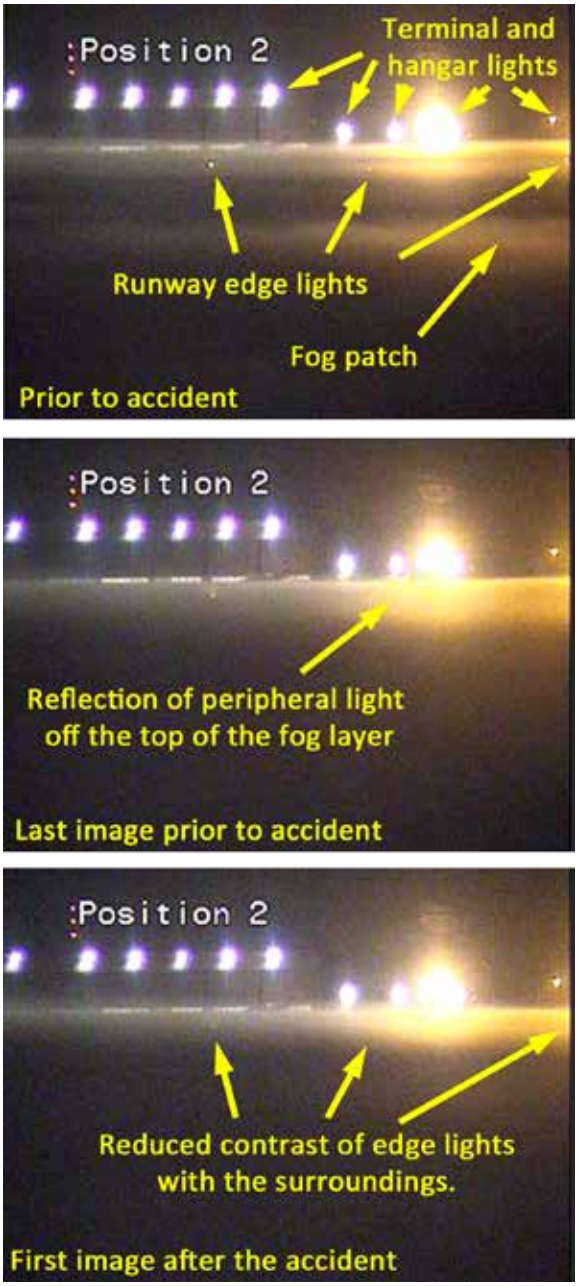

Figure 5

CCTV images from Position 2 taken 1 minute 25 seconds apart

The lights associated with the hangars, terminal and apron areas are significantly brighter than the runway lights. The CCTV images do not fully represent the extent of this as the image brightness of the peripheral lights (such as those at the apron and the terminal) was recorded at the maximum brightness the image can represent. Therefore the contrast in actual brightness was greater than the images in Figure 5 indicate.

Aerodrome information

The aerodrome chart used by the crew was contained in an iPad app which was updated through a subscription service with the product supplier. The authoritative source for the aeronautical information contained within the app is the Biggin Hill Airport Aerodrome Chart contained in the UK Aeronautical Information Publication (AIP), maintained by NATS AIS. Sections of the iPad and AIP charts showing the area between Holding Point J1 and the beginning of Runway 03 are shown in Figure 6. The path that an aircraft must follow after passing Holding Point J1 is shown by the yellow taxiway markings in the 'Overhead view' within the figure.

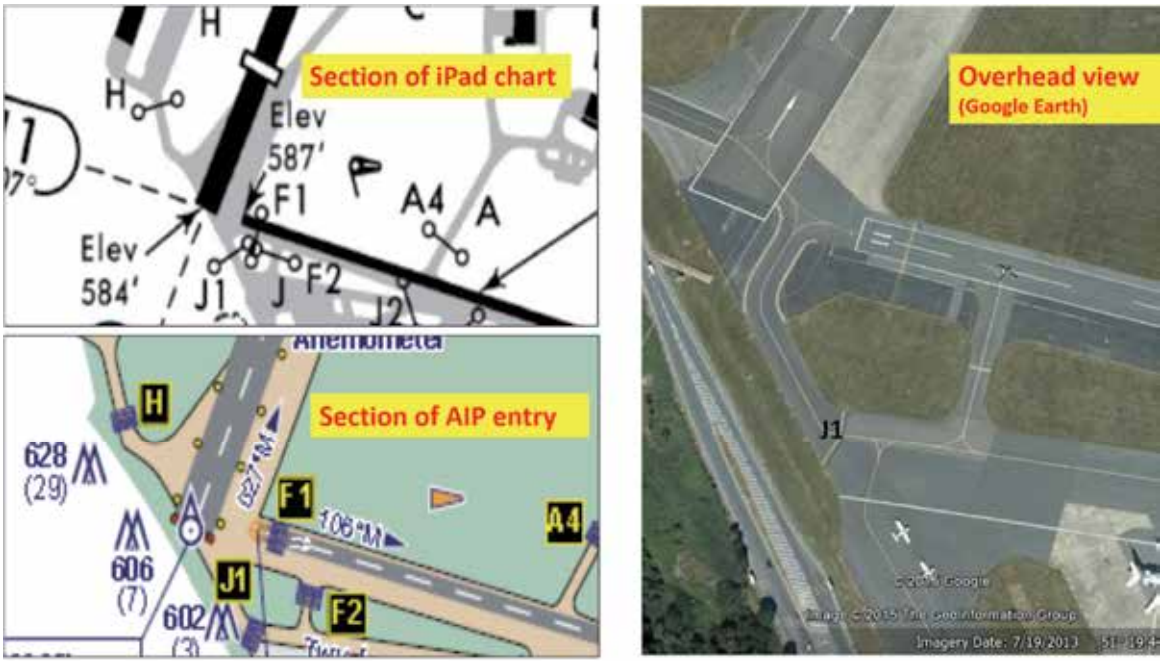

Figure 6

Taxi route from J1 to Runway 03

The AIP entry for Biggin Hill Airport contains information on the use of runways in section AD 2.20, *Local Traffic Regulations*. It states in paragraph 6 (a):

> *'The width at both ends of Runway 03/21, is twice that delineated by the associated edge lights due to extra pavement at one side. Since runway centre-line lighting is not installed, pilots should ensure that they are correctly lined up, especially if take-off is at night or when the runway is contaminated or in low visibility.'*

This information was not available to the crew in their charts.

Commercial chart suppliers

Operators of commercial aircraft are regulated and audited against a requirement to provide up-to-date route documents to their crews. Companies supplying the documents are not

regulated but can apply for a Letter of Acceptance (LOA) from EASA (or the FAA) as a navigation database supplier. A condition of receiving an LOA is that a company submits itself to a voluntary audit by the regulator in respect of its quality system for the processing of data[2]. The provider of the charts used by the crew in this accident has relevant LOAs from the FAA and EASA.

Each chart supplier uses its own format for presenting data obtained from national AIPs, which are themselves compiled using different formats and languages. Chart suppliers do not reproduce the entire AIP entry for every airport they cover because the result would be unusable by flight crew in an operational environment. An editorial process is required to decide which data, or changes to data, should be included in the published charts. This editorial process involves reviewing data for applicability against company specifications/ processes, or Service Level Agreements (SLAs) in respect of contracts with specific operators. In response to this investigation, the chart supplier stated that:

> *'All AIP source from the United Kingdom is reviewed and checked it against [the Company's] Specifications in order to determine whether source content should be applied to specific charts or airport directories.'*

Applicable regulations

N103CD was operated within the USA under Federal Aviation Regulation (FAR) Part 91, '*General Operating and Flight Rules'*. Part 91 describes rules for operating aircraft within the USA including over waters within 3 nm of the coast. Subpart H to Part 91, is applicable to the operation of USA-registered civil aircraft outside the USA. Article 91.703 (a) (2) states that persons operating outside of the USA shall:

> *'When within a foreign country, comply with the regulations relating to the flight and maneuver of aircraft there in force.'*

Civil Aviation Publication (CAP) 393, '*Air Navigation: The Order and the Regulations'* dated May 2014 was applicable to this flight. Part 14, '*Operating Minima and Equipment Requirements for Aerial Work and Private Aircraft'* stated at Article 109 (2) that an aircraft:

> *'must not take off when the relevant runway visual range is less than 150 m otherwise than under and in accordance with the terms of an approval to do so granted in accordance with the law of the country in which it is registered.'*

CAP 746 Meteorological Observations at Aerodromes

Civil Aviation Publication (CAP) 746, '*Requirements for Meteorological Observations at Aerodromes',* discusses the reporting of visibility in Chapter 4. The visibility reported in a METAR[3] is the 'prevailing' visibility and, in some circumstances, the minimum visibility. The 'prevailing' visibility is defined as:

Footnote

[2] The relevant Standards for processing aeronautical data are RTCA DO-200A or Euro CAE ED-76. ASI 9001 is a Standard for quality management within the aerospace industry.

[3] METAR is the format for reporting weather observations.

> *'the greatest visibility value that is reached within at least half the horizon circle or within at least half of the surface of the aerodrome. These areas could comprise contiguous or non-contiguous sectors.'*

If the visibility in another direction is less than 1500 m, or less than 50% of the prevailing visibility, then it is also reported.

Fog is reported when the prevailing visibility is less than 1,000 m and fog patches are reported when:

> *'fog, 2m or more deep, is present on the aerodrome in irregularly distributed patches. The meteorological visibility reported will depend on the proximity of the nearest fog patch to the observer.'*

Lighting

Visibility from the Gulfstream III cockpit

In response to a question from the AAIB on the visibility to the crew of runway features ahead of the aircraft, the manufacturer stated that, for a pilot in the normal sitting position within a Gulfstream III standing on the ground, approximately 13.1 m of pavement ahead of the pilot's eye is obscured by aircraft structure.

Aerodrome lighting

The CAA guidance document CAP 168, '*Licensing of Aerodromes'*, discusses aerodrome lighting in Chapter 6, '*Aeronautical Ground Lighting'*, and was used as the reference document in this investigation. Standards associated with aerodrome lighting and, more specifically, runway lighting are derived from ICAO Annex 14, Volume 1, '*Aerodrome Design and Operations'*. For the UK, responsibility for the regulation of aerodromes is passing from the CAA to EASA.

Paragraph 6.58 of CAP 168 details requirements for runway edge lights. The text relevant to this investigation states:

> *'Runway edge lights should be white except …, where a threshold is displaced, the lights between the beginning of the runway and the displaced threshold should show red in the approach direction'; and*
>
> *'White runway centreline lights are required for takeoff in RVR below 400 m and for precision instrument approach runways Category II and III.'*

Runway 03 at Biggin Hill does not have centreline lighting and cannot be used for takeoffs in RVRs below 400 m. Its edge lights are white but, because the runway has a displaced threshold, edge lights between the beginning of the runway and the threshold show red in the approach direction.

The white runway edge lights in use at the aerodrome have an omni-directional element and a bi-directional element and are raised above the ground. The minimum intensity of the omni-directional element is stipulated as 200 cd[4]. The intensity minimums for the bi-directional element depend on the angle it is being observed from, both laterally and vertically, and are shown in Figure 77 for a 45 m wide runway. The intensity of runway lighting is adjusted depending on ambient light levels but the intensity settings are not logged by the aerodrome authority.

The only CAP 168 requirement relating to peripheral lighting is a minimum lighting level in apron areas and there are no requirements relating to this light 'spilling' onto other areas of the aerodrome.

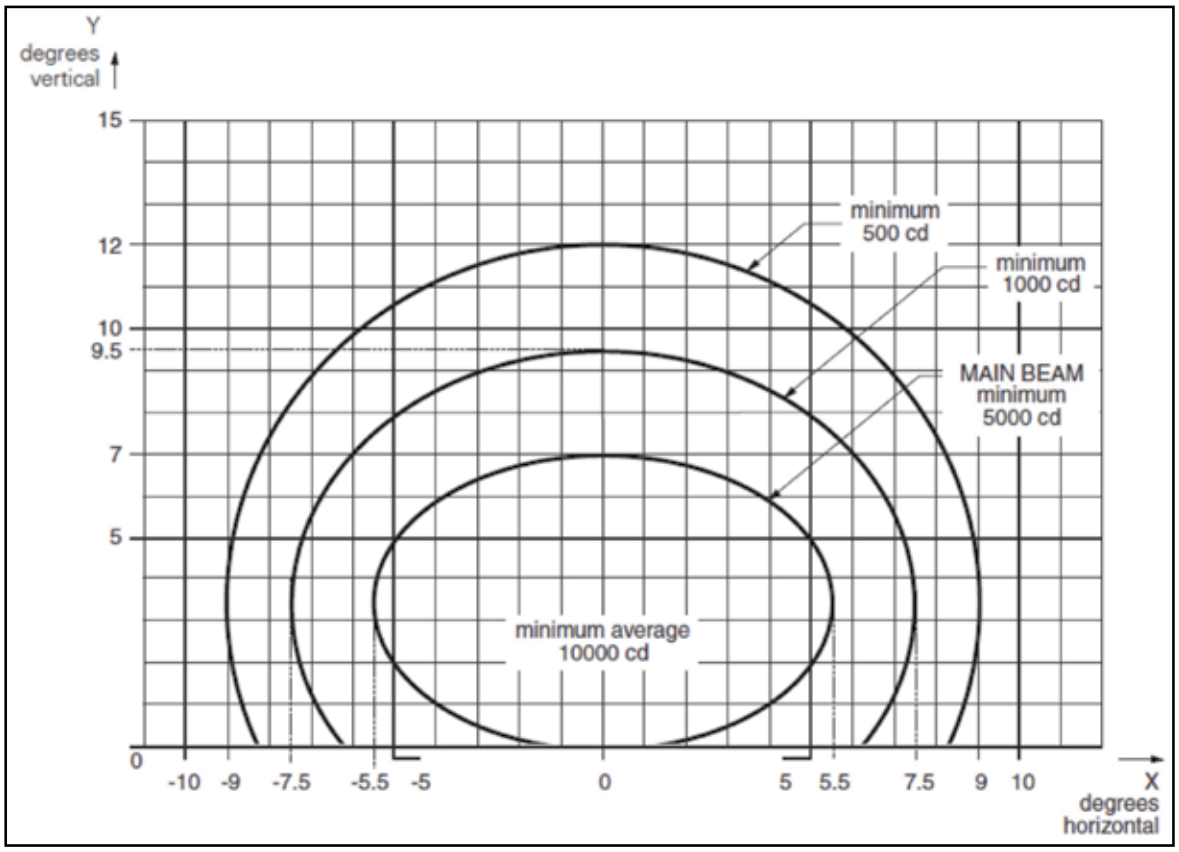

Figure 7

Requirements for the directional element of runway edge lights
(extracted from Figure 6A.9 of CAP 168)

Light intensity

When on the runway centreline, each successive pair of left and right runway edge lights will appear equally bright. For the lights closest to the aircraft only the omnidirectional part will be visible, but the main beam (directional element) will become progressively more visible for the lights further along the runway. However, when positioned in line with one

Footnote

[4] The Candela (cd) is the SI base unit of luminous intensity.

set of edge lights, the pilot will be looking at the highest intensity part of every light along that edge. Edge lights on the other side of the runway will need to be twice as far along the runway, compared to the aircraft-centred scenario, before the main directional beams become visible. This would make the edge lights with which the pilot was aligned a visually compelling line, whereas the corresponding edge lights on the far side of the runway would have been less visible and may not have appeared to the pilot as a line.

To show this point, Figure 8 illustrates the modelled illuminance of the edge lights from the approximate start position of the accident flight, using the minimum light intensity values given in the standards. This assumes the lights were set at 100% power and, as an indicative value, uses 1 km visibility.

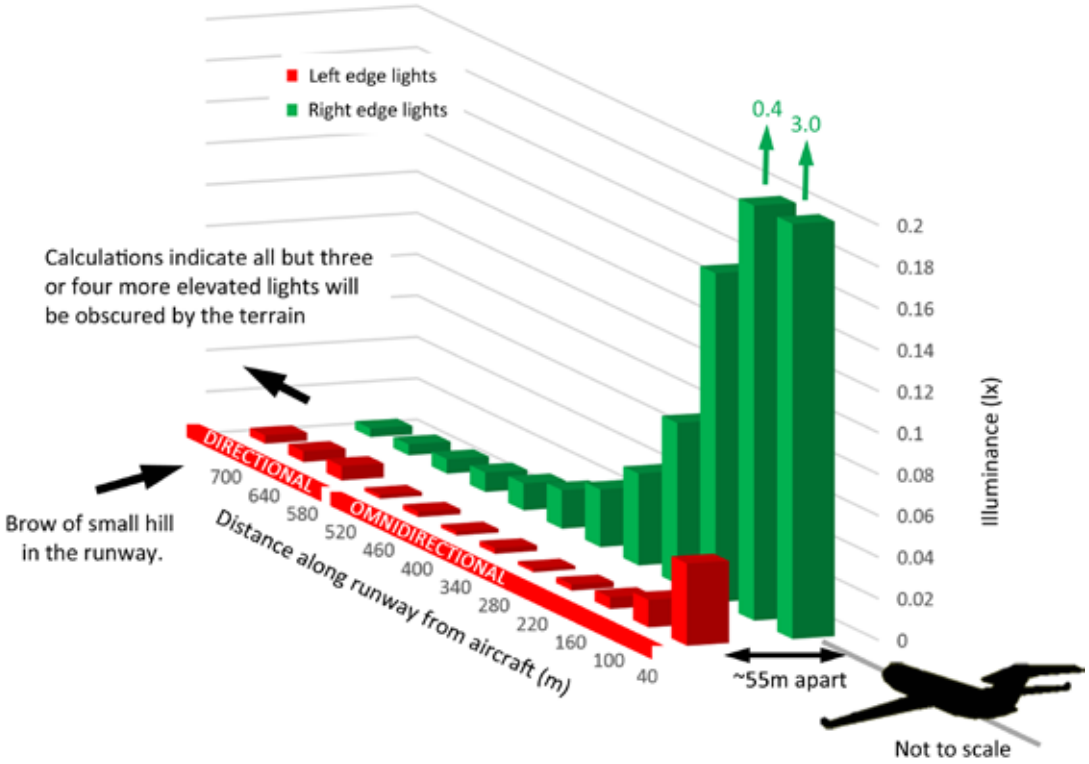

Figure 8

Illustration of light intensity of a combined omnidirectional and bi-directional runway edge light, assuming optimal vertical viewing angle and 1 km visibility

Light technology

Lighting standards are largely based on the tungsten light bulb technology that was prevalent at the time the standards were promulgated. LED lighting technology has since improved the capability of lights to hold colour over varying power ranges and over time, and has improved directional control of lighting.

Contrast

The human eye can cope with very high and very low light intensity conditions, but there is a limit to how much contrast the eye can perceive at any given time, so bright lights degrade the eye's ability to detect dim lights. For the illustrative 1 km visibility conditions used for Figure 8, the contrast between the nearest edge light and one 500 m further down the runway was calculated as more than 300:1. Reducing the visibility increases the contrast between lights close to the aircraft and those further away, making it more difficult for the eye to detect the distant lights. The eye's ability to detect a low-intensity light, attenuated by fog, will be degraded by the halo-effect of other higher intensity lights shining through the fog. A similar problem occurs if the viewer and high-intensity lighting are outside the fog layer that the light of interest needs to penetrate, due to the scattered reflection of the higher intensity lights.

The actual threshold of the pilots' ability to detect light in any particular direction at the time of the accident is not known.

Taxiway markings

The requirements for taxiway markings are contained in Chapter 7 of CAP 168 which states in paragraph 7.108:

> *'Where it is necessary to define the outer edges of a taxiway, e.g. … where a taxiway lies adjacent to a paved area not intended for use as a taxiway, the outer edges of the taxiway should be marked* [as shown in Figure 9]*':*

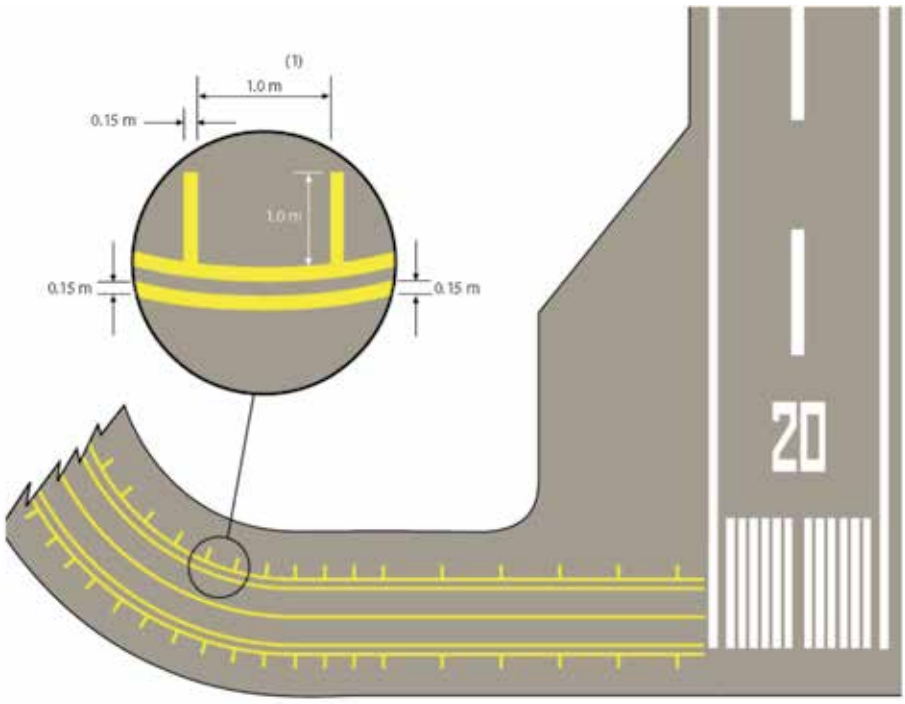

Figure 9

Extract of CAP 168 showing taxiway edge markings at a representative aerodrome

The eastern side of the ORP at the beginning of Runway 03 at Biggin Hill Airport is used as Taxiway C and the boundary between the southern end of the ORP and Taxiway J was not marked as shown in Figure 9 at the time of the accident.

Previous events

The CAA MOR database contained 13 recorded events involving misidentification of runway edge lights as centreline lights. This covered a period from 1982 to 2015 and involved 11 different aircraft types and nine different airfields. These included three AAIB investigations:

1. ATR42-300, G-TAWE, at Prestwick on 22/1/2006
   (AAIB reference EW/G2006/01/16)

2. Piper PA-34-200T, G-MAIR, at Bristol on 12 December 1996
   (AAIB reference EW/C96/12/3)

3. Fokker F27 Mk 200, G-BHMX, at Teeside on 7 December 1990
   (AAIB reference EW/C1186)

A further search for similar events from other countries found, as examples: a Cessna 402B at Chicago Midway in 1999, an ATR 72 at Dresden in 2002, an A319 at Las Vegas in 2006, an Embraer 190 at Oslo in 2010, a CRJ200 at Dubai in 2011 and an A330 at Abu Dhabi in 2012.

Factors influencing misaligned takeoffs at night

In 2009-2010 the Australian Transport Safety Bureau (ATSB) produced a report, '*Factors influencing misaligned take-off occurrences at night*'[5], which showed that this type of event occurs around the world and is not limited to a particular aircraft type or operator.

The report discussed environmental factors relating to misaligned takeoffs, which included the weather and the physical environment. The report stated:

> *'Confusing runway entry, lighting or taxiway layout/lighting was the most frequent environmental factor identified. Also common was [the layout of] the area around the entry to the runway and beyond the edge of the runway (e.g. extra pavement in that area); and the width of the runway and the lighting layout, colour and intensity.*
>
> *Areas of additional pavement around the taxiway entry and runway threshold area can provide erroneous visual cues for pilots at night. Pilots operating from a runway with a greater width (or additional paved areas at taxiway entry) than most standard runways can believe that they are in the centre of the runway when they are actually lined up on the edge.*

Footnote

[5] Available: http://www.atsb.gov.au/media/1543486/ar2009033.pdf

The importance of the colour, positioning and intensity of taxiway and runway lighting was highlighted in the events reviewed. During night operations, flight crew rely heavily on taxiway lead-in lights and available runway lights to position the aircraft correctly for takeoff. In some cases, [crew] believed the lights were the correct colour when they were not.

Aircraft using a displaced threshold will not be able to see the normal threshold markings, such as the runway number or 'piano keys', which provide important cues during the line-up phase of flight. If the runway does not have centreline lighting, it may be less evident to the pilots that the aircraft is lined up on the edge lighting given the limited cues available from the displaced threshold.'

The report concluded:

'The following were identified as the most prevalent safety factors in the data reviewed. In all occurrences, one or more of these factors were present and contributed to the event. Each of these factors may increase the risk of a misaligned takeoff occurrence:

a. Night time operations

b. The runway and taxiway environment, including confusing runway entry markings or lighting, areas of additional pavement on the runway, the absence of runway centreline lighting, and recessed runway edge lighting.

c. Flight crew distraction (from within the cockpit) or inattention.

d. Bad weather or poor/reduced visibility.

e. Conducting a displaced threshold or intersection departure.

f. Provision of air traffic control clearance when aircraft are entering the runway or still taxiing.

g. Flight crew fatigue.'

Safety actions

Biggin Hill Airport

Before the accident to Gulfstream N103CD the airport's Safety Management System (SMS) had identified a need to improve the lighting in the area surrounding the Runway 03 threshold. Some pilots landing on Runway 21 in the dark had been finding it difficult to identify the correct taxiway when vacating the runway near the threshold of Runway 03, and the decision had been taken to install taxiway lights in the area. Because the installation would require significant ground works, and the provision of a new lighting sub-station, it was not anticipated that the work would commence before the summer of 2015.

Following this accident, reflective studs were installed as a temporary measure to delineate the taxiways and runway access points around the Runway 03 threshold. Blue taxiway edge markers were installed leading from Holding Point J1 to the runway, and alternating yellow/green studs were installed on the taxiway centreline. In addition, a bar of red studs was placed across the southern edge of the ORP, along with taxiway edge markings (see Figure 9), to reduce the risk that crews following the taxiway around the first right turn after J1 would proceed straight ahead, as the aircraft in this accident did.

Chart supplier

Following this accident, the chart supplier decided to revise its Biggin Hill Airport Diagram Chart to include the information contained in Section AD 2.20, paragraph 6 (a) of the airport's entry in the UK AIP (see earlier section on Aerodrome information). It decided to include the information in its Chart Change Notices for the UK to cover the period until the revision was issued.

Analysis

Takeoff visibility

This was a private flight which could not depart in conditions of less than 400 m RVR. RVR cannot be measured at the threshold end of Runway 03 but the prevailing visibility was reported as being more than 10 km. The crew reported that there was moisture on the windscreen from the mist and they could see a "glow" around lights which were visible to them. They were also aware while taxiing that there was some patchy ground fog on the airfield. The ATC controller transmitted that visibility had not been measured in the fog patches but there seemed to be 'VERY LOW, VERY THIN FOG FROM THE ZERO THREE THRESHOLD TO APPROXIMATELY HALF WAY DOWN THE RUNWAY'. With hindsight, this piece of information is significant but, at the time, the crew did not consider the fog to be widespread or thick; operating under FAR Part 91 in the United States, they were used to making their own judgments as to whether the visibility was suitable for a takeoff. However, after the aircraft came to a halt following its abortive takeoff attempt, the controller could only see the top of the fuselage and tail above the layer of fog. It is likely, therefore, that the visibility was worse than the crew appreciated at the time N103CD taxied from Holding Point J1.

The route from J1 to the runway

The information on the aerodrome chart used by the crew, and the source of information in the UK AIP, suggested that the aircraft would be required to taxi in a straight line from J1 to the runway and then make a right turn onto the runway heading. In fact, in order to taxi from J1 onto the runway, an aircraft must: taxi in a straight line; follow a curve to the right onto runway heading but still displaced to the right of the runway itself; turn left towards the runway; and then turn right again onto runway heading.

Aerodrome lighting

The UK AIP states that there is no centreline lighting on Runway 03, and that the pavement width at the beginning of the runway is twice the normal runway width. It recognises the potential for confusion and urges crews to ensure that they have lined up correctly. This information was not available to the crew on their aerodrome charts and both crew members believed that the runway had centreline lighting. Further, the light from those left-side runway edge lights covered in fog would have been scattered, making it harder for the crew to perceive them as a distinct line of lights. The situation is likely to have been made worse by the bright lights reflecting off the top of the fog layer, making the underlying runway lights even harder to see, or swamping them completely as shown in Figure 5.

The CCTV images in Figure 5 show that peripheral lighting can interact with low fog layers to reduce the visibility of underlying aerodrome lighting. Current standards associated with apron lighting only address the minimum light levels required to make the areas safe and there are no standards relating to light spilling into other areas.

Human and environmental factors

Five of the factors identified by the ATSB as being present in misaligned takeoffs were present in this accident:

1. It was dark.
2. It was potentially a confusing taxiway environment given that the aerodrome chart did not reflect the actual layout of the taxiways. Pilots had previously reported having difficulty when vacating the runway near the Runway 03 threshold because of a lack of taxiway lighting.
3. There was an additional paved area (the ORP) near the runway.
4. There was no runway centreline lighting and the runway edge lights before the displaced threshold were recessed.
5. There was reduced visibility.

It appeared that the information available to the crew caused them to develop an incorrect expectation of their route to the runway. Both crew members believed that the runway had centreline lighting and, when the first right turn almost lined the aircraft up with some lights, their incorrect expectation was reinforced and they believed that the aircraft was lined up correctly. Cues to the contrary, such as runway edge lights on the other side of the runway, or the fact that the first three lights ahead of the aircraft were red (indicating that they were edge lights before the displaced threshold), did not appear to have been strong enough to make the crew realise that they had lost situational awareness. Figure 8 indicates that the apparent intensity of the white left-side runway edge lights was significantly less than that of the right-side lights, when viewed from the position where the aircraft lined up. This, along with other visual issues relating to contrast and the fog, is a plausible explanation as to why they were not noticed by the crew. The aircraft began its takeoff roll from a location beyond the first red runway edge light and approximately 46 m short of the next light, as shown

in Figure 1. Aircraft structure only obscures approximately the first 13 m of pavement ahead of pilots within a Gulfstream III aircraft and therefore these lights would not have been obscured by the aircraft. However, it is likely that the recessed nature of the red edge lights before the displaced threshold made them less compelling than the elevated white edge lights beyond, which would explain why their significance – that they could only have been runway edge lights – was not appreciated by the flight crew.

Aeronautical information

Authoritative information in respect of aerodromes is contained in national AIPs. The process of distilling that information and presenting it to crews in a usable format is not regulated, although LOAs provide a level of assurance that the process is sound. This accident shows, however, that information considered important by the aerodrome authority, and therefore included in the AIP, might not always be presented on an aerodrome chart following the inevitable editorial process. Editorial decisions, although guided by company standards, nevertheless involve individual judgments as to whether a piece of information will be included or excluded. In this case, the missing information became a latent weakness in the aerodrome operator's attempt – through its AIP entry – to ensure pilots lined up correctly, and contributed to the crew's loss of situational awareness.

Runway edge lighting

Factors associated with this accident that are in common with many of the previous events reviewed include visibility, ORPs (or other expanses of hard surfaces to the side of the runway) and the lead-in from the taxiways.

The dominant common factor between this accident and other misaligned takeoffs is that a visually compelling line of edge lights was visible to the crew and was assumed to be centreline lighting. There is nothing inherent in an individual edge light that distinguishes it from a centreline light when viewed along the axis of the bi-directional element. It is the pattern of edge lights, and the relationship of this pattern to the pattern of other lights and to other visual cues, which identifies them as edge lights. If this complex relationship becomes disrupted or misinterpreted, perhaps for the reasons highlighted in the ATSB report, pilots can lose situational awareness. If individual edge lights could be identified as such directly, rather than through a process of interpretation, a crew would notice their error more easily should they line up for takeoff incorrectly. Modern lighting technology offers more options to identify lights directly than does the tungsten lighting technology on which the current standards are based. Global aerodrome lighting standards are, in general, derived from ICAO Annex 14, Volume 1, '*Aerodrome Design and Operations'*. Therefore the following Safety Recommendation is made:

Safety Recommendation 2015-038

It is recommended that the International Civil Aviation Organisation initiate the process to develop within Annex 14 Volume 1, '*Aerodrome Design and Operations',* a standard for runway edge lights that would allow pilots to identify them specifically, without reference to other lights or other airfield features.

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.

SERIOUS INCIDENT

Aircraft Type and Registration:	Airbus A319-111, G-EZDN	
No & Type of Engines:	2 CFM56-5B5/3 turbofan engines	
Year of Manufacture:	2008 (Serial no: 3608)	
Date & Time (UTC):	13 May 2015 at 2135 hrs	
Location:	On approach to Bristol Airport	
Type of Flight:	Commercial Air Transport (Passenger)	
Persons on Board:	Crew - 6	Passengers - 99
Injuries:	Crew - None	Passengers - None
Nature of Damage:	None	
Commander's Licence:	Airline Transport Pilot's Licence	
Commander's Age:	56 years	
Commander's Flying Experience:	11,500 hours (of which 5,000 were on type) Last 90 days - 172 hours Last 28 days - 60 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot, and the Company safety report	

Synopsis

During a manually flown night visual approach to Runway 27 at Bristol Airport the pilots became disorientated and, at an altitude of 1,200 ft the aircraft, flew across a ridgeline south of the city of Bristol. The crew realised that they had lost positional awareness and conducted a go-around. The radio altimeter showed the aircraft had descended to 488 ft agl. The aircraft landed safely from its subsequent approach.

History of the flight

The aircraft was inbound to Bristol Airport from Glasgow and the weather conditions were good. This was the fourth and final sector for the crew and their second approach into Bristol that evening. They were expecting and had briefed for an ILS approach to Runway 09, which would have been a repeat of their earlier approach. The commander, who was the pilot flying, used a function of the navigation system to place a 5 nm range ring centred on the threshold of Runway 09 as depicted on his Navigational Display (ND).

On contacting the approach controller at Bristol Airport, the pilots were advised that the wind had changed direction and an aircraft ahead of them had made its approach to Runway 27. The pilots checked the position of this aircraft using TCAS and decided it would be more expeditious for them also to use Runway 27. When they saw the preceding traffic, they requested a visual approach to the airfield from the north.

This was approved by the approach controller, in accordance with noise abatement procedures[1]. The commander then disconnected the autopilot and autothrust, and asked for the Flight Directors (FD) to be switched off, the Flight Path Vector (FPV) to be selected and for the inbound course to the runway (268° M) to be selected on the Flight Control Unit (FCU). He then asked for 2,300 ft to be set in the altitude window of the FCU and turned the aircraft onto a heading that would take it to a point near where the 5 nm range ring intercepted the extended centreline of Runway 27. He could not recall if he had updated the range ring to be centred on the threshold of Runway 27 instead of Runway 09.

The commander was conscious of the need to make a sharp 90° turn onto the final approach track, so, at what he perceived was 1 nm before crossing the centreline, turned the aircraft towards a point at 4 nm on final approach and descended towards 2,100 ft, intending to comply with Bristol Airport's noise abatement procedures. The pilots made no reference to the selected altitude of 2,300 ft as the aircraft descended through it. The co-pilot was unaware that the commander had changed his initial aiming point. He considered the aircraft was getting too close to the airfield and said the approach looked "a bit tight". The commander interpreted this to mean that the co-pilot thought the aircraft was above the intended approach profile.

The commander saw what he perceived, based on the airfield lighting, to be the threshold and turned the aircraft onto an intercept heading to the centreline. The crew then configured the aircraft for landing and changed frequency to Bristol tower, whilst the aircraft continued to descend.

As the aircraft passed 1,800 ft the first officer became concerned about the tracking of the aircraft, and looked at the ND to orientate himself. He became aware that they had turned too early were north of the correct approach track and stated this to the commander. The commander reassured him that they were "on glide path", which gave the first officer the impression that the commander still had situational awareness.

The first officer then saw the communication masts, which are positioned next to the village of Dundry, to his right in the 1-2 o'clock position instead of the normal 3 o'clock position. Although they were well clear of these masts, their position confirmed that the aircraft was north of the runway centreline. He looked across at the commander, who had stopped the aircraft descending at 1,200 ft and saw he was scanning outside for references. He instructed the commander to go-around. Simultaneously, the commander decided that he did not have the correct visual references and started to execute a go-around. The ATC Tower controller and the Approach controller were discussing that the aircraft's approach was not in accordance with their noise abatement procedures and that a violation would be unavoidable. They were about to inform the crew when the aircraft transmitted that it was commencing a missed approach.

Footnote

[1] The noise abatement procedures required the aircraft to maintain 2,100 ft amsl until on the final approach track and thereafter not to descend below the height an aircraft would be on the glidepath. Aircraft approaching from the north should intercept the final approach at no closer than 3 nm.

The village of Dundry sits on top of a ridgeline roughly 705 ft amsl; within the village is a church, which extends up to height of 97 ft agl. There are communication masts located on higher ground approximately 0.3 nm to the west of Dundry. These masts are lit; the highest mast is depicted on the approach chart as being 886 ft amsl (275 ft agl). Bristol Airport is 622 ft amsl.

The go-around was commenced just to the north of the village and the lowest radio altimeter reading recorded during the manoeuvre was 488 ft agl. The aircraft was then repositioned for an ILS approach onto Runway 27 from which it landed safely.

Recorded data

The company investigation made use of data from a wireless quick access recorder and the noise monitoring system at Bristol Airport gave a pictorial representation of the aircraft's track and height amsl. (Figure 1)

The aircraft made its turn towards Runway 27, approximately 2 nm to the north of the runway centreline at a slant range from the threshold of 4.3 nm. The aircraft was turned through 50˚ and its rate of descent was reduced. The aircraft then flew level at 1,200 ft for 25 seconds, during the last 10 seconds of this, the indicated radar altimeter height reduced from 950 ft to 488 ft. The go-around was executed at 2.75 nm slant range from the threshold, still approximately 1 nm north of the centreline. The go-around altitude was set in the altitude window of the FCU during the manoeuvre.

Figure 1

Bristol Airport noise trace

Analysis

The crew made a late change to their briefed approach, but did not update their brief. This meant the co-pilot was not fully aware of how the commander intended to fly the approach, so was not properly able to monitor it. The commander probably did not update his 5 nm range ring from being centred on the threshold of Runway 09, and its subsequent use for situation awareness may have caused him to position too close in to the threshold of Runway 27. Both crew members then lost situational awareness, but neither communicated this to the other until the co-pilot called for a go-around. The fact the go-around altitude was not set until the go-around had commenced indicates either the landing checklist had not been completed or that it had not been completed satisfactorily.

Comment

The operator conducted an investigation of this incident and made three safety recommendations to its internal procedures.

ACCIDENT

Aircraft Type and Registration:	Airbus A321-231, G-ZBAD
No & Type of Engines:	2 International Aero Engine V2533-A5 turbofan engines
Year of Manufacture:	2013 (Serial no: 5582)
Date & Time (UTC):	23 June 2015 at 0710 hrs
Location:	Manchester Airport
Type of Flight:	Commercial Air Transport (Passenger)
Persons on Board:	Crew - 7 Passengers - 193
Injuries:	Crew - None Passengers - None
Nature of Damage:	Puncture to aircraft's fuselage
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	41 years
Commander's Flying Experience:	6,400 hours (of which 4,000 were on type) Last 90 days - 181 hours Last 28 days - 91 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot and further enquiries by the AAIB

Synopsis

After being pushed back the aircraft was pulled forward onto the taxiway centreline using a tug and towbar. As it did so the tug's raised cabin came in to contact with the aircraft, puncturing the fuselage. While the towbar used was suitable for the aircraft type it was shorter than that normally used. It has now been removed from service.

History of the flight

The aircraft was to be pushed back from Stand 86R using a tug and a towbar. In attendance were two ground crew, one on a headset to communicate with the flight crew and one to drive the tug.

After the aircraft had been pushed back the aircraft was required to be pulled forward onto the taxiway centreline. Prior to this the tug driver's cabin needed to be raised to allow him forward visibility during the pull. At the tug driver's request the headset operator monitored the raising of the cabin. This was achieved with the headset operator using a thumbs up during the raising and a clenched fist to signal when to stop. When raised the cabin was clear of the aircraft. It had been raised about 45-55 cm. The cabin's height when fully raised is 254 cm.

As the tug started to pull the aircraft forward the headset operator noticed that the cabin was getting close to the aircraft's underside and attempted to attract the tug driver's attention,

but was unable to do so because the latter was looking away from him and the aircraft. After the aircraft had been pulled forward 2-3 metres the tug driver heard a "crunch" to which he responded by applying the brakes. The roof of the tug's beacon light and cabin had come into contact with the aircraft, puncturing the underside of the fuselage just aft of the radome. At the time of impact the tow bar's shear pin, which connects the towbar to the aircraft's nose leg, also sheared. The aircraft remained in its position and the passengers subsequently disembarked. There were no injuries.

Additional information

A two-man pushback is standard from Stand 86R.

Stand 86R is at the end of a taxiway cul-de-sac. A pull forward is required after a pushback, to position the aircraft onto the taxiway centreline, due to a fence at the end of the cul-de-sac.

The towbar used in this incident was 4,300 mm long and suitable for this aircraft type. However, all other tow bars for this aircraft type at the airport were 5,200 mm long.

Safety actions

The 4,300 mm towbar was suitable for the aircraft type. However, the handling agent believed that if a 5,200 mm towbar had been used the tug's cabin would not have contacted the aircraft.

The handling agent subsequently removed the 4,300 mm towbar from service.

ACCIDENT

Aircraft Type and Registration:	Boeing B75N1 Stearman, N56200	
No & Type of Engines:	1 Lycoming R680 piston engine	
Year of Manufacture:	1943	
Date & Time (UTC):	17 August 2015 at 1115 hrs	
Location:	Goodwood Aerodrome, Sussex	
Type of Flight:	Private	
Persons on Board:	Crew – 1	Passengers - 1
Injuries:	Crew - None	Passengers - None
Nature of Damage:	Damage to propeller and tears in left wing	
Commander's Licence:	Private Pilot's Licence	
Commander's Age:	53 years	
Commander's Flying Experience:	1,430 hours (of which at least 350 were on type) Last 90 days - 16 hours Last 28 days - 9 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot	

The aircraft was parked outside a hangar, in an area where construction works were ongoing and temporary buildings had been erected in preparation for an event. The pilot boarded the aircraft and started the engine, before beginning to taxi. After moving off the aircraft turned through 90° to go between buildings towards the runway. The width of the area between the buildings was insufficient to allow the turns necessary for the pilot of a Stearman to see the area ahead. The pilot saw one helicopter parked ahead on the left, and another on the right, but could not see directly forward, and the propeller and nose of N56200 contacted the front of a Robinson R44 helicopter which had been parked between the other two.

The pilot of N56200 immediately realised that there had been a collision, and shut down the aircraft, she and her passenger vacating it without difficulty. The helicopter was not occupied, and no injuries resulted, but its cockpit was destroyed. The collision could have been avoided if the pilot of N56200 had ensured that the area into which it taxied was clear of obstructions, either by observation, or the use of wing-walkers or marshallers.

ACCIDENT

Aircraft Type and Registration:	Cessna 172B Skyhawk, G-ARMR	
No & Type of Engines:	1 Continental Motors Corp O-300-D piston engine	
Year of Manufacture:	1961 (Serial no: 172-48566)	
Date & Time (UTC):	7 June 2015 at 1133 hrs	
Location:	Sandown Airport, Isle of Wight	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - 1
Injuries:	Crew - None	Passengers - None
Nature of Damage:	Nosewheel collapsed and damage to propeller	
Commander's Licence:	Private Pilot's Licence	
Commander's Age:	52 years	
Commander's Flying Experience:	253 hours (of which 76 were on type) Last 90 days - 10 hours Last 28 days - 7 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot	

The aircraft was landing at Sandown Airport when, just after touching down, it hit a bump and became airborne again. The pilot applied full throttle and elected to go around. The engine then appeared to backfire and so the pilot made the decision to land. The aircraft bounced three or four times and the nose gear collapsed. Both occupants sustained very minor injuries and exited the aircraft without assistance.

ACCIDENT

Aircraft Type and Registration:	Cessna 172N Skyhawk, G-OSII	
No & Type of Engines:	1 Lycoming O-320-H2AD piston engine	
Year of Manufacture:	1976 (Serial no: 172-67768)	
Date & Time (UTC):	20 August 2015 at 1650 hrs	
Location:	Andrewsfield Aerodrome, Essex	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - 2
Injuries:	Crew - None	Passengers - None
Nature of Damage:	Nose landing gear and propeller damaged	
Commander's Licence:	Private Pilot's Licence	
Commander's Age:	68 years	
Commander's Flying Experience:	272 hours (of which 185 were on type) Last 90 days - 5 hours Last 28 days - 3 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot	

The final approach to the grass Runway 27L at Andrewsfield was stable at an airspeed of 65 to 70 kt, with 20º of flap set. The aircraft crossed the threshold at 65 kt but flared "a little high", landing hard and flat. The cast yoke at the bottom of the nose landing gear oleo fractured and the nose dropped, resulting in the propeller striking the ground. The aircraft came to rest with the engine cowling in contact with the runway. The aerodrome emergency services arrived quickly and all three occupants exited the aircraft without injury using the doors, which opened normally. The pilot assessed the cause of the accident as flaring too high, resulting in a hard landing.

ACCIDENT

Aircraft Type and Registration:	Druine D.62A Condor, G-ASEU
No & Type of Engines:	1 Continental Motors Corp C90-8F piston engine
Year of Manufacture:	1963 (Serial no: RAE/607)
Date & Time (UTC):	18 April 2015 at 1235 hrs
Location:	Insch Airfield, Aberdeenshire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Extensive damage to the wings and forward fuselage; engine shock-loaded
Commander's Licence:	National Private Pilot's Licence
Commander's Age:	81 years
Commander's Flying Experience:	740 hours (of which 583 were on type) Last 90 days - 6 hours Last 28 days - 3 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

The pilot was carrying out a flight from Inverness Airport to Insch Airfield. The weather was good, with a light and variable wind and visibility in excess of 10 km. There were few clouds, with a base at 2,000 ft at Inverness, increasing to 3,500 ft at Insch.

On arrival at Insch, the pilot positioned the aircraft to join the left hand circuit for Runway 13. He descended from 1,500 ft and lowered full flap during the crosswind leg. As the aircraft turned left onto the downwind leg, it stalled, the left wing dropped and it descended rapidly to the left. There was insufficient height to recover and the aircraft struck a stock fence, coming to rest inverted. Personnel from the airfield quickly attended the scene and helped the pilot to free himself from the wreckage. He immediately received medical assistance and was found to be uninjured.

The pilot concluded that he had lowered full flap earlier than usual and had allowed the speed to decay during the left turn leading to the stall and wing drop. The aircraft had a tendency to drop a wing when stalled, with full flap, at about 36-38 kt.

ACCIDENT

Aircraft Type and Registration:	Europa, G-OWWW	
No & Type of Engines:	1 Rotax 912ULS piston engine	
Year of Manufacture:	2003 (Serial no: PFA 247-12683)	
Date & Time (UTC):	29 August 2015 at 1230 hrs	
Location:	Lydeway Field, near Devizes, Wiltshire	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - 1
Injuries:	Crew - None	Passengers - None
Nature of Damage:	Damage to both wings, propeller and windscreen	
Commander's Licence:	Private Pilot's Licence	
Commander's Age:	68 years	
Commander's Flying Experience:	1,710 hours (of which 1,010 were on type) Last 90 days - 42 hours Last 28 days - 13 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot	

The aircraft was on its takeoff roll when, at a speed of approximately 40 kt, it veered to the left, departed the runway and entered a standing crop of corn about 2 ft high. Despite closing the throttle and applying the brakes, the pilot could not prevent the aircraft colliding with a hedge some 15 m from the edge of the runway.

The pilot is unsure of the cause of the swing, but considers it is possible that he experienced a sticking brake or a sudden gust of wind. He was taking off in a westerly direction and the wind was from the south, at 5 kt.

ACCIDENT

Aircraft Type and Registration:	Extra EA 300/L, G-KIII
No & Type of Engines:	1 Lycoming AEIO-540-L1B5 piston engine
Year of Manufacture:	2006 (Serial no: 1246)
Date & Time (UTC):	26 September 2015 at 1553 hrs
Location:	Swansea Airport
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Landing gear, propeller and lower outer edge of right wing
Commander's Licence:	Private Pilot's Licence
Commander's Age:	59 years
Commander's Flying Experience:	960 hours (of which 520 were on type) Last 90 days - 10 hours Last 28 days - 3 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

The pilot was intending to fly to Goodwood Airport in Sussex. During the pre-flight checks the pilot noticed that he had to apply the right brake pedal more firmly than normal when turning to the right but that the operation of the left brake pedal appeared normal. The aircraft entered Runway 28 and taxied towards the Runway 10 threshold prior to takeoff. As it approached the intersection with Runway 04/22 the pilot applied both left and right toe brakes evenly, but rather than maintaining direction, the aircraft suddenly turned to the left. The pilot tried to release the left brake whilst maintaining pressure on the right brake in an attempt to control the turn, but the aircraft ground looped; the right landing gear collapsed and the propeller and right wing struck the runway. The pilot shut down the engine and exited the aircraft. He noticed there was a fuel leak and moved away from the aircraft prior to the arrival of the AFFRS. The pilot considered that the cause was a loss of right brake effectiveness.

ACCIDENT

Aircraft Type and Registration:	Piper PA-28-140 Cherokee, G-BCJN	
No & Type of Engines:	1 Lycoming O-320-E3D piston engine	
Year of Manufacture:	1974 (Serial no: 28-7425350)	
Date & Time (UTC):	7 September 2015 at 1339 hrs	
Location:	Cotswold Airport, Gloucestershire	
Type of Flight:	Training	
Persons on Board:	Crew - 1	Passengers - None
Injuries:	Crew - None	Passengers - N/A
Nature of Damage:	Damage to propeller and engine mounts, engine possibly shock-loaded	
Commander's Licence:	Student	
Commander's Age:	18 years	
Commander's Flying Experience:	32 hours (32 were on type, and less than 1 hour was PIC) Last 90 days - 15 hours Last 28 days - 15 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot	

The aircraft, which was being flown solo by the student pilot, landed heavily, bounced and the propeller struck the runway. The aircraft then veered to the right, departed the runway and came to a stop on the grass.

ACCIDENT

Aircraft Type and Registration:	Piper PA-28-180 Cherokee, G-AVZR	
No & Type of Engines:	1 Lycoming O-360-A4M piston engine	
Year of Manufacture:	1967 (Serial no: 28-4114)	
Date & Time (UTC):	18 July 2015 at 1545 hrs	
Location:	North Coates Airfield, Lincolnshire	
Type of Flight:	Training	
Persons on Board:	Crew - 2	Passengers - 2
Injuries:	Crew - None	Passengers - 1 (Minor)
Nature of Damage:	Extensive (left wing detached)	
Commander's Licence:	Commercial Pilot's Licence	
Commander's Age:	57 years	
Commander's Flying Experience:	1,199 hours (of which 314 were on type) Last 90 days - 23 hours Last 28 days - 10 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot	

Synopsis

During an instructional flight the aircraft departed the left side of a grass runway on takeoff and struck a shrub, causing the left wing to detach. The aircraft came to rest in a dyke, inverted and partially underwater.

History of the flight

The instructor reported that the pilot was undergoing training to add a Simple-Single Engined Aircraft (SSEA) Class rating to his existing National Private Pilot's Licence (Microlights). The instructor had previously demonstrated the techniques for soft/short field takeoffs and the student had practised these on the concrete runway at Sturgate.

On the day of the accident the aircraft had flown from Sturgate to North Coates. Departure from the latter involved training for a soft field takeoff from the grass landing strip. The instructor, the student and two other occupants were on board the aircraft. A weight and balance calculation supplied by the instructor indicated that the aircraft was operating at a weight approximately 150 lb below the maximum all up weight (AUW), with a CG very close to the forward limit.

The aircraft was started and configured by the student using the checklist, under the instructor's supervision. Following the power checks, which were normal, the decision was taken to practise a soft field departure and this was briefed accordingly.

The aircraft was then turned onto the runway and full power was applied. The engine performance appeared normal and the aircraft accelerated down the centre of the runway. After a 150 to 200 m ground run the student over-rotated the aircraft slightly and forward view was partly obscured. The instructor told the student to ease the control column forward to reset the correct takeoff attitude. It then became clear that the aircraft had turned left by about 15º and was converging on the left side of the runway. The student was instructed to steer to the right.

The instructor stated that the ASI was reading 60 mph and he did not take control because he expected the aircraft to become airborne before reaching the side of the runway. Although it did become airborne and the student levelled off to allow the aircraft to accelerate, it then descended slightly and the left wheel came into contact with tall grass alongside the runway. This caused the aircraft to deviate to the left and decelerate, with the result that the left wingtip struck a shrub and the wing detached. The aircraft came to rest inverted in an irrigation dyke, with the windscreen underwater and tall grass and reeds obstructing the view through the side windows. The instructor initially had difficulty reaching the fuel pump switch, the key for the magnetos and the master switch, but was eventually able to select all to the off position.

Escape was facilitated by the arrival of the North Coates rescue team, who helped remove the window in the main door before assisting the occupants out of the aircraft.

In hindsight, the instructor realised that he should have taken control, but he believed the aircraft would easily become airborne and the student would succeed in steering right before reaching the edge of the runway.

ACCIDENT

Aircraft Type and Registration:	Pulsar, G-BUDI	
No & Type of Engines:	1 Rotax 582 piston engine	
Year of Manufacture:	1994 (Serial no: PFA 202-12185)	
Date & Time (UTC):	11 August 2015 at 1600 hrs	
Location:	Fairoaks Airport, Surrey	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - 1
Injuries:	Crew - None	Passengers - None
Nature of Damage:	Fracture of nose landing gear fork and damage to propeller tips	
Commander's Licence:	Private Pilot's Licence	
Commander's Age:	69 years	
Commander's Flying Experience:	273 hours (of which 140 were on type) Last 90 days - 3 hours Last 28 days - 2 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot	

After a local flight, the pilot carried out a touch-and-go landing on the main wheels without incident, and then flew a circuit. On the subsequent landing, up-elevator was applied to hold the nose of the aircraft off the ground as long as possible. When, at a low speed, the nose was lowered slowly onto the runway, the nose landing gear collapsed. The occupants vacated the aircraft without difficulty; there was no fire. The nose leg casting was found to have fractured.

ACCIDENT

Aircraft Type and Registration:	Reims Cessna FA152 Aerobat, G-FLIP	
No & Type of Engines:	1 Lycoming O-235-L2C piston engine	
Year of Manufacture:	1981 (Serial no: 375)	
Date & Time (UTC):	22 July 2015 at 1204 hrs	
Location:	Rochester Airport, Kent	
Type of Flight:	Training	
Persons on Board:	Crew - 1	Passengers - None
Injuries:	Crew - None	Passengers - N/A
Nature of Damage:	Nose leg collapsed, engine shock-loaded and damage to left wing	
Commander's Licence:	Student	
Commander's Age:	29 years	
Commander's Flying Experience:	15 hours (of which 15 were on type) Last 90 days - 15 hours Last 28 days - 10 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot with additional comments from instructor	

The student pilot had successfully completed five circuits with his instructor at Rochester Airport from Runway 20, amounting to approximately 55 minutes of flight. The fifth circuit ended with a full stop landing after which the instructor briefed the student for his first solo circuit.

The reported wind was from 240º at 15 kt and the student considered that the approach to Runway 20 was normal. During touchdown, the aircraft bounced to approximately three feet in a level attitude, after which it touched down again and the nose landing gear collapsed. The aircraft skidded to a halt on its nose and left wing. The pilot, who was wearing a full harness, was uninjured.

ACCIDENT

Aircraft Type and Registration:	Streak Shadow, G-WESX
No & Type of Engines:	1 Rotax 582 piston engine
Year of Manufacture:	1991 (Serial no: PFA 161A-11561)
Date & Time (UTC):	10 July 2015 at 1030 hrs
Location:	Rhedyn Coch Airfield, Denbighshire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Tail boom and nose landing gear
Commander's Licence:	Private Pilot's Licence
Commander's Age:	53 years
Commander's Flying Experience:	309 hours (of which 130 were on type) Last 90 days - 10 hours Last 28 days - 6 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

The pilot planned to visit Rhedyn Coch Airfield for the first time and called ahead to obtain permission and discuss local procedures. After departing from Lleweni Parc Airfield, he routed directly overhead Rhedyn Coch and performed several orbits to familiarise himself with the airfield. He then conducted a local flight, before returning to Rhedyn Coch and landing uneventfully on grass Runway 36. After a short time on the ground, the pilot took off again with the intention of flying circuits. After the first circuit, during the latter stages of the approach to Runway 36, the pilot became distracted by some livestock movement in an adjacent field. Upon returning his focus to the landing he found the aircraft was much lower than he had expected. The pilot flared, but was unable to arrest the rate of descent sufficiently to prevent the aircraft landing heavily on its main landing gear, followed by the nose landing gear. He was uninjured, but the aircraft sustained damage to the tail boom and nose landing gear. The pilot attributed the hard landing to his distraction, which resulted in a late flare.

ACCIDENT

Aircraft Type and Registration:	Aeroprakt A22-L Foxbat, G-PHOX	
No & Type of Engines:	1 Rotax 912ULS piston engine	
Year of Manufacture:	2008 (Serial no: PFA 317A-14635)	
Date & Time (UTC):	16 August 2015 at 0800 hrs	
Location:	Oldbury-on-Severn, Gloucestershire	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - None
Injuries:	Crew - None	Passengers - N/A
Nature of Damage:	Damage to nose landing gear, left main landing gear and fuselage attachment point	
Commander's Licence:	Private Pilot's Licence	
Commander's Age:	69 years	
Commander's Flying Experience:	1,003 hours (of which 452 were on type) Last 90 days - 25 hours Last 28 days - 17 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot and additional enquiries by the AAIB	

On arrival at a private airfield near Oldbury-on-Severn the pilot had twice overflown the site to check that the runway was clear. Whilst flaring to land, the aircraft struck two sheep, one of which was killed, and the left main landing gear detached from the aircraft. The aircraft skidded along the ground on the damaged nose landing gear and right main landing gear until coming to a halt. He made the aircraft safe and was able to vacate the aircraft through the normal door.

He stated that the airfield is part of a meadow used to graze sheep and would normally be protected by an electric fence. However, in this instance, the electric fence was not operational and, contrary to his normal practice, the pilot had not contacted the land owner prior to his arrival.

ACCIDENT

Aircraft Type and Registration:	Dynamic WT9 UK, G-NGLS
No & Type of Engines:	1 Rotax 912ULS piston engine
Year of Manufacture:	2008 (Serial no: DY288)
Date & Time (UTC):	25 September 2015 at 1155 hrs
Location:	Hollym Airfield, Yorkshire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 1
Injuries:	Crew - None Passengers - None
Nature of Damage:	Left wing tip detached, damage along leading edge of left wing, and propeller scuff
Commander's Licence:	National Private Pilot's Licence
Commander's Age:	55 years
Commander's Flying Experience:	95 hours (of which 18 were on type) Last 90 days - 15 hours Last 28 days - 5 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

Synopsis

After touchdown on a narrow grass strip, the pilot was unaware that the aircraft was drifting to the left. The left wing struck a fence, resulting in damage to the wing and causing the aircraft to ground loop.

History of the flight

The aircraft was flying to Hollym Airfield from its home airfield of Old Sarum, having stopped at Sywell, Northants to refuel. The pilot was accompanied by a companion (who was also licensed and who had flown into Hollym before) but the pilot wanted to fly the Sywell-Hollym leg, as she was keen to build her hours.

Hollym is an unlicensed strip located on the edge of a cliff with three runways, two of which (Runways 31 and 17) are subject to coastal erosion (Figure 1). The pilot performed a fly-by to assess the options and reports that she felt that, although it was the most into-wind, the usable part of Runway 31 looked rather short. Runway 32 was longer and, although narrow and partially bordered by a fence to the west (that is, the landward side of the runway), she felt it was preferable to use this and accept the increased crosswind component, which she estimated to be about 7 kt and relatively steady. The pilot lined up on finals and, after an approach and touchdown which she thought was "OK", she concentrated on looking straight ahead and admits that she was not initially aware that the aircraft was drifting to the

left, towards the fence. Her companion, however, had seen the proximity of the fence and tried to alert her but it was too late; the left wingtip struck about four of the fence posts and ground looped around the last one before coming to a halt in the long grass at the side of the runway.

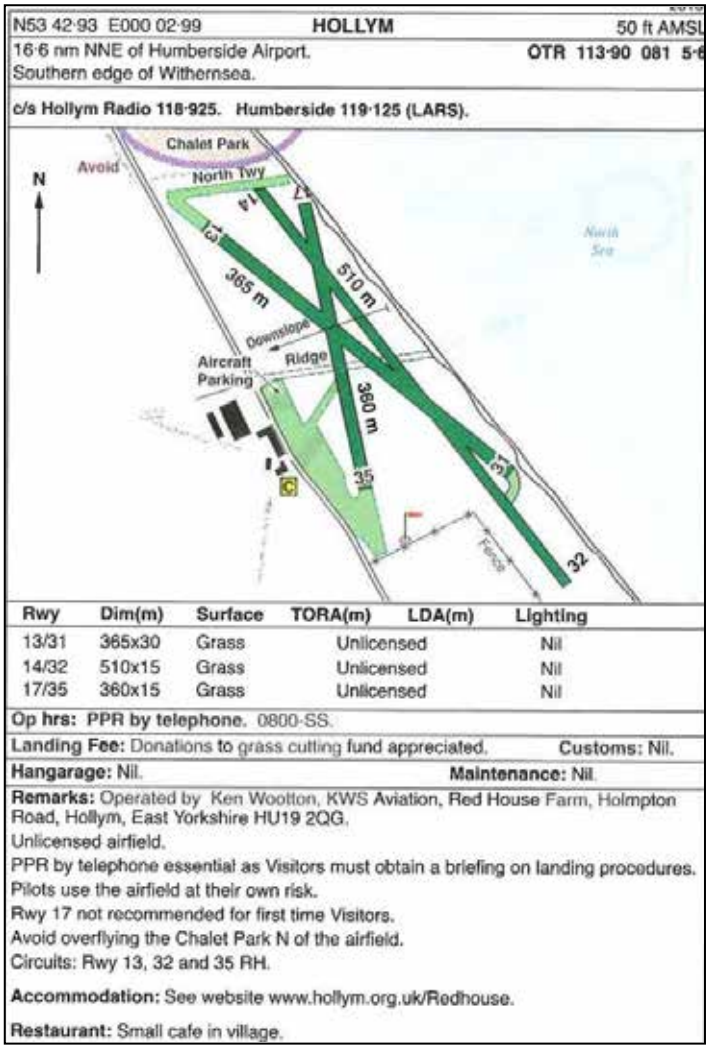

Figure 1

Chart of Hollym Airfield. Note proximity of fence to the first part of Runway 32

The pilot felt that the flight was within her capabilities but she had failed to notice, and correct, the left drift, possibly because she had been concentrating straight ahead. She also considers she had exercised poor judgement in electing to fly into such a “challenging” airfield for the first time when she was somewhat tired, having not slept properly the night before.

ACCIDENT

Aircraft Type and Registration:	EV-97 Teameurostar UK Eurostar, G-CHJG
No & Type of Engines:	1 Rotax 912-UL piston engine
Year of Manufacture:	2012 (Serial no: 3938)
Date & Time (UTC):	7 May 2015 at 1000 hrs
Location:	Bagby Airfield, North Yorkshire
Type of Flight:	Training
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Nose gear collapse, propeller damage, minor damage to firewall
Commander's Licence:	Student
Commander's Age:	59 years
Commander's Flying Experience:	29 hours (of which 27 were on type) Last 90 days - 18 hours Last 28 days - 9 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

The student pilot was on his fourth solo flight and was landing on grass Runway 06 at Bagby Airfield. The approach and initial touchdown appeared normal but, as the aircraft rolled out, an undulation in the runway caused it to bounce about six inches into the air. The student applied forward stick and the aircraft touched down on the nosewheel first before bouncing back into the air. The instructor who was observing the flight from the ground, radioed to the student to apply aft stick, but the student pushed the stick forward again and the aircraft landed heavily on the nosewheel. The nose gear collapsed and the propeller contacted the ground. The aircraft came to a stop shortly after and the student, who was wearing a full harness, vacated the aircraft uninjured.

ACCIDENT

Aircraft Type and Registration:	Flight Design CTSW, G-CGIZ	
No & Type of Engines:	1 Rotax 912ULS piston engine	
Year of Manufacture:	2010 (Serial no: 8512)	
Date & Time (UTC):	10 June 2015 at 1640 hrs	
Location:	Manchester Barton Aerodrome	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - None
Injuries:	Crew - None	Passengers - N/A
Nature of Damage:	Left wheel spar broke and moderate damage to left underside of the aircraft	
Commander's Licence:	Private Pilot's Licence	
Commander's Age:	47 years	
Commander's Flying Experience:	871 hours (of which 685 were on type) Last 90 days - 43 hours Last 28 days - 20 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot	

The pilot was returning to Barton Aerodrome from Haydock Park. The flying conditions were good, with the surface wind varying from calm to 15 kt. He reported that on short final for the grass Runway 08, at about 5 ft, the left wing "fell away". He applied full power with right rudder and the aircraft climbed to approximately 15 ft, in a normal climbing attitude. He then attempted to level the wings, applying right aileron, and the left wing abruptly dropped again. The aircraft turned through 180° with approximately 30° angle of bank before the pilot was able to level it. The aircraft was now downwind and descending; the pilot realising that an impact with the ground was inevitable, closed the throttle. The aircraft's left main wheel contacted the ground firmly and the wheel spar snapped. The aircraft then settled onto the grass, damaging the propeller and airframe. The pilot, who was uninjured, shut the aircraft down and vacated it normally.

The pilot recalled that his approach speed seemed normal and he believed that windshear may have caused the initial wing drop. The secondary stall probably occurred because the pilot, unfamiliar with the climbing attitude of the aircraft in the landing configuration, did not allow it to accelerate to a safe airspeed before climbing.

ACCIDENT

Aircraft Type and Registration:	Ikarus C42 FB80 Bravo, G-MRSS
No & Type of Engines:	1 Rotax 912-UL piston engine
Year of Manufacture:	2011 (Serial no: 1110-7175)
Date & Time (UTC):	21 September 2015 at 1545 hrs
Location:	Eshott Airfield, Northumberland
Type of Flight:	Training
Persons on Board:	Crew - 2 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Damage to landing gear and propeller
Commander's Licence:	National Private Pilot's Licence
Commander's Age:	21 years
Commander's Flying Experience:	250 hours (of which 113 were on type) Last 90 days - 103 hours Last 28 days - 34 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

On the accident flight, the handling pilot was a flex-wing microlight instructor who wished to convert to 3-axis machines and was receiving instruction from an Assistant Flying Instructor who was appropriately rated. The wind was from 265°at 7 kt, gusting 11 kt and the visibility was good.

Having completed the pre-start and post-start checks, the pilot taxied to the threshold of Runway 26 where he completed the pre-flight checks and deployed the first stage of flap. The instructor advised him to position the control column just aft of neutral during the takeoff roll so that the nosewheel would lift off as flying speed was reached. When this happened, however, the instructor reports that the aircraft became airborne but the nose rose too high. The pilot pushed forward on the column but the instructor could see that the nose was still too high so, at a height of about 50 ft, he took control and pushed the stick further forward to recover speed. However, the left wing dropped, the aircraft started to drift left and the instructor was unable to prevent the aircraft from impacting in a field to the left of the runway.

ACCIDENT

Aircraft Type and Registration:	Pegasus Quantum 15, G-MZJH	
No & Type of Engines:	1 Rotax 503-2V piston engine	
Year of Manufacture:	1997 (Serial no: 7350)	
Date & Time (UTC):	19 September 2015 at 1330 hrs	
Location:	Private strip, near Slipton, Northamptonshire	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - 1
Injuries:	Crew - 1 (Minor)	Passengers - 1 (Minor)
Nature of Damage:	Damage to nosewheel assembly, fibreglass body, right wheel spat and wing	
Commander's Licence:	National Private Pilot's Licence	
Commander's Age:	80 years	
Commander's Flying Experience:	208 hours (of which 92 were on type) Last 90 days - 3 hours Last 28 days - 1 hour	
Information Source:	Aircraft Accident Report Form submitted by the pilot	

Following a local flight in good weather the aircraft was stable on the approach at approximately 55 mph when it dropped suddenly from an estimated height of 30 ft agl and struck the ground. The aircraft slid for approximately 30 yards before rolling onto its right side and coming to rest. Both occupants sustained minor injuries and the pilot considered the most likely cause to be a sudden unexpected downdraught.

BULLETIN CORRECTION

A Bulletin Correction was issued online concerning this report on 16 December 2015 and also reproduced in the February 2016 AAIB Bulletin.

The pilot declared incorrect details against hours on type when he submitted the AARF.

Commander's Flying Experience states:

- 208 hours (of which 3 were on type)

Commander's Flying Experience should state:

- 208 hours (of which **92** were on type)

ACCIDENT

Aircraft Type and Registration:	Pegasus Quantum 15-912, G-MDBC
No & Type of Engines:	1 Rotax 912 piston engine
Year of Manufacture:	2001 (Serial no: 7814)
Date & Time (UTC):	29 June 2015 at 1730 hrs
Location:	Arclid Airfield, Cheshire
Type of Flight:	Training
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Damage to wing and trike
Commander's Licence:	Student
Commander's Age:	47 years
Commander's Flying Experience:	24 hours (of which 10 were on type) Last 90 days - 3 hours Last 28 days - 1 hour
Information Source:	Aircraft Accident Report Form submitted by the pilot

Synopsis

The solo student was landing on Runway 20 at Arclid Airfield. He had abandoned the first two attempts but, whilst happy with all aspects of the approach, found that the aircraft hopped on touchdown and started to drift to the left. He was unable to prevent the aircraft from entering a tall crop by the side of the runway and falling over onto its right side.

Neither the instructor nor the student could explain the reason for the loss of directional control.

History of the flight

The student had earlier flown with his instructor, including executing a standard overhead join for Runway 20 followed by a landing and a further circuit and landing on the same runway. The wind was down the runway at less than 5 kt. The instructor was happy with his student's performance and briefed him for a solo exercise.

The student was to carry out all the normal pre-flight checks, taxi and depart using Runway 20, leave the circuit and re-join, using standard procedures, and land on Runway 20. He was then briefed to depart a further three times, using other standard routes, and re-join overhead to land after each one.

On the first of his approaches to land, the student felt he was not lined up correctly and went around. He performed a circuit and this time was happy with his position on finals but, on

touchdown, the aircraft bounced and he decided to go around again. On the third attempt, the student was entirely happy with the approach but, as he was about to flare, the aircraft started to drift to the left and again performed a small hop on touchdown. Before touching down again, the aircraft had drifted to the left and its left mainwheel contacted a tall crop growing alongside the runway. The aircraft entered the crop and fell over onto its right side. The student commented that a combination of adrenalin, tangled flying wires and a misting visor caused him some difficulty in releasing his seat belt but eventually he managed to escape on his own, uninjured.

The student's instructor had seen the three approaches and considered that the last one "looked fine". Neither he nor the student could understand the reason for the loss of directional control.

ACCIDENT

Aircraft Type and Registration:	Pegasus Quik, G-CCYJ	
No & Type of Engines:	1 Rotax 912ULS piston engine	
Year of Manufacture:	2004 (Serial no: 8054)	
Date & Time (UTC):	23 May 2015 at 0914 hrs	
Location:	Linton Airfield, Kent	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - 1
Injuries:	Crew - None	Passengers - None
Nature of Damage:	Damage to left wing structure, propeller, left wheel and pods	
Commander's Licence:	National Private Pilot's Licence	
Commander's Age:	44 years	
Commander's Flying Experience:	370 hours (of which 70 were on type) Last 90 days - 10 hours Last 28 days - 7 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot	

The pilot reported that he had planned a local flight with a passenger, and had carried out his pre-flight checks and started the engine, when he noticed a split pin which was seated incorrectly. He shut the engine down, exited the aircraft, attended to the pin, re-boarded, and started the engine again.

The aircraft took off normally but, at a low height, the engine power reduced. The pilot decided to land on the remaining runway ahead. The aircraft touched down but did not stop by the end of the runway, and struck a fence. Neither occupant was injured but the aircraft sustained damage.

The pilot reported that after the aircraft had come to rest, he found his passenger's headset cable wrapped around the choke cable, and the choke about ⅓ open. He considered that this was a possible cause of the power loss, and that the interruption of his normal checks caused by the split pin may have prevented identification of the headset cable problem; although he had checked the choke position before the first engine start, he had not repeated this check after the second one.

ACCIDENT

Aircraft Type and Registration:	Pegasus XI-Q, G-MWPE	
No & Type of Engines:	1 Rotax 462 HP piston engine	
Year of Manufacture:	1991 (Serial no: SW-WQ-0416)	
Date & Time (UTC):	6 July 2015 at 1000 hrs	
Location:	Sutton Meadows Airfield, Cambridgeshire	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - None
Injuries:	Crew - None	Passengers - N/A
Nature of Damage:	Damaged beyond economic repair	
Commander's Licence:	Private Pilot's Licence	
Commander's Age:	85 years	
Commander's Flying Experience:	559 hours (of which 559 were on type) Last 90 days - 5 hours Last 28 days - 4 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot	

The aircraft was on approach to land at Sutton Meadows, having previously performed a go-around because the pilot felt he had been too high on the final approach. This time, the aircraft was correctly positioned and touched down on its rear wheels. However, as the nose was lowered, the aircraft flipped inverted. The pilot was able to escape uninjured. He believes that the nosewheel may have been off-centre and that he did not check its position on the second approach.

ACCIDENT

Aircraft Type and Registration:	Pegasus XL-R, G-MVDV
No & Type of Engines:	1 Rotax 447 piston engine
Year of Manufacture:	1988 (Serial no: SW-WA-1349)
Date & Time (UTC):	6 September 2015 at 1155 hrs
Location:	Field near Otherton Airfield, Staffordshire
Type of Flight:	Training
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Nose landing gear collapsed, damage to wing and trike pod
Commander's Licence:	Student
Commander's Age:	37 years
Commander's Flying Experience:	55 hours (of which 16 were on type) Last 90 days - 1 hour Last 28 days - 1 hour
Information Source:	Aircraft Accident Report Form submitted by the pilot

The student pilot was undertaking a solo flight from Otherton Airfield as part of his training. After about ten minutes of warming the engine and taxiing, he took off from Runway 25 and later reported that the engine was performing normally throughout the takeoff roll and initial climb. However, at a height of about 100-150 ft agl, he sensed that the engine was losing power so he checked that the fuel tap was on and pumped the throttle. The engine continued to slow down and cut intermittently and he therefore decided that he would shut it down and commit to a forced landing straight ahead into a field of potatoes.

During the landing, the nose landing gear collapsed due to the soft nature of the ground and the aircraft rolled onto its left side as it came to a halt. The pilot later reported that, as part of the subsequent investigation, it was found that the engine ran normally over an extended period of testing after the carburettor had been cleaned and this led to the conclusion that a particle of dirt had blocked the jet or that, possibly, water had been present.

ACCIDENT

Aircraft Type and Registration:	Quik GT450, G-CEGJ	
No & Type of Engines:	1 Rotax 912 ULS piston engine	
Year of Manufacture:	2006 (Serial no: 8234)	
Date & Time (UTC):	8 April 2015 at 0930 hrs	
Location:	Sywell Aerdrome, Northamptonshire	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - None
Injuries:	Crew - None	Passengers - None
Nature of Damage:	Damaged pylon and wing	
Commander's Licence:	Student	
Commander's Age:	46 years	
Commander's Flying Experience:	27 hours Last 90 days - Not known Last 28 days - Not known	
Information Source:	Aircraft Accident Report Form submitted by the pilot and subsequent enquiries by the AAIB	

Having just flown dual with his instructor, the student pilot was practising solo circuits using Runway 03L. The aircraft was on final approach, slightly to the left of the centreline but the pilot was not concerned given the width of the runway. At a height of approximately 20 ft agl, the pilot noticed that the aircraft was drifting further left and on touchdown it was heading towards the grass. He attempted to steer to the right but felt the aircraft 'tipping' and applied the brakes. The aircraft came to rest with the trike on its left side but the pilot was uninjured. He considered that the accident may have been caused by a gust of wind or insufficient compensation for the slight crosswind; the flight training school advised that the wind was from 050° at about 7 kt.

ACCIDENT

Aircraft Type and Registration:	QuikR, G-CFYO	
No & Type of Engines:	1 Rotax 912ULS piston engine	
Year of Manufacture:	2009 (Serial no: 8434)	
Date & Time (UTC):	21 August 2015 at 1335 hrs	
Location:	North Weald Airfield, Essex	
Type of Flight:	Training	
Persons on Board:	Crew - 1	Passengers - None
Injuries:	Crew - None	Passengers - N/A
Nature of Damage:	Wing, landing gear, propeller, airframe and possible engine damage	
Commander's Licence:	Student	
Commander's Age:	51 years	
Commander's Flying Experience:	59 hours (of which all were on type) Last 90 days - not provided Last 28 days - not provided	
Information Source:	Aircraft Accident Report Form submitted by the pilot	

The student pilot was flying a solo navigation exercise from Headcorn to North Weald. With a forecast wind speed of 10 kt and in good visibility, the pilot made an approach to land on asphalt Runway 20. The aircraft bounced on the first touchdown and then landed heavily with a slight yaw to the right. The pilot stated that, at that point, the aircraft appeared to be caught by a gust of wind which tipped the aircraft onto its side and it departed the right side of the runway and came to rest on the adjacent grass Runway 20. The pilot was unhurt and he turned off the engine before stepping out of the aircraft. He later attributed the cause to having rounded out too early during the landing.

ACCIDENT

Aircraft Type and Registration:	Rotorsport UK Calidus, G-CLDS	
No & Type of Engines:	1 Rotax 912ULS piston engine	
Year of Manufacture:	2008 (Serial no: RSUK/CALS/001)	
Date & Time (UTC):	31 July 2015 at 1339 hrs	
Location:	Hereford Golf Academy, Hereford	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - 1
Injuries:	Crew - 1 (Minor)	Passengers - 1 (Minor)
Nature of Damage:	Aircraft destroyed	
Commander's Licence:	Private Pilot's Licence	
Commander's Age:	64 years	
Commander's Flying Experience:	284 hours (of which 231 were on type) Last 90 days - 28 hours Last 28 days - 8 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot	

Synopsis

The aircraft rotated to an excessive nose-up attitude during a 'short-field' takeoff. The aircraft became airborne but its airspeed was too low and reducing. The aircraft turned right and its rotor blades struck the ground. The pilot and passenger received minor injuries but the aircraft was destroyed.

History of the flight

The pilot intended to take the passenger for a short flight from a small grass strip, located near to a golf course. This would be only his second flight with a passenger from this strip, so he practised his short-field takeoff technique several times, flying with his passenger at a nearby airfield. The short-field takeoff technique in this aircraft involves pre-rotating the blades to 250 rotor rpm at one end of the takeoff strip, then accelerating down the strip with full power and the control stick fully aft. When the nosewheel leaves the ground, the control stick should be moved forward to hold the aircraft's nose just off the ground until the best angle of climb speed is reached, when the speed-stable attitude is selected and the aircraft climbs away.

The pilot accelerated the rotor rpm at the start of his takeoff run, applied full power and commenced his takeoff roll. As the airspeed reached approximately 40 mph, the nose rose rapidly and the aircraft became airborne. With the attitude remaining excessively nose-high and full power still applied, the airspeed reduced rapidly and the aircraft began descending

and turning to the right. The pilot realised a collision was imminent and shouted a warning to his passenger, before the rotor blades made contact with the ground, the aircraft rolled onto its side and the engine stopped. The passenger was able to vacate the aircraft normally, but the pilot needed assistance from both the passenger and some passing golfers to free his arm from the wreckage of the aircraft. Both the pilot and his passenger received minor injuries; the aircraft suffered substantial damaged, but there was no fire.

The pilot considered that during the takeoff roll, approaching the speed at which the aircraft's nose should have come off the ground, the aircraft probably hit a bump in the grass which caused the nose to pitch up excessively. He did not move the control stick sufficiently far forward to return the aircraft to a normal climbing attitude, and the aircraft became too slow. At this point the pilot could have closed the throttle and aborted the takeoff.

ACCIDENT

Aircraft Type and Registration:	Team Minimax 91, G-MYLB	
No & Type of Engines:	1 Rotax 447 piston engine	
Year of Manufacture:	1993 (Serial no: PFA 186-12419)	
Date & Time (UTC):	13 June 2015 at 1255 hrs	
Location:	Near Bowburn, County Durham	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - None
Injuries:	Crew - 1 (Minor)	Passengers - N/A
Nature of Damage:	Damaged beyond economic repair	
Commander's Licence:	Private Pilot's Licence	
Commander's Age:	70 years	
Commander's Flying Experience:	231 hours (of which 72 were on type) Last 90 days - 4 hours Last 28 days - 2 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot and additional inquiries by the AAIB	

Synopsis

The aircraft was returning to its departure airfield when the engine rpm decayed, then stopped. The pilot carried out a forced landed in a field of crops, during which the aircraft was badly damaged. He believed there had been a partial seizure of the engine, which he was investigating.

History of the flight

The pilot departed Fishburn Airfield on a local flight, routing northwest before turning north towards Brandon. After about 10 minutes of flight, he performed the en-route 'FREDA' checks and switched on the carburettor heat because he felt the conditions were quite humid. In this case, the carburettor heater was an aftermarket electrical element which heats the carburettor body itself and, thus, can be left switched on for long periods without detriment to the engine performance.

After the pilot had turned south to return to Fishburn, with the aircraft at a height of about 1,500 ft agl, the engine rpm decayed and then stopped completely. He tried to restart the engine but without success. Therefore, having alerted Fishburn Airfield to his situation, he selected a field for a forced landing. There were three possibilities but they all contained a standing crop, so he selected the largest, which was approximately 600-700 metres in length, and set the aircraft up for an approach. The pilot tried to land in the tracks left by a tractor but, as the main landing gear contacted the crop, the nose pitched down and the

aircraft was spun to the right. The pilot, suffering only minor scratches and bruising, undid his harness and vacated the aircraft through the aperture left by the canopy, which had been wrenched off during the accident. The aircraft had been severely damaged but there was no fire.

The pilot initially felt that the symptoms he had experienced were consistent with carburettor icing, possibly indicating that the carburettor heater may have been inoperative. However, he subsequently tested the element and confirmed that it appeared to be drawing a normal amount of current. It was noted that the original supplier of the heater modification also designed a similar device which illuminated a light in the cockpit, to indicate that the element was drawing current. However, G-MYLB was not fitted with this modification.

The pilot subsequently advised that he believed there may have been a partial seizure of the engine, internally, which he was investigating.

ACCIDENT

Aircraft Type and Registration:	Vierwerk Aerolite 120, G-OLAS	
No & Type of Engines:	1 Polini Thor 200 Evo piston engine	
Year of Manufacture:	2015	
Date & Time (UTC):	13 September 2015 at 1100 hrs	
Location:	Darley Moor, Derbyshire	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - None
Injuries:	Crew - 1 (Minor)	Passengers - N/A
Nature of Damage:	Damaged beyond economic repair	
Commander's Licence:	National Private Pilot's Licence	
Commander's Age:	57 years	
Commander's Flying Experience:	187 hours (of which 3 were on type) Last 90 days - 23 hours Last 28 days - 8 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot	

Synopsis

Whilst taking off from a local airstrip, the pilot encountered difficulty maintaining a steady rate of climb. The aircraft stalled and dropped a wing before striking the ground just off the runway. Unfamiliarity with the class of aircraft and its marginal performance were considered by the pilot to be amongst the factors which caused the accident.

History of the flight

The Vierwerk Aerolite 120 is a Single-Seat De-Regulated microlight (SSDR) aircraft. The owner-pilot had purchased G-OLAS about a week before at the Light Aircraft Association rally at Sywell and flown it direct from the rally to Calton Moor Airfield, which was to be its new base.

On the day of the accident, the pilot had flown the aircraft from Calton Moor to Darley Moor Airfield, some 5 miles to the southeast. Aware that this aircraft type had a crosswind limit of only 8 kt, he had taken a reading of 4 kt of wind using a hand-held anemometer and noted its direction from the windsock and a nearby wind turbine. He opted to use Runway 13 for takeoff and embarked on a low-level indirect flight of some 42 minutes duration during which he experienced some sink and had difficulty maintaining a steady rate of climb.

The aircraft landed normally at Darley Moor on Runway 19, where the pilot waited for an hour before taking off again from the same runway, with an observed wind speed of 6-8 kt

from the south-east. He had applied 12° of flap and rotated the aircraft at 20 kt, lifting off at around 30 kt. He stayed in ground effect until the airspeed indicator (ASI) showed 40 kt and increased to 42 kt (the best climb speed). The aircraft seemed to be climbing slowly but steadily and the pilot retracted the flaps at a height of 80 ft, whereupon it stopped climbing and the right wing dropped slightly. He recovered to wings level but the aircraft stalled, dropping the right wing and entering a nose-down spin to the right before impacting the ground. The aircraft was badly damaged but the pilot suffered only a minor injury.

Analysis

In his very full account, the pilot stated that he believed that he had retracted the flaps at too low an airspeed, even though the ASI showed he was above the clean stall speed of 35 kt. He recalled that as he approached the stall he had not realised this and consequently had not lowered the nose.

In addition, the pilot made several observations concerning what he feels were probable contributory factors:

- The Aerolite 120 is a relatively low-powered, high-drag machine compared with other types of microlights he has flown. He had purchased the aircraft without seeking proper consultation with the agents or manufacturer on the best way to convert onto type.
- G-OLAS was the first of its type in the UK and there was a scarcity of expertise to draw upon.
- He had mistakenly assumed that an SSDR would be easier to fly than, say, converting to a heavier, faster aircraft. In his opinion differences training is just as necessary when making the transition in the opposite direction.
- He expressed doubts as to the accuracy of the ASI, since calibration records were not required. He noted that his GPS log showed that he never achieved a groundspeed of more than 32 kt, and, by applying wind velocity calculations, it is possible that his airspeed was very close to the clean stalling speed when he retracted the flaps.
- As he had so little time on the aircraft and had no formal conversion training, he had little awareness of the correct attitude and relative view of the horizon. This had led him to place too much faith in the indicated airspeed.

AAIB comment: at least some of the above factors, particularly marginal performance and lack of performance information, also applied to an accident to a different SSDR type, registration G-CIMA, which was reported in AAIB Bulletin 9/2015.

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

7/2010 Aerospatiale (Eurocopter) AS 332L Super Puma, G-PUMI at Aberdeen Airport, Scotland on 13 October 2006.

Published November 2010.

8/2010 Cessna 402C, G-EYES and Rand KR-2, G-BOLZ near Coventry Airport on 17 August 2008.

Published December 2010.

1/2011 Eurocopter EC225 LP Super Puma, G-REDU near the Eastern Trough Area Project Central Production Facility Platform in the North Sea on 18 February 2009.

Published September 2011.

2/2011 Aerospatiale (Eurocopter) AS332 L2 Super Puma, G-REDL 11 nm NE of Peterhead, Scotland on 1 April 2009.

Published November 2011.

1/2014 Airbus A330-343, G-VSXY at London Gatwick Airport on 16 April 2012.

Published February 2014.

2/2014 Eurocopter EC225 LP Super Puma G-REDW, 34 nm east of Aberdeen, Scotland on 10 May 2012 and G-CHCN, 32 nm south-west of Sumburgh, Shetland Islands on 22 October 2012.

Published June 2014.

3/2014 Agusta A109E, G-CRST Near Vauxhall Bridge, Central London on 16 January 2013.

Published September 2014.

1/2015 Airbus A319-131, G-EUOE London Heathrow Airport on 24 May 2013.

Published July 2015.

2/2015 Boeing B787-8, ET-AOP London Heathrow Airport on 12 July 2013.

Published August 2015.

3/2015 Eurocopter (Deutschland) EC135 T2+, G-SPAO Glasgow City Centre, Scotland on 29 November 2013.

Published October 2015.

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 System
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
DFDR	Digital Flight Data Recorder
DME	Distance Measuring Equipment
EAS	equivalent airspeed
EASA	European 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)
FIR	Flight Information Region
FL	Flight Level
ft	feet
ft/min	feet per minute
g	acceleration due to Earth's gravity
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
PNF	Pilot Not Flying
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
TGT	Turbine Gas Temperature
TODA	Takeoff Distance Available
UHF	Ultra High Frequency
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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